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PAST EXPERIENCES WITH ENERGY AND ENVIRONMENT COOPERATION BETWEEN THE U.S. AND JAPAN

INTRODUCTION

Lawrence Scheinman

United States-Japanese energy relations have been marked by vigorous and productive cooperation, and by periods of tension and difficulty. These experiences reflect the mixture of common objectives, goals and purpose (stable markets, assured supply) on the one hand, and differences in situation and perspective (the U.S. as relatively rich in a variety of energy resources, Japan with much more limited energy assets) as well as political roles (the U.S. having a more political global, strategic outlook in the great competition of the Cold War, and Japan a more economic and regional outlook).

In terms of nuclear energy, this was reflected in how the two countries viewed plutonium in the period after the mid 1970s. After having encouraged a Japanese development program that operated on the assumption that plutonium would be recovered from light water reactor spent fuel and used in developing breeder reactors as well as for some thermal recycle, the United States reversed course and began a campaign to put the plutonium genie back in the bottle. This was driven by strong convictions about nuclear proliferation which, if it were to occur, would vastly complicate U.S. and Soviet efforts to manage their competition without the risk of nuclear tinder boxes going off around the world and possibly engaging them in direct conflict that even could lead to nuclear war. This consideration, prompted by the Indian nuclear test in 1974, and the surfacing of a Congressional

conscience and activism that competed with the Executive branch in promoting nuclear nonproliferation, resulted in some sharp reversals of conventional assumptions in U.S. nuclear energy policy and in how the U.S. chose to deal with nuclear material over which it had some control regarding spent fuel disposition. [The evolution of changing US policy is mapped in two different but complementary ways in the following paper. One part, by Warren Donnelly, looks closely at Congress; the other by Lawrence Scheinman -- and taken from his book on the IAEA and World Nuclear Order -- looks at Congress, the Executive and the international setting of changing policy.]

Because of the close linkage of the U.S. and Japanese nuclear energy development programs, including U.S. prior consent rights before U.S. origin spent fuel could be processed and the plutonium separated and used, and the U.S. view that no interest would be served by encouraging the separation and use of plutonium, Japanese energy concerns were in some degree held hostage by U.S. policy. The U.S., driven by nonproliferation concerns and enjoying a diversified and accessible energy base (though also highly dependent on imported oil which played a major role in its energy economy), discounted the energy situation of many of its key allies and partners such as Japan, exhorting them to endorse the plutonium-avoidance policies that were seen as fundamental to achieving nonproliferation. Japan, not at all unsympathetic to the proliferation issue, but driven by a more limited and localized set of concerns, and seeing itself as anything but a prolif-

eration risk, and therefore fully qualified to continue to pursue its earlier course of nuclear development involving extensive use of plutonium, saw itself as an ill-fated casualty of American policy. Anticipated cooperation in such areas as breeder reactor development, or thermal recycle suffered, and one of the fallouts of this was to increase the task of the Japanese government before its own public to persuade it that despite differences of view with the United States regarding nuclear development strategy there was nothing inherently wrong or deficient in the Japanese program.

Nuclear energy was not the only arena of energy cooperation between the two countries. Indeed, programs, projects and planned activities cut a wide swath through the traditional menu of energy approaches including fossil as well as nuclear, renewable as well as exhaustible resources, conservation as well as production strategies. One of the areas of interest in this regard is that of new techniques for extracting usable fuel from shale, coal and the like. An important landmark experience in this regard was the collaborative effort in solvent refined coal, and the SRC-II project.

In the following pages, the SRC-II project is discussed and analyzed in terms of the lessons it bears for bilateral cooperation in energy technology development. As well, the evolution of change in the U.S. attitude toward plutonium is traced. Common to both -- neither of which were easy experiences -- are some important conclusions:

1. That despite difficulties that ensued in the evolution of these cooperative arrangements, there were strong and sustaining common interests and values that not only survived the test of policy change, but offered valuable insights on both sides to the policy dynamics of the other; insights that would be important building blocks for future cooperation.

