

FORMULATION OF A POSSIBLE ADVANCED REACTOR LEGISLATIVE
STRATEGY AND PROPOSAL

LEGISLATIVE INITIATIVES TAKEN TO DATE

A number of initiatives have been taken to date regarding the formulation of legislation to support in various ways the DOE advanced nuclear reactor program. Among the more prominent of these are bills that have been introduced by Sen. Johnston (D-La) and Rep. Udall (D-Az) as well as a draft bill put together by the nuclear industry and that could be introduced by Rep. Stallings (D-Id). These legislative initiatives are attached to this paper.

The Johnston bill, which was introduced in the Senate last year (Johnston is planning to introduce a new version shortly), recognizes an important role for nuclear fission in supplanting fossil energy. It therefore calls on DOE to conduct a comprehensive R&D program for nuclear power generation, and authorizes some appropriations for such a program although the funds authorized (\$500 million) appear woefully inadequate and would amount to less than a third of the cost of a lead demonstration MHTGR or LMR. Moreover, in past statements presenting the bill Johnston has asserted that the light-water reactor needs to be replaced, but this bias is not reflected in the text of the bill per se.

The Udall proposal, which was introduced both last year and this year, calls for the development of a new plan to carry out a "standard reactor program," implicitly recognizing the importance of advanced U.S. reactor technology in helping meet future U.S. energy needs. However, the bill is detailed and prescriptive in nature in specifying the criteria that future reactors would have to meet, the text is explicitly pejorative about current light water reactors, and it sets forth new conditions for the DOE program but is silent on the authorization of funds, etc. It places

new requirements on DOE but does not give the Agency new benefits or greater flexibility to execute the R&D program.

The draft Stallings bill also advocates a significant role for nuclear energy in meeting future electric generating requirements, and it leaves room in the DOE R&D program for all concepts that represent improvements over currently deployed reactor technology, including the evolutionary advanced light-water reactor, the simplified passive light-water reactor, and the more revolutionary high-temperature gas-cooled reactor and the liquid metal reactor. However, the Stallings bill has few tangible goals, simply requiring the Secretary of Energy to prepare an "overall, integrated plan for the development of advanced nuclear reactors," and to establish a technical panel on Advanced Nuclear Reactor Development within the Energy Research Advisory Board that would make recommendations on the advanced reactor plan and the resulting R&D program.

POSSIBLE DESIRABLE CRITERIA FOR A BILL TO SUPPORT ADVANCED REACTOR RESEARCH

General Points

- The bill would recognize (in preambular parts) the importance of nuclear power in helping to meet U.S. energy needs - assuming reactors can be deployed and operated in a safe, economic and environmental manner.
- The text should avoid any pejorative references to the past performance or adequacy of existing light-water reactors. At the same time it should stress the importance of continuing to advance U.S. reactor technology in the interest of improving the safety, competitiveness and attractiveness of nuclear power and preserving U.S. technological leadership and international influence.

- In this regard, it should underscore the importance of preserving an active advanced reactor R&D program as part of the on-going DOE program under stable conditions that will facilitate the development, construction and operation of appropriate demonstration reactor projects.
- The bill should be technologically neutral between generic reactor types. In other words, it should be susceptible to giving endorsement to:
 - the advanced light water reactor program (including both the nearer term evolutionary designs and the proposed passively safe mid-size version of the ALWR);
 - the on-going development of the MHTGR; and
 - the on-going support of the LMR.
- While the text might enunciate some general criteria to be met by the next series of reactors these should not be overly prescriptive or detailed to the point of putting the DOE advanced reactor program in an undesirable straight jacket.
- The text also should give endorsement to the concepts that standardized designs should be introduced into the U.S. nuclear power program and that continued efforts should be made to further rationalize and improve the NRC licensing process by moving to combine the issuance of construction and operating licenses.
- The bill should really make a difference at the policy, program and budgetary level in fostering advanced reactor R&D, including demonstration projects. (In other words, it should have an operative effect and not be just hortatory.)

- It also should not be disruptive to existing desirable DOE R&D activities.

