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FEDERAL SUPPORT OF DOMESTIC ATOMIC POWER DEVELOPMENT—THE POLICY ISSUES

JAMES L. MORRISSON*

INTRODUCTION

The possibility that controlled nuclear fission could produce useful energy was recognized early in 1939.¹ During World War II developmental effort was focused on production of the bomb. Since the war, the U. S. atomic power program has grown to substantial proportions. By June 30, 1958, there were in operation in the United States one full scale civilian power reactor and seven civilian power reactor experiments, with a total rated electrical capacity of over 77,000 kw, as well as a number of military propulsion reactors and reactor experiments. There are currently planned fourteen power reactors in addition to the one now in operation. These present plans, if fully carried out, would result in a U. S. nuclear power capacity of over 1,300,000 electrical kilowatts by the end of 1963.²

Policy decisions concerning the domestic atomic power program typically reflect the interaction of a number of sometimes conflicting considerations. These include technical considerations such as the optimum size, type and location of reactors, the relative emphasis on construction of prototype power plants as compared with basic research and development, the proper timing of prototype construction, and the optimum use of scientific manpower; fiscal considerations such as the overall permissible level of federal expenditures; political considerations such as the desirability of public or private ownership of nuclear power stations and the proper allocation of responsibility between the executive and legislative branches; and foreign policy considerations such as the need to protect the competitive position of American reactor manufacturers in foreign markets, and the importance of establishing or maintaining American primacy in nuclear engineering as a matter of national prestige and as a means of demonstrating our determination to use atomic energy for peace and not war. Personalities have sometimes played a major role. It is not surprising that the debate on these issues has at times been both heated and confused.

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1. See SMYTH, *ATOMIC ENERGY FOR MILITARY PURPOSES* 24-25, 31 (1945). On May 1, 1939, three French scientists filed an application for French patent for a nuclear reactor for the production of energy. See Application of Commissariat à l'Énergie Atomique, AEC Patent Compensation Board, Docket No. 18.

2. 23 AEC SEMIANN. REP. 93, 335-36 (1958). This would amount to about ½ of 1% of total electric generation capacity. *ATOMIC INDUSTRIAL FORUM, INC., A GROWTH SURVEY OF THE ATOMIC INDUSTRY*, 1958-68, at 25 (1958).

The central fact is that nuclear power plants now in operation are high cost plants, and that predicted power costs for plants now under construction are substantially in excess of costs of efficient conventional plants.³ The AEC has set, as a target which it believes optimistic but feasible at the present rate of effort, the achievement in ten years of nuclear power costs which will be competitive in some parts of the United States.⁴ The staff of the Joint Committee on Atomic Energy has set a comparable goal.⁵ Presumably, it would take an appreciably longer period of time before nuclear costs were enough lower than conventional costs to result in any measurable savings to power consumers. From the domestic point of view the nuclear power program as presently conducted will, under these estimates, be a burden on the economy for something like ten years; it will not begin to produce measurable benefits for some time after that.

This central fact has become increasingly evident during the past year or so. In 1954 and 1955 there was some tendency to feel that competitive nuclear power in the United States was just around the corner; many of the "first generation" of demonstration power plants were initiated on the basis of rosy cost estimates, which have risen very substantially as the hard realities of the complex engineering task involved began to be apparent.⁶

Thus it is now clear that the major problem for perhaps the next ten years is to provide for the performance of the necessary research and development and to decide how the heavy cost burden of that research and development should be shared. During that stage, con-

3. See, e.g., ATOMIC INDUSTRIAL FORUM, INC., A GROWTH SURVEY OF THE ATOMIC INDUSTRY, 1958-68, at 25 (1958); *Proceedings of a Conference sponsored by Atomic Industrial Forum, Inc. and National Industrial Conference Board, MANAGEMENT AND ATOMIC ENERGY*, 348-66 (July 1958); NUCLEONICS 47, 49 (Jan. 1958). As is often pointed out, these estimates of costs of plants not yet operated are subject to a wide margin of error. E.g., Roddis, *How Nuclear Cost Estimates Are Made*, MANAGEMENT AND ATOMIC ENERGY 265-70 (July 1958); NUCLEONICS 47, 49, 50-53 (Jan. 1958). Dr. Lane, of the Oak Ridge National Laboratory, estimates present nuclear power costs at 10 + or - 6.5 mills per kwh. NUCLEONICS 47 (Jan. 1958).

4. JOINT COMMITTEE ON ATOMIC ENERGY, 85TH CONG., 2D SESS., AUTHORIZATION HEARINGS 215-16 (1958); see Bibliography, p. 243 *infra*. Commissioner Vance explained that by "competitive" he meant that a utility, deciding to build a plant ten years from now, could conclude that it would achieve costs over its lifetime that would be as cheap as those of a conventional plant in areas of relatively high cost conventional power. *Id.* at 215, 222-23.

5. JOINT COMMITTEE ON ATOMIC ENERGY, 85TH CONG., 2D SESS., PROPOSED EXPANDED CIVILIAN NUCLEAR POWER PROGRAM 1 (Comm. Print 1958) set the goal "to demonstrate economically competitive nuclear power in the United States by 1970." Since the AEC objective refers to the date when the decision to construct a plant is made, while the JCAE objective refers to the date when a plant has been in operation long enough to demonstrate power costs, the Joint Committee on Atomic Energy target date is, if anything, a year or two earlier than AEC's.

6. See, e.g., ATOMIC INDUSTRIAL FORUM, INC., A GROWTH SURVEY OF THE ATOMIC INDUSTRY, 1958-68, at 31 (1958); MANAGEMENT AND ATOMIC ENERGY, *supra* note 3, at 265-70.

cern with subsidies, or with competition between public and private power, for example, should be secondary. On the other hand, at such times as nuclear power becomes more economical than conventional power, the question of how the benefits of this new development should be shared will become dominant. There may at times have been a tendency to allow jockeying for position, looking toward a situation which perhaps may arise ten years hence, to distract attention from, and interfere with, performance of the immediate task of research and development.⁷

In considering the particular issues discussed below, this distinction between immediate and long-range problems needs to be kept constantly in mind.

THE BASIC STATUTORY FRAMEWORK

The Atomic Energy Act of 1954⁸ reflects certain fundamental decisions which established guide posts for atomic power development. The full scope and meaning of those decisions, and the importance of the problems still to be resolved, will become more apparent in the light of the discussion in subsequent portions of this article.

(1) *Surrender of the Government Monopoly*: Atomic Energy in the United States originated as an exclusive federal government monopoly. The 1954 act, by removing the legal prohibitions against private ownership of nuclear reactors, made possible an industrial atomic power program. It declares the policy that the development of atomic energy shall be directed so as to "strengthen free competition in private enterprise"⁹ and it permits private persons, under license, to own and operate reactors and possess fissionable material.¹⁰ The legislative history emphasizes the importance which Congress attached to a vigorous industrial program of atomic power development.¹¹

7. "The injection of the public-private dispute into the atomic field at this time is unnecessary and unfortunate. During the period of the next years when the best that can be expected is uneconomic demonstration projects, public and private power agencies have a common, not a conflicting, interest in the program. A truce is possible on terms which will not prejudice the respective role of private and public power groups and which will not inhibit either group in its stand on the broad principle of the proper roles of government and industry in a democratic society." Final Report of the Twelfth American Assembly, Arden House, Columbia University, Reprinted in *ATOMS FOR POWER: UNITED STATES POLICY IN ATOMIC ENERGY DEVELOPMENT* 155 (Arden House Report) (1957).

8. 68 Stat. 919 (1954), 42 U.S.C. §§ 2011-281 (Supp. V, 1958).

9. 68 Stat. 921 (1954), 42 U.S.C. § 2011(b) (Supp. V, 1958).

10. 68 Stat. 936 (1954), 42 U.S.C. §§ 2073, 2133-34 (Supp. V, 1958).

11. "[W]e do not believe that any developmental program carried out solely under governmental auspices, no matter how efficient it may be, can substitute for the cost cutting and other incentives of free and competitive industry." H.R. REP. No. 2181, S. REP. No. 1699, 83d Cong., 2d Sess. (1954).

During the consideration of the 1954 act this decision was unsuccessfully challenged as premature, in the absence of a comprehensive report and study

The surrender is, however, incomplete. Not only is industrial atomic power development subject to federal licensing regulation; it is intimately bound up with and profoundly affected by, the policies and activities of the federal government taken in its proprietary capacity as the exclusive owner of fissionable materials and the sole or principal supplier or purchaser of important materials and services.

(2) *Continued Federal Support of Atomic Power Development:* The act, however, does not abandon the atomic power field to industry. It authorizes and directs the AEC to arrange for the performance of research and development relating to the use of atomic energy for "the generation of usable energy, and the demonstration of the practical value of [reactors] for industrial or commercial purposes," either "through its own facilities" or "by private or public institutions or persons." Continued performance of research and development by the AEC was deemed indispensable.¹²

(3) *No AEC Control of Utility Accounts or Rates:* In surrendering the federal monopoly over a technology developed with federal funds, and in licensing private ownership of reactors, Congress could have required that the licensee submit to federal accounting control and rate regulation to ensure that the benefits of the lower costs anticipated from the new technology were passed on to consumers. However, the act confers no such authority; it preserves the normal jurisdiction of federal, state and local agencies over rates, accounting, and financial practices.¹³

(4) *No Federal Commercial Power Sales:* The 1954 Act was a defeat for proponents of federal generation and distribution of atomically produced power on a commercial basis as a form of competition to bring private rates down—an "atomic TVA."

of its social, political, economic and international effects. *E.g.*, *Minority Views of Congressmen Holifield and Price*.