2. That the peripatetic shifts of U.S. policy reflected not an indifference or insensitivity to Japanese interests and objectives, but the difficulty of accommodating local and economic interests with global and political-strategic interests that happen to intersect in the same policy space.

3. That failures in the sense that the outcome of cooperation did not yield an identifiable, substantive 'product' does not necessarily mean failure of cooperation per se; the learning process of cooperative ventures is sometimes as, if not more, important than the specific result. For the United States and Japan, whose interests and destinies are commingled in complex and eclectic ways, the learning process may be the single most important value of collaborative effort.

4. Learning means understanding. In the case of the U.S. and Japan one of the most important things for each to understand about the other is the dynamic of policy development; how political institutions that contribute to the policy making process interact; how different kinds of changes in policy direction affect perceptions of one another and how this can impact on confidence and the nature of future cooperation. The experiences

discussed here, in a preliminary way, (and to be elaborated and expanded in a subsequent rendering of this study) are valuable primarily for this learning process, and only secondarily for the substantive outcome.

Collaboration in Fossil Energy Technologies

Roger LeGassie

The joint U.S.-Japan experience in technology collaboration on the Solvent Refined Coal II (SRC-II) Project was ultimately a difficult one for both countries. The project was terminated while still in the design phase. Because of its large size and consequent high cost and visibility, the project termination has sometimes been used as an example of the problems, often viewed as inherent, in the joint conduct of international projects. While such problems were certainly present in this case example, other factors unique to the project were also present. Accordingly, this section of the study examines the history of SRC-II within the larger context of international collaboration in fossil fuels technologies in order to consider what lessons may be drawn from the experience.

The relevant time frame is the late 1970s through the early 1980s. This was a period of extensive swings in political leadership and related energy policy for the U.S.

Prior to 1975, energy research and development in the U.S. was scattered among a variety of agencies. The largest energy budget was in the U.S. Atomic Energy Commission. Coal technology

development was housed in the Bureau of Mines. Solar, conservation, and other "exotic" technologies were researched in the National Science Foundation. However, the oil supply and price disruption of 1973 galvanized U.S. concern about undue reliance upon unreliable overseas sources of energy and led to U.S. leadership in the establishment of the International Energy Agency in 1974 and the creation of the U.S. Energy Research and Development Administration (ERDA) in early 1975.

All energy technologies were thus relocated into a single agency. However, there was no agreement at political or public levels as to the energy policy which should guide energy R&D priorities. Several previous attempts to do so had failed to develop the necessary consensus. As a result, ERDA-48, A National Plan for Energy Research, Development and Demonstration -- Creating Energy Choices for the Future, published in June of 1975, had to define such a policy context in order to carry out its mandate to issue a long-range energy R&D plan.

Not surprisingly, ERDA defined the "serious and continuing energy problem" of the U.S. as related to a "heavy reliance on imported energy" with "serious national security implications." The ERDA analysis indicated no single technological solution would suffice, and thus began the implementation of a broad multi-technology attack which included major new initiatives in the areas of coal liquefaction and gasification, oil shale, renewables (e.g., solar and wind), and energy efficiency.

The ERDA report was issued under a Republican Administration, and received intensive review at the Executive levels of the Office of Management and Budget (OMB), the Executive Office of the President (EOB), and the President. While views as to appropriate solutions may differ, its analysis of the key aspects of the U.S. energy problem remain valid today. It became and remained the driver for major U.S. funding initiatives in energy until the election of President Carter in 1976 and his Democratic Administration's formation of the U.S. Department of Energy (DOE) in late 1977.

ERDA and DOE initiated and/or funded a number of major fossil fuels technology projects and pilot plants. Those projects which are relevant to the history of SRC-II are listed in Table 1. These eight projects share the objective of providing for displacement of imported oil supplies through the production of "synthetic" fuels derived either from coal or from oil shale, the two major indigenous energy resources of the U.S. in addition to uranium and renewable fuels.