Possible Detailed Features

1. Enunciate criteria to be met by the next generation or generations of reactors, but not in overly detailed terms.
2. Call upon the Secretary of Energy to prepare a long-term strategic plan that would take into account or conform to the forementioned criteria. From a broad perspective, the plan would recommend desirable steps designed to promote the revitalization of nuclear power within the United States - including the nature of the advanced reactor program that the Federal Government and the private sector should be encouraged to pursue over the next few decades.
3. Call upon the Secretary of Energy to make suitable recommendations to the Congress pertaining to the establishment of a special fund to be employed for the support of advanced reactor development and demonstration in the United States. The fund would be expected to provide for or include:
 - support of a demonstration reactor project or projects meeting specified technical, safety, economic, waste handling and non-proliferation criteria;
 - a requirement that there would be an equitable sharing of the agreed estimated costs of any demonstration projects between the private sponsors and DOE. Unless otherwise approved by the Secretary of Energy, it would be assumed that the private sponsors would enter into funding agreements to bear at least 50% of the total estimated cost of an approved project. All proposed projects would be submitted to Congressional review for a 30 day period.

- a provision that all or a portion of the Government's contribution could be made available on a "no year" funding basis - namely the Government's cash contribution could be available until spent. (Would help assure constancy in Government support of a project).
- a provision that a mutually agreed fraction of the DOE contribution to a project could be in the form of a financial bonus if a project meets or betters previously agreed upon performance criteria.
- a provision that the parties could set aside an agreed fraction of their contributions to a project to help cover the costs of any unanticipated major new modifications imposed by the USNRC on a DOE approved demonstration project after it receives an NRC construction permit. (Concept of indemnifying the private parties against unexpected change).
- possible provisions aimed at encouraging simplification of the NRC licensing process (commending standardized design as well as "one step" licensing).

To be meaningful it is suggested that at least \$1 billion in incremental Federal monies be authorized to be allocated to DOE selected demonstration projects over a 7 to 10 year period.

Comment/Question

One basic question is whether any bill should be broadly pitched to the "revitalization" of nuclear power or more limited to the support of the demonstration of advanced reactor concepts.

HYPOTHETICAL BILL IN SUPPORT OF THE DOE ADVANCED REACTOR PROGRAM

Basic Thrust

The following text of a hypothetical bill in support of the DOE advanced reactor program attempts to not only give the DOE advanced reactor development program hortatory support (as reflected in the draft Stallings bill) but also a tangible specific boost by calling for the establishment of a reactor demonstration program, and by authorizing funds for this specific purpose. This proposal attempts to be supportive of all three advanced reactor types (advanced light-water reactor, liquid metal concepts and the HTGR) and to the concept of expediting the NRC licensing process through the certification of standard designs.

It should be noted that this draft has been deliberately written in a fashion designed to accommodate the interests of various factions that have surfaced proposals related to legislation on the advanced reactor program. In other words, it is an attempt to be an overall compromise that incorporates the views (as expressed by past proposals) of different elements. It thus does not contemplate a "shoot out" between different competitive reactor types. This admittedly adds to the length of the proposed bill.

More specifically, it draws on the "findings" section of the Stallings bill, (but does not call for the establishment of a new technical panel as called for by that bill), it contemplates a program of tangible assistance to demonstration reactors as contemplated in the earlier Johnston bill, and incorporates a number of the ideas of Dan Meirs, the head of Gas-Cooled Reactor Associates.

Special attention is called to the section of this draft (Section 3f) that deals with the proposed establishment of a new special

fund to include all DOE civilian advanced reactor work - including DOE support of a lead demonstration civilian MHTGR plant. It will be noted that some of the proposed language in this section appears as an alternative with the title "Special Funding Arrangements for a Modular High-Temperature Gas Cooled Reactor". The author of this informal paper has some reservations as to how much of this detailed information should be included in the body of any proposed legislation itself for two reasons. First, the inclusion of such details tends to reduce the flexibility of the parties involved to agree to alternate arrangements. Second, the inclusion of so much material on the modalities for financing a lead MHTGR could serve to give the entire bill the cast of being a basically MHTGR proposal - which could be a liability.