12. 68 Stat. 927 (1954), 42 U.S.C. §§ 2051, 2061 (Supp. V, 1958).

13. 68 Stat. 936 (1954), 42 U.S.C. §§ 2133(b), 2018-19 (Supp. V, 1958); see also 68 Stat. 954 (1954), 42 U.S.C. § 2233(c) (Supp. V, 1958). During consideration of the 1954 act proposals were made to subject all AEC commercial licensees to the provisions of the Federal Power Act, 49 Stat. 854 (1920), 16 U.S.C. §§ 825 (a)-(u) (1952), establishing federal control over accounting practices of licensees of hydroelectric projects. See *Minority Views*, H.R. REP. No. 2181, S. REP. No. 1699, 83d Cong., 2d Sess. 123 (1954); 100 Cong. Rec. 11567 (1954) (remarks of Senator Humphrey). As adopted by the Senate and as enacted in 68 Stat. 960 (1954), 42 U.S.C. § 2019 (Supp. V, 1958). However, the amendment was limited to licensees who transmit or sell electric energy at wholesale in interstate commerce, and thus merely confirmed existing FPC authority. 100 Cong. Rec. 11712-13 (1954).

AEC licensees are not required, as a condition of their licenses, to transmit technical or financial information to the AEC, except for purposes of the national defense, health and safety. 42 U.S.C. § 2133-34 (Supp. V, 1958). A license is not an "arrangement" under § 2182 and does not give AEC any rights to inventions resulting from the licensed activities. *Opinion of AEC General Counsel*, 10 C.F.R. § 8.1 (1956).

A Senate amendment specifically authorizing the AEC to engage in the generation and sale of electric energy was dropped in conference.¹⁴ And section 44 of the act, while authorizing sale of electricity produced from production and experimental facilities, expressly disclaims any authority in the AEC to engage in "the sale or distribution of energy for commercial use."

This prohibition applies only to the AEC. The act specifically provides that any federal agency now or hereafter authorized by law to engage in the production, marketing or distribution of electric energy may be licensed by the AEC to construct power reactors for the primary purpose of producing electric energy for disposition for ultimate public consumption. However no other federal agency has been given general authority to produce, transmit and sell atomically produced electric energy.¹⁵

The decision in 1954 as to the AEC's authority was, however, not clearcut. The Commission is authorized by section 44 to sell to the public energy produced incident to its operation of research and development and production facilities. Under this authority the Commission may construct "large-scale" demonstration power reactors and sell the energy from them.¹⁶ All power reactors built for some time to come—perhaps ten years—are expected to be regarded as research and development facilities. Thus the act in its present form could be construed as authorizing the AEC to construct, and sell power from, nuclear plants having an aggregate capacity of many millions of kilowatts.¹⁷ Once such a program was embarked upon, it might not be difficult to amend the act to permit its continuation into the period when nuclear reactors became commercial facilities. This possibility has had an important influence on the debates on the nuclear power program.

FORMS OF FEDERAL ASSISTANCE

Federal assistance to private atomic power development has in fact

14. H.R. REP. No. 2666, 83d Cong., 2d Sess. 47 (1954).

15. The act leaves existing public and cooperative utilities free to operate power reactors on the same basis as private utilities. For example, TVA within its geographic area can produce and market nuclear power on the same basis on which it now produces and markets energy from coal. The act thus leaves the existing balance between public and private power unaffected. Marks, *Public Power and Atomic Power Development*, 21 LAW & CONTEMP. PROB. 132 (1956).

16. Conference Report, H.R. REP. No. 2666, 83d Cong., 2d Sess. 47 (1954). Section numbers referred to in the text are to the original act. Sections which will be discussed below and their *United States Code* section numbers are: 31 (2051), 44 (2064), 103 (2133), 104 (2134), 152 (2182), 161 (2201), 169 (2209), 170 (2210), 251 (2016), 261 (2017).

17. Whether AEC would have incidental authority to construct transmission lines may be more doubtful, especially in view of the carefully delimited authority of § 2201r.

been given at an increasing rate. Such assistance has taken three major forms:

- (a) Performance of research and development of general benefit;
- (b) Specific assistance to particular reactor projects;
- (c) Materials and services furnished or acquired.

At present the preponderant part of AEC expenditures for power reactor development takes form (a) and a significant amount takes form (b). While it is clear that AEC undertakings to furnish certain materials and services and to purchase special nuclear material constitute an important form of assistance, the relative importance of this assistance as compared to the other two forms is less easy to assess. As the number of reactors increases this form of assistance could become the most important of all.

A. *The Straight AEC Program*

The atomic power industry derives indirect benefits from the AEC's general research and development in the physical and biological sciences,¹⁸ and from the military reactor program. But it derives direct and immediate benefits from the civilian reactor program. According to the AEC, that program currently involves annual expenditures of over \$200 million,¹⁹ by contrast expenditures on the cooperative program are a little over \$20 million. Government spending on such a large scale for development to promote a non-military objective is unusual.²⁰ The immediate relationship between this government

18. A few of the many examples are fundamental physics and chemistry, special reactor materials, uses of reactor-produced isotopes, biological effects of radiation, etc., and the steps taken by AEC to ensure an adequate supply of special reactor materials such as beryllium and zirconium, and facilities such as test reactors.

19. AEC submitted these figures for civilian reactor development:

Operating costs, Civilian	1957	1958	1959
Power Reactors (in millions of dollars)			
Government Program	52.8	74.5	90.9
Cooperative Program	1.5	8.2	22.7
General Engineering	22.2	30.1	44.4
Materials and Services3	32.8	36.6
	-----	-----	-----
Total operating expenses	76.9	145.7	194.3

AUTHORIZATION HEARINGS, *op. cit. supra* note 4, at 291. AEC's budget for power reactor construction during fiscal year 1959 approximates \$29 million. (Source: AEC Division of Finance).

20. While nearly half of industrial research and development in the United States is federally supported (\$3.1 billion out of \$6.5 billion), the great bulk of this is for military purposes. NSF 58-10, RESEARCH AND DEVELOPMENT COSTS IN AMERICAN INDUSTRY, 1956 (May, 1958). Significant non-military federal research and development expenditures of direct benefit to industry include those of the National Advisory Committee for Aeronautics (1956 actual, \$71 million; 1958 estimated, \$86.5 million); and the Bureau of Mines (1956 actual, \$15.6 million; 1958 estimated, \$20.2 million). By far the greatest part of these expenditures, however, are characterized as research rather than development. NSF 57-24, FEDERAL FUNDS FOR SCIENCE, VI THE FEDERAL RESEARCH AND DEVELOPMENT BUDGET, FISCAL YEARS 1956, 1957, AND 1958, at 29, 37-38, 43-44 (1957).

program and private power reactor projects is clear: most of the private projects are directly derived from and related to one or more AEC projects.²¹ Indeed the assistance which some of these projects receive under the cooperative program is quite small by comparison with the benefits which they derive from directly related work financed under the straight AEC program.²² It is thus clear that the principal AEC assistance to the atomic power industry comes from the AEC's own program.

B. The Cooperative Program

Beginning in January 1955, the AEC embarked on what was for it a new venture in government-industry relationships. This was the Power Demonstration Program. The program has been described in detail elsewhere.²³ It is an exercise of AEC authority under section 31 to make arrangements for the conduct of research and development activities. It is embodied in a group of contracts between the AEC and utility organizations (publicly, cooperatively and privately owned) by which the AEC, in support of a reactor project proposed by the utility and approved by the AEC as capable of contributing to the development and demonstration of nuclear power, obligates itself to extend financial assistance of a specified amount and character. It has two branches. In one group of contracts, with privately owned utilities, the utility bears the major part of the cost of the project,

21. Project	Type of Reactor	Related AEC Program
Yankee	} Pressurized Water	PWR (also Navy submarine program)
Consol. Edison Carolinas-Virginia		
Vallecitos	} Pressurized Heavy Water	Same (also AEC production reactors)
Comm. Edison Northern States Pacific Gas & El.		
PRDC	} Boiling Water	Borax 1, 2, 3, 4; EBWR
Penna. P. & L.		
Florida		
	Fast Breeder	EBR-I, EBR-II
	Homogeneous	HRE-I, HRE-II
	Gas-cooled heavy water moderated	(British gas-cooled power reactor; AEC research and production reactors)

22. For example, the PRDC contract obligates AEC to provide \$8.2 million of assistance. See note 35 *infra*. By comparison AEC's own expenditures for fast breeder reactor research, development and construction totaled over \$37 million through fiscal year 1958 and are budgeted at approximately \$35 million for fiscal year 1959. (Source: AEC Division of Reactor Development). Similarly the \$7.9 million assistance contracted for the Yankee project is dwarfed by the over \$100 million spent by AEC on the Shippingport PWR and other pressurized water reactor research and development.

It makes little difference to a private reactor owner whether research and development is conducted by AEC under the straight AEC program, or as specific assistance to a private proposal, so long as it is performed and the results are made available. Indeed the two programs may at times be interchangeable. Thus when Congress refused to authorize funds to carry out the PRDC contract, AEC was able, with the complete knowledge and approval to perform the identical work called for by the contract. See AUTHORIZATION HEARINGS, *op. cit. supra* note 4, at 378-84 (1958) and references there cited.