As the table indicates, five projects (Great Plains, H-Coal, Memphis, SRC-I, and Union) had no international participation. The remaining three (Cool Water, EDS, and SRC-II) had significant Japanese participation.

When President Carter came into office in January of 1977, he made major changes in U.S. energy policy, but continued to support and even significantly expand the fossil fuels portion of the ERDA R&D budget which was incorporated into DOE in the fall

Table I
Selected Fossil Energy R&D Projects

1. **Cool Water Demonstration Plant** -- Coal Gasification (based on ERDA support of Texaco gasifier development and initiated in 1978 by Southern California Edison and the Electric Power Research Institute). Participants included JCWP, a consortium of Japanese companies led by Tokyo Electric Power. Electric power capacity at 100 megawatts electric.

2. **Exxon Donor Solvent (EDS) Pilot Plant** -- Direct Coal Liquefaction (funded by ERDA). Participants included Japan Coal Liquefaction Development Corporation. Sized at 250 tons per day input of high sulfur coal.

3. **Great Plains High-BTU Pipeline Gas Pioneer Plant** -- Coal Gasification (funded by DOE in 1980, but initiated in 1972 based on Lurgi technology). No international participation. Pipeline gas production capacity at 125 million cubic feet per day based on 14,000 tons per day input of lignite feed.

4. **H-Coal Ebulating Bed Pilot Plant** -- Direct Coal Liquefaction (funded by ERDA). No international participation. Sized at 200 tons per day input of high sulfur coal.

5. **Memphis Medium BTU Industrial Fuel Gas Demonstration Plant** -- Coal Gasification (funded by ERDA). No international participation. Fuel gas production capacity at 154 million cubic feet per day based on 3,110 tons per day input of high sulfur coal.

6. **Solvent Refined Coal-I (SRC-I)** -- Direct Coal Liquefaction Demonstration/Commercial Plant (funded by DOE with prior ERDA R&D support). No international participation. Solid clean fuel production capacity equivalent to 20,000 barrels per day liquids based on 6,000 tons per day input of high sulfur coal.

7. **Solvent Refined Coal-II (SRC-II)** -- Direct Coal Liquefaction Demonstration/Commercial Plant (funded by DOE with prior ERDA R&D support). Joint project of SRC International (a consortium of Gulf Oil's Pittsburgh and Midway Coal Mining Co., Ruhrkohle AG of the Federal Republic of Germany and Japan SRC Inc. - five Japanese firms), DOE, and the governments of Japan and the Federal Republic of Germany. Liquids production capacity of 20,000 barrels per day based on 6,000 tons per day input of high sulfur coal.

8. **Union Oil Parachute Creek Pioneer Plant** -- Oil Shale Retorting (based on ERDA support of shale retorting technology). No international participation. Liquids production capacity of 10,400 barrels per day.

of 1977. As noted in Table 1, government support of demonstration plants for Great Plains, SRC-I, and SRC-II were all DOE initiatives although R&D on SRC technology was also previously supported by ERDA.

The 1976-77 changes in energy policy had little to do with the earlier statement of the nature of the energy problem, and were mostly associated with a difference in view as how best to address it. President Carter and his new Secretary of Energy, James Schlesinger, increased the depth of government involvement in energy matters through extensive new legislative initiatives. Although the R&D program was maintained, there was a retreat from long-range planning (by which to guide and prioritize near-term actions) and an emphasis on "quick fixes" which forced actions through regulations rather than incentivized them through market place signals.

Nevertheless, oil supply issues and energy security remained dominant. The U.S. Strategic Petroleum Reserve was supported. In addition, action was initiated to create a Synthetic Fuels Corporation (SFC) which would financially support near-commercial, pioneer-plant, oil-displacement technologies with price supports, fuel purchase contracts, and loan guarantees.

