common dedication will mobilize that spiritual power in the world against which the forces of greed and selfishness and totalitarianism cannot prevail. Let us go forward and remain true to the things that we believe in and true to ourselves, with high faith in our purposes, with high faith in the values that we believe in, and with high faith in ourselves.

If we do that, as I know that we shall, we shall share in the great human satisfaction that having been called to duty we performed that duty well, that having had an opportunity to serve our fellow man we subordinated ourself in total dedication in the pursuit of the advancement of the interests and well-being of our fellow man.

There is no greater calling than to serve your brother. There is no greater contribution than to help the weak. There is no greater satisfaction than to have done it well.

I say to you this is not the end. This is part of that great historic struggle that goes on as long as hope beats within the human breast—that hope for a better tomorrow, that hope for a better world, that dream that mankind can fashion a world in which man's inhumanity to man can be ended, and which the great power of creation which God gave us can be used by man to create a better world—a world in the image of the things that the Prophets talked about, that the poets dreamed about, that the philosophers sketched with their broad strokes.

This is one of those glorious hours. We are fortunate to be blessed, each of us in his own humble way, with our little place on the page of history, and to share in this kind of great historic decision. Millions of people have been denied that kind of opportunity. Let us pray we shall be worthy of it.

Let us go forward with courage, with humility, with dedication. Let us make the most of the new opportunity that the new beginning presents us with. Having done these things, we will contribute, we will help build with our fellow workers in America and our fellow workers in the world, and with men and women of good will everywhere, a wonderful new world society in which the teachings of the great religions can be applied in the everyday life in man's relationship to man. Let us never forget that he who would serve God must prove that he is worthy by serving man. This is our pledge. This is the great challenge. I believe that we shall be worthy of that challenge and I pray that God may make us strong in our faith, that He may sharpen our vision, that He may raise our sights, and that the days that lie ahead shall be days in which together we shall labor in the broad

vineyards of American democracy and in the broader vineyards of the world, in which peace, freedom, social justice, and brotherhood must be given meaning and purpose.

And so I say to you, not as the president of your union, but as a human being, thank you for having enriched my life, for my having had the privilege of associating with you. Let us go forward together and build more strongly the instruments of social justice, the tools with which we can build and the weapons with which we must fight the good fight for the good life.

Atoms for Peace

A Separate Opinion to the Joint Congressional Committee on Atomic Energy, submitted as a member of the Panel on the Peaceful Uses of Atomic Energy.

January 25, 1956

I joined the report of the panel because I am in agreement with its general conclusions and recommendations and because I feel it was motivated by a high sense of duty and public interest on the part of the members of the panel. However, I advised the panel that I wished to exercise the usual privilege accorded to members of such advisory groups in submitting on my own behalf a separate statement of views concurring with the report in general but differing in conclusions and emphasis on particular points.

The chairman of the panel, Mr. McKinney, said he interpreted the assignment of the panel as requiring it to report only a consensus of the members' views. Accordingly, he declined to include my statement as a part of the panel's report to your Committee.

I therefore had no alternative but to send my separate views to you directly and request that, in accordance with customary procedure in advisory committees of this kind, the Committee incorporate them in its records as an integral part of the panel report and include them in any report to Con-

gress or other publication which the Committee may make of that report.

The points which I wish to emphasize are as follows:

In the cold war—in freedom's struggle against the forces of Communist tyranny—in the struggle for the hearts and minds of men—speed, all possible speed, in harnessing the atom to man's peacetime needs—can be decisive.

Access to low-cost nuclear power may prove the key to the economic development of backward areas and make possible the liberation of millions of people from poverty, hunger, ignorance, and disease. America's leadership is essential if we are to block the Communists in their efforts to forge poverty into power.

Our success in harnessing the atom to lift the burden of poverty and disease from hundreds of millions of the world's people living in hunger and ill-health would establish America in a position of moral leadership against which Communist propaganda would be impotent.

Harnessing of the atom for peaceful purposes will give us the tools with which to wage freedom's most effective propaganda to these people—the propaganda of the democratic deed. Failure on the part of America to pursue the peaceful harnessing of the atom with maximum speed, determination, and dedication may prove to be the Achilles' heel of the cold war.

We shall not give leadership to other people if we refuse to exercise it in our own behalf. The fact is that the United States is failing to demonstrate the outstanding leadership in releasing atomic energy for peaceful purposes which it demonstrated in putting the atom to work for war.

We are not moving with speed and determination to convert atomic energy into an instrument of peaceful progress. Our program for developing atomic energy as a source of electric power is moving too slowly.

For many years after the war no really significant beginning was made to apply the atom to peaceful uses. Finally, one year ago, the AEC invited private enterprise to submit proposals for participating in the development of atomic reactors for the generation of electric power. But no private power reactors are now under construction and none has completed the initial stages of design.

The one large-scale reactor now building is the AEC demonstration reactor at Shippingport, Pennsylvania. Apart from this government project, the sobering fact is that, today, ten and a half years after the end of the war, America's peacetime atomic power program has not advanced beyond the

drawing boards. The head of the AEC reactor division states that as of today there is no certainty when, if ever, private industry will build and operate a power reactor.

The British government recently announced that its first full-scale power reactor will begin to deliver electric current on October 17, 1956. Soviet Russia claims to have a small-scale pilot model delivering electric power now. Japan's atomic energy commission has been assured by the General Electric Company, according to press reports, that it can build a full-scale power reactor for that country to deliver power within three years at a cost competitive with existing power rates in many areas of the United States.