23. See Green, *The Strange Case of Nuclear Power*, 17 Fed. B.J. 100 (1957).

owns the reactor, and bears the risk of cost overruns; the AEC's contribution is subject (with minor exceptions) to a fixed ceiling. In the other group, with publicly and cooperatively owned utilities, the AEC bears all or the major part of the costs of the nuclear reactor, owns the reactor or part of it, and bears all or many of the risks of cost overruns. In each case, the AEC receives, and may transmit to others, full technical and economic information from the project, and substantial patent rights in the nuclear field. Since 1957, all appropriations for such cooperative arrangements must first be authorized by Congress, and the basis for each arrangement must be submitted to the JCAE, and lie before it for thirty days, before the arrangement becomes effective.²⁴

The AEC now has assistance contracts for six privately owned reactors, involving a maximum of 465,000 kilowatts of electrical capacity. Approximately \$57.2 million is presently obligated by the AEC. The AEC costs range from 11 to 34 per cent of the total; thus the AEC dollar buys from three to nine times as much nuclear capacity under this part of the cooperative program as under the straight AEC program.²⁵

The forms of AEC assistance under this part of the program have varied somewhat from time to time. Basically, however, they consist of two. First, the AEC obligates itself to pay for research and development costs, up to a fixed ceiling. This may now include research and development both prior to construction and during operations; it may be performed either by the AEC in its facilities or by the proposer in private facilities; but it does not include any direct payment of construction or operating costs. Second, the AEC agrees to waive, for a limited period (usually five years of operation) certain charges which it would otherwise impose for the use of fuel and heavy water.²⁶

24. Fiscal Year 1958 Authorization Act, 71 Stat. 409 (1957).

25.

<i>Project</i>	<i>Capacity (EKW)</i>	<i>AEC Obligation (millions)</i>	<i>Est. Total Cost (millions)</i>
Yankee	110,000	\$ 7.9	\$ 61.8
PRDC	90,000	8.2	77.7
Northern States	62,000	7.0	29.8
Florida	46,000	12.4	56.3
Carolinas-Virginia	17,000	14.7	42.9
Penn. P. L.	150,000	7.0*	12.5*
Total	465,000	\$57.2	\$280.9

* Phase I only.

Source: 23 AEC SEMIANN. REP. 357 (1958) (Column 1); *Hearings before the House Committee on Appropriation on the Supplemental Appropriation Bill*, 85th Cong., 2d Sess. 1051-52 (1957) (Columns 2 and 3).

26. In addition to these direct benefits the proposer may get certain intangible benefits from having the status of "contractor" rather than a licensee. Thus he may be eligible to receive classified information concerning military or foreign reactors which is not available to private industry generally under

The AEC also has cooperative contracts for four AEC owned reactors, with a total electric capacity of 119,500 kw and an estimated AEC obligation of \$96.8 million. The AEC costs range from 66 to 92 per cent of the total.²⁷ While owned by the AEC, these reactors will be operated by public and cooperative utility bodies as part of their regular utility systems, and those bodies will have the option to purchase the reactor after a specified period of operation. In one case the utility will incur normal operating costs and take the steam from the reactor; in the other three the AEC will bear all operating costs and sell the steam to the utility at a "dump" rate.²⁸

C. Materials and Services

The AEC is by statute the exclusive owner of fissionable material—uranium 233, uranium 235, and plutonium—used as fuel in power reactors.²⁹ It is in fact the principal or sole source of supply of other materials and services needed for power reactor projects, including source material (natural or depleted uranium and thorium), heavy water, and chemical processing services. It is authorized to lease fissionable material, to sell or lease other materials and services, and to buy back plutonium and uranium 233, at charges which must generally be reasonable and non-discriminatory.³⁰

The costs of these various materials and services constitute an important part of the total costs of nuclear power. Current estimates indicate that fuel costs for the present generation of reactors amount to some thirty to forty per cent of the total power cost,³¹ and are

the Civilian Access Program. 10 C.F.R. Part 20 (Supp. 1957). And, by virtue of the formal assignment of his contract for administration to a particular AEC field office, he may enjoy a closer liaison with AEC activities related to his project than is the case for purely private projects. AEC has sought to minimize these differences in treatment, but it may still be true that the best way to get cooperation from the federal government is to ask it for money.

27.

<i>Project</i>	<i>Capacity (EKW)</i>	<i>AEC Obligation (millions)</i>	<i>Est. Total Cost (millions)</i>
Consumers	75,000	\$51.5	\$ 77.7
RCPA	22,000	11.4	13.9
Chugach	10,000	21.6	23.5
Piqua	12,500	12.3	16.3
Total	119,500	\$96.8	\$131.4

Source: See note 25 *supra*. The Shippingport PWR project, entered into prior to enactment of the 1954 act, is in many ways similar to these four projects. Because it originated as an AEC proposal, however, it is usually treated as part of the straight AEC program.

28. Fiscal Year 1958 Authorization Act, § 111; Op. Comp. Gen., No. B-13, 6015, May 7, 1958, CCH ATOMIC ENERGY L. REP. ¶ 3044 (1958).

29. 68 Stat. 929 (1954), 42 U.S.C. § 2072 (Supp. V, 1958).

30. 68 Stat. 921 (1954), 42 U.S.C. §§ 2072, 2076, 2093, 2201(m) (Supp. V, 1958).

31. ATOMIC INDUSTRIAL FORUM, INC., A. GROWTH SURVEY OF THE ATOMIC INDUS-

perhaps two to three times the cost of coal.³² The payments to the AEC for use and burnup of fuel and for chemical processing and the credits from the AEC for plutonium are the principal elements in these costs, perhaps accounting for as much as two-thirds of the total fuel cost.³³ The plutonium credit alone, at the presently effective minimum price of \$30 per gram, may amount to two or three mills per kwh, depending on the type of reactor.³⁴

The potential importance of the plutonium buy-back alone is illustrated by three examples. First, a reduction in the plutonium price from \$30 per gram to \$12 per gram would result, over a ten year period, in a net increase in operating costs for the PRDC reactor of more than twice the total AEC assistance under the cooperative contracts.³⁵ Second, at the \$30 price, the AEC's total costs for plutonium bought from U. S. reactors by 1963 could approximate \$20 million,³⁶ a figure which approximately equals the present annual expenditures on the cooperative program.³⁷ Third, assuming the projections for nuclear power in 1980 given by the AEC's former Director of Reactor Development, the annual cost to the United States of buying the plutonium from those reactors at \$12 per gram could exceed \$1 billion.³⁸

TRY 1958-68, at 26 (1958), gives the following estimates for large power reactors starting operation in 1960 (in mills/kwh):

	High	Low	Alt. Low
Capital Charges	10.3	8.2	8.2
Fuel Costs	8.4	5.4	3.6
Operation and Maintenance	1.0	1.0	1.0
Total	19.7	14.6	12.8

The fuel cost is a net figure after allowing credit for plutonium bought by AEC. by AEC.

32. Roboff, *Reducing the Cost of the Nuclear Fuel Cycle*, MANAGEMENT AND ATOMIC ENERGY 271 (1958).

33. See NUCLEONICS 51, 63 (Jan. 1958). EDISON ELECTRIC INSTITUTE, *Status and Prospects of Nuclear Power, an Interim Survey* (July 1958); testimony of Michael Michaelis, *Hearings Before the Joint Committee on Atomic Energy on Development, Growth and State of the Atomic Energy Industry*, 85th Cong., 1st Sess. 131 (1958) [Hereinafter 202 Hearings].

34. ATOMIC INDUSTRIAL FORUM, INC., GROWTH SURVEY, *op. cit. supra* note 31, at 63, uses an overall figure of 1 mill for each \$10 of plutonium price. Roboff, note 32 *supra*, treats that figure as applicable only to some types of reactor. NUCLEONICS 50 (Jan. 1958) uses for pressurized water reactors 1.3 mills for an \$18 price difference (about .7 mills per \$10). By comparison the total average fuel cost for coal-fired plants is said to be 2.7 mills/kwh. NUCLEONICS 53 (Jan. 1958).

35. The cost increase is over \$18 million. Matter of PRDC, Docket No. F-16, Acker Exhibit No. 26. The total AEC assistance, including waiver of fuel use charges, is \$8.2 million.

36. $1,300,000$ (kw capacity see p. 195 *supra*) X 365 (days) X 24 (hours) X .80 (plant factor) X 3 (mills/kwh) = \$27 million. At 2 mills the figure is \$18 million.

37. See note 19 *supra*.

38. Davis and Roddis estimated in 1957 that by 1980 installed nuclear kilowatts would total 227.2 million kw and annual nuclear output would total 1285.9 billion kwh. *Latest Prospects for Economic Nuclear Power*, CCH ATOMIC

As a recent study has pointed out:

The salient feature in U. S. nuclear fuel economics at this stage is the predominant position of the government in determining all major process costs, except those for fuel preparation and fabrication. While this predominance has been evident in principle since the passage of the Atomic Energy Act of 1954, the practical effect in its many ramifications is just beginning to become apparent.³⁹

It is not clear whether the AEC's present prices and charges for these materials and services involve a subsidy. The AEC has generally sought to avoid subsidized prices and charges. But the establishment of those prices and charges calls for complex economic analysis; the basis on which they have been established have not always been clearly stated, and some of the underlying data is still classified. In any event, however, the existence of a guaranteed government supply or market is an important form of assistance. The following examples are illustrative of the possibilities for subsidy which exist:

(1) While the AEC may have a present need for plutonium for weapons purposes and for certain experimental purposes, it is difficult to see any basis on which it can have such a need for fuel purposes, since the Government has no present intention of engaging in nuclear power production. The extent to which it will have a future need for plutonium for any of these purposes which cannot be satisfied by its own production plants will depend largely on international and military conditions which are difficult to predict. Moreover, at present it is not known whether plutonium can be economically used as a fuel.⁴⁰ Thus it is impossible to tell what a proper fuel price should be.