The SRC projects, however, were recognized as highly risky events because of the degree of technical extrapolation required to extend the technology to full-scale plants. The technology involved stemmed initially from work in Germany in the 1920s. In 1962, the Office of Coal Research in the Bureau of Mines began to

support research in the U.S. at Spencer Chemical which was subsequently acquired by Gulf Oil. A 50 tons of coal per day pilot plant became operational in 1974 and was funded by ERDA thereafter. The step from 50 tons per day to 6,000 tons per day is enormous for chemical process plants which incorporate solids handling. Nevertheless, DOE was so strongly convinced of the importance of near-term demonstrations of technologies that could place a price cap on foreign oil that the financial and technical risk was felt to be justified.

Initially there was to be only one project (either SRC-I or SRC-II). However, Congressional support, combined with the ability to reduce the U.S. cost for SRC-II through international collaboration, eventually led to the decision to proceed with both projects. While the U.S. companies involved in SRC-I played a strong role in lobbying and sustaining funding for SRC-I, Gulf Oil did not do the same for SRC-II. In fact, Gulf's financial participation in SRC-II was minimal under the terms of its Cooperative Agreement with DOE. The evidence strongly supports the view that SRC-II was more of a true government initiative than an industry one. The R&D Department at Pittsburgh and Midway was interested in continuing research, but Gulf Corporate Headquarters had many other matters of much greater near-term financial relevance. Perhaps the greatest failure in the initiation and funding of the SRC-II project was that of the U.S. government in preferring to "sell" the virtues of the project to its prospec-

tive partners rather than to caution them about the magnitude of the risks involved.

In any event, the formation of the government-to-government partnerships and a companion international company with a serious interest in, and ownership of, resulting Intellectual Property Rights was a classic case of how to put such a project together, equitably and creatively, on an international scale. The good work and harmonious beginning (including an international Board of Directors and an international Project Team housed in DOE Headquarters) was soon to be impacted by a political change and by technical bad news.

President Reagan came into office in January of 1981 with a return to a Republican Administration and a new energy policy mandate. The new view adopted by the President was that there was no energy problem that required other than the operation of market forces. The plan (which never proved feasible) was to abolish the DOE. In the meantime, the R&D program was to revert to "long-range, high-risk research," a phraseology that might well have embodied a political philosophy, but which was also seen by many as a convenient formula to call for the termination of any expensive pilot and demonstration plants. There was also a recommendation to abolish the SFC. However, this was allowed to continue with the view that only the most risk-free and financially secure projects would be accepted for support. Much of the detail of all of these matters was developed by Presidential advisors and the OMB rather than by President Reagan personally.

Officially, the ERDA/DOE pilot plants were not to receive any further government funding, and the demonstration plants (regardless of risk status) were to seek funding from the SFC. The resulting fate of several of the non-SRC projects is instructive. Both of the liquefaction pilot plants (H-Coal and EDS) gained additional non-federal funding from their sponsors, and continued through successful operation to accomplish the objectives for which they were built (perhaps justifying the Administration view that additional government funds were unnecessary). Similarly, Cool Water successfully engaged the SFC funding sources, was built, and operated successfully. Thus, two of the three projects involving Japanese participation proceeded successfully (although with some interim difficulties which were overcome). Another large demonstration plant (Great Plains) which had already received a loan agreement from DOE also proceeded, and is still operating in 1992. Memphis sought and failed to win SFC approval, resulting in its cancellation by its sponsors. Union received SFC approval and product purchase contracts, was built, and encountered technical difficulties in its operation, leading to eventual early shut down.

Thus, of the six non-SRC projects, only one (Memphis) failed to proceed. One of the five that did proceed (Union) was a technical and economic failure overall, although it did provide a large body of important and useful information relative to oil shale extraction and retorting. The remaining four, including two with Japanese participation, were successfully completed.

