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REVENUE BOND FINANCING BY THE TVA  
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HEARING  
BEFORE THE  
SUBCOMMITTEE ON  
D CONTROL—RIVERS AND HARBORS  
OF THE  
MMITTEE ON PUBLIC WORKS  
UNITED STATES SENATE  
EIGHTY-NINTH CONGRESS  
SECOND SESSION



H.R. 15225, S. 3419, and S. 2827

BILLS TO INCREASE THE BORROWING AUTHORITY OF THE TVA

JUNE 28, 1966

Printed for the use of the Committee on Public Works



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## REVENUE BOND FINANCING BY THE TVA

TUESDAY, JUNE 28, 1966

U.S. SENATE,  
SUBCOMMITTEE ON FLOOD CONTROL—RIVERS AND HARBORS,  
OF THE COMMITTEE ON PUBLIC WORKS,  
Washington, D.C.

The subcommittee met at 10 o'clock a.m., pursuant to call in room 4200, New Senate Office Building, Senator Jennings Randolph (chairman of the committee) presiding.

Present: Senators Randolph, Young, Inouye, and Cooper.

Also present: Richard B. Royce and Joseph F. Van Vladriken, professional staff members.

The CHAIRMAN. Good morning, ladies and gentlemen.

The purpose of this hearing is to consider several bills that have been introduced providing for an increase in the bonding authority available to the Tennessee Valley Authority under the provisions of section 15d of the TVA Act of 1933, as amended.

We have before us, S. 3419, introduced by Senator Hill and others, and the House companion bill, H.R. 15225, introduced by Mr. Jones, which passed the House on June 13, providing for an increase in bonding authority of \$1 billion.

Also on the agenda is a bill introduced by Senator Bass, S. 2827, which would remove the limitation relating to the amount of bonds that can be issued by the Tennessee Valley Authority.

Without objection, I will place in the record at this point copies of each of these bills, together with an explanation of the purpose of the pending legislation. Included in this statement is the letter from the President of May 20, 1966, transmitting proposed legislation to raise the bond ceiling.

(The exhibits follow:)

[H.R. 15225, 89th Cong., 2d sess.]

AN ACT To amend section 15d of the Tennessee Valley Authority Act of 1933 to increase the amount of bonds which may be issued by the Tennessee Valley Authority

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the first sentence of subsection (a) of section 15d of the Tennessee Valley Authority Act of 1933, as amended (16 U.S.C. 831n-4), is amended by striking out "\$750,000,000" and inserting in lieu thereof "\$1,750,000,000".

Passed the House of Representatives June 13, 1966.

Attest:

RALPH R. ROBERTS,  
Clerk.

## REVENUE BOND FINANCING BY THE TVA

[S. 3419, 89th Cong., 2d sess.]

A BILL To amend the Tennessee Valley Authority Act of 1933, as amended, to increase the limitation on the authority to issue bonds to finance its power program

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That section 15d of the Tennessee Valley Authority Act of 1933 (16 U.S.C. 831n-4), is hereby amended by striking from the first sentence of subsection (a) thereof "\$750,000,000" and substituting therefor "\$1,750,000,000".

TENNESSEE VALLEY AUTHORITY—ADDITIONAL AUTHORITY TO ISSUE  
REVENUE BONDS

Bill number: S. 3419.

Companion bill: H.R. 15225, by Mr. Jones of Alabama. Identical bill introduced by other members of the House.

Title: A bill, to amend the Tennessee Valley Authority Act of 1933, as amended to increase the limitation on the authority to issue bonds to finance its power program.

Sponsored by: Senators Hill, Sparkman, Gore, Bass, Cooper, Eastland, Metcalf, Morton, and Stennis. (Administration bill.)

## PURPOSE OF BILL

The purpose of the bill is to permit the Tennessee Valley Authority to issue revenue bonds in excess of the present ceiling of \$750 million imposed by the TVA Revenue Bond Financing Amendments of 1959, Public Law 86-137.

