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I. Introduction

Twelve years ago, in an address before the National Association of Bank Auditors and Comptrollers, the then Director of the Bureau of the Budget, Rowland R. Hughes, stated:

> The Federal Government . . . operates over a hundred business-type activities. It is, among other things, the largest electric power producer in the country, the largest insurer, the largest lender and the largest borrower, the largest landlord and the largest tenant, the largest holder of grazing land, the largest holder of timber land, the largest owner of grain, the largest warehouse operator, the largest shipowner, and the largest truck-fleet operator.
>
> For a country which is the citadel and the world's principal exponent of private enterprise and individual initiative, this is rather an amazing list.[1]

Among the one hundred or so business-type activities of the Government are certain operations of the Atomic Energy Commission. In this article we shall examine the origin, growth and usefulness of just one phase of these AEC activities, that is, the production and distribution of radioisotopes. This activity is singled out for emphasis partly because of the remarkable success story resulting from the use of such isotopes, but more especially because of an unusual and even unique aspect of "state trading" introduced into the business by the AEC. We refer to, and shall explain in some detail, an unusual self-limiting feature which the Commission has invoked to bring the governmental activity to an end if, and when, private nuclear enterprise enters the field and serves the needs of consumers. It is this last feature that warrants calling the Commission's radioisotope activity something notable; in fact, it is virtually an ideal in state trading and a credit to a free enterprise economy.

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1. Quoted in *Staff Study on Business Enterprises Outside of the Dep't of Defense* 1 (1955), prepared for the Commission on Organization of the Executive Branch of the Government [hereinafter cited as *Staff Study on Business Enterprises*].

II. GENERAL SCOPE OF STATE TRADING BY THE UNITED STATES

Before discussing the AEC production and distribution of radioisotopes, we must, for the purpose of showing that the AEC is not a mere interloper in our American free enterprise system and that state trading is not unheard of in this country, take a quick look at the larger scene—namely, the full dimensions of business enterprise, or "state trading," engaged in by the Government of the United States. These activities, as noted by Mr. Hughes, are both numerous and diversified; but it is only fair to state that most of them have been undertaken to serve some large public purpose or public need which has been a legitimate governmental concern. The government does not engage in state trading for commercial gain and nothing else.

Accordingly, for background purposes we note the following as the principal activities of the United States Government that tend to invade the free enterprise sector of the economy.

A. *Generation and Sale of Electric Power*

A principal government commercial type of activity is the generation and distribution of electric power. Among the most important installations are those of the Tennessee Valley Authority[2] with its fifteen hydroelectric and twelve steam plants and over 15,000,000 kilowatts of installed capacity. Additionally, there are the Columbia River Basin[3] (with such dams as the Bonneville and the Grand Coulee) and the Colorado River projects[4] (including the Hoover Dam, the Parker Dam and others). These are all multi-purpose projects directed toward flood control, navigation aids, irrigation and power supply. There are others of similar nature, but smaller so far as electric power generation is concerned—*i.e.*, the Central Valley project in California,[5] the Missouri River Basin project,[6] the Southwestern

2. The Tennessee Valley Authority was created by Act of Congress May 18, 1933. 48 Stat. 58 (1933), 16 U.S.C. § 831 (1964).

3. The Columbia River basin is under the jurisdiction of three government agencies—the Bureau of Reclamation of the Department of the Interior, the Corps of Engineers of the U.S. Army, and the Bonneville Power Administration. The last named was created by Act of Congress August 20, 1937. 50 Stat. 731 (1937), as amended, 16 U.S.C. § 832 (1964). The authority of the Secretary of the Interior was established by the Reclamation Act of 1902, § 2, 32 Stat. 388, 43 U.S.C. § 373 (1964).

4. The Colorado River projects are under the jurisdiction of the Bureau of Reclamation.

5. The Central Valley Project is under the jurisdiction of the Bureau of Reclamation and the Corps of Engineers.

6. The Missouri Basin Project is under the jurisdiction of the Bureau of Reclamation and the Corps of Engineers.

Power Administration,[7] and the Southeastern Power Administration.[8] From the standpoint of general public welfare, the United States can and does justify these projects both because they are necessary for flood control, navigation, and irrigation and because they would not be developed by private enterprise. The electric power that is generated is deemed a by-product—yet a valuable one—that should not go to waste. In 1965, approximately 68.5 billion kilowatt hours were generated by the TVA alone, and total revenues of 286.4 million dollars were received from the sale of power. This approximated ten per cent of the total electric power generated in this country. It is a big business. Indeed, there are those who feel that the generation of electric power is more than a mere by-product—that it is a major government enterprise competing with private power.[9]

Additionally, the TVA has used its World War surplus nitrate plants at Muscle Shoals, Alabama, to produce nitrate fertilizers; it has developed phosphate production facilities; and it has launched a large scale program of research and education in the use of fertilizers. At one time it promoted commercial sales of fertilizers; but recently, in view of the fact that privately owned plants have been able to supply the commercial market, that phase of the government fertilizer operation has been terminated.[10]

B. *Financial Agencies in General: The Federal Reserve System*

A multitude of agencies in the lending, guarantying, and insurance fields have been created by the United States Government in various forms and with various objectives. They constitute "state trading" in a massive degree although they are all grounded on substantial public purposes and supply an element of fiscal stability of great public

7. The Southwestern Power Administration was created by the Secretary of the Interior to carry out functions assigned to the Secretary by the Flood Control Act of 1944, § 5, 58 Stat. 890, 16 U.S.C. § 825(s) (1964).

8. The Southeastern Power Administration was created by the Secretary of the Interior in 1950 to carry out functions assigned to the Secretary by the Flood Control Act of 1944, § 5, 58 Stat. 890, 16 U.S.C. § 825(s) (1964).

9. For a comprehensive review of the electric power program of the U.S. Government, see COMM'N ON ORGANIZATION OF THE EXEC. BRANCH OF THE GOV'T, WATER RESOURCES AND POWER 89-123 (1955); and for a vast amount of statistical and other background on government electric power, see also TASK FORCE REPORTS, submitted to the Commission on the same subject. The latter are in three volumes with 1783 pages and are a mine of information on water power resources in this country.