In addition to loss of Administration support, both SRC projects began to encounter serious technical difficulties in the process design stage (even prior to the onset of detailed design for construction). It developed that the underlying SRC process concept required many more steps and more complex steps than originally envisioned. Scale-up issues and solids handling also became a problem. Cost estimates began to rise rapidly as the design effort proceeded. The problem was much more serious than finding funds to handle a cost overrun. If the projects became too expensive, they would have no value whatsoever for their intended purpose in being built (even if they operated successfully) which was to establish a cost cap on the price of imported oil. In this respect, the Union project, which did not discover its cost/capacity problem until after operation began, is an analogous lesson in technology risks in proceeding to large scale facilities without sufficient prior verification of all key features. Both Cool Water and Great Plains successfully avoided most of the problems of this character which they might have encountered.

The SRC-I (U.S. industry) proponents correctly recognized that SFC support could never be achieved for their project, and, instead, lobbied the Democratic Congress successfully for a time for continued financial support. The activity was finally terminated when the baseline design was completed, and its cost found to be substantially in excess of the original estimates.

The SRC-II proponents were, as noted previously, mainly governments, without a strong U.S. industry proponent to engage the Congress. Not only did the U.S. government not desire to proceed (given the cost-cutting desire of the new Administration, combined with the projected further cost increases arising from the ongoing design work), but the same decision for much of the same reasons was also quickly reached by the Federal Republic of Germany. The Japanese government, on the other hand, had worked long and hard to build a Japanese consensus in support of the project. This consensus was so strong and so painfully built that it was nearly unthinkable to decide to dismantle it.

Accordingly, a considerable period of time passed in which the project was officially alive but actually dead in the eyes of two of its three international collaborators. Both Germany and the U.S. avoided pressing the point in order to try to allow for graceful Japanese withdrawal. Eventually, all three partners were able to agree, in the light of continuing new cost increase revelations from ongoing process design activity, that the project should be terminated by mutual and unanimous consent.

On October 23, 1981, the U.S. government shipped to Japan nearly sixty volumes of engineering information assembled as part of the SRC-II project. Still more information was provided subsequently.

Were the SRC-II projects successes or failures? Was Union a success or failure? R&D is an investment in information generation. Sometimes the information is negative rather than positive.

However, the R&D has still been successful, even though the answer obtained is not the answer hoped for.

If the SRC projects are seen as commercial adventures, they were massive failures. If they are seen as costly but desirable R&D, they truly repaid their investments to their sponsors.

While political changes heavily impacted the SRC projects along with the others, the fate of the other six projects suggest that such changes may have affected how they were implemented but not their ultimate success or failure. The underlying issues remained the degree of technical risk, the degree of underlying industry support in the host country, and the perceived value of the project relative to its cost.

For those deeply involved in SRC-II, it was and is a model example of a serious effort at effective international collaboration. The participants worked together harmoniously, the results were fully shared, and all participants remained sensitive to each others needs throughout the entire experience. Cool Water and EDS also support the view that effective partnerships can be put together and implemented successfully. Other successful fossil fuels international projects (the Grimethorpe Pressurized Fluidized Bed Test Facility with the United Kingdom and the Federal Republic of Germany under the sponsorship of the International Energy Agency) also come to mind.

Even the initial aversion of the new Republican Administration to demonstration plants could not withstand the test of time. President Reagan, and then President Bush, have in recent

years strongly supported the U.S. Clean Coal Technology Development Program with scores of such facilities funded in concert with industry, and using technology from around the world.

It remains true that shifting political winds in the United States constitute an issue which international collaborators must keep in mind. Such matters are not necessarily unique to the U.S., however, nor do they necessarily and automatically result in project failure. The potential for successful partnerships remains in place. There have been both successes and failures in the past; the same will be true in the future. The experience, to date suggests the continuing value of identifying and implementing bases of common interests and objectives. Where there is sufficient good will, good work will be done.