Hypothetical Bill

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

Short Title

Section 1. Short Title - This act may be cited as the "Advanced Nuclear Reactor Research, Development and Demonstration Act of 1989."

Findings and General Policy

Section 2. Findings

(a) The Congress, recognizing that a clear and coordinated policy consistent with public health and safety is required for the development of future commercial electric power, finds and declares that --

- (1) Electricity demand growth and the growth of the U.S. economy are directly linked. To aid future economic growth, and to replace aging facilities, substantial new electrical generating capacity will be needed.
- (2) Although fossil fuels will continue to play a major role in future power generation needs, there is growing concern over the environmental effects of burning fossil fuels.
- (3) The continued buildup of carbon dioxide and other trace gases, in the global atmosphere constitutes a potential environmental threat of unparalleled proportion. Scientific opinion varies on the future consequences of a continued buildup, but it is an appropriate time now, through research and development

programs, to address the problem before it reaches a crisis stage.

- (4) In addressing a problem of the scale of the environmental effects of burning fossil fuel, no single technology is likely to be sufficient. Conservation and all practical technologies for electricity production, including advanced nuclear power, will be needed.
- (5) National security is served by increasing U.S. generating capacity without increasing the dependence on foreign oil.
- (6) Nuclear power can be used in a safe, reliable manner as an economical source of electrical power, and it is essential that acceptable forms of nuclear power be available among the range of energy options for future electrical generating capacity.
- (7) The technology available today for nuclear power generation, represented by the Light Water Reactor, is a mature one, based on thousands of reactor-years of operating experience.
- (8) Advanced nuclear reactor concepts and designs are being developed which represent improvements over the reactors available today. Among these are the evolutionary advanced light water reactors, the simplified passively safe light water reactors, and the more revolutionary high-temperature gas-cooled reactors and liquid metal reactors.
- (9) These advanced nuclear reactor alternatives can be complementary to each other in the role they can play in meeting future energy needs. They also are at different stages of development and readiness for

commercial application, standardization of designs and certification by the U.S. Nuclear Regulatory Commission.

- (10) The standardization of reactor designs should serve to facilitate timely licensing plus improved economics of construction, operation and maintenance of facilities.
- (11) For those advance reactor concepts that will be successfully demonstrated as concepts that evolve from technology available today and which require no demonstration, there is a need to promote activities that will facilitate the regulatory certification of designs and use of such designs in license applications.
- (12) A certification process that encourages early public participation and permits timely resolution of all safety issues, prior to construction, and that leads, barring a significant change in circumstances, to implementation of a one-step licensing procedure by the Nuclear Regulatory Commission, will enhance public health and safety and provide stability and predictability to the licensing process.
- (13) It is a proper role for the Federal Government to conduct a research and development and demonstration program in advanced nuclear reactor technology.
- (14) There is a need for an overall plan to assure that activities necessary for the development of advanced nuclear reactor technologies are conducted in an integrated manner reflecting the state of development of alternative technologies and the potential of each to address the key issues that are barriers to nuclear reactor deployment.

(b) It is therefore declared to be the policy of the United States and the purpose of this Act to conduct an integrated national effort in research and development activities related to advanced nuclear reactor technology. Further, it is declared to be the policy of the United States and the purpose of this Act that the objective of such an advanced reactor program shall be --

- (1) to promote an integrated program ranging from basic research to larger-scale development; and, if needed to the demonstration of advanced concepts provided that the development activities have been successful, and provided that appropriate cost-sharing arrangements with private sponsors can be developed;
- (2) to promote, as appropriate, the certification of standard designs that reflect a readiness for licensing;
- (3) to ensure that advanced reactor options that might contribute significantly to relieving an atmospheric buildup of carbon dioxide have a central role in the program;
- (4) to emphasize the importance of enhanced nuclear reactor safety in the design and development of advanced reactor systems;
- (5) to emphasize the desirability of developing improved nuclear waste forms associated with the development of alternative advanced nuclear reactor technologies;
- (6) to foster cooperation in advanced reactor research and development among government, universities, industry, and national laboratories; and

- (7) to continue international cooperation in the development of advanced nuclear reactor technology and to maintain the United States as a world leader in this development.