The first sentence in subsection (a) of section 15d of the Tennessee Valley Authority Act of 1933, as amended, reads as follows: "The Corporation is authorized to issue and sell bonds, and other evidences of indebtedness (hereafter collectively referred to as 'bonds') in an amount not exceeding \$750,000,000 outstanding at any one time to assist in financing its power program and to refund such bonds."

S. 3419, amends section 15d by striking out "\$750,000,000", and inserting in lieu thereof, "\$1,750,000,000".

The language therefore has the effect of increasing the borrowing authority of TVA by \$1 billion dollars.

## GENERAL STATEMENT

The natural course of the Tennessee River traverses a distance of about 650 miles from Knoxville, Tennessee, to Paducah, Kentucky, where it empties into the Ohio River. It has six principal tributaries which drain the highest mass of mountains east of the Rockies in an area of the highest rainfall in the United States, excepting the Pacific Northwest. The Tennessee basin includes parts of seven States, having an area of approximately 41,000 square miles; valley counties have a population of about 3,662,900, about three-fifths of which is classified as rural.

The Tennessee Valley Authority is a corporation created by act of Congress approved May 18, 1933 (48 Stat. 58; 16 U.S.C. 831-831dd). The statute provides for the development of the Tennessee River and its tributaries in the interest of navigation, the control of floods, and the generation and disposition of hydroelectric power. It also directs the corporation to operate the chemical facilities at Muscle Shoals, Alabama, built during World War I, to develop new types of fertilizer in the interests of improved agriculture as well as of national defense.

Efforts to improve the Tennessee River system for navigation, dating from the administration of President Monroe in 1824, culminated in the statute creating the Tennessee Valley Authority, which imposes upon that agency the duty of bringing about an adequate and complete development of the river system through the construction of a series of dams upon the stream and its principal tributaries.

The Board of Directors, appointed by the President with the approval of the Senate, is authorized by the Tennessee Valley Authority Act to exercise all powers of the corporation. It establishes general policies and programs, appraises progress and results, approves items of major importance, and establishes the basic organization. The General Counsel advises the Board on legal matters and is Secretary to the corporation.

## BOND FINANCING PROVISIONS OF TENNESSEE VALLEY AUTHORITY ACT

In 1959, after consideration over a period of four years with extended hearings before the Public Works Committees of both House and Senate, Congress adopted and the President approved an amendment to the TVA Act permitting TVA to issue bonds as a source of capital for power facilities. The bonds are not guaranteed by the government nor are they tax exempt. They are power revenue bonds.

Adoption of the bond amendment was a pioneering venture and the Congress incorporated a ceiling of \$750 million on the amount of borrowing that could be outstanding at any one time, to assist in financing needed additions to the TVA power system. Proceeds of the bonds could be used for construction, acquisition, enlargement, improvement, or replacement of any plant or other facility used for the generation or transmission of electric power or in connection with lease-purchase transactions, within a specified area.

The Senate Committee in its report on the self-financing bill, indicated that when the limitation was reached that consideration could then be given by the Congress to raising the ceiling if required to meet the growth in the area's power needs.

A summary of the status of TVA bond financing authority, as of the Spring of 1966, is as follows:

	<i>Million</i>
Bond Financing Limitation, P.L. 86-137.....	\$750
Bonds issued to date.....	345
Bonds obligated to be issued to cover existing contracts.....	155
Financing required to cover cost of power facilities presently planned for completion by 1970—to be obligated prior to end of fiscal year 1967.....	250
<b>Total.....</b>	<b>\$750</b>
Remaining bond authority.....	None.

It is understood that it takes at least four years to build a power project, and financing must be available in ample time to complete construction on schedule. Therefore, since the bond financing ceiling will be reached shortly, an increase in borrowing authority is required at an early date.

## REMARKS

The President in his message, which is set forth below, indicated that TVA would exhaust its borrowing authority before the end of fiscal year 1967. He recommended an increase in bonded indebtedness of \$1 billion dollars, which would cover the issuance of bonds for at least a 7 year period, through 1973.

The message of the President, together with draft legislation is as follows:

THE WHITE HOUSE,  
Washington, May 20, 1966.