10. Commercial fertilizer sales by the TVA were criticized by the Commission's Task Force on Business Enterprises, as well as by the Commission itself. See *Staff Study on Business Enterprises*, 9-16; COMM'N ON ORGANIZATION OF THE EXEC. BRANCH OF THE GOV'T, BUSINESS ENTERPRISES 91-94 (1955) [hereinafter cited as COMM'N REPORT ON BUSINESS ENTERPRISES] Shortly thereafter the TVA suspended commercial sales in the United States.

value. Over eighty of these agencies fall under the Government Corporation Control Act of 1945.[11]

Many of the lending, guarantying, and insurance agencies are "mutualized," that is, the United States subscribes the initial capital, usually by purchasing common stock. Thereafter, the beneficiaries of loans, guaranties, or insurance make proportionate payments to retire the capital stock owned by the Government. Thus, individuals and firms become stockholders, and management passes into their hands, subject to federal regulation. This is "mutualization," and in this sense the Federal Reserve Banks[12] are mutualized. These agencies with their vast resources and federal backing have furnished a bridge in the financial arena between the private enterprise financial system of the country and the vast fiscal powers and strength of the federal government.

C. *Housing Agencies*

There are also the federal housing agencies, established to provide better housing for the general public, for veterans, and for the poor. The methods used include loans, mortgages, guaranties, insurance of mortgages and loans, grants in aid, and the purchase of mortgages. The principal agencies are the Federal Home Loan Bank Board,[13]

11. 59 Stat. 597 (1945), 31 U.S.C. §§ 846-47, 850-52 (1964). This act imposes certain uniform requirements on agencies brought under the act. The principal requirements are (1) adopting of budget, accounting and management methods similar to those of private business, (2) auditing by the General Accounting Office, (3) presentation of annual budgets to Congress, (4) requirement that all banking and checking accounts of more than $50,000 be kept with the Treasury, and (5) approval of purchases or sales of United States obligations by the Secretary of the Treasury. The important net effect of these requirements is to assure good business methods in enterprise-type operations of the Government.

12. Federal Reserve Act of 1913, 38 Stat. 251, 12 U.S.C. § 221 (1964). With 12 banks and 24 branches, this system, under the direction of the Board of Governors of seven members appointed by the President, helps to furnish an elastic currency, affords a means of re-discounting commercial paper and establishes a more effective supervision of banking in the United States. All national banks and certain state banks are stockholders, and are obliged to purchase stock to the extent of 6% of the subscribing bank's paid up capital and surplus. This ownership structure provides the element of mutualization, *i.e.*, mutual government-private operation. In this sense the Home Loan Banks, the Federal Savings and Loan Insurance Corporation, the Federal Land Banks, the Bank for Cooperatives and the Federal Deposit Insurance Corporation are also mutualized.

13. The Federal Home Loan Bank Board is an independent agency in the executive branch under the Housing Amendments of 1955, § 109, 69 Stat. 640, 12 U.S.C. § 1437 (1964). The Board's activities are set up under the Federal Home Loan Bank Act of 1932, 47 Stat. 725, 12 U.S.C. § 1431 (1964); Home Owners' Loan Act of 1933, 48 Stat. 128, 12 U.S.C. §§ 1461, 1464 (1964); National Housing Act, 48 Stat. 1255 (1934), 12 U.S.C. §§ 1724-30 (1964).

the Federal National Mortgage Association,[14] the Federal Savings and Loan Insurance Corporation,[15] the Housing and Home Finance Agency,[16] the Public Housing Administration,[17] and the Veterans Administration.[18] Several of these agencies are now gathered together in the new Department of Housing and Urban Development. Together these agencies promote better housing for Americans by furnishing or guarantying federal financial support in the billions of dollars, far in excess of sums available in the private market for this purpose. These housing agencies are indeed an important part of the "state trading" operations of the federal government.

D. *Aid to Farmers*

Then there are the agencies created primarily to finance farmers and to assure adequate agricultural products for the nation. These include the Federal Land Banks,[19] the Federal Intermediate Credit Banks,[20] the Banks for Cooperatives,[21] the Commodity Credit Corporation,[22] the Federal Crop Insurance Corporation,[23] the Farmers Home Administration,[24] and the Rural Electrification Administration.[25] Fed-

14. Chartered under the Housing Act of 1954, § 302, 68 Stat. 613, 12 U.S.C. § 1717 (1964). It was later made a constituent of the Housing and Home Finance Agency, and now is a constituent of the Department of Housing and Urban Development, 79 Stat. 667, 5 U.S.C. § 624(c) (Supp. I, 1965).

15. Created by Title IV of the National Housing Act § 402, 48 Stat. 1256 (1934), 12 U.S.C. § 1725 (1964).

16. Housing Act of 1949, 63 Stat. 413, 42 U.S.C. § 1441 (1964). The agency is now a part of the new Department of Housing and Urban Development, 79 Stat. 667, 5 U.S.C. § 624(c) (Supp. I, 1965).

17. A constituent agency of the Housing and Home Finance Agency. Its predecessor was the United States Housing Authority, which was created to administer the low rent, public housing program. 50 Stat. 888 (1937), 42 U.S.C. §§ 1401, 1403 (1964).

18. The Veterans Administration is responsible for carrying out a large complex of laws and functions, including loans, guaranties or insurance for homes, farms and businesses for veterans, in addition to many other benefits and services. For a summary of functions, see U.S. GENERAL SERVICES ADMINISTRATION, GOV'T ORGANIZATION MANUAL 525-42 (1965-66).

19. The Federal Land Banks were established under the authority of the Federal Farm Loan Act, 39 Stat. 360 (1916), 12 U.S.C. § 641 (1964).

20. These banks were established under the Agricultural Credits Act, 42 Stat. 1454 (1923), I2 U.S.C. § 1021 (1964).

2I. The Banks for Cooperatives were established by the Farm Credit Act of 1933, 48 Stat. 257, 12 U.S.C. § 1134 (1964).

22. Originally established in 1933, this agency is now chartered by Cougress under the Commodity Credit Corporation Charter Act, 62 Stat. 1070 (1948), 15 U.S.C. § 714 (1964). It finances the price-support and production-stabilization programs.

23. This corporation was created within the Department of Agriculture under the Federal Crop Insurance Act, 52 Stat. 72 (1938), 7 U.S.C. § 1503 (1964).

24. This agency makes farm improvement loans to small farmers. It operates under three statutes: Consolidated Farmers Home Administration Act of 1961, 75 Stat. 307, 7 U.S.C. § 1921 (1964); Honsing Act of 1949, 63 Stat. 432, 42 U.S.C. § 1471 (1964); Economic Opportunity Act of 1964, 78 Stat. 524, 42 U.S.C. § 2851 (1964).

25. Created by Exec. Order No. 7037, May 11, 1935, and currently operating under the Rural Electrification Act of 1936, 49 Stat. 1363, 7 U.S.C. § 901 (1964).

eral aid to farmers dates back to the establishment of the Federal Land Banks in 1916; and the agricultural institutions, agencies, and programs that have been created in the intervening fifty years are legion. Several of the above named agencies are now united under the jurisdiction of the Farm Credit Administration. Again, many billions of dollars of federal funds are used for loans, guaranties, and insurance—all in the interest of strengthening and encouraging the agricultural economy of the country for the common good.