Despite these uncertainties, the AEC is not only a compulsory purchaser of all reactor-produced plutonium, but it has guaranteed a minimum price for plutonium through July 1963.⁴¹ The fluctuations which the guaranteed price has undergone do not inspire confidence

ENERGY L. REP. § 3032 (1957). At 0.9 mills/kwh for plutonium at \$12/gm this comes to \$1.15 billion. While the Davis-Roddies estimates may be optimistic as to time, there is little doubt that nuclear capacities of the magnitude predicted will be reached at some time.

39. ATOMIC INDUSTRIAL FORUM, INC., GROWTH SURVEY, *op. cit. supra* note 2, at 10. See also testimony of Michael Michaelis, 202 Hearings, *op. cit. supra* note 33, at 127.

40. Davis, early this year, referred to the \$12/gm price as a "guess that it will be worth \$12/gm as a fuel for reactors when this use becomes technically and economically feasible." NUCLEONICS 99 (Jan. 1958).

41. Section 2076 authorizes a seven year guarantee. AEC early this year, however, proposed a fifteen year guarantee for plutonium from foreign reactors. JOINT COMMITTEE ON ATOMIC ENERGY, 85TH CONG., 2D SESS. AMENDING THE ATOMIC ENERGY ACT OF 1954, at 9, 14-18 (1958). The proposal was not acted on by the Joint Committee on Atomic Energy. If there is to be a guarantee a good argument can be made for a longer period than seven years. The existing guarantee period is inadequate to provide effective assurance to those now deciding to construct a reactor, since it will cover only two or three years of effective operation.

that the present \$30 minimum price is soundly based.⁴² The AEC has stated an intention to reduce that price, at some unstated time in the future to something like \$12 per gram.⁴³ The AEC's own uncertainty is reflected in its failure to extend its guarantee from 1963 to 1965.

(2) The AEC's statutory monopoly of fissionable material has another important consequence. Since reactor operators cannot own fissionable material, the AEC leases such material at an annual charge of four per cent. Assuming that the normal return on investment to a privately owned utility is about 10.5 per cent⁴⁴ it would seem that the lease system results in a significant cost saving to the operator. Since a typical fuel inventory may well exceed \$10 million, the annual saving may be very substantial.⁴⁵

(3) Another important element in fuel costs is the cost of chemical reprocessing of spent fuel. The AEC has undertaken to contract for the performance of such processing services until June 1967 at fixed prices.⁴⁶ This guarantee is an important form of assistance regardless of the prices established. Moreover, the prices are based, not on the AEC's actual costs of performing these services, but on the calculated cost of performing them in a hypothetical plant—not built, and perhaps never to be built—assumed to operate at full capacity. The unreal quality of these prices is indicated by the statement of one commentator that "the processes selected by the AEC for its conceptual plant may prove to be uneconomical or even infeasible in actual use."⁴⁷

(4) By section 170 of the act, Congress has directed the AEC to enter into contracts with all licensees indemnifying them against

42. The AEC in 1955 established a price on a sliding scale from \$45 to \$12/gm, depending on the quality of the material. It announced a flat \$12 minimum price for domestic and foreign plutonium. Finally, in May, 1957 it established a \$30 price for domestic plutonium, which was a floor up to July, 1962 and a flat price thereafter. CCH ATOMIC ENERGY L. REP. ¶ 2802 (1957).

43. In announcing its current price AEC said: "It is the expectation of the Commission that the prices for plutonium will be reduced, as dictated by consideration of the value of the material for its intended use and giving such weight to the actual cost of producing the material as the Commission finds to be equitable, to a level based upon the fuel value of the plutonium in commercial power reactor facilities." CCH ATOMIC ENERGY L. REP. ¶ 2802 (1957).

This year, however, Commissioner Vance indicated that as long as AEC in fact continued to use plutonium for weapons purposes it would continue to pay a weapons price. 202 Hearings, *op. cit. supra* note 33, at 63.

44. See Joint Committee on Atomic Energy, *Report of the Panel on the Peaceful Uses of Atomic Energy*, vol. 2, Background Material, p. 21 (1955).

45. The PRDC inventory, including material in the reactor, being fabricated, being processed, and in transportation, is about \$18 million.

46. CCH ATOMIC ENERGY L. REP. ¶ 2798 (1957).

47. Ullman, *Economics of the Fuel Cycle: Reprocessing*, MANAGEMENT AND ATOMIC ENERGY 416 (1958). Another commentator has calculated that a realistic estimate of the cost of performing these services in a privately owned plant might be five times what AEC has charged. NUCLEONICS 52 (Jan. 1958). Significantly, the AEC has thus far been unsuccessful in obtaining satisfactory proposals for the private construction of a chemical processing plant, despite its willingness to guarantee a minimum load.

third party liability. The indemnity is in the amount of \$500 million, over and above available insurance protection. There is a limitation of liability to that amount. This form of protection to a segment of private industry is without precedent, so far as I am aware. The cost to the licensee is nominal—\$30 a year per 1,000 kw capacity or \$3,000 for a 100,000 kw reactor. This cost cannot be compared with private insurance rates, because the private insurance industry was unable to confer protection in such an amount, regardless of premium.

THE ACCELERATION CONTROVERSY

Most of the debates on the civilian power program since 1954 have centered around the issue whether the program should be accelerated. That issue has served as the focal point for questions, not only of fiscal policy and optimum technological rate of progress, but even more importantly, of public versus private power development, subsidy, and the role of the executive and legislative branches of government.

A. *The Need for Acceleration*

In 1953 and 1954 there was a tendency to think that economic nuclear power was just around the corner. Some private utility officials were saying that they were prepared to build demonstration power reactors with no federal support of any kind.⁴⁸ In 1955, the chairman and former chairman of the Joint Committee on Atomic Energy severely criticized the AEC for offering to assist licensed reactor projects without waiting to determine whether an adequate number of private projects could be constructed without federal assistance.⁴⁹

Subsequently, however, actual experience with the engineering problems involved led to a reevaluation of both costs and time schedules. Construction cost estimates rose markedly;⁵⁰ fuel costs, once hopefully thought to be zero or less, appeared to be several times coal costs;⁵¹ time schedules were postponed, in some cases several years.⁵² Following the initial announcement in 1955 of five large scale reactors to be constructed with substantial non-AEC contributions, the utilities

48. See, e.g., statement of Walker Cisler in 1953, quoted in *202 Hearings*, *op. cit. supra* note 33, at 63.

49. *202 Hearings* 155-80 (1955), e.g., Senator Anderson: "You are not trying to find out if industry is going ahead. You are saying to industry, 'Don't put up your own money, because if you just wait, we will come along and give you part of it.'" *Id.* at 157.

50. See *202 Hearings* 690-95 (1957). Some of the more extreme increases, there shown, in millions of dollars were:

	<i>1955 Estimate</i>	<i>1957 Estimate</i>
PWR	47.75	70.0
Consumers	25.1	38.6
Consol. Ed.	55.0	70.0

51. ATOMIC INDUSTRIAL FORUM, INC., *GROWTH SURVEY*, *op. cit. supra* note 31, at 30 treats a 115% increase as typical. See also p. 204 and note 32 *supra*.

52. See note 46 *supra*.

appeared to adopt a wait-and-see attitude. Meanwhile increasing indications were coming in of the vigor and magnitude of the British and other foreign reactor programs.⁵³ These facts led to an increasing concern over the adequacy of the U. S. program.

The controversy over an accelerated program reached its peak in 1956 when the Gore-Holifield bill was unanimously reported out by the Joint Committee on Atomic Energy (JCAE) and narrowly defeated in the House.⁵⁴ Since that time the acceleration issue has arisen, not in connection with substantive legislation,⁵⁵ but on the annual authorization bill. With an expansion by the AEC of its own program and a moderation by the JCAE of its position, it appeared possible in 1958 that agreement between the AEC and the JCAE could be reached on a power program.⁵⁶ However, at the end of the session the JCAE chairman and vice-chairman issued a staff report of a proposed expanded civilian nuclear power program calling for construction by 1965 of an additional one million kw of plants not already under construction or implemented, at an estimated cost of \$125 million annually.⁵⁷

In fact, the civilian power program, under the pressure both of congressional prodding and of events, has expanded markedly in magni-

53. The following figures of installed capacity in megawatts by the end of the year stated were recently given by Great Britain in reply to a U. N. questionnaire. 1961: 725 MW; 1963: 2,400 MW; 1965: 6,000 MW. UNITED NATIONS, ECONOMIC APPLICATION OF ATOMIC ENERGY 59 (1957). The announced target of the six Euratom countries is 15,000 MW by 1967. A TARGET FOR EURATOM, REPORT OF THE TECHNICAL STAFF OF THE EUROPEAN ATOMIC ENERGY COMMUNITY MAY 7, 1957. These figures compare with 1,300 MW now under construction or planned in the United States for completion by 1963.

A Soviet scientist in 1956 announced a program calling for 2,400 to 2,500 MW capacity by 1960. *Hearings Before the Joint Committee on Atomic Energy on Accelerating Civilian Reactor Program*, 84th Cong., 2d Sess. 8-12 (1956). The Soviet Report to the U.N. merely refers to four reactors with a total capacity of 765 MW, UNITED NATIONS, *op. cit. supra* at 58. However, USSR representatives at the 1958 Geneva Conference on Peaceful Uses of the Atom described as still valid the ambitious program announced in 1956.

54. S. REP. No. 2390, 84th Cong., 2d Sess. (1956); 102 Cong. Rec. 13038 (1956). As reported the bill would have directed AEC to build and operate 3 "large scale" demonstration reactors and 2 smaller (10-20 MW) prototype reactors, and would have authorized appropriations of \$400 million for the purpose.