The need to develop atomic energy as a practical source of power for use in the United States is urgent. There are power-hungry areas in our country today. There are other areas where the high cost of power retards economic progress and is encouraging the flight of industry to other parts of the country.

Total power requirements in the United States will expand at a tremendous rate over the next twenty-five years. We shall need nuclear power to meet those requirements. I cannot accept the comfortable assurance that our conventional fuel resources will meet all our power needs for another twenty to twenty-five years. Nor will I rely upon the Federal Power Commission's consistently conservative forecasts of power requirements as reflecting the true growth potential of our economy or the increasing needs of the American people.

No power ceiling should be imposed upon the normal and necessary expansion of our economy. Of that we must make sure. We must develop every source of energy we have, including atomic energy.

To meet the challenge and to realize the opportunity of the peaceful uses of atomic energy, we must mobilize all our forces and enlist the active participation of every segment of our economy. We must make full use of the capabilities both of government and of private enterprise. Only by drawing upon the special contributions of each can we make satisfactory progress toward our objectives—fortifying the strength of our nation, advancing the welfare of our people, and discharging our world responsibilities.

The technological barriers ahead of us are formidable. Enormous investments are required. The financial risks are great. But all these difficulties can be overcome by a united, determined, and coordinated effort.

It would be tragic to destroy this great opportunity for national achievement and world leadership by dissipating our

strength in ideological warfare over the respective roles of government and private enterprise. That is a sure-fire formula for standing still here in the United States while the rest of the world moves forward in the practical application of atomic energy to human needs.

The opportunities for government and private enterprise to make their special contributions in this new field will arise out of the particular problems encountered at each stage of development. Both will have a vital part to play throughout, but the character and degree of their responsibilities will change as we make progress in mastering the new technology.

The early research and experimental phases of the program are primarily the government's responsibility, it is generally agreed. The development and construction of small-scale power reactors is also primarily a government responsibility, according to the panel report.

As to the next stage of the program, I question whether the present AEC policy of placing prime responsibility on private utility companies to provide risk capital for the construction and testing of full-scale demonstrations reactors is sound. I share the point of view that the productive know-how and managerial skill of American private enterprise can make an important contribution to this phase of development, providing, however, the government takes the initiative and assumes the financial risks involved in the construction and testing of these full-scale reactors. Building these first full-scale power reactors is an extension of the research and experimental work which only the government is capable of performing under present circumstances. Accordingly, I suggest that the AEC policy of placing primary reliance on private enterprise at this stage of development be subjected to early review and reappraisal by the Joint Committee.

Once the practical possibilities of atomic energy have been demonstrated, a realistic and attractive opportunity will have been created for private enterprise to engage in the new atomic industries and develop their full potential. When this stage is reached, the government is obligated to guard against monopoly control in the new industries, and to make sure that consumers are protected by effective competition in the sale of nuclear power and other atomic services. Both publicly and privately financed electric utility systems should engage in supplying nuclear power to the public just as in the past they have supplied power generated from conventional energy sources.

Further elaboration will be given to each of these five

general observations, followed by points I wish to emphasize on the subjects of manpower and training, and hazards and protection.

When Senator Clinton P. Anderson (D., New Mexico) appointed the panel on March 26 of last year, he said:

> Other industrialized nations, besides the United States, are pressing to become leaders in the manufacture and sale of atomic power plants for export. Around the winners of this race, underdeveloped, power-hungry nations may group themselves in new satellite orbits, far different from present alliances.
>
> We dare not ignore this challenge. As the strongest of the free nations, America's responsibilities of world leadership require that the achievement of maximum progress in the peaceful uses of atomic energy be dealt with as a matter of highest national priority.
>
> We must help make it possible for the hungry and desperate millions of the world to develop their economic and human resources so they may win economic security and material well-being without political or spiritual enslavement. Recent Soviet offers of economic assistance to Egypt and Middle East nations, and the increased economic aid promised by Soviet leaders during their recent Asian tour, testify to the increasing emphasis that economic penetration will play in Soviet foreign policy in the new phase of the cold war.
>
> Speed may prove to be the very essence of survival. The free world cannot win the cold war except as it succeeds in winning to freedom's side the vast majority of the uncommitted people of the world.
>
> If less than our best effort would result in the Soviet Union's gaining the initiative and capturing the position of leadership in the field of nuclear power, then this potent weapon of economic penetration would be used to enslave further millions of people and could dangerously shift the center of world balance to the jeopardy of the free world. Only with the initiative and leadership securely in the hands of America and the free world can we be certain that nuclear power will be used as an instrument of economic liberation rather than a weapon of political enslavement.

The seriousness of the challenge that we face in maintaining leadership is reflected in a story in *The New York Times*, dated January 24, 1956, which reported as follows:

> The prospect of Soviet leadership in nuclear energy de-

velopment by 1960 is causing concern among United States specialists in the field.

Should present plans be realized, the Soviet Union will have atomic electricity plants with greater capacity than the United States and Britain combined in 1960.

The new Soviet Five-Year Plan calls for completion by 1960 of atomic energy plants with total capacity of 2,000,000 to 2,500,000 kilowatts.