E. *Aid to Business*

Next there are the agencies engaged in providing financial aid to business. These include the twelve Federal Reserve Banks,[26] the Federal Deposit Insurance Corporation,[27] the Export-Import Bank,[28] the Small Business Administration,[29] and the Maritime Administration.[30] Once again, large amounts of government financing are used to support activities deemed essential to the maintenance of a balanced economy in fields where private banking and lending institutions cannot or do not meet the needs. Indeed, all these government financial institutions and aids play a significant part in maintaining a viable economy, and are therefore maintained by Congress as a proper public purpose at no inconsiderable expense to the American taxpayer. Their activities constitute "state trading," either directly or indirectly by way of subsidy.[31]

F. *Other Government Enterprises*

Although the electric power plants and financial institutions are monumental in size and in their impact on the economy, they are by no means the only examples of "state trading" in the United States. Since we seek to view the broader sweep of such trading we

26. Federal Reserve Act of 1913, 38 Stat. 251, 12 U.S.C. § 221 (1964). See also note 12 *supra*.

27. The FDIC was established in 1933 to insure bank deposits. 48 Stat. 168 (1933), 12 U.S.C. § 1811 (1964).

28. Originally authorized by Exec. Order No. 6581 of 1934, and later chartered under the Export-Import Bank Act of 1945, 59 Stat. 526, 12 U.S.C. § 635 (1964).

29. Originally authorized by Exec. Order No. 6581 of 1934, and later chartered amended, 15 U.S.C. § 631-33 (1964); additional functions were added by the Small Business Investment Act of 1958, 72 Stat. 689, 15 U.S.C. §§ 661, 681-87, 695-96 (1964).

30. Established as an independent agency by Reorganization Plan 7 of 1961. See U.S. GENERAL SERVICES ADMINISTRATION, GOV'T ORGANIZATION MANUAL 306 (1965-66).

31. These financial agencies and their powers are discussed along with recommendations for improvement, in COMM'N REPORT ON BUSINESS ENTERPRISES 97-98.

should also mention certain miscellaneous items such as the Alaska Railroad[32] and the Virgin Islands Corporation,[33] both within the Department of the Interior; the business activities of the Panama Canal Company which operates the Panama Railroad; the air transportation furnished by Military Air Transportation Service (MATS); the post exchanges; the scrap metal plants; and many other activities of the Department of Defense. Then, although perhaps not direct state trading, we should take note of the 500 million dollar atomic industry indemnity program adopted by Congress and administered by the Atomic Energy Commission.[34] This program was designed to support and encourage private industry to enter the atomic field by insuring private operators against catastrophic tort liabilities. Also of a similar nature are the various indemnification arrangements to protect private contractors who deal with the National Aeronautics and Space Administration, the Department of Defense, and other agencies of the Government. The purpose of these arrangements is to facilitate private contracting on government projects by protecting the contractors against ruinous losses. As an indemnitor, the Government is in the casualty insurance business in a big way; and under the Social Security Act,[35] it is one of the largest general insurers.

Then, mention may properly be made of the Communications Satellite Corporation (Comsat) established in 1962.[36] Although federal funds are not directly involved, and Comsat may not, therefore, be "state trading" in the narrowest sense, nevertheless, both federal executive authority and government personnel figure importantly not only in regulating Comsat, but also in controlling and guiding its policies. The statutes provide that the President of the United States shall aid in the "planning and development" of the program; he provides for "continuous review of all phases of the development and operation" of the system; and he "exercises such supervision over relationships of the corporation with foreign governments or entities or with international bodies as may be appropriate to assure that such relationships shall be consistent with the national interest and foreign policy."[37] Additionally, the National Aeronautics and Space Administration furnishes services, such as satellite launching, on a

32. 38 Stat. 305 (1914). It operates about 480 miles of railroad serving Seward, Anchorage, Fairbanks and Whittier, frequently at a financial loss.

33. Created by Act of Congress June 30, 1949, 63 Stat. 350, 48 U.S.C. § 1407 (1964), to promote the economic development of the Virgin Islands.

34. The AEC operates under the Atomic Energy Act of 1954, 68 Stat. 919, 42 U.S.C. §§ 2011-394 (1964). The indemnity provision was added as § 170 of the act, 71 Stat. 576 (1947), 42 U.S.C. § 2210 (1964).

35. Social Security Act of 1935, 49 Stat. 620, 42 U.S.C. § 301 (1964).

36. Created by the Communications Satellite Act of 1962, 76 Stat. 419, 47 U.S.C. § 731 (1964).

37. 76 Stat. 421 (1962), 47 U.S.C. § 721(a)(4) (1964).

reimbursable basis; the Federal Communications Commission supplies the usual regulatory authority and, in addition, is empowered to "require the establishment" of communication systems with foreign countries as requested by the Secretary of State. In other words, due to the extensive degree of control, supervision, joint effort, and regulation, Comsat is no ordinary private enterprise. It has been called a "working partnership" between government and private industry, but there are those who say that it is government rather than private enterprise that really controls.[38] It is "state trading" in a grand, although somewhat elusive, manner.

Comsat is of especial interest in any overview of state trading in the United States because the concept of a "working partnership" is beginning to emerge in other areas. It has been suggested in high quarters that urban slums should be attacked by a massive 100 billion dollar "Comsat-type" corporation, enlisting both public and private capital; that air pollution and water pollution should be approached in a similar manner; and most recently, we have the Ford Foundation plan for a massive joint government-private approach to educational television. Advanced by Ford Foundation President, McGeorge Bundy, this proposal involves a "Comsat-type," but nonprofit, domestic satellite system supported by private donations, together with local and state aid and approximately 100 million dollars of annual federal subsidy. These funds would supplement the profits derived from use of the system by commercial television services. We shall be hearing more of Comsat-type "state trading" as the years go by.

The foregoing brief account of "trading-type" enterprises by the United States is not intended to be a complete catalogue. However, it will serve as a sketch of some of the principal features of our government economy, just to show that, while we are generally devoted to private enterprises, our Government does engage in business enterprises (in "state trading"). Indeed, most, if not all, of the enterprises are grounded in reasons more-or-less closely connected with public needs and public purposes,[39] which explains why they have been

38. See Segal, *Communications Satellites—Progress and the Road Ahead,* 17 VAND. L. REV. 677 (1964).

39. At various times questions have arisen concerning the constitutionality of certain of the state trading activities of the United States, but since the decision of the United States Supreme Court in Ashwander v. Tennessee Valley Authority, 297 U.S. 288 (1936) (holding the TVA constitutional), there has been but little likelihood of federal judicial interference with government activities that serve a public need even though they may impinge more or less directly on the private sector. See also, Alabama Power Co. v. Ickes, 302 U.S. 464 (1938); Duke Power Co. v. Greenwood County, 302 U.S. 485 (1938). See Lilienthal, *The Conduct of Business Enterprises by the Federal Government,* 54 HARV. L. REV. 545 (1941), who gives an excellent review and also a preview as to the future of United States state trading.

created or authorized by Congress. Some of them are attacked occasionally as government invasions of the private sector. For example, when the two Hoover Commissions carefully examined all the government's commercial-type enterprises, they viewed some of them with a critical eye and recommended that they be terminated or limited in scope. Nevertheless, these enterprises are on the statute books and are a significant part of the government establishment. The United States is not a 100 per cent pure private enterprise economy, although to recognize the fact is not necessarily to condemn it.