Program

Section 3. Research, Development and Demonstration Program

- 3(a) Criteria. The Secretary of Energy shall carry out a comprehensive program of research and development of technologies for the generation of commercial electric power from nuclear fission that to the maximum extent practicable:
- (1) are cost effective in comparison to alternative sources of electricity of comparable availability, reliability and impact on the rate and scope of global climate change;
 - (2) exhibit passive safety and investment protection features that make for an insensitivity to operator errors as well as equipment failures and that are compatible with the policy statements of the Nuclear Regulatory Commission pertaining to advance reactors, severe accidents and safety goals;
 - (3) are adaptable to standardized construction and licensing;
 - (4) permit the application of modular design techniques;
 - (5) help minimize the volume of nuclear waste produced and the cost of nuclear waste disposal;

- (6) involve the use of fuel cycles that present a nuclear proliferation risk determined by the Department of Energy in consultation with the Arms Control and Disarmament Agency and the Nuclear Regulatory Commission to be no greater than those currently in prevalent use [Note: Possible alternate text: "to be no greater than is represented by a light water reactor fuel cycle in which spent fuel is not reprocessed"]*;
- (7) are anticipated to maximize acceptance by the public, the financial community, utilities, state utility regulators, and the Nuclear Regulatory Commission;
- (8) are to be employed in a definable development and demonstration program which, preferably provides for a predictable closeout or phase down in the need for government support;
- (9) involve, in the case of demonstration projects, the participation of experienced and capable private sponsors with a willingness to share a significant portion of the costs and risks related to the development or design and construction of demonstration projects.

3(b) Program Plan. The Secretary of Energy shall prepare an overall, integrated program plan for the development

* An issue to be considered in reviewing this text which comes from some bills that already have been tabled is whether the IFR fuel cycle can be posing no greater risk than the LWR operating on a once through fuel cycle.

of advanced nuclear reactors that will be consistent with the findings of Section 2 and criteria of Section 3(a) of this Act. The Secretary may consult with the Energy Research Advisory Board, or any special sub-groups of that Board, in the preparation of the program plan.

The Secretary shall submit on an annual basis, a report to the Congress on the program including up-dates of the plan as necessary as well as analysis of the progress being made toward realizing the objectives of the plan, for use in the consideration of authorization requests by the Department of Energy and other departments or agencies.

3(c) Disposition of Existing Programs and Facilities.

- (1) Within six months after the date of the enactment of this Act the Secretary of Energy shall report to Congress on the recommendations of the Secretary as to the disposition of programs and facilities of the Secretary in existence on such date of enactment for research, development and demonstration of technologies for the generation of commercial electric power from nuclear fission that will be replaced by the program under subsections (a) and (b).
- (2) The Secretary may implement any of the recommendations under paragraph (1) that have not been disapproved by Congress by law within one year after the report under paragraph (1) is received by Congress.

3(d) Solicitation of Proposals. The Secretary of Energy shall:

- solicit proposals, on a time scale consistent with the plan, for one or more advanced nuclear demonstration projects that exhibit the characteristics set forth in sub-section 3(a) of this Act; and
- participate in such projects if acceptable proposals are submitted.

3(e) Special Fund and Appropriations. A special fund is authorized to be appropriated to carry out the purposes of the Act. There is authorized to be appropriated for this fund for the fiscal year beginning on October 1, 1990 not more than \$100,000,000, for the fiscal year beginning on October 1, 1991 not more than \$100,000,000, for the fiscal year beginning on October 1, 1992 not more than \$150,000,000, for the fiscal year beginning on October 1, 1993 not more than \$150,000,000, for the fiscal year beginning on October 1, 1994 not more than \$200,000,000, for the fiscal year beginning on October 1, 1995 not more than \$200,000,000, for the fiscal year beginning on October 1, 1996 nor more than \$200,000,000, for the fiscal year beginning on October 1, 1997 not more than \$200,000,000 and for the fiscal year beginning on October 1, 1998 not more than \$200,000,000.