I support the report of the panel which recommends that "the United States call a series of regional conferences of bilateral partners for the immediate establishment of realistic goals for the installation of atomic power abroad. And that the United States announce that it is prepared to furnish the nuclear fuel, provide the necessary technical assistance, and permit contracts for the installation of at least one million kilowatts of atomic generating capacity outside the United States at as early a date as possible, hopefully by 1960."

The panel then notes: "Such a [foreign] program would parallel and possibly exceed the capacity installed during the same period at home."

While supporting the panel's recommendation that America must lead in providing assistance to friendly nations in the development of nuclear power, I think it is dangerously unrealistic to expect America to achieve and maintain a position of leadership in the world if we are not in a position of leadership at home. American leadership in the world contest must rest upon and be a reflection of a highly developed and advanced nuclear power industry in America. I am at a loss to understand how America can be in a position of technological leadership in building nuclear power plants in underdeveloped countries if we have not advanced the level of our technology by building a nuclear power industry in America.

As an interim measure the panel proposes that the foreign nuclear power program be carried out by bilateral agreements between the United States and other countries.

I wish to emphasize in addition the special responsibility that devolves upon our government in the forthcoming conference where twenty nations will make plans to establish a special atomic agency in the United Nations. The United States should take the lead in urging that this UN atomic agency provide practical fulfillment of the "atoms for peace" proposal which President Eisenhower made to the world in his appearance before the UN Assembly in December, 1953. The inspiration and the rallying point which he provided for forging the positive instruments of peace brought new hope

into the hearts of men. His bold initiative placed a solemn obligation upon our nation to do all within its power to fulfill the pledge he made and to justify the hopes which he called forth.

Full participation of the atomic "have-not" nations in the policies and programs of the UN agency is imperative and should be provided for. The international atom-bank, which was the core of the President's proposal, should be entrusted to this agency. It should have powers of inspection and control adequate to prevent diversion to military use of the fissionable fuels and by-products thus dedicated to peaceful uses.

I believe that the present state of development of peaceful uses of atomic energy in the United States fails to reflect the urgency which our domestic needs and our responsibilities of world leadership demand. Let's look at the record.

In January, 1955, the Atomic Energy Commission asked for proposals by interested parties or groups to participate with it in the development and construction of large-scale nuclear power reactors. Two such proposals are now under negotiation with the AEC. Two other proposals to proceed independently were received and are in negotiation with the AEC on the issuance of licenses. Two other participation proposals submitted were not accepted by the AEC as a basis for negotiation.

On October 10, W. Kenneth Davis, director of the AEC reactor division, publicly stated:

> There is one aspect of this search for development contractors that is most important; we would like to have new contractors get into the business. The expanding program badly needs more contractors.

No private construction of power reactors has begun. No firm construction contracts have been signed. None of the private proposals has reached the end of the first five stages which, according to the director of the AEC reactor division, must be completed in order to test the commercial feasibility of full-scale power reactors.

Because of the many difficulties to be overcome and the financial risks involved, we are told by this AEC official that there is today no definite assurance how many privately financed full-scale reactor projects will be carried to completion, or whether any of them will.

Thus, while a beginning has been made, progress is lagging. In contrast to our record in the United States, Great Britain has launched an extensive power reactor program which,

within five to ten years will take over a considerable part of the burden of meeting that country's power needs. It has announced that power from its first full-scale reactor will go on the lines October 17 of this year.

There is no question that interest in putting nuclear power to work is lively in Soviet Russia, in western Europe, in Japan, and in other countries. With the same degree of interests and urgency in the United States, our unquestioned superiority in technology and resources could quickly restore our country to the position of leadership which rightfully belongs to us.

The world's first chain reaction of uranium under human control was set off by the United States in December, 1942. Two and a half years later we detonated the first atomic bomb. In that short interval, experiment, discovery, plant construction, demonstration, development, production, and practical results followed each other at a pace unparalleled in the history of the world.

This was under the urgency of a world war. The government mobilized our energies to achieve the goal regardless of cost. We cannot expect development of the peaceful uses of the atom to proceed at that pace. But it cannot be disputed that the little progress which has been made toward peaceful application of the atom in ten and a half postwar years is much less than we should have accomplished with the great scientific, technical, and material resources available to us.

One reason for the slow start we have made in developing nuclear power appears to be the view held by some that there is no urgent need for a new source of energy in the United States. Another cause of delay can be found in the excessive, overheated and, in my judgment, unwarranted controversy that is given so much attention in official circles today—the issue as to the proper roles of government and of private enterprise in carrying out projects of national concern. I express my views on this question in the sections below.

There is unquestionably real and urgent need for the additional power which atomic energy will give us just about as soon as we make up our minds and commit our resources to its development as a commercial source of electricity.

The fact is we could use nuclear power today in many power-hungry and high fuel-cost areas of the United States [illegible] producing it were far enough advanced to

Estimates given to the panel on the declining capital and fuel costs of nuclear power that are to be expected as development progresses suggest that it will become a competitive source of power in many areas. Indeed we can safely assume, I believe, that before too long nuclear power will begin to bring to some areas of the United States the same stimulating effects on business prosperity and employment opportunities that low-cost power has brought to the Tennessee Valley and the Pacific Northwest. I am attaching copies of a working paper which I submitted to the panel on cost estimates of nuclear power in comparison with conventional power costs.