G. *The Atomic Energy Commission*

With the foregoing as background setting forth some of the salient facts concerning the general scope of state trading by the United States, we can now focus upon the agency and the specific state trading that is the principal objective of this article, namely, the Atomic Energy Commission with its strictly modern and unique activities. These activities are diverse and are economically of very great importance. They comprise authority over most aspects of nuclear science and technology, including production of atomic fuels, generation of atomic electric energy, atomic propulsion of ships, "plowshare" operations,[40] desalination of sea water, the military applications so important to national security, and, last but by no means least, the production and distribution of radioisotopes. It is this last item on which we now focus especial attention, for it is an especially unique "state trading" activity of the Government. As previously indicated, it is singled out for close examination partly because it is a remarkable success story in the annals of state trading, and partly because of its unique self-limiting feature which is unusual in governmental affairs.

III. Production and Distribution of Isotopes

A. *Twenty Years of History*

We first look at the historical record. Early in 1946 the "Manhattan Engineer District" of the United States Army, the organization that produced the atomic bomb, established an Isotopes Branch at Oak Ridge, Tennessee. Note that this took place only five years after Enrico Fermi instituted the world's first controlled chain reaction under the football stands at Stagg Field in Chicago. The

40. "Plowshare" is the name given to AEC's program to study and develop peaceful uses in science and industry for nuclear explosives. The Plowshare Program was formally established in 1957. It has many potential applications including such possibilities as deeply buried explosives for gas and oil recovery, mining, excavation of harbors, canals and mountain passes, etc. See Division of Industrial Participation, AEC, The Nuclear Industry 139-45 (1966).

Isotopes Branch had the facilities to make radioisotopes on a large scale, a capability not then possessed by private industry. The first announcement that radioisotopes were to be made available for distribution to private licensees was published a little over twenty years ago, in June, 1946.[41] The first shipment of radioistopes, consisting of a small unit of carbon 14, was sent on August 2, 1946, to the Barnard Free Skin and Cancer Hospital in St. Louis, Missouri. Then, as of January 1, 1947, Congress transferred jurisdiction over all atomic development from the Manhattan Engineer District of the Army to the newly-created civilian Atomic Energy Commission.[42] The succeeding twenty years has witnessed the development of a new area of governmental, trading-type enterprise that, to an astonishing degree, has contributed (and promises even greater contributions) to the general welfare, not only of this country but abroad as well. The importance of the development merits a closer view. We focus on radioisotopes alone, laying to one side AEC activities in other nuclear fields.[43]

To continue with the historical development, during the first AEC year, 1947, some 1,650 radioisotope shipments of nearly 100 different varieties were sent from Oak Ridge to 189 AEC licensed institutions and agencies throughout the United States.[44] They were used largely for fundamental research purposes. During the first five years, 1947-1952, approximately 32,000 shipments of radioisotopes were sent to over 1,100 United States institutions and agencies; and another 2,000 shipments were made of stable isotopes.[45] Additionally, in 1947, the first "labelled compound," methyl alcohol labelled with radio-carbon, was made available. Meanwhile, the Federal Food and Drug Administration had been drawn into the field and, in 1951, after a period of investigation, iodine 131 was accepted as an effective new drug, to be used primarily in connection with thyroid disorders. A year later phosphorus 32 was approved, and wide scale medical uses of radioisotopes were on their way. Similarly during these early years, numer-

41. 103 SCIENCE 697 (1946).

42. The transfer was effected pursuant to the Atomic Energy Act of 1946, 60 Stat. 755, 42 U.S.C. § 2015 (1964).

43. As an example of other AEC commercial-type activities there is the production of enriched uranium for lease or sale for use in civilian reactors. With reductions in defense requirements, civilian reactors are expected to become the primary market for enriched uranium in the future. The plants, built for national defense purposes at a cost of $2.3 billion, are located at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. The Commission is now considering the possible desirability of selling or leasing to the private sector one or more of these plants. See AEC Release No. J-297, Dec. 29, 1966.

44. See 3 AEC SEMIANN. REP. 7, 48 (1948).

45. See AEC, ASSURING PUBLIC SAFETY IN CONTINENTAL WEAPONS TESTS 38 (1953). The stable isotopes (non-radioactive elements), shipment of which was instituted in 1947, consisted largely of boron 10, deuterium and deuterium oxide (heavy water).

ous valuable uses of radioisotopes of service in industry and agriculture were being discovered. An entirely new technology was being developed and put to use for the benefit of mankind, and a state-trading type of activity was doing it. It must be remembered, however, that, at this early stage, private enterprise lacked capability for entering the field. There were no private reactors to produce the isotopes. If the Government had not entered the business, nothing would have happened.[46]

The benefits of the new technology were also being shipped abroad. On September 3, 1947, international distribution of isotopes was authorized, and, by the close of 1954, forty-six countries around the world had requested and received some 3,122 shipments of radioisotopes.[47] In the same year, distribution abroad of stable isotopes was begun. By 1965, the foreign trade had grown to a big business with an annual total of over 800 shipments containing more than 450,000 curies of radioactivity, priced at over 600,000 dollars. A sizable international trade has thus been inaugurated.[48]

Oak Ridge was the source from which the products of this new technology came forth, and it still remains the principal source of supply. Other AEC facilities, however, have been drawn into the enterprise—Argonne National Laboratories in Illinois, Brookhaven on Long Island, Mound Laboratories in Ohio, the National Reactor Testing Station in Idaho, the Hanford Operation in Washington and the Savannah River plant in South Carolina have all contributed to the grand total.