3(f) General allocation of resources. An appropriate portion of the funds available under subsection 3(e) shall be used to:

- provide the maximum of \$_____⁽¹⁾ each for

(1) Meirs suggested \$50,000,000.

completing the certification of two qualifying advance light water reactor designs selected by the Department of Energy and on the condition that the private sponsors of the projects shall contribute at least half of the agreed total qualifying costs through fiscal year 1995;

- provide a maximum of \$_____ (2) for the continued development through fiscal year 1988 of a preliminary reference design and demonstration of a reference liquid metal reactor design and its associated fuel cycle and supporting technology;
- provide a maximum of \$_____ (3) for the continued design, licensing and technology development in support of a lead demonstration project of a modular high temperature, gas-cooled reactor on the condition that the private sponsors shall contribute at least 45% (4) of the agreed total project costs through fiscal year _____.

(Note: Possible Elaboration of Section 3(f). Special Funding Arrangements for a Modular High-Temperature Gas-Cooled Reactor

Subject to the selection of a suitable proposal for a modular high temperature gas-cooled reactor and evident commitment by one or more sponsors in the private sector to firmly support a lead demonstration project during design construction and operational phases, the

- (2) Meirs suggested \$300,000,000.
- (3) Meirs suggested \$850,000,000 total Government contribution plus \$150,000,000 contingency provision.
- (4) This assumes I understand the numbers Meirs has proposed correctly.

fund would provide the following forms of assistance to the project at various stages:

- For the period prior to the issuance of a construction permit or through the fiscal year beginning October 1, 1993 or whichever comes last, the fund would contribute a maximum of \$_____*
- for the continued design, licensing and technology development in support of the selected project and subsequent certification of design by the Commission. This would be on the basis that at least 25% of the agreed total costs incurred during this period for these purposes would be paid by the private sponsors of the project and the balance by the Government.

- For the period covering the final design, construction, manufacturing and start-up operations of the lead plant the Fund would provide a maximum of \$_____million to the project. This would be on the basis that the private sponsors would contribute at least 50% of the agreed project costs during this period and that the Government would provide the balance of funding. In order to provide the equivalent risk protection established through certification, the Fund will have a \$150,000,000 contingency provision that covers cost increases due to Government policy and regulatory changes that take place between the Lead Plant Construction Permit and Commercial Operating License.

- The fund would provide a maximum of \$_____ (5) to the lead project in support of certification by the Nuclear Regulatory Commission of the final design for the project. These funds

would be made on the basis that the Government would not contribute more than 25% to the certification of the final design with the necessary balance coming from the private sponsors of the project. These funds would be made available for four years after the application for certification is filed with the Nuclear Regulatory Commission.

- 3(g) Retrospective Costs. Retrospective cost contributions from sponsors of a project supported through the Fund shall not qualify for the purpose of calculating required cost sharing contributions.
- 3(h) Indemnification for Project Cancellation. At any time, the unspent authorized Fund shall be available to reimburse the Project sponsors to the limit of their expenditures in case the Department of Energy cancels support for any Project, as prescribed herein.
- 3(i) Payment of Royalties. The Government shall recoup a portion of its cost, up to the limit of full repayment, through a royalty fee equal to one million dollars per 200 MWt of installed capacity of certified plants, paid at the time of commercial operation, for a period of ten years from the date of certification.
- 3(j) No Year Funds. Any amounts appropriate for the fund shall be made available until expended.
- 3(h) Report by Secretary of Energy to Congress. In his special annual report to Congress called for by Section ____ of this Act the Secretary of Energy shall:
- 1) Summarize the scope and objective of the selected projects, assisted by the Fund;

- 2) Identify any issues which have or are likely to have a significant effect on the cost or schedule of selected project; and
- 3) Provide an assessment of the effectiveness of the NRC licensing process as it applies to projects assisted by the Fund.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.