The urgency of our need for nuclear power will intensify as total power requirements of the United States increase. Energy needs of this country have grown rapidly in the past and will grow more rapidly in the future. Sixteen years ago each man-hour of a production worker in manufacturing required 4.6 kilowatt-hours per man-hour. Today the requirement is 7.8 kilowatt-hours per man-hour. Fifteen years from now, according to *Electrical World*, it will be 14.1 kilowatt-hours. No one today can even begin to estimate how much the automation of production processes may increase the consumption of power per man-hour. Rapidly expanding uses for the light metals, especially in military applications, can create large new demands for power.

Reliable estimates of our future power needs show that in the next twenty-five years we probably shall have to add five times as much new capacity to the nation's installed generating capacity as the total capacity we have created over the past fifty years. From 115 million kilowatts today we shall need to expand to approximately 600 million by 1980. This is the forecast given to the panel by an industry group brought together to advise on this question.

A second and lower forecast of power requirements is also included in the panel report. This shows a need for only 360 million kilowatts by 1980. The panel concludes that actual requirements probably will fall somewhere between these two widely divergent forecasts.

Whereas the forecast of 600 million kilowatts by 1980 is based on a forecast issued by *Electrical World*, the lower forecast was made by the Federal Power Commission. The industry group that advised the panel would not accept the FPC forecast as a reliable basis for anticipating our future

proves that the Federal Power Commission's forecasts of power requirements have consistently failed to anticipate the expansion of power consumption that has actually occurred. For example, the Federal Power Commission's estimate for the southeastern area of the United States for 1955 was 58 billion kilowatt-hours while actual power use in this area (excluding AEC consumption) was 110 billion kilowatt-hours, almost double the FPC forecast for 1955 and 32 per cent higher than its forecast for 1970. I do not think Federal Power Commission forecasts should be taken into account in appraising our future power needs.

A fivefold increase in power supply in twenty-five years presents a tremendous challenge. We should enthusiastically welcome the opportunity which the advent of nuclear power gives us to meet that challenge.

The necessary expansion of our dynamic economy must not be restricted or limited by a power deficit. Adequate power resources are essential for the economic growth that is needed to meet the possibility of war and to fulfill the opportunities of peace. The need to prepare today to meet tomorrow's requirements is an urgent and compelling one.

There are two other reasons why the need for nuclear power is urgent. The panel was advised that some informed observers question the capacity of our coal industry to meet competitively the enormous requirements that will be made upon it by the anticipated increase in electric power generation.

The other reason is the tremendous hunger of our economy, both in peacetime pursuits and in military operations, for liquid and gaseous fuels. There is no indication that our dependence on these fuels, especially for motive power, will decline. There is every reason to expect a large increase in demand.

The supply of liquid and gaseous fuels is exhaustible. The ultimate supply of atomic energy would appear to be almost inexhaustible. Every unit of oil or gas that can be replaced by atomic energy in the generation of electricity is, from a national point of view, money in the bank. This will be true of coal also when we decide, as we undoubtedly will, to develop the technology of converting coal into liquid fuels.

The big task before us is to achieve major technological breakthroughs in the construction and operation of full-scale demonstration power reactors, the fabrication of fuel elements and the reprocessing of spent fuels. Only by doing these things on a full-scale basis will we begin to find solutions that will lead ultimately to an efficient atomic power industry. Demonstration power reactors of all the promising types must be built, operated and put to the test.*

The AEC program for getting us through this development phase is to turn the primary responsibility over to electric utility companies, or groups of them, who in turn call upon manufacturers to contribute designs and build the components. While the AEC will furnish information, assist in research and development, make nuclear fuel available at low rentals, reprocess spent fuel, and lend considerable financial assistance, it still requires private participants to take the basic risk and gives priority to proposals which impose the least financial burden upon the government.

AEC policy thus seeks to achieve two purposes at once: to promote the development of nuclear power, and to transfer to private enterprise a major part of the initiative and responsibility.

The panel report recognizes that it may not prove possible to achieve these two purposes simultaneously. It recommends that, in the event industry does not take on the full risks and burdens which the AEC has assigned to it, the AEC should construct a full-scale demonstration reactor of each major type and bring atomic power to a point where it can be used effectively and widely on a competitive basis.

In support of the panel's recommendations, I urge the Joint Committee to institute early inquiry in order to determine how far and how fast private enterprise can and will assume the full risks and burdens of getting us over the hump and on to the highroad of practical nuclear power.

* W. K. Davis, director of the AEC division of reactor development, described in a speech on October 10, 1955, the nature of the full-scale development problem:

"The plain fact is that today we do not know how to do many of the things required for economically competitive power in the United States. . . .

"The construction of large prototype, or demonstration, reactor power plants is a very necessary step for a variety of reasons. For example, many features of power reactors simply do not scale up in a wholly predictable fashion. Therefore it is necessary to go essentially to full size to get certain technical data. In addition, it is impossible to estimate the cost of components, the cost of construction, or the cost of operating a power reactor with sufficient accuracy without building one. Until some of the steps are actually taken one simply cannot have a reasonable estimate of power costs in the new nuclear field.

"It is also necessary that someone build the first generation of full-scale nuclear power plants—a generation that will be relatively expensive —so that there will be the cheaper second, third, and following generations. The first prototypes of any power reactors will be expensive. The second will be simpler by virtue of experience gained with the first. Simpler and cheaper manufacturing methods will be learned and the expanding volume will still further reduce costs."