Three different types of facilities for the production of radioisotopes have been exploited. The principal source has been the large nuclear reactor in which the neutron flux has irradiated target materials. Also, cyclotrons have been, and are being, used for this purpose,[49] and

46. The AEC has made available to the lay reader an exceptionally lucid explanation of the new technology resulting from the fissioning atom. A 176-page illustrated monograph was issued largely to promote public awareness of the increasing influence of radioisotope technology in so many facets of our daily lives. See AEC, RADIOISOTOPES IN SCIENCE AND INDUSTRY 1 (1960), where Dr. Willard F. Libby, a member of the AEC from 1956 to 1959, in writing the foreword to the monograph, said: "In all the span of recorded history, one of mankind's more spectacular achievements has been the exploitation of atomic energy. . . . Radioisotopes, which are versatile by-products of reactor operation, are having great impact in accelerating scientific progress, assisting agricultural progress, aiding in medical diagnosis and therapy and contributing to industrial productivity. Even if there were no other benefits from atomic energy, isotopes could, in time, justify much of the effort and funds invested in the nation's atomic projects. . . ."

47. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 98 (1954).

48. See ISOTOPES INFORMATION CENTER, LIST OF AEC RADIOISOTOPE CUSTOMERS WITH SUMMARY OF RADIOISOTOPE SHIPMENTS 68-73 (1965) [hereinafter cited as RADIOISOTOPE SHIPMENTS (1965)].

49. In fact cyclotrons were used to produce radioactive isotopes before the reactor technology was discovered. By 1934 scientists had learned that, by the use of "atom

more recently useful radioisotopes have been separated and recovered from AEC owned high-level wastes—that is, the fission products remaining in spent fuel elements from reactors processed to recover unused fissionable material.

The sheer size to which this new industry has grown in twenty years is impressive. Although it does not reach the dimensions of typically large scale American industry, nevertheless, from small beginnings in 1946, it has grown from year to year so that by 1962 the Commission reported sales from Oak Ridge National Laboratories alone totaling over 542,000 curies[50] of radioactivity, with a dollar value of domestic shipments amounting to 1,458,000 dollars and, in addition, foreign shipments totaling 284,000 dollars. Oak Ridge, as has been noted, is the principal Commission supplier. In the succeeding years, notwithstanding withdrawal of the Commission from the production of certain isotopes (a development which will be explained later in this discussion), the quantities and the dollar value continued to climb, largely because of the distribution of sizable quantities of cobalt 60 for various types of irradiators. In 1964, the total AEC sales of radioisotopes amounted to 1,633,477 curies, in 12,553 shipments returning 2,632,013 dollars to the treasury; and in 1965, sales amounted to 1,875,118 curies, in 11,980 shipments worth 3,533,098 dollars.[51] At the same time a substantial private market was developing. Not only was the Government in business but, as we shall see in greater detail later, it was continuously encouraging and helping the building of a private business in the production and distribution of radioisotopes.

B. *The Legal Setting for the Radioisotopes Business*

We should now examine briefly the legal setting in which this new government enterprise has come into existence and in which it operates. The Atomic Energy Act of 1954 is the legislative parent of the radioisotopes industry.[52] As has already been noted, this act and its forerunner, the Atomic Energy Act of 1946, placed responsibility upon the Atomic Energy Commission to take over the wartime atomic facilities and atomic weapons program of the Manhattan Engineer District. The Commission was authorized and directed to continue

smashers," radioactivity could be induced in normally stable elements, and with this discovery powerful research tools and versatile sources of radiation came into existence. See AEC, RADIOISOTOPES IN SCIENCE AND INDUSTRY 1 (1960).

50. A curie is a quantity of radioactive material that produces 3.7 x 10^{10} disintegrations per second. It is a fairly large unit.

51. The figures are taken from DIVISION OF TECHNICAL INFORMATION, AEC, LIST OF AEC RADIOISOTOPE CUSTOMERS WITH SUMMARY OF RADIOISOTOPE SHIPMENTS 87 (1964); RADIOISOTOPE SHIPMENTS 73 (1965).

52. 68 Stat. 919, 42 U.S.C. §§ 2011-394 (1964).

production of nuclear materials. Moreover, under Congressional mandate, atomic bomb technology was to be diverted, in part at least, to peaceful uses.

Three kinds of nuclear material are subjected to governmental control under the act. They are "source material," "special nuclear material," and "by-product material."[53] The ownership of all special nuclear material (by which is meant, in effect, material capable of releasing substantial quantities of atomic energy in a chain reaction), was originally placed solely in the Commission, as agent of, and on behalf of, the United States, with authority to lease or otherwise distribute it to qualified persons. Special nuclear material is the stuff of which bombs are made and by which atomic reactors are fueled. Because it is dangerous, very close government control is essential.[54] On the other hand, source material and by-product material are less hazardous; hence they can, under the Atomic Energy Act, be owned by private persons who are properly qualified and duly licensed by the Commission. The radioisotopes with which we are concerned in this article are derived by the Commission principally from by-product materials, either from target materials placed in the flux streams of operating reactors or by way of extraction from the waste products remaining in spent reactor fuel elements.[55]

Regarding the licensing of radioisotope users, section 81 of the act provides that no person may "transfer or receive in interstate commerce, manufacture, produce, transfer, own, possess, import or export any by-product material except as authorized by the Commission."[56]

53. These terms are defined in § 11 of the Atomic Energy Act in the following manner: Definitions: (e) The term "by-product material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material. (x) The term "source material" means (1) uranium, thorium, or any other material which is determined by the Commission pursuant to the provisions of Section 2091 of this title to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the Commission may by regulation determine from time to time. (y) The term "special nuclear material" means (1) plutonium, uraniun enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of Section 2071, of this title, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material. 68 Stat. 922 (1954), 42 U.S.C. § 2014 (1964).

54. In 1964 Congress amended the act to clear the way for the sale and private ownership of special nuclear materials needed for privately owned electric power reactors and other licensed civilian uses. 78 Stat. 602, 42 U.S.C. 2013 (1964). This amendment is concrete evidence of the Commission's desire to move atomic energy into the private sector as rapidly as it can be done consistently with the public interest.

55. As has hitherto been noted, radioisotopes can also be derived from cyclotron bombardment of stable isotopes, but in 1955 the AEC discontinued processing such radioisotopes for routine commercial distribution. These are now produced by private industry or are imported from abroad.

56. 68 Stat. 935 (1954), 42 U.S.C. § 2111 (1964).

Provision is also made for the issuance by the AEC of "general or specific licenses" for the use of such material "for research or development purposes, medical therapy, industrial uses, agricultural uses or such other applications as may be developed." Then it is further provided that "the Commission may distribute, sell, loan, or lease such by-product material as it owns to licensees with or without charge." Although there is no positive assertion of the right of private persons to *own* radioisotopes derived from by-product material, and although the existence of the right has in fact been questioned in legislative hearings, it has been generally assumed that the authority given the AEC to *sell* includes the right of the purchaser to *own*. The licensees under section 81 of the act are the domestic purchasers of the AEC produced radioisotopes.