55. The Gore-Holifield bill was reintroduced in the 85th Congress but died in committee.

56. The fiscal year 1959 authorization bill as reported out included one major project—a dual purpose plutonium production reactor at \$145 million—not requested by AEC. The bill was reported unanimously; it passed the House without objection or dissent, characterized as "an effort by the members of the Joint Committee to bury past differences of personality and policy and to reach agreement"; in the Senate only the dual purpose feature of the production reactor was seriously debated. However, in signing the bill the President sharply criticized a number of its features as "unsound" and as "discouraging private proposals."

57. JOINT COMMITTEE ON ATOMIC ENERGY, 85TH CONG., 2D SESS., PROPOSED EXPANDED CIVILIAN NUCLEAR POWER PROGRAM (Comm. Print 1958).

tude.⁵⁸ The AEC estimates that it will spend over \$200 million in fiscal year 1959 directly for civilian power reactor development.⁵⁹ Federal spending of this magnitude for research and development for the benefit of one segment of American industry appears to be without precedent.⁶⁰

It is clear that the present program constitutes a forced-draft approach, designed to accelerate U. S. atomic power development at a rate faster than normal economic considerations would warrant.⁶¹ The costs of the program are borne primarily by taxpayers and utility ratepayers.⁶² The purpose of this development is not to produce a new commodity, but to provide an alternative means of producing an exist-

58. AEC lists the following as direct costs of the straight AEC program through fiscal year 1957 (in millions of dollars):

<i>Fiscal Year</i>	<i>Res. and Dev.</i>	<i>Construction</i>	<i>Total</i>
1948-50	2.2	0.9	3.1
1951	3.2	1.9	5.1
1952	5.9	0.4	6.3
1953	10.0	0.1	10.1
1954	18.0		18.9
1955	26.3	2.1	28.4
1956	45.8	9.4	55.2
1957	56.7	33.3	90.0
Cumulative	169.0	48.1	217.1

Source: 19 AEC SEMIANN. REP. 32 (1956), 22 AEC SEMIANN. REP. 455 (1957); AEC Div. of Finance (1958-59); these figures do not include supporting research and development.

The comparable figures for Research and Development for FYs 1958 and 1959 are as follows: FY 1958 (actual): \$71.5; FY 1959 (est.): \$95.4.

59. See p. 200 and note 19 *supra*. By contrast the current level of industry spending for atomic power research and development has been estimated at \$60-\$80 million annually. ATOMIC INDUSTRIAL FORUM, INC., GROWTH SURVEY, *op. cit. supra* note 31, at 22.

60. See note 20 *supra*.

61. "Thus, we are faced with a situation where the majority is convinced that we should not let the natural forces of a free economy decide the future of technical development. I am sure, however, that there are many people who have grave doubts as to whether history will approve this course. It seems that even those who are unsympathetic to the idea are bowing to the inevitable, so to speak, and rather than vigorously opposing an accelerated program are doing what they can to guide it in the direction they hope will be least disturbing to the domestic economy which eventually will have to assimilate this new technological development." Address by Fred W. Argue, Vice President, Stone & Webster Engineering Corp., printed in *Proceedings of a Conference Sponsored by Atomic Industrial Forum, Inc. and National Industrial Conference Board, MANAGEMENT AND ATOMIC ENERGY 57-58 (1958)*.

62. The bulk of the spending on atomic power development is by the government. Between 3/4 and 5/6 of the industrial spending is by utilities. ATOMIC INDUSTRIAL FORUM, INC., GROWTH SURVEY, *op. cit. supra* note 31, at 22. Part or all of the remainder may ultimately be passed on by manufacturers to their utility customers. By contrast, development costs associated with conventional power plants are usually borne initially by the manufacturers, and passed on to the utilities as part of the cost of hardware purchased by them.

State regulatory bodies have generally allowed private utilities to express in their rate structures the costs of atomic power development (including excess capital costs over a conventional plant). See, *e.g.*, Duke Power Co., CCH ATOMIC ENERGY L. REP. ¶ 3046 (1958), citing cases in other states and the District of Columbia.

ing commodity—electric energy. And in view of present high nuclear costs, it is at least a moot point whether foreseeable improvements in coal boilers and transmission techniques do not offer greater short term promise in reducing the cost of electricity to the consumer than does the development of nuclear power.⁶³

While the desirability of atomic power development is unquestioned, the need for an accelerated program is difficult to justify by domestic considerations. Hence it is that the argument for an accelerated program is expressed primarily in terms of considerations of international prestige—the need to maintain world “technological leadership” and the need of the nation which first used the atom for destruction to emphasize to the world the depth of its concern with peaceful uses of atomic energy.⁶⁴

B. *The Public Power Controversy*

It was perhaps inevitable, once the atom was shown to be capable of producing electricity, that it, like other forms of electric power, should become embroiled in controversy between public and private power advocates. Whether or not this is so, the heritage of the bitter controversy over the so-called Dixon-Yates contract, and the continued presence as chairmen of the AEC and Joint Committee on Atomic Energy of two of the chief protagonists in that controversy, made it inevitable. More than any other factor, this public power controversy has colored the acceleration fight.

The 1954-1956 AEC power program was characterized by a complete dependence on private industry to decide what full-scale demonstration reactors should be built, at what locations and on what time schedules. The AEC proposed to construct no such reactor itself. And its first two invitations for cooperative proposals did not specify or even suggest any particular type of reactor as being appropriate, in

63. “In the past 17 years the cost of conventional power in terms of stable dollars has come down 50 per cent There is every reason to believe that . . . another 17 years is going to again show a remarkable improvement.” AEC Commissioner Vance, *AUTHORIZATION HEARINGS, op. cit. supra* note 4, at 226-27. A study in 1955, however, concluded, with respect to coal plants, “it is believed that the major benefits of cost reduction through simplified plant design have been exploited and that future improvements will about offset the increased cost of equipment.” McKinney Panel, Background Material p. 14.

64. See, e.g., *AUTHORIZATION HEARINGS, op. cit. supra* note 4, at 223; *JOINT COMMITTEE ON ATOMIC ENERGY, 85TH CONG., 2D SESS., PROPOSED EXPANDED CIVILIAN NUCLEAR POWER PROGRAM 3-4* (1958); Arden House Report, *supra* note 7, at 153. Even now, some 83% of AEC's budget goes for military purposes. *Hearing Before House Committee on Appropriations on Supplemental Appropriation Bill, 85th Cong., 2d Sess.* 907 (1958).

A further consideration, sometimes stated, is the desire to maintain a strong competitive position in the world market for American manufacturers. One manufacturer, however, has stated that even with such federal support “it is quite clear . . . to most U. S. manufacturers that the foreign market cannot exist for us as a very long-term profitable market.” Starr, *The Reactor Manufacturing Industry, MANAGEMENT AND ATOMIC ENERGY*, at 52 (1958).

the AEC's technical judgment, for prototype construction.⁶⁵ These actions of the AEC reflected an avowed judgment that industry was "in much better position than the Commission" to determine which reactors were suitable for prototype construction.⁶⁶

In addition, while the AEC's power demonstration contracts typically obligated the proposer to construct the reactor and operate it for five years, neither the invitation nor the contract prescribed any completion dates.⁶⁷ Thus it appeared that the AEC had completely surrendered the direction and control of the prototype stage of its program, both as to technical decisions and timing, to the utilities.

The Gore-Holifield acceleration bill was a reaction to this surrender—a reassertion of governmental direction to the program.⁶⁸ Some of its proponents undoubtedly questioned whether the utility industry genuinely intended to proceed vigorously with its projects or merely proposed them as stalking horses to stave off a competitive government program.⁶⁹ And some may have seen an opportunity to establish such a competitive program.

As introduced, the Gore-Holifield bill would have required the AEC to build six full-scale reactors, and provided that in selecting their sites the AEC should consider the "need for additional electric generating capacity in this region of the site under consideration." It thus clearly contemplated sale to the public of the power produced. The bill was amended by the Joint Committee, however, to provide that the reactors should be built at AEC installations and the power used by the AEC and not sold. This has set the pattern. Subsequent authorization bills, in providing for AEC construction of reactors, have uni-

65. CCH ATOMIC ENERGY L. REP. ¶ 3021, 3022. The second round invitation did specify size using fuel with a low enrichment of U-235, and reactors of relatively advanced design.

The failure of the AEC to identify reactor types suitable for prototype construction had especially unfortunate consequences in the second round. The first round proposers had acquired a considerable familiarity with nuclear engineering through an AEC study program, operating since 1951; their proposals were for reactors already fairly well developed by AEC and extensively studied by the proposer. The second round utility proposers generally had no prior knowledge of nuclear technology. Many of them were induced by AEC's invitation to propose relatively advanced types of reactors. Thus out of seven proposals, two (Mt. Holyoke and Orlando) were rejected by AEC as too advanced; a third (Wolverine) was abandoned by the proposer, in part because of difficulties experienced in AEC's own homogeneous reactor program; a fourth (Chugach) was a novel concept the fundamental feasibility of which is still being tested.

66. AEC report on the Gore-Holifield bill, *Accelerating Hearings*, *op. cit. supra* note 53, at 69.

67. See, *e.g.*, The PRDC Contract, AEC Docket No. F-16, Acker Exhibit 19-A.

68. Thus Senator Anderson said: "It raises a fundamental question of whether AEC has abdicated some of its responsibilities to private industry." *Accelerating Hearings*, *op. cit. supra* note 53, at 4.