Application of U.S. Plutonium Policy to Japan Since India's Nuclear Test in 1974: Substance and Dynamics of its Evolution

Warren Donnelly

U.S. attempts to influence production and use of plutonium as a civil nuclear fuel, since India's test of a nuclear explosive in 1974 shocked the world into an awareness of the realities of nuclear proliferation, have several times caused friction in U.S. relations with its major partners -- Europe and Japan. The following analysis traces the general evolution of U.S. plutonium policy since the 1974 test. A central theme is that these U.S. policies have not discriminated solely against Japan; rather, they reflect the continuing interaction of U.S. attempts to pre-

vent the further spread or proliferation of nuclear weapons in a rapidly changing world with energy policies of advanced non-nuclear weapons states, especially those seeking to develop and use plutonium as a fuel for their nuclear power industries.

[The question of what to do with thousands of kilograms of plutonium from dismantled Soviet and U.S. nuclear weapons has added a new dimension to national and international policies for fuel use of this fissile material, but this issue goes beyond our concern here.]

The evolution of U.S. non-proliferation policy and its interaction with U.S. plutonium policy is a complicated story of interactions between the president, the congress, the U.S. nuclear industry, and many strongly motivated public interest groups and individuals. It is a story of starts and stops and redirection as the U.S. faced the reality that many nations did not share fears in some quarters of U.S. opinion over the risks of catastrophes if non-weapons states able to make plutonium were to use it to make these weapons, or that terrorists might steal plutonium to make crude nuclear explosives for terrorist acts or blackmail.

While the story begins in U.S. attempts to keep the secret of atom bombs in 1946, India's test of a nuclear explosive in 1974 rekindled world concern and led to the radical non-proliferation policies of the Carter administration and the enactment of the Nuclear Non-Proliferation Act of 1978. With this in mind, the

following review of the evolution of U.S. policy on commercial plutonium begins with the Nixon administration.

The Nixon Administration

India's test came shortly before the resignation of President Nixon which led to Vice President Ford becoming president. The initial response of the Nixon administration was muted. Secretary of State Kissinger briefly considered but decided against canceling a scheduled visit to India. Later the Nixon administration supported U.S. participation in the secret meetings in London that produced the voluntary nuclear suppliers guidelines, which remain active today. The guidelines, it will be recalled, apply to supply of facilities for reprocessing and call for restraint in the transfer of "sensitive facilities, technology and weapons-usable material," as well as encouraging alternatives to additional enrichment or reprocessing plants and application of IAEA safeguards to nuclear exports to non-NPT states.

The Ford Administration

The Ford administration, which took office in 1974, went further. Secretary of State Kissinger testified at a hearing of the Senate Committee on Government Operations in 1976 that "plutonium reprocessing plants abroad post the most immediate problems," and that the U.S. was making "the strongest representations" to nuclear suppliers to halt export of potentially dangerous nuclear facilities to sensitive areas such as Pakistan.

The Symington amendment. Also during the Ford administration, Congress enacted the Symington Amendment to the Foreign Assistance Act. This amendment mandated a cutoff of U.S. economic and military aid to countries that supplied or received equipment, materials or technology for reprocessing and enrichment unless, before delivery, it was agreed that all such items would be under IAEA safeguards and would be placed under multilateral auspices and management whenever available.

In the final weeks of his re-election campaign, President Ford issued a statement on policy and actions to control proliferation. Concerning plutonium, he called on all nations to join the U.S. "in exercising maximum restraint in the transfer of reprocessing...technology and facilities by avoiding such sensitive exports or commitments for a period of at least three years." Moreover, U.S. nuclear export policy would favor nations that are "prepared to forego, or postpone for a substantial period the establishment of national reprocessing...activities." As for domestic U.S. nuclear policies, the Energy Research and Development Administration (ERDA) was to change its policies and programs which "heretofore have been based on the assumption that reprocessing would proceed."

As for candidate Jimmy Carter, writing in the Bulletin of the Atomic Scientists, he called on all nations to adopt a voluntary moratorium on the national purchase or sale of enrichment and reprocessing plants.