Pursuant to the foregoing statutory provisions, and supplemented by appropriate Commission regulations,[57] a substantial government enterprise involving the production and distribution of radioisotopes has been developed and carried on under the regulatory jurisdiction of the Atomic Energy Commission during the last twenty years.[58]

In a free enterprise system, there is always a temptation to question any new venture in which a government agency produces, sells, and distributes to consumers. In the case of radioisotopes, however, the nation was confronted with an extraordinary state of affairs. For wartime purposes, the military establishment, with the devoted assistance and skill of a large segment of the scientific talent of the nation, had mastered the technology of nuclear fission and had created a new asset for mankind—one of the most significant if not the most significant in all history. This new technology was made available during World War II for military purposes by a supreme and

57. See 10 C.F.R. §§ 30-36 (Supp. 1966), for regulations pertaining to the following: common requirements applicable to all radioisotopes licenses (Part 30); general licenses for certain quantities of by-product material contained in certain named items (Part 31); specific licenses to manufacture, distribute or import exempted and generally licensed items containing by-product material (Part 32); specific licenses of broad scope for by-product material (Part 33); licenses for radiography and radiation safety requirements for radiographic operations (Part 34); human uses of by-product material (Part 35); and export and import of by-product material (Part 36).

58. Although the AEC is the principal producer and commercial market supplier of radioisotopes, it is gradually transferring to the states the responsibility for licensing and regulating the use of radioisotopes. In 1959 Congress amended the Atomic Energy Act by adding § 274, authorizing the Commission to enter into contracts with those states that had, by setting up compatible state regulatory systems, properly prepared themselves for the responsibility. Thirteen states have now qualified and the responsibility has been transferred to them. Upwards of twenty additional states have adopted enabling legislation and soon will be ready to assume the task. 73 Stat. 688 (1959), 42 U.S.C. § 2021 (1964). See Stason, *Workmen's Compensation for Radiation Injuries in Tennessee,* 19 VAND. L. REV. 571 (1966). For a more detailed treatment of the legal setting for the radioisotopes branch of the atomic industry, see 1 CCH ATOM. ENER. L. REP. ¶¶ 2901-53.

super-secret effort which involved the building of a multi-billion dollar complex of atomic production plants. The plants had capability not only for the manufacture of devastating weapons, but also, for the production, in large quantities and at modest cost, of many radioisotopes that could be utilized for peaceful purposes. Although there was great potential for valuable peacetime applications, in 1946, when the government plant was removed from the wraps of wartime secrecy, private industry had no production capability to get the isotopes on the market. They could be made available only by use of government owned reactors and related facilities. The Atomic Energy Commission had virtually everything, and the enormous facilities had to be retained by the Government for military purposes. Accordingly, the Government went into the business of supplying the needs of consumers in research, medicine, agriculture and industry. It was "state trading" with a worthy purpose and, as events have proved, a most benign result.

C. *The Uses of Radioisotopes*

In exploring this new business activity of the Government, we should pause to take note of the principal peaceful uses of radioisotopes. It is a truly fascinating story. Medicine was an early beneficiary. Mention has already been made of iodine 131, widely employed along with iodine 132 in the diagnosis and treatment of thyroid disorders. Phosphorus 32 is used in brain tumor localization and in the treatment of polycythemia vera; radiogold colloid is used in implantation therapy, using needles similar to those used in radium therapy; cobalt 60 and cesium 137 are used in supervoltage teletherapy for deep radiation treatment of cancer; strontium 90 has been used to a limited extent in the treatment of the eye; and boron 10 is used to a limited extent in tumor therapy, especially in brain tumor cases. This last procedure, initiated at the Brookhaven National Laboratories, is rather fantastic. The boron 10 (a stable isotope) is introduced into the tumor, and there it is bombarded with a neutron beam received by the patient directly from a reactor. This causes the non-radioactive boron to become radioactive, thus initiating beta emission to ionize and destroy the adjacent cancerous tissue. The process is limited to really serious cases.

Over 2,000 hospitals or medical groups currently use isotopes for various kinds of diagnosis and treatment, including upwards of 300 teletherapy units licensed for use in the United States. In short, during the past decade, medicine has made exceptional advances which are uniquely dependent upon radioisotopes. Undoubtedly

many more applications will be developed in the future.[59]

Radioisotope techniques also find wide application in agriculture. They are important research tools in basic studies on plant physiology, biochemistry, plant genetics and plant pathology. Improvements in resistance to plant diseases have resulted from their use. Irradiation of seeds has produced a number of promising mutations. Studies of photosynthesis by using carbon 14 are giving significant insights into the process by which electromagnetic energy reacts with the chlorophyll in plant life to convert inorganic carbon dioxide and water into digestible energy-containing sugars and starch. Radioactive phosphorus, sulphur, calcium, potassium, magnesium, and iron have been used as tracers in fertilizer studies to determine the plant uptake of these substances from the soil and intake from foliage. They are now almost routine tools for precise measurement of fertilizer effectiveness.

The use of radioactive isotopes has also made possible the study and improvement of herbicides, fungicides and insecticides; and insect sterilization has resulted spectacularly in the virtual eradication of the screw worm from Florida and the southeastern region of the United States. In studies of animal nutrition, radio-tracer techniques have been widely and effectively used. By the use of radioisotopes, the metabolism of many elements in farm animals can be conveniently followed from their uptake in food in the form of organic and inorganic compounds through their incorporation into various regions of the body. Thus, the isotopes are of unusual value in nutritional studies. In short, the radioisotopes, produced and widely distributed by the AEC, have vastly improved agricultural processes and are making an important contribution to the world's food supply—a not inconsiderable matter in view of impending food shortages among the world's too rapidly increasing populations.

It is perhaps in industry that radioisotopes have made, or will soon make, their greatest dollar contribution to the economy. Industrial uses fall into three categories: radioisotopes used in tracing, low level radiation sources for radio-inspection purposes, and high level radiation sources for food, drug and materials sterilization and processing applications. Radio-tracing applications include: wear and lubrication tests to ascertain the most effective lubricants for given conditions of operation; wear tests on paints, varnishes, wax coatings, and the like; studies concerning the effectiveness of detergents and other cleaning agents; finding leaks inside complicated piping systems and underground storage facilities; and tracing flow in pipelines, streams, chemical processing plants, and various other fluid or slurry

59. See AEC RADIOISOTOPES IN SCIENCE AND INDUSTRY 17-25 (1960).

systems. Radio-inspection processes include radiography (the photographing of joints and welds); radiation beam inspection of rapidly moving packages, cans, bottles, and sheet material such as paper, cloth and metal; and other similar processes. Finally, high level radiation is used or is being planned for use in connection with upgrading of plastics, curing of paints, upgrading of solid state devices, sterilization of medical supplies, production of wood plastics combinations, sterilization of parts for space programs, production of bio-degradable detergents, and synthesis of chemical compounds. About ten years ago, during a twelve month observation period, 595 American industries out of the 1,600 licensed industries reported annual net savings of nearly 40 million dollars from the use of radioisotopes in one way or another. The industries reporting included chemicals, petroleum, natural gas, drugs, electric and gas supply, food products, metal mining, plastics, stone, clay and glass, and textiles.