I make this supplementary recommendation because so much evidence has come to light that indicates private enterprise cannot reasonably be expected to shoulder so much of the burden in this development phase. Tremendous capital investments and development expenditures are called for. The chance of incurring major losses through unsuccessful design or early obsolescence are considerable. Neither the AEC nor the manufacturers of reactors and components can give a utility system entering this field the kind of safety standards, performance guarantees, and other assurances which bankers financing a private venture normally require. The AEC will contribute substantial financial and other assistance, but the basic risk remains with the private participants.

The serious shortage of engineers and scientists trained in this field is another barrier to widespread participation of private industry in this development work. I shall discuss this question in a later section.

Another serious deterring factor with respect to private enterprise carrying the prime responsibility relates to the matter of classified information and national security. The panel properly recommended that "the Commission remove all reactor technology from the 'restricted data' category, including such areas as fuel element fabrication and processing techniques, leaving specific military applications of such technology to be protected in so far as national security is involved, by the defense classification system."

This delicate matter of national security versus free accessibility to secret data is a further factor discouraging private construction of full-scale demonstration reactors in this stage of the program.

The panel accurately reports that "no administrative agency can even give a guarantee that a private citizen has all the information needed for decisions and actions." For example, a private group might use the information available from the AEC to plan and build a reactor which already has been made obsolete by new information in reactor technology which the AEC cannot make available because it is in the restricted military category. Under these circumstances only the scientists, engineers, and technicians working on government projects can have free access to all of the latest data since they are working on both the military and the peacetime phases of the reactor program.

Manufacturers of equipment in this field have shown a great interest and undoubtedly have a vital contribution to make, but their experience and inventive qualities are brought into play only as they are engaged to join in the actual

construction of a full-scale demonstration reactor. If the initiative in such construction is left in the hands of the private utilities at this stage of the program, the manufacturers' creative contribution will not be fully realized.

The utility companies are not powerfully motivated to develop new sources of low-cost power. The policies of state regulatory commissions assure them a fair return on their investment whether they expand or not, whether they increase power use through rate reductions or hold it back by keeping rates high. The incentive to them is rather to occupy the nuclear power field in order to hold it against the nonprofit public power systems. This is the motive ascribed to them by a dispatch to the *Wall Street Journal* from the "atoms for peace" conference at Geneva, August 22, 1955:

> Officials of the companies which make reactors say frankly that most of their utility company customers have no early expectation of cutting costs by building atom plants; their primary motive is to stake this out as an area of private rather than public power.

The attempt by the AEC to transfer prime responsibility to private enterprise at this time appears to be premature. If, as a result, we continue to encounter serious delay in nuclear power development, we shall be guilty of pursuing a doctrinaire "free enterprise" approach to a problem which, at least for the present, is essentially national in purpose and scope and involves risks and losses of a magnitude which only government can reasonably be expected to incur.

The development of large-scale reactors is, essentially, an experimental operation—as fully experimental as the construction of the small research reactors for which the AEC is assuming the full responsibility and cost. If it is economically sound and proper for the government to bear the burden of primary research in building the small experimental reactors, it would appear to be equally sound and proper for the government to carry the major responsibility and risk in the second phase of experimentation—the building of full-scale demonstration reactors.

This view of the problem is confirmed by the views expressed by Gordon Dean, former Chairman of the AEC, in his book, *Report of the Atom*, published in the fall of 1953:

> To help create the technological climate needed for further rapid progress, it is quite evident to me that the government,

through the Atomic Energy Commission, must continue to play a significant and leading role in reactor development, not only for military purposes, but for general power purposes as well.

In close association with industrial groups, whether public or private, the Commission must, therefore, design and build and operate the forerunners of the large reactors which will some day feed appreciable quantities of electricity into the utility networks of the country.

Further indication that the government is better equipped than private enterprise to advance the development program can be found in the speed with which the AEC demonstration reactor at Shippingport, Pennsylvania, is being built, in contrast to the slow progress of private projects. Admiral Hyman Rickover, who built the reactor for the *Nautilus* and is in charge at Shippingport for the AEC, made this statement last December about that project:

> We started constructing this plant in May of this year (1955). We expect to have it done in 1957. So you see that we are designing, developing, manufacturing, constructing and building an atomic power plant in generally less time than it takes to build a conventional power plant.

We do the utility companies no service by asking them to accept burdens which in view of all the unknowns in the present state of atomic technology they cannot finance as sound or normal business ventures. We do them no disservice when we ask the government to recognize the national importance and scope of the task at hand, to carry the basic risk of this full-scale reactor development, while affording the designing and manufacturing segments of private enterprise full opportunity to make their valuable contributions to the program.

The ingredients of the present situation do not add up to a formula for progress. If we want useful civilian atomic energy as soon as we can get it, both for domestic use and for international purposes, something must be done, starting immediately, to solve and overcome the many important technological problems that stand in the way.

Only bold initiative by government can accelerate needed progress and get full-scale reactors in operation so that the time lag between theory and practice can be minimized. Only when the government has completed both phases of this basic research work by completing and getting into operation both the model reactors and the full-scale demonstration reactors can we expect to get the influx of private risk capital

and the resulting full impact of the dynamic qualities of individual initiative essential to carry the program to higher levels of development.