69. Compare Senator Anderson's recent reference to the existence in the past of some question "as to the good faith . . . of private organizations." AUTHORIZATION HEARINGS, *op. cit. supra* note 4, at 432.

formly provided that the power generated shall be used by the AEC and not sold, and that the reactor, after it has served research, development and defense uses, shall be either sold or dismantled.⁷⁰ Proponents of acceleration also explicitly disavowed any intent to promote a public power program.⁷¹

These attempts to avoid a public power issue could not, in the nature of things, succeed wholly. For once reactors are built and operating, it might not be difficult to remove the restrictions on the sale of power and the requirement of dismantling. Hence, proposals for government construction of large scale reactors tended, regardless of these restrictions, to be attacked as "socialistic" and as an "opening wedge" towards putting the government in the power business.⁷²

For a time the vigor of this fight over public power threatened to obscure all other considerations. But a compromise was at hand which, it may be hoped, will reduce the emphasis on the public power issue.

At the hearings on the Gore-Holifield bill in 1956, the AEC announced a new policy to accelerate its program. This was that whenever the AEC decided that a concept reached the stage of development where construction of a prototype was appropriate, it would invite proposals for construction of that specified type and, receiving none, would request funds to build it itself.⁷³ Since then, AEC invitations for cooperative proposals have invariably specified certain types of reactors which the AEC would build itself unless a suitable private proposal was received calling for construction by a specified date.⁷⁴ Thus the AEC has retaken an essential element of program direction. On the other hand, there is a growing tendency for Congress, in requiring the AEC to build a particular type of reactor, to provide that the AEC shall first solicit proposals for a cooperative arrangement.⁷⁵

Under this pattern the need for a particular reactor on a particular

70. *E.g.*, Fiscal Year 1958 Authorization Act, 71 Stat. 409 (1957); 1959 Authorization Act, 72 Stat. 490 (1958).

71. *E.g.*, Senator Gore, *Accelerating Hearings*, *op. cit. supra* note 53, at 11, 13.

72. See, *e.g.*, the minority report on the 1957 authorization act, H.R. REP. No. 978, S. REP. No. 296, 85th Cong., 1st Sess. (1957). The opposition may also have been reacting to the fact that public power organizations supported these proposals.

73. *Accelerating Hearings*, *op. cit. supra* note 53, at 39, 69.

74. See the Third Round Invitation, Jan. 7, 1957, CCH ATOMIC ENERGY L. REP. ¶ 3023 (1957); the Gas-cooled Reactor Invitation, Sept. 21, 1958, *id.* ¶ 3023.

See § 111 (f) of the 1958 Authorization Act, 71 Stat. 409 (1957), which requires the AEC to announce publicly the reactor types which "it considers technically desirable for construction" and to specify completion and other dates. The November 17, 1958 amendment to the Third Round Invitation states that the AEC will only consider proposals for reactor projects which it has specified; in specifying projects it will consider recommendations by industry.

75. Fiscal Year 1958 Authorization Act, § 110, 71 Stat. 409 (1957); 1959 Authorization Act, § 110, 72 Stat. 490 (1958).

time schedule can now be decided without regard to who builds it. And the question who builds it is made to turn largely on fiscal considerations, a satisfactory cooperative proposal involving less cost to the government will be accepted in preference to government construction, but if no such proposal is obtained the Government will construct the reactor. This compromise, together with the appointment to the AEC of a new chairman and two new Commissioners, may herald an "era of good feeling" in which public power issues will, at least for a time, be subordinate.⁷⁶

C. *The Problem of Subsidies*

With this de-emphasis on the public power issue will probably come an increased emphasis on the issue of subsidies, or assistance payments. In fact, of course, the two are closely related, for the ability of private utility and manufacturing companies to enter into cooperative proposals for prototype reactor construction may depend on the contribution which the federal government is able and willing to make to such cooperative projects. Given present rising nuclear costs, and fairly general agreement by the nuclear industry on a need for further acceleration, it is not surprising that industrial representatives are now asking for a greater measure of governmental assistance.⁷⁷

Expansion of straight AEC research and development presents no legal problems. But the possibilities for further expansion of assistance under the cooperative program may be limited by two features of the Atomic Energy Act. The first is section 44 which provides that in disposing of energy produced at "experimental utilization facilities of the Commission," preference must be given to "public bodies and cooperatives." The second is section 169, under which the AEC, at least as a matter of policy, will not pay any part of the cost of construction or operation of a privately owned, licensed facility. The net effect of these two provisions, as presently applied by the AEC, is that the AEC can contribute directly to the cost of construction and operation of reactors under the cooperative program only by (a) taking title to part or all of the facility, (b) treating it as an AEC facility and not a licensed facility, and (c) disposing of the energy from it under

76. Compare, *e.g.*, the strenuous effort of the JCAE and the AEC to arrive at an agreed program, Senator Anderson's invitation "to let the dead past bury its dead and go on to happier days." AUTHORIZATION HEARINGS, *op. cit. supra* note 31, at 432, and the statement of AEC's new chairman that "I am not persuaded by the fact that in a matter of this kind, which is in an experimental stage, a developmental stage, that the question of public and private power is particularly overriding in its power. Perhaps down the road a way it will be. I am not so sure that it is right now." Quoted in ATOMIC INDUSTRIAL FORUM, INC., FORUM MEMO 4 (July 1958).

77. Recent polls of utilities and manufacturers interested in atomic energy show a large majority of manufacturers and about 50% of utilities in favor of accelerating the program and in favor of additional federal assistance. ATOMIC INDUSTRIAL FORUM, INC., FORUM MEMO 16-17 (Feb. 1958); NUCLEONICS 18 (Feb. 1958).

the preference provisions of the act. Hence AEC direct contributions to construction and operating costs have occurred, and are likely to occur, only in projects involving publicly and cooperatively owned utilities.⁷⁸

At the Eighty-fifth Congress two bills were introduced to provide for grants to private utilities of amounts based on the difference between the construction and operating costs of conventional facilities and those of nuclear facilities.⁷⁹ Similar assistance was suggested as a possibility in the recent JCAE staff report, which also pointed out that "any such types of assistance would involve consideration of revisions of sections 44 and 169 of the Atomic Energy Act of 1954."⁸⁰

The preference provision of section 2064 is deeply rooted in the history of United States power legislation.⁸¹ Although it has been vigorously objected to from time to time by private utility interests, the likelihood that it will be deleted or limited in scope seems nil. There are possibilities, however, for both amendment and reinterpretation of the "no subsidy" provision of section 169.

Section 169 provides in full:

No Subsidy. No funds of the Commission shall be employed in the construction or operation of facilities licensed under Section 103 or 104 of this title except under contract or other arrangement entered into pursuant to Sec. 31.

This would appear to mean that any contract or arrangement authorized by section 31 is exempt from the prohibitions of section 169. Thus section 169 would permit the grant of direct AEC assistance in construction and operation of a licensed reactor if that assistance could be justified as a means of providing for the conduct of research and development activities looking towards the demonstration of competi-

78. The PWR project was entered into prior to the effective date of the 1954 act and hence disposition of energy from it by contract to a private utility without a prior offer to public and cooperative groups was legally possible. Such an arrangement might also be possible in an area in which there were no public or cooperative bodies capable of exercising their preference rights. Even then, AEC might have to retain the right to offer the power to preference groups at a later time should any become eligible. Compare 41 Ops. Att'y GEN. 36 (1955).

79. H.R. REP. No. 7472, 85th Cong., 1st Sess. (1958); H.R. REP. No. 8191, 85th Cong., 1st Sess. (1958). Both died in committee.

80. *Supra* note 5 at 12. Senator Anderson has recently proposed "a grant of perhaps not to exceed 90 percent of the estimated difference between the cost of the nuclear plant and a conventional plant of the same output." AUTHORIZATION HEARINGS, *op. cit. supra* n. 4, at 431.

An alternative formula for assistance might be patterned on the Euratom Cooperation Act of 1958, 72 Stat. 1084, section 4 of which authorizes the AEC to guarantee the reactor operator, for a 10-year period of operation, against fuel cycle costs in excess of a stated amount. Such a guarantee would, presumably, be limited to reactors constructed by certain dates, which promised to make a contribution to the development program, and as to which a need for the guaranty was shown.

81. See Marks, *supra* note 15.

tive nuclear power, and was granted pursuant to contractual arrangements entailing an appropriate consideration moving to the Commission and containing the provisions relating to health, safety, inspection, reporting and patent rights required by sections 31 and 152.

There is no relevant published legislative history on section 2209. In 1955, however, the chairman and former chairman of the JCAE relied on excerpts from unpublished committee proceedings to support a different view—that the only thing permitted by the “except” clause in section 169 is a contract, entered into after the reactor is built, for the performance in the reactor of specific research and development for the Commission. Two other members of the JCAE sharply disputed this interpretation.⁸²

Faced with this conflict of opinion, the AEC, without abandoning the legal interpretation of section 169 stated above, arrived at a practical *modus vivendi* under which it has restricted its assistance to licensed projects to specific research and development and waiver of charges, and has declined to contribute directly to the cost of construction or operation.⁸³ It may be, however, that, particularly in view of the opportunities for congressional review afforded by the authorization process, the AEC would now feel free to apply section 169 according to its literal terms, and the Joint Committee on Atomic Energy would not contest such an application.⁸⁴ Alternatively, a clarifying amendment to section 169 might be considered.

As an alternative to such direct payment of construction and operating costs, some have advocated a deliberate revision of the AEC's

82. *202 Hearings, op. cit. supra* note 39, at 155-76. This split crossed party lines, Senator Anderson (D) and Congressman Cole (R) against Senator Hickenlooper (R) and Congressman Holifield (D). A more unlikely alignment could hardly be conceived.