In short, a broad spectrum of the American economy is receiving substantial benefits from the use of radioisotopes. They have become a significant and valuable factor in American life. This new government enterprise has demonstrated utility for the benefit of mankind in medicine, agriculture and industry. The end results of this atomic phase of "state trading" have been most benign.

D. *AEC Pricing Policies*

In any commercial enterprise, whether private or governmental, there must be a pricing policy to guide the hands that attach the price tags. The basic pricing policy for the Atomic Energy Commission is created by section 81 of the Atomic Energy Act. It provides as follows:

> The Commission may distribute, sell, loan or lease such byproduct material as it owns to licensees with or without charge: *Provided, however,* That, for byproduct material to be distributed by the Commission for a charge, the Commission shall establish prices on such equitable basis as, in the opinion of the Commission, (a) will provide reasonable compensation to the Government for such material, (b) will not discourage the use of such material or the development of sources of supply of such material independent of the Commission, and (c) will encourage research and development. In distributing such material, the Commission shall give preference to applicants proposing to use such material either in the conduct of research and development or in medical therapy. . . .[60]

Pursuant to the authority of the quoted language, the Commission publishes a handbook implementing the statutory provisions by setting forth the details of its pricing policy.[61] For reactor produced isotopes,

60. 68 Stat. 935 (1954), 42 U.S.C. § 2111 (1964).

61. See OFFICE OF THE CONTROLLER, AEC, PRICING HANDBOOK (1965). For a convenient source of information on prices, see 1 CCH ATOM. ENER. L. REP. ¶ 2932. The

the Pricing Handbook states that costs include, *as a minimum*, applicable out-of-pocket costs of (1) target materials (that is the stable isotopes that are placed in reactors to be made radioactive) (2) reactor operating costs, including the cost of operating auxiliary facilities, (3) net fuel costs, taking into account fuel burn-up allowances, (4) transportation, handling, and analytical work, (5) decay losses, (6) chemical processing, purification, and the like. With respect to isotopes derived from waste products, no value is assigned to unprocessed fission products contained in the waste storage tanks. No charges are made for depreciation or the basic construction cost of the facilities. The minimum costs are not, however, the whole story. Basically, the Commission seeks to establish a reasonable compensation for the Government, which ordinarily is the higher of either the AEC full cost recovery or the current commercial rates, unless this would significantly interfere with research, development and use, or would discourage development of private sources of supply. The latter point is one of the more important aspects of Commission policy in this new enterprise, and we shall discuss it in more detail in the next section of this article. The Commission publishes not only catalogues and price lists for each of the producing laboratories, but also gives a thirty-day prior notice of proposed price changes, including the reasons for changes.[62]

In practical application, these pricing policies have resulted in a gradual reduction of radioisotope costs to the consumer. Prices have decreased steadily since 1947. Price reductions have been accomplished by improvements in processing methods as well as through efficiencies and increased sales volume. Quantity discounts have been established. Isotopes for cancer research were formerly distributed at a cost that covered only the shipping charges; in 1955, however, a broader program was established under which isotopes were made available at about twenty per cent of list price for all life science research in the United States.

In short, the Atomic Energy Commission has sought to pursue a pricing policy that is really compatible with the spirit and purpose of the Atomic Energy Act of 1954.

E. *Termination of Radioisotope Distribution*

Not only is the AEC radioisotopes business important as to size, useful to the general public by reason of its many valuable ap-

current CCH listing includes upwards of 85 items as routinely available on order. The list sets forth for each item the half life, the day shipped, the cost per unit and the minimum size of order for each. See also RADIOISOTOPE SHIPMENTS 73 (1965), which reveals that 165 different isotopes were actually furnished to customers in 1965.

62. See 1 CCH ATOM. ENER. L. REP. ¶ 2917.

plications, and modestly priced for the consumer, but also it possesses one feature that is truly extraordinary for a government operation—it follows a policy of self-termination. The Commission has adopted and implemented a policy of withdrawal from production of radioisotopes for consumers just as soon as they become available in the commercial market from private enterprises. Since privately-owned reactors have become increasingly available for irradiation of target materials, private enterprise is entering the market whenever it can be done on a commercially profitable basis. As soon as private enterprise steps in the Government steps out. This is a unique aspect, for usually the corollary of Parkinson's law applies and government enterprise expands rather than contracts.

The Commission has stated that, as a matter of policy, it will refrain from competing with private sources when the isotopes are reasonably available commercially, and it has in fact discontinued the production of selected types and quantities of radioisotopes and related services as these have become available from the private sector. In a statement of policy dated March 2, 1965, the Commission announced that

> It . . . wishes to reaffirm its policy to transfer its commercial radioisotope production and distribution activities to private industry as rapidly as possible consistent with the public interest. . . . The Commission has now adopted policies and procedures for the transfer of commercial AEC radioisotope production and distribution activities to private industry. . . .[63]

In accordance with this policy, the Commission has established a definite procedure for withdrawal. This it does both on its own motion and on petition from outside entrepreneurs. Any private industry or group can formally request AEC withdrawal from the production and distribution of particular radioisotopes. The announced "guidelines" for Commission withdrawal are:

(1) Demonstrable existence of private capacity to furnish the isotopes to the public, thus to assure that the market will be supplied;

(2) Presence of effective competition in the private sector, thus to assure fair prices (foreign competition is taken into account in this connection);

(3) Assurance that private industry will not discontinue service to the market, thus making certain that if the private entrepreneur does not make a profit the service will not be unceremoniously abandoned;

(4) Assurance that private pricing policies will be reasonable and will be consistent with encouragement of research and development in the use of radioisotopes;

63. The AEC statement of March 2, 1965, is set forth in full in 1 CCH ATOM. ENER. L. REP. ¶ 2951.

(5) Understanding that, notwithstanding AEC withdrawal from the general market, radioisotopes will be supplied to other government agencies whenever it is necessary to avoid significantly higher costs to the Government.