I hope that the ideological barrier will not be raised against my recommendation that the Joint Committee examine the AEC development policy with a view to putting the AEC to work building demonstration reactors, as the 1954 Act already authorizes it to do.

Neither government nor industry can do this job alone. It was the blending of the special contributions of each that provided the genius which gave America the atomic know-how to produce the first bomb. At this stage of our national atomic effort, nothing could be more tragic than to split our forces by engaging in a sterile and senseless fighting of ideological windmills. Our free enterprise system is not being challenged in America. If it were, less than 1 per cent of the American people would support such a challenge, for the American people understand clearly that our free economy motivated by individual initiative and enterprise has given them a higher standard of living than any other people enjoy. We must approach this problem free from preconceived prejudices or fixed theoretical or ideological positions. We need to make judgments on a sane and sensible basis as to how best we can, as a free nation and a free people, get the job done.

As the operation and testing of full-scale demonstration reactors begin to show how nuclear power can be produced on a commercially competitive basis, realistic and valuable business opportunities will arise.

Electric utility systems, both private and public, will then find it feasible to finance their investments in the generation and distribution of nuclear power as new capacity is required to serve areas where such power can be supplied at lower cost. This will create an expanding market for the manufacturers of reactors, fuel elements, and other components, and for others who equip themselves to perform the various service operations required by the new industry, such as fuel element fabrication and the reprocessing of spent fuels.

At this stage of development the declaration of Congress in section 1 of the 1954 Act deserves emphasis; namely, that it is the policy of the United States that "the development, use and control of atomic energy shall be directed so as to . . . strengthen free competition in private enterprise."

To make sure that this purpose is carried out, the attention of the Joint Committee should, in my opinion, be directed to three considerations that bear directly upon it.

One is the policy with respect to patents. Both to prevent monopoly and to encourage progress the Joint Committee should give consideration to a simpler and more expeditious procedure than section 153 of the Act which now provides for the cross-licensing of all essential patents, so that the application of past discoveries and the stimulation of new ones will invigorate the atomic industry in the same way it has invigorated the automobile and radio industries. Atomic energy is a basic resource of the American people, developed for them at their expense by the government, and it must be put to the widest possible use in advancing the public interest.

The antimonopoly provisions of the 1954 Act also deserve the consideration of the Joint Committee. Section 105 of the 1954 Act permits the AEC to use revocation of license as an antimonopoly procedure only after adjudication of the facts in an antitrust proceeding. Thus this remedy is available only if court action is instituted and only when such action has been successfully concluded. This is taking action after the damage is done, usually long after, and it is likely to prove ineffective because of the delay. I suggest that the Joint Committee give consideration to amending the 1954 Act so as to give the AEC authority to take action when the danger is clear and such action is necessary, to prevent by revocation of license the consummation of monopoly control.

The third consideration I call to the attention of the Joint Committee in connection with this Congressional declaration is the necessity for making competition possible in the sale of nuclear power.

Electric utility companies are not competitive enterprises. They are, and must be, local monopolies, franchised by state authority to serve defined areas and protected from competition within those areas. Their rates are set by state authority at levels calculated to provide a return on investment sufficient to attract the capital required to continue to serve the needs of their customers.

Long experience with electric power rates in the United States has demonstrated that the only effective competition which brings lower rates to consumers is the competitive yardstick that is applied to public power projects. The power policy of the United States government, and of state governments, has long recognized the right of the people to develop their power resources for their own benefit, acting through their federal, state, or local governments.

Experience has also demonstrated that the competitive rates of public power can stimulate greater consumption of electricity, speed up industrial progress, increase job opportunities, and raise the living standards of workers, farmers, and all consumers. It has also been demonstrated that electric utilities which, because of this competitive yardstick, sell power on a low-rate high-use basis find their own prosperity advancing along with that of the communities they serve, thus demonstrating the truth of the principle that there can be more prosperity in sharing abundance than in dividing scarcity.

No exceptional and artificial barriers should be erected against nuclear power. It should be permitted like any other power, where the people so elect, to fulfill its promise of bringing lower costs to areas where power rates are high. The estimates of future nuclear power costs given to the panel indicated roughly that nuclear power publicly produced could speed up by some ten years the relief from high power costs which nuclear power may be expected to bring.

The 1954 Act permits only limited application of the national power policy to the field of nuclear power. It does not allow the AEC to engage in the production or distribution of nuclear power for commercial use. This erects an exceptional and artificial barrier against nuclear power. If it stands, the full benefits of this new source of power will be denied to industry, workers, farmers, and consumers generally.

I suggest that the Joint Committee give consideration to amendment of the 1954 Act to bring it into harmony with national power policy by authorizing the AEC directly, or through a specially designated agency or division, to produce nuclear power for its own use, and to transmit, or arrange for the transmission of, such power to load centers, and to give nonprofit electric systems first call upon such power for sale to consumers at lowest possible rates.

The acute shortage of highly trained scientific, engineering, and specialized technical personnel is the most serious limiting factor in every phase of the program of applying the atom to peacetime uses. This is not a short-run problem. Failure to take effective and adequate steps now to make both a qualitative and quantitative solution will put in serious jeopardy our domestic economic growth and progress and will strip us of the ability to meet the responsibilities of world leadership.

Admiral Lewis L. Strauss, Chairman of the AEC, recently stated that America's colleges and universities are providing less than half of the people required in the fields of science and engineering in all classifications and that we are training less than one-third of the scientists and engineers needed in the field of atomic energy.