83. The dividing line between research and development costs, and construction and operation costs is not always easy to draw in a developmental project. AEC has, however, leaned over backwards by refusing to pay for any “hardware” incorporated into the reactor, even though the item may be developmental in character, and by confining its assistance during the operating period to specific research and development clearly separate from the experimental operation of the reactor plant.

84. The views expressed in the two foregoing paragraphs are stated more fully in the memorandum of William Mitchell, AEC General Counsel, reprinted in 103 Cong. Rec. 9128 (1957) and in my remarks in *MANAGEMENT AND ATOMIC ENERGY* 157-59 (July 1957). A further advantage of this position is that it would permit the government-owned projects under the cooperative program to be handled under license, and hence would ensure the application to those projects of the requirements for report by the Advisory Committee on Reactor Safeguards and public hearing imposed by §§ 182 (b) and 189 (a) of the act. The desirability of this course is suggested by the recent concern over the selection of sites for the Piqua and Chugach projects. See as to Piqua, AEC Release No. A-240, Sept. 9, 1958; *CCH ATOMIC ENERGY L. REP.* ¶ 9753 (1958); and as to Chugach, *Hearings Before the Joint Committee on Atomic Energy on Review of Proposals Under Power Demonstration Program*, 85th Cong., 2d Sess. (1958).

prices and charges relating to fuel costs so as to reduce net fuel costs.⁸⁵ The provisions relating to the establishment of those prices and charges contain sufficient flexibility to confer a considerable measure of discretion on the AEC. But the underlying concept of a "fair" price would appear to prohibit a deliberately subsidized price. Moreover, the pricing provisions of the act must be read in conjunction with section 169, and when so read the conclusion is clear that subsidized prices and charges may not be used as an indirect means of paying for the cost of construction and operation of licensed reactors. Thus a proposal for deliberate use of those prices and charges as a subsidy would require legislation.

The argument against the use of AEC prices and charges as a deliberate form of assistance is, I submit, overwhelming. In the first place, while the other two forms of assistance discussed at pages 199-203 of this article can be specifically tailored to meet the needs of the present research and development period, a system of subsidized prices and charges, once established, would be very difficult to disestablish.⁸⁶ Thus this form of assistance, unlike the other two, threatens to perpetuate itself into the period of economically competitive operations, and permanently to distort the comparative economics of nuclear and other fuels. Second, prices and charges must, by their nature and by the terms of the act, be applied across the board, regardless of the merits or need of a particular project, whereas assistance of the other two types can be geared to the specific needs of a research and development program.⁸⁷ Third, the cost of assistance conferred through subsidized prices and charges is concealed and difficult to determine; the cost of assistance conferred through the other two means is specifically identified and, since it requires appropriation of funds, is subject to annual congressional review. Fourth, assistance granted through the prices and charges route does not result in the grant to the Government of any rights to information and patents. Fifth, subsidized prices and charges may seriously distort the development of nuclear technology by unduly encouraging types of reactors which have high-cost fuel cycles or produce large amounts of plutonium.

Government assistance—or subsidization—is justifiable if the amount of assistance is clearly identified, and reasonably related to specific research and development needs. But concealed subsidies, which threaten a permanent distortion of reactor economics, are unjustifiable. Hence the sound course, I submit, is to reject proposals

85. Testimony of Michael Michaelis, 202 *Hearings, op. cit. supra* note 33, at 126.

86. Compare the enormous difficulty of loosening up the rigid agricultural parity system.

87. For example, the AEC would be unlikely, under the straight program or the cooperative program, to support ten "Chinese copies" of the PWR; deliberate adoption of subsidized prices and charges could have that result.

for deliberately subsidized prices and charges, and also to take all necessary action to ensure that existing prices and charges are not subsidized.

Congress has taken one step along this direction by requiring that any new prices established by the AEC for purchase of special nuclear material must lay before the JCAE for forty-five days before becoming effective. Thus far, the AEC has avoided the application of this provision by not extending its plutonium price guarantees. But such laying before Congress—with the possibility of congressional hearings—is not an effective substitute for action by the AEC to satisfy itself and the public that all of its important prices and charges are soundly based. It would be a salutary step for the AEC, in the future, to treat those of its prices and charges which have major economic importance as if they were rule-making actions under section 4 of the Administrative Procedure Act; to issue such prices and charges in proposed form for public comment; to make available necessary background data to permit informed comment; and to hold public hearings where the comments received indicate any serious doubts about the soundness of the proposed action.⁸⁸

Ultimately a more drastic solution may be necessary. As long as the AEC is both supplier and customer of nuclear materials, the possibility of large subsidies is inherent. The elimination of this inherent possibility would require amending the Atomic Energy Act to eliminate the AEC's statutory monopoly of fissionable material. Such a step would require careful study, since the constitutionality of the AEC's regulatory provisions has sometimes been thought to rest on continued government ownership of fissionable material, so as to bring into play the powers of Congress over property of the United States.⁸⁹ But it would be unfortunate for many reactors to go into operation in reliance on the continued availability for the indefinite future of uranium at a 4 per cent lease charge and of a government market for plutonium. Hence it would be salutary for the AEC or the JCAE or both to indicate that the present situation is temporary only, and that the possibility of eliminating the Government's statutory monopoly of fission-

88. To the extent that the underlying data is classified Restricted Data, AEC should declassify it if possible; if that is impossible it has available the resources of its Access Program, 10 C.F.R. Part 20 (Supp. 1958) and its parallel procedures, for handling comments and hearings on a classified basis, 10 C.F.R. § 2.800-2.814 (Supp. 1958).

89. U. S. Const. art. IV, § 3. See S. REP. No. 1699, 83d Cong., 2d Sess. 11 (1954). It is difficult to see how Congress has any greater power to prohibit private ownership of fissionable material than it has to regulate it and hence it is by no means clear that the retention of ownership has real constitutional importance.

Statutory amendment is not the whole answer, since the government may for a long time be the sole producer of enriched uranium. Eventually, however, reactor produced plutonium should reduce the importance of enriched uranium as a fuel.

able material—and hence its status as lessor and compulsory purchaser of such material—is under active consideration.

In short, most of the concern about subsidies has, in my judgment, been misplaced. It has been focused on the cooperative program. But in essence, the cooperative program is a way of getting development done at less cost to the AEC than by direct government construction. It is also a means of easing the transition from a government program to a truly private program. So long as the private contribution is at least equal to the costs of a conventional plant, and the information and patent rights from the project are made available to the AEC without restriction, it is difficult to find a serious subsidy problem.⁹⁰ On the other hand, the continued furnishing and purchase by the AEC of important materials and services inherently involves subsidies which are not limited to a transitional period. To the extent that relaxation of the limitations on assistance to cooperative projects would release the pressure now building up for subsidized fuel prices, it would reduce, rather than increase, the possibilities for subsidy under the act.

D. *Role of the Executive and Legislative Branches*

Prior to 1954, while there had been some congressional prodding to accelerate reactor development,⁹¹ Congress did not attempt to impose requirements as to program direction. The years since 1953, however, have seen a startling increase in assertion of congressional direction.

This increase has been accomplished through the appropriation process. The 1954 act materially increased the control of the JCAE over the AEC appropriations by providing, in section 261, that all appropriations for construction of new "facilities" must first be authorized by Congress.⁹² In 1957, following a vehement attack by the chairman of the House Appropriations Committee on the workings of the new system,⁹³ Congress further tightened up its review of the AEC program by amending section 261 to require (1) that appropriations for civilian "experimental" power projects, which the AEC had been

90. There would seem to be more danger of subsidy in the provisions for forced sale of government owned reactors contained in §§ 110 and 111 (a) (1) of the Fiscal Year 1958 Authorization Act, 71 Stat. 409 (1957); and § 110 of the Fiscal Year 1959 Authorization Act, 72 Stat. 490 (1958).

91. See reports cited in S. REP. NO. 2390, 84th Cong., 2d Sess. 2 (1956). The AEC's announcement of its Five Year Reactor Program, published in 1953, resulted from a demand by the Joint Committee on Atomic Energy for a statement of the program.

92. Thus the appropriation has to be reviewed by two sets of congressional committees; the authorization bill goes to the Joint Committee on Atomic Energy and the appropriation bill to the appropriations committees. In view of the JCAE's greater familiarity with the AEC program this results in a substantial increase in effective legislative control.

93. 103 CONG. REC. 5189 (1957). Mr. Durham's attack was directed to the legality of prior activities; the answering legal arguments stated in Mr. Mitchell's memorandum, 103 CONG. REC. 9128 (1957), apparently satisfied most, if not all of the JCAE members.

placing in its operating rather than its construction budget, must receive specific authorization, and (2) that appropriations for cooperative projects must receive authorization.⁹⁴ The 1958 Authorization Act, enacted shortly thereafter, required the AEC, before entering into a cooperative arrangement, to lay the basis of the arrangement before the Joint Committee for 45 days.⁹⁵

The new authorization procedure, as it has been applied in 1957 and 1958, raises several questions as to the proper scope of the legislative function as it relates to program direction:

(1) *Determination of types of reactors to be built.* One of the Joint Committee's complaints has concerned the failure of the AEC to formulate and publish a long range program, with reactor types, sizes and time schedules.⁹⁶ The AEC made one such formulation in 1953 in response to a JCAE request.⁹⁷ A similar formulation was submitted by the AEC in 1958, again in response to a JCAE request.⁹⁸ Subsequently, the JCAE staff prepared its own program formulation as a basis for discussion at the next Congress.⁹⁹

In 1957, the JCAE reported out an authorization bill which would have directed the AEC to construct (1) "a natural uranium graphite-moderated gas-cooled reactor, 40,000 kilowatts," and (2) a "plutonium recycle reactor experiment, 15,000 kilowatts equivalent," and to perform preliminary studies on a plutonium production reactor. The Committee report¹⁰⁰ further specified various technical features of these projects, and even went so far as to designate the location, contractor, and branch chief within the AEC who should be responsible.¹⁰¹

94. The act also required a laying before the Joint Committee on Atomic Energy of new plutonium prices, and of any proposed waivers of fuel and other charges.