This termination procedure is more than an empty rule-making exercise. It is applied conscientously by the staff on which responsibility is placed. In fact, it was applied informally even prior to the adoption of the formal policy statement of March 2, 1965. As long ago as 1955, the AEC discontinued processing and distributing cyclotron-produced isotopes. Private industry then supplied and continues to supply the entire market. In 1958, the Commission announced that it would no longer accept requests for gamma irradiation services since these had become available from private industry.[64]

In 1961, the Commission announced the withdrawal from "routine" production of cobalt 60 with specific activity greater than 30 curies per gram to the extent that the market was being supplied by private producers.[65] In 1963, it was reported that iodine 125 and 131 would no longer be produced by the Commission.[66] In 1964, six radioisotopes were withdrawn.[67] During 1965, the Commission withdrew from preparation for sale a total of seven isotopes. Additionally, the Commission looked forward three years and announced that in 1968 it would withdraw from its lists four important radioisotopes: strontium 90, cesium 137, cerium 144, and promethium 147, all of which would then be available from the privately-owned Fission Products Conversion and Encapsulation Plant being constructed by Isochem, Inc., near Richland, Washington.[68] Finally, as of May 1, 1966, the Commission announced a total of seventeen withdrawals, a long list of important items all of which had been developed sufficiently to find private producers in the free enterprise system.

64. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 61 (Jan.-June 1958).

65. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 190 (1963). The supply of cobalt 60 is somewhat complicated. Notwithstanding its 1961 announcement, in 1965 the AEC felt obliged to help the private market by making downward revisions in its cobalt 60 price schedule in order to encourage the development of large scale industrial applications and to assist American producing firms to compete more effectively in the world market. In 1961 both Westinghouse and General Electric started producing high specific activity cobalt 60 in their test reactors. Later Westinghouse withdrew from the field, leaving only G.E. in the production of substantial quantities of predominately teletherapy and radiography grade high specific activity cobalt 60. Currently Consumers Power Company of Michigan is starting to produce megacurie quantities. With these developments the production of the important cobalt 60 radioisotope is in a state of flux, with the Commission still supplying to a limited extent, but trying to encourage the establishment of adequate private sources. See DIVISION OF INDUSTRIAL PARTICIPATION AEC, THE NUCLEAR INDUSTRY 108-09 (1966).

66. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 189 (1963).

67. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 180 (1964).

68. See AEC, MAJOR ACTIVITIES IN THE ATOM. ENER. PROGRAMS 227 (1965).

The fact is that the Commission's practice of voluntary withdrawal has been so satisfactory to the private market that only one petition for withdrawal has been filed by industry, and it has not been seriously pressed. The Commission has been making a sincere attempt to encourage private industry to enter the market—it prices the government product at a level designed to stimulate an attractive private market, and it withdraws promptly as soon as the private sector supplies the demand in a reasonable manner.

This self-termination procedure can be regarded as rather unique in the field of "state trading." It is in marked contrast with the Tennessee Valley Authority, which now announces that, in addition to its vast complex of hydro-electric and steam-electric power plants, it will add a new 1,200,000 kilowatt capacity nuclear plant in the near future. Assuming the highest motives in both agencies, it is fair to conclude that the Atomic Energy Commission's attitude toward the private market is somewhat more consistent with the free enterprise system on which this nation's economy is founded. The Commission deserves credit for its efforts in carrying out the statutory mandate of section 81 of the Atomic Energy Act, which asserts that the pricing structure established for by-product material shall "not discourage . . . the development of sources of supply of such material independent of the Commission." Moreover, the Commission complies generously with the even more significant language in the Declaration of Purpose in section I of the act which reads: "It is therefore declared to be the policy of the United States that . . . the development, use and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise."[69]

IV. A Projection into the Future

In high government quarters the general policy of favoring private enterprise has frequently been expressed. For example, in 1954, the Committee on Government Operations of the United States House of Representatives, after an extended investigation, reported that

> Though economy in government operation may be proved in a given case, or the necessity for the Government to operate a service may be proved at one time, it is essential to develop competitive industries as soon as possible, and the Government should step out of the picture at the earliest date. Government's continued monopoly in a field may prevent free industry from entering."[70]

69. 68 Stat. 921 (1954), 42 U.S.C. § 2011(b) (1964).

70. H.R. Rep. No. 1197, 83d Cong., 2d Sess. 4 (1954).

The two Commissions on the Organization of the Executive Branch of the Government (the Hoover Commissions),[71] in their monumental multi-volume reports, presented to Congress many recommendations of similar import concerning the proper relations between Government and the private sector.

In its production and distribution of radioisotopes, the Atomic Energy Commission is conforming to the principles thus set forth, not only with respect to radioisotopes, but also in some of its other commercial-type activities, for example, the private ownership of special nuclear materials and possibly the sale of government diffusion plants. These constitute important steps in the free enterprise direction.

All of this is much as it should be in a free enterprise economy. If the private sector is able to do a job, it should be permitted, and even encouraged, by the Government to do so. An examination of the record will reveal that in past years many governmental agencies that for one reason or another have embarked on state trading activities have subsequently abandoned them in favor of private enterprise. Should these examples lead us to conclude that there is a gravitational tendency inducing a continual shift from the public arena to the private sectors in the free enterprise system? Probably so, yet a caveat is in order.

In predicting the future of American state trading, we would blind ourselves to the realities if we failed to take account of the character of the innovations now being introduced into our economy by the remarkable technology of current times. We should note particularly the enormous amounts of capital required to build and operate the mechanical behemoths created by the minds of modern man. For example, we are on our way to the supersonic transport plane that will project us across the Atlantic in less than two hours. Yet only Government can find the two billion dollars of capital necessary to get the test model off the ground. As mentioned earlier, educational television on a countrywide scale and free from corrosive commercials is on its way, if only the Government will cooperate by laying on the line about 100 million dollars per year for carrying charges. Also, world-wide live television news coverage by Comsat-type satellites is on its way; we will soon be able to spread the news live from anywhere to everywhere on the instant—from Katmandu in Nepal to Patagonia, from the North Cape of Scandanavia to the Southwest Cape of Tasmania, and thence to Oshkosh, Wisconsin. All of this will be "spin-off" from the NASA research that will rocket us to the moon. But who, other than the federal government, can foot the

71. These two Commissions reported in 1949 and 1955 respectively.

bill? A massive national electronic-data-processing system has also been proposed (and we may have it before 1984). This would be a national system of marvelous efficiency to record on thousands of reels of tape all facts, figures, statistics, personal data, historical data, legal materials, tax data, criminal data, and perhaps even library materials and literary products of a non-fictional character. Presumably such a system would serve all comers on a cash-and-carry basis. Research would be immeasurably facilitated. But who would be able to finance the multi-billion dollar monster—who but Washington?

The point is this: many of the products of modern technology contain in themselves vast benefits for mankind which we want to enjoy, but an ever-increasing number of them outrun the fiscal capabilities of the private enterprise system. The AEC's 2.3 billion dollar atomic production plants were merely an early example—a taste of things to come. We can expect to experience a very great escalation of "state trading" in the United States, not only from the occasional, more-or-less conventional activities to which we have grown accustomed, but, also, and more dramatically, from the wonders wrought by the technological age.