I believe that insufficient attention and urgency has and is being given this problem of assuring an expansion of our highly trained manpower base. The AEC program is being seriously delayed because it cannot get needed scientists, engineers, and technical personnel. Private industry by the attraction of high salaries is robbing the AEC of key scientific and engineering personnel and is depleting our already inadequate faculties of colleges and universities. The practice of robbing Peter to pay Paul has already inflicted an inestimable price in delaying our progress in harnessing the atom to man's peaceful needs. Only a realistic approach to our problem of training and education through expanded facilities, larger and adequately paid faculties, stepped-up scholarship programs, better apprenticeship courses, and other such measures can overcome this serious and costly manpower deficit. It must be recognized that the tax structure of both state and local governments and the financial problems of private schools make substantial federal aid to education essential if we are to remove the roadblocks and make our school system adequate to the challenge and equal to our needs.

I am confident that, as a free people, we can find a formula to provide federal aid to education without federal control. We need to reduce the size of our classes and to give greater attention to gifted students. We need to give greater attention to the curriculum of our secondary schools for they form the basis on which our higher schools of education build. Speaking in Cleveland in December, 1955, Admiral Strauss stated: "Our atomic progress will be determined primarily by the numbers of young people who study science and mathematics in our high schools and go on to college to become scientists and engineers."

We are losing precious and irreplaceable time for every year we fail to provide educational opportunities to facilitate to the fullest the growth and development of our youth. This loss cannot be recaptured. It is an asset gone forever.

The extension of human knowledge and the training of adequate numbers of competent scientists, engineers, and technicians can be decisive in freedom's struggle against the immoral forces of Communist tyranny. The seriousness of our national educational deficit is reflected in the fact that in 1955 American universities and colleges graduated twenty-seven thousand engineers and scientists, while it is reported that the Soviet Union graduated thirty-four thousand students in these fields. A reliable educator reports that the Soviet Union has approximately three times as many students in the

fields of engineering and physical sciences enrolled in their higher schools of learning than does the United States and that the Soviet Union is doing a comparably qualitative job of training.

If these reports are true, this is a frightening and dangerous situation, for the struggle between freedom and tyranny is both real and for keeps. It is already clear that the Soviet Union is prepared to send scientific and technical personnel to foreign countries for purposes of economic penetration and subversion in greater numbers than we can afford for our program of economic aid and liberation from poverty.

Dr. James R. Killian, Jr., President of the Massachusetts Institute of Technology, as reported in *The New York Times*, January 24, 1956, recognized that Russia has outstripped the United States in the output of scientists and engineers. *The New York Times* reported that Dr. Killian urged the government to draft a master plan for maintaining the nation's technological lead in the face of swift Russian gains. Dr. Killian proposed a scientific commission for giving direction and velocity to our technological advance. He stated that the safety of the free world depended "increasingly on that combination of science, engineering, and industry which we call technology." Dr. Killian further noted Russia's long-range planning, her short lead time from idea to finished production, the percentage and monetary awards accorded her scientists, and her budget for her technological projects.

The shortage of highly trained scientific and technical personnel will continue to be the most serious retarding and limiting factor both in our domestic progress and in our ability effectively to carry out our responsibility of world leadership. Here again bold and imaginative action is needed by the federal government in cooperation with state and local governments in the field of education.

As a practical step in overcoming our educational deficit and manpower shortage, I would like to suggest that Congress give consideration to the creation of a broad and comprehensive system of federal scholarships to be awarded to students on a competitive basis. Such scholarships would be granted on condition that, upon the completion of their education and training, students would be obligated to serve wherever their training and skill was most needed. If their services were needed to help overcome the teacher shortage or the manpower needs of the AEC's military or peacetime atomic programs, they would be obligated to serve whenever assigned for a period of one year greater than, and in lieu of, the period of their normal military service. If their services were

needed in the implementation of our foreign aid program, they could be assigned anywhere abroad for a period equal to, and in lieu of, the period of normal military service. Such a scholarship program would expand our trained manpower base and would enable tens of thousands of young Americans to develop the capabilities more effectively to serve their country and the cause of human freedom.

I believe that such a scholarship program would inspire thousands of our young people with a sense of democratic idealism and devotion and would afford them an opportunity to make a positive contribution in freedom's peaceful struggle against the forces of Communist tyranny. Such a program would enlist thousands of America's youth as technical missionaries in the struggle against man's ancient enemies—poverty, hunger, ignorance, and disease—and would strip the Communists of the opportunity of forging human desperation and poverty into power.

In the struggle for the hearts and minds of millions of yet uncommitted people in the economically underdeveloped portions of the world, the more young Americans we send to help as technical missionaries with slide rule, with textbook, and with medical kit to work in the pursuit of peace, the fewer we might need to send with guns and flame-throwers to resist Communist aggression on the battlefields.

Workers in atomic energy in installations exposed to ionizing radiations far above levels normally received from the natural environment must be protected by the adoption of federal standards fixing safe maximum limits of exposure, both on a short-time and cumulative basis, requiring full use of protective devices, and constant use of recording devices to accumulate the record of each worker's exposure, with the facts of that record available to the worker as a matter of right.

Compliance with these federal standards should be made a condition of AEC licenses for the use of nuclear materials, with revocation of license available as a penalty for noncompliance.