95. These provisions, and their effect, particularly in requiring resubmittal to the JCAE of amendments to the arrangement, were ably discussed in an address by Trowbridge, "Implications of Authorization Legislation for AEC's Power Reactor Development Program," at the Fortieth Annual Conference of the Atomic Industrial Forum, Inc., New York City, Oct. 29, 1957.

96. Industrial groups, technical experts and other have often joined in this criticism of AEC. *E.g.*, JOINT COMMITTEE ON ATOMIC ENERGY, AUTHORIZATION HEARINGS, 85th Cong., 2d Sess. 203 (1958); NUCLEONICS 10, 17 (Feb. 1958); ATOMIC INDUSTRIAL FORUM, INC., FORUM MEMO. 14, 16 (Feb. 1958); ATOMS FOR POWER: UNITED STATES POLICY IN ATOMIC ENERGY DEVELOPMENT 159 (1957) (Arden House Report).

97. JCAE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT, FIVE YEAR POWER REACTOR DEVELOPMENT PROGRAM PROPOSED BY THE AEC, 83D CONGRESS, 2D SESS. (Comm. Print 1954).

98. AUTHORIZATION HEARINGS, *op. cit. supra* note 96, at 206, 214.

99. See note 5 *supra*.

100. H.R. REP. NO. 978, 85th Cong., 1st Sess. (1957).

101. The report said it was "essential" that the gas-cooler reactor "be assigned to the Naval Reactors Branch under Admiral Rickover" and "carried on by the [Westinghouse] industrial organization at Bettis"; it referred to "the availability of the AEC installation at Bettis, and Idaho." *Id.* at 26-27. It referred to work done by General Electric at Hanford, Wash. on the plutonium recycle concept and said "it would appear appropriate that the experimental recycle reactor be constructed there." *Id.* at 29. It also referred to

However, before the act was passed the gas-cooled reactor project was reduced to a study. The 1959 Authorization Act required the AEC to build a plutonium production reactor, "convertible type," notwithstanding administrative opposition both to the reactor and to its "convertible" power-producing features. It also specified several design studies of particular concepts not requested by the AEC.

The level of effort and expenditure is clearly a proper matter for congressional determination under its appropriation power. There would also not appear to be any objection to the formulation, by the committee or its staff, of suggested programs as a basis for discussion. Congressional directions to the AEC to build reactors of specified types and characteristics, however, present a different question; while such directions may at times be justified, they invite individuals whose advice has not been acted on by the AEC, or who have been unsuccessful in selling a proposal to the AEC, to have a second bite at the cherry before the JCAE.¹⁰² And congressional designation of particular contractors is a clear invasion of the executive function.

(2) *Review of individual contracts.* The provision of the authorization act for laying before the Joint Committee the basis for cooperative arrangements was patterned on section 169 of the 1954 act, requiring a similar laying before the Joint Committee of certain contracts by which the AEC bought utility services. In adopting that section, Congress made clear that it did not intend to require Joint Committee "approval" of such contracts, but merely to give Congress an opportunity by legislation to withdraw the authority to make such a contract. Congress clearly sought to avoid the constitutional problems which would be raised by a grant of authority to a congressional committee to validate or invalidate a contract;¹⁰³ it recognized that "writing a contract is executive in nature rather than legislative."¹⁰⁴ These principles have at times been lost sight of in subsequent years.

Thus the fiscal year 1958 authorization bill prescribed in some detail the nature of the contractual arrangements on the basis of which the

Hanford (and by implication G. E. as contractor) as the desirable location for the production reactor. *Id.* at 25. The Commission followed this admonition in two cases but it assigned the gas-cooled reactor project (reduced to a study when the Act was passed) to its Civilian Power Reactors Branch, and awarded the study contract to Kaiser Engineers.

The JCAE minority properly objected to these expressions in the Report as "improper favoritism and rank discrimination by legislative fiat," *id.* at 52; and as putting the Joint Committee "in the place of the Commission in the making of arrangements and the letting of contracts and the priority of proposals." *Id.* at 54.

102. For example, the Congressional directive to construct a dual purpose plutonium reactor was supported by testimony before the JCAE of officials of the General Electric Co., an AEC contractor which has long and unsuccessfully been urging AEC to authorize such a project.

103. See Ginnane, *The Control of Federal Administration by Congressional Resolution and Committees*, 66 HARV. L. REV. 569 (1952).

104. *E.g.*, 100 CONG. REC. 11018, 11029, 11214, 11216 (1954).

AEC was to contract with the Second Round proposers—arrangements which differed substantially from the basis on which the AEC and the proposers were then negotiating. The committee report went further and laid down “general principles” to which the AEC was expected to adhere in its negotiations.

In addition, the Joint Committee, in its hearings on individual proposals, has on occasion come close to insisting on certain contract changes.¹⁰⁵ It is true that the Committee is, nominally, merely suggesting and not directing; it has no constitutional power to direct.¹⁰⁶ Nevertheless, just as legislative investigations of the conduct of particular regulatory cases can constitute a form of pressure on an administrative agency to take particular regulatory action,¹⁰⁷ so detailed committee hearings on proposed contracts prior to their becoming effective have a tendency to involve the legislative committee directly in contract negotiations and to dilute executive responsibility for the discharge of executive functions.

The fiscal year 1958 authorization act, and the committee report on it, are, it may be hoped, the high water mark of legislative encroachment on the executive function. The effort now being made to reach agreement on the atomic power program, and the general “era of good feeling” in Washington on atomic power, warrant the hope that a serious issue of executive versus legislative responsibility can be avoided for the future.

E. Public Participation in Decisions on Acceleration

As noted above, the tendency now is for all issues concerning the atomic power program to be resolved in the authorization legislation rather than by substantive legislation. So far as the level of effort is concerned, this appears wholly proper. The Joint Committee report on the 1957 amendments to section 251, however, suggests that the authorization route be used even to make substantive amendments or modifications to the act.¹⁰⁸ Such a procedure, should it be followed,

105. For example, in the hearings on the Pennsylvania Power and Light Proposal, some members of the Joint Committee raised questions as to the patent rights, if any, retained by AEC in the event PPL abandoned its project at the end of Phase I. There followed, in effect, a contract negotiation in the hearing room with PPL offering to give AEC an additional option which AEC accepted. *Hearings Before the Joint Committee on Atomic Energy on Review of Proposals Under Power Demonstration Program 96, 98, 115 85th Cong., 2d Sess. (1958)*.

106. See note 103 *supra*.

107. See, *e.g.*, address by Hon. Ralph Gwinne, Chairman, FTC, Federal Bar Ass'n Annual Convention Washington, D.C., September, 1958.

108. “In its consideration of the various alternative methods of handling current questions, the Joint Committee determined (except as to sec. 261 and new sec. 58) not to attempt to rewrite or clarify various substantive provisions of the act, such as section 169 (no subsidy) section 53 (waiver of use charges), and section 56 (establishment of prices). Rather, as explained in this report, the Joint Committee proposes to revise the act to provide for

would seriously dilute public participation in the legislative process, both because the effect of the amendment is thereby obscured, and because the participation in the authorization hearings and the hearings on particular cooperative proposals has generally been limited to the AEC and the proposer, and has excluded other groups having an interest in the atomic power program.¹⁰⁹ While the issue here suggested has not thus far arisen in clear cut fashion, it could become significant.

CONCLUSION

If the foregoing discussion has done nothing else it has perhaps suggested two things. The first is the complexity and interrelated character of the decisions called for by the civilian power program, which is after all only one part of the program for which the AEC and the JCAE are responsible. Indeed it has not been possible even to mention many issues, especially of technical judgment and contract policy, which have played an important part in the program. The second is that atomic energy has required exploration and development of new techniques, not only in science and engineering, but also in government, economics and law. In these fields, as in science, there have been experiments, some of which have succeeded and some of which have not. Given the nature of the atomic power program in the period 1954-1958, and the background out of which it emerged, the wonder is, not that there has been some confusion and controversy, but that so much has been accomplished in spite of it.*

appropriate review and authorization by the Joint Committee and Congress of atomic power projects and review of schedules of prices and criteria of waiver of use charges before they become effective. In this manner it was intended to permit the AEC the needed amount of flexibility and yet provide substantial review authorization by the Congress." S. REP. No. 437, H.R. REP. No. 471, 85th Cong., 1st Sess. (1957).

109. See *MANAGEMENT AND ATOMIC ENERGY 170-73* (July 1958), where the foregoing point is well developed by Joseph Volpe.

* On December 16, 1958, after the foregoing article had been set in type, Pennsylvania Power and Light Co. and Westinghouse announced that the PPL homogeneous reactor project, referred to in footnotes 45 and 48 *supra*, had been abandoned. The reasons for abandonment apparently relate to technical problems and the economic promise of the reactor. There is nothing to indicate that the participants would have gone forward had a greater measure of AEC assistance been available. While the press release issued by Senator Anderson takes the view that it is inappropriate for private industry to develop "advanced reactor concepts," it also reiterates the proposal to support "private second and third generation projects with increased Government assistance." See note 104 *supra*. Hence it does not appear that the abandonment of this project, and the Congressional reaction to it, requires any basic revision of the conclusions expressed in this article.