The Carter Administration

The first year of the Carter administration, 1977, was strongly influenced by two significant reports. One came from the Ford Foundation's Nuclear Energy Policy Study Group, the other from the Congressional Office of Technology Assessment (OTA). Both argued against commercial plutonium because of dangers of theft or diversion, and because uranium was a cheaper fuel in ample supply. The Ford Foundation report recommended that reprocessing should be deferred indefinitely and no effort be made to subsidize completion or operation of existing facilities. Also, the U.S. should work to "reduce the cost and improve the availability of alternatives to reprocessing worldwide and seek to restrain separation and use of plutonium."

OTA was more blunt in its report, saying:

> Because they provide access to bomb-grade nuclear material, reprocessing technologies and facilities have been the focus of much recent attention. It is generally agreed that the diffusion of reprocessing plants will significantly increase the opportunity of proliferation.

President Carter's nuclear policy statements. As a new president, President Carter moved quickly and dramatically onto the stage of non-proliferation policy. His statement of April 7, 1977 reiterated his concern over risks from the spread of sensitive nuclear technologies. He then announced his decision to defer indefinitely the commercial reprocessing and recycling of pluto-

nium in the U.S., a restructuring of the U.S. breeder program to give greater priority to alternatives and to defer the date for commercial operation of breeders, and to continue to embargo the export of equipment or technology for enrichment and reprocessing. A few days later, on April 27, 1977, he announced that his administration would avoid new commitments to export significant amounts of separate plutonium except for gram quantities for research and analysis.

Senator Kennedy's visit to Japan. While visiting Japan in 1978, Senator Edward Kennedy opposed commercial use of plutonium. Speaking to the Japan-America Society at Hiroshima University, he said, in part:

> Still facing Japan and the United States is an extremely serious issue of the direction of our nuclear energy policies. If we decide to use sensitive nuclear materials, particularly plutonium, for commercial purposes, then I fear that other countries will follow suit. The resulting damage of our non-proliferation efforts could be great, even irreparable.
>
> Most importantly, my colleagues and I feel that commercial production of plutonium would be an extremely bad example to set. Taiwan and South Korea have decided not to produce or use plutonium. They deserve credit for agreeing not to do so.

The Glenn-Symington amendment. In 1977 Congress went further in Senator Glenn's amendment to the Symington amendment. The

revised law required cut-off of U.S. economic and military aid to any state which

> delivers nuclear reprocessing equipment, materials, or technology to any other country or receives such equipment, materials, or technology from any other country...or is a non-nuclear weapons state which... exports illegally (or attempts to export illegally) from the United States any material, equipment, or technology that would contribute significantly to the ability of such country to manufacture a nuclear explosive device.

However, the president could waive this cutoff if he determined and certified to Congress that the termination would be "seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security."

The Nuclear Non-Proliferation Act of 1978. The high-water mark for U.S. non-proliferation and anti-plutonium policy came when Congress passed the Nuclear Non-Proliferation Act (NNPA) of 1978 with the active support of the Carter administration.

Policy. In the NNPA Congress found and declared that:

> the proliferation of nuclear explosive devices or of the direct capability to manufacture or otherwise acquire such devices poses a grave threat to the security interests of the United States.

Criteria for reprocessing and timely warning of diversion. The NNPA codified past policy and practice by requiring government authorization for the reprocessing of spent fuel containing U.S.-supplied special nuclear material, or its transfer for reprocessing in a new reprocessing plant in a third country (at the time, COGEMA in France was expanding its reprocessing plant) unless the Secretaries of ERDA and State determined that:

> ...such reprocessing or retransfer will not result in a significant increase of the risk of proliferation beyond that which exists at the time the approval is requested. Among all the factors in making this judgment, foremost consideration will be given to whether or not the reprocessing or retransfer will take place under conditions that will ensure timely warning to the United States of any diversion well in advance of the time at which the non-nuclear weapons state could transform the diverted material into a nuclear explosive device.

No bar to reprocessing. Congress exercised some restraint concerning reprocessing limitations and gave the executive branch some latitude in administering its arrangements for nuclear cooperation (i.e., "subsequent arrangements") when it provided that "Nothing in this section is intended to prohibit, permanently or unconditionally, the reprocessing of spent fuel owned by a foreign nation which fuel has been supplied by the United States..." (92 STAT. 129).