Justification for high safety standards and their strict enforcement in this field derives from the unusual nature of the hazards incurred by workers exposed to radiation over a period of years. In addition to the more easily identified injuries resulting from brief exposure to severe radiation, the injury that can result from moderate overexposure continued for many years may not become apparent until long after the damage has been done.

Experts in the field state that shortening of life by a period of years may result; the victims will die of the usual causes that other people die of but they will die earlier.

Other experts report that genetic mutations adversely affecting the offspring of overexposed individuals may transmit undesirable human characteristics through many generations.

These are, or certainly should be, matters of grave concern for a nation that is about to enter into the age of the peaceful use of the atom in a large way. They should not cause hysteria. They do not require us to discard the atom as a too hazardous instrument for employment in industry, medical therapy, or research. But they do compel us to ascertain just as quickly and as surely as we can what the real hazards are, and, from the beginning, to exercise an excess of precaution until more is known about the hazards and how to guard against them.

This much is known already that justifies great concern about the course we are now following. We know, in the first place, that the National Committee on Radiation, acting under the auspices of the United States Department of Commerce, recommends maximum permissible exposure of 300 milliroentgens per week for persons under forty-five years of age, 600 milliroentgens for persons over forty-five. We know, in the second place, that the AEC has adopted a much more exacting standard than 300 milliroentgens per week for the protection of workers in its atomic installations. It has been publicly stated, for example, that the average exposure of all Hanford and Oak Ridge workers in 1949 was held down to 4 milliroentgens per week, as contrasted with the 300 figure permitted by the Department of Commerce. Weekly average exposure of the ten most highly exposed workers at Oak Ridge in 1949 was only 80 milliroentgens per week.

G. Hoyt Whipple, who was invited to discuss this subject at the Nuclear Engineering and Science Congress in December, 1955, asserted that workers subjected for a working life of thirty years to the maximum permissible exposure promulgated by the Department of Commerce would incur the risk of having their lives shortened, on the average, by three years. This, according to Whipple, is almost double the reduction of life span resulting from cancer that thirty-year-old males can anticipate, and more than three times the average number of years that will be subtracted from their lives by accidents of all kinds.

If every individual in a generation, Whipple's figures indicate, were subjected to an exposure of 65 to 130 milliroentgens per week over a working life of thirty years, the

mutation burden of the next generation would be twice that which would normally occur.

Whipple recommended that the government standard promulgated by the Department of Commerce be reduced from 300 milliroentgens to 30 milliroentgens per week.

I do not doubt that almost any statement made today concerning the life-shortening and mutation effects of ionizing radiations can, and probably will be disputed. I have recited the above statements that have come to my attention not by way of proof, but to give my reasons for believing that the protection of workers in atomic industries must be given immediate and exhaustive study by unions, by Congress, by the government agencies concerned, and by industries which expose workers to atomic radiations. I hope that the Joint Committee on Atomic Energy will take the initiative, through hearings of its own or by other means, to ascertain the facts so that adequate standards to safeguard workers will be established and to remove unfounded fears that might impede progress.

India, the United States, and the Free World

Address before the Indian Council on World Affairs

New Delhi, India
April 5, 1956

My visit to India is the fulfillment of a long cherished dream. I have come to see and learn of your great achievements in building a new India. Word of your village development programs has inspired people everywhere as the most promising example of mass democracy at work in the world. Your River Valley Development Programs are the largest and boldest in the world. Your five-year plan is a practical demonstration of democratic economic planning at its best. I want to see these great and impressive economic achievements, but most of all, I want to meet and learn to know the

people of India better so that I can in some small way help in building and enriching the friendship and understanding between the peoples of our two great countries.

In 1947, when you raised your flag of independence, millions of Americans shared the joy of your successful struggle for political freedom. Since that day, the American people have been inspired by your sense of devotion and dedication in your heroic effort to solve the problems of India through democratic methods which recognize the worth and the dignity of the human individual.

India and America have much in common. Both of our nations were born out of the sweat, the tears and the sacrifice of the common struggle to throw off the chains of colonial domination. Both of our nations were conceived and dedicated to the proposition that all men are created equal. Each of our nations contributed to the world and to the ages, two of the world's great moral giants, Gandhi and Lincoln. In an age of nuclear giants, we need more than ever a rededication to the human and moral values of both Gandhi and Lincoln, for neither peace nor freedom can be made secure in a world of nuclear giants and moral pigmies.

It is universally recognized that man has mastered the weapons of total self-destruction and that the H-bomb has made peace a condition of survival. To end war and to banish forever man's inhumanity to man, we need to develop a moral force in the world greater than the power of the H-bomb.

We live in the most challenging period in human history, for the same scientific and technical know-how that gives us the H-bomb and the weapons of total self-destruction also provides us with the tools of economic abundance. These new tools of economic abundance, if used constructively and morally to satisfy man's needs, his hopes, and his aspirations, can usher in an unprecedented period of human progress and human betterment.

The great challenge before us is to find a way to use the bright promise of science and technology in massive retaliation against poverty, hunger, and social injustice in the world.

For the first time in human history, mankind has the tools with which to master his physical environment. For the first time, we have the tools of economic abundance with which to eliminate poverty, hunger, ignorance, and disease—the ancient enemies which have plagued the human family throughout the ages.

As we satisfy man's basic economic and material needs of food, clothing, and shelter, we shall be able to devote greater