The Reagan Administration

A policy of discrimination. The Reagan administration was more relaxed about commercial plutonium. His statement on U.S. nuclear non-proliferation policy of July 16, 1981 said the U.S. would "continue to inhibit the transfer of sensitive nuclear material, equipment and technology, particularly where dangers of proliferation demands." However, his administration "would not inhibit or set back civil reprocessing and breeder reactor development abroad in nations with advanced nuclear power programs where it does not constitute a proliferation risk." Subsequently, in his October 12, 1981 statement on nuclear energy policy, he announced the lifting of the previous ban on domestic commercial reprocessing. The U.S. nuclear industry did not, however, choose to reenter the reprocessing arena. The economics of pursuing that path no longer were persuasive; and there existed considerable uncertainty regarding the commitment of the US Government to maintaining a consistent policy on this matter.

Long-term authorization for Japan. In June 1982 the Reagan administration approved a "modified and limited approach" towards reprocessing and subsequent use of the plutonium subject to U.S. consent rights. According to the State Department:

> Specifically, we are offering Japan and the countries of EURATOM new, long-term arrangements for implementation of U.S. consent rights over the reprocessing and use of material subject to our agreement for peaceful nuclear cooperation. This advance long-term approval

would apply only for facilities and activities which we determine meet our strict statutory criteria.

In July 1985 the Reagan administration further explained its plutonium-use policy as follows:

> The Reagan Administration recognizes full well that plutonium is a dangerous material, the use of which must be carefully controlled and safeguarded. The President has categorically reaffirmed our commitment to inhibiting the transfer of sensitive nuclear material where the danger of proliferation requires restraint. We believe that sensitive nuclear facilities and activities should be limited to those countries where their presence results in no significant risk of proliferation. We have urged that this view be accepted as an international norm.

No civil U.S. plutonium for military purposes. The great expansion of the U.S. nuclear arsenal begun by the Reagan administration put pressure on plutonium supplies. To prevent civil plutonium from being upgraded and used for weapons, in 1983 Congress enacted the Hart-Simpson amendment to the Atomic Energy Act of 1954 to prevent the transfer of such plutonium for this purpose.

The Bush Administration

The Bush administration has continued the Reagan policy of opposing production of plutonium by states without advanced

nuclear programs, although the limitations of that approach were revealed in 1991 by Iraq's clandestine nuclear weapons effort. Two negative policy decisions in 1989 were the administration's decision not to continue funding of a long-planned facility to separate plutonium isotopes and not to start a pilot model of this process at DOE's Lawrence Livermore Laboratory. Development of this process would make all plutonium of whatever isotopic content a source material for weapons grade material. This action was seen as a victory for arms control and non-proliferation interests.

President Bush's annual non-proliferation report to Congress for 1991 mentioned plutonium twice. It notes cooperative U.S.-Japanese efforts for application of safeguards to the Plutonium Fabrication Facility (PFPF), which produces mixed oxide fuels, and to develop effective safeguards for the new large Japanese reprocessing plant at Rokkasho-mura in northern Honshu. Also, through an agreement between the Power Reactor and Nuclear Fuel Development Corporation (PNC) and the U.S. Department of Energy, PNC is funding the development by DOE laboratories of instruments for IAEA use at the PFPF. Non-destructive assay (NDA) instruments are also being developed and fabricated at the Los Alamos National Laboratory. In addition, PNC is funding work by Sandia in the design of containment/surveillance devices. One new project expands the DOE/PNC effort into a different Japanese facility -- the Plutonium Conversion Development Facility (PCDF) -- to develop remote-controlled NDA safeguards techniques for process

holdup. Remote-controlled safeguards instrumentation was also developed and installed at the fast breeder reactor JOYO in 1991, and a similar system should be available for the fast breeder reactor MONJU in 1992.