HON. HUBERT H. HUMPHREY,  
*President of the Senate.*

DEAR MR. PRESIDENT: I am pleased to transmit to the Congress proposed legislation to amend the Tennessee Valley Authority Act by raising to \$1,750 million the ceiling on TVA's authority to issue revenue bonds.

Thirty-three years ago the Congress created the Tennessee Valley Authority. The success of this venture is a tribute to the vision of those political parties who worked to make a reality of this experiment in regional cooperation.

Today large industrial firms nourish the economy of this once poor region, encouraged by plentiful transportation and low-cost electric power.

Today green pastures and leafy woodlands have replaced the desolate brown craters of eroded acres.

Today almost every farm in the Tennessee Valley has electric power, while only 3 out of every 100 were served in 1933.

Today the per capita income of this region is 69 percent of the National average, compared to 45 percent at the time of TVA's creation.

Congress has shown its wisdom in allowing TVA flexibility to do its job well. In 1959, the Congress gave TVA authority to issue revenue bonds—up to \$750 million—to finance capital improvements in its power program. Congress also acted wisely by placing a specific limitation on the borrowing author-

ity so it could periodically review the TVA power operations to determine future needs.

TVA has used its authority well. Funds are no longer appropriated to TVA to finance power operations. On the contrary, TVA is paying back the original U.S. investment in power facilities, with interest, and is making payments to State and local governments in lieu of taxes.

The power demands in the Tennessee Valley should about double in the next 10 years, which is consistent with the rate of growth for private utilities. TVA must have the authority to issue bonds to finance its operations, just as other utilities do to meet future demands.

TVA will need new borrowing authority before the end of fiscal year 1967. I recommend, therefore, an increase of \$1 billion—from \$750 million to \$1,750 million—which should provide borrowing authority for at least 7 more years.

Without an increase in borrowing authority, TVA cannot continue to carry out its responsibility to meet the growing demand for electric power in the Tennessee Valley. This is essential to the well-being of the people and the economy of this region. For this reason, I respectfully urge the Congress to give early and favorable consideration to this proposed legislation.

Sincerely,

LYNDON B. JOHNSON.

A BILL To amend the Tennessee Valley Authority Act of 1933, as amended, to increase the limitation on the authority to issue bonds to finance its power program

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That section 15d of the Tennessee Valley Act of 1933 (16 U.S.C. 831n-4) is hereby amended striking from the first sentence of subsection (a) thereof "\$750,000,000" and substituting therefor "\$1,750,000,000."

[S. 2827, 89th Cong., 2d sess.]

A BILL To amend the Tennessee Valley Authority Act of 1933, as amended, to remove the limitation on the authority of the Tennessee Valley Authority to issue bonds to finance its power program, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the Tennessee Valley Authority Act of 1933, as amended, is hereby amended by striking from the first sentence of section 15d thereof (16 U.S.C. 831n-4) "in an amount not exceeding \$750,000,000 outstanding at any one time".

#### TENNESSEE VALLEY AUTHORITY—REMOVAL OF BONDING AUTHORITY LIMITATION

BILL NUMBER: S. 2827.

TITLE: A bill, to amend the Tennessee Valley Authority Act of 1933, as amended, to remove the limitation on the authority of the Tennessee Valley Authority to issue bonds to finance its power program, and for other purposes.

SPONSORED BY: Senator Bass.

#### PURPOSE OF BILL

The purpose of the bill is to permit the Tennessee Valley Authority to issue bonds without regard to the limitation of \$750 million imposed by the TVA Revenue Bond Financing Amendments of 1959, Public Law 86-137.

The first sentence in subsection (a) of Section 15d of the Tennessee Valley Authority Act of 1933, as amended, reads as follows:

"The Corporation is authorized to issue and sell bonds, and other evidences of indebtedness (hereafter collectively referred to as 'bonds') in an amount not exceeding \$750,000,000 outstanding at any one time to assist in financing its power program and to refund such bonds."

S. 2827, amends section 15d by striking out "in an amount not exceeding \$750,000,000 outstanding at any one time".

The language therefore has the effect of removing the limitation on the amount of bonds that can be issued by the TVA to finance its power program.

The CHAIRMAN. We have a number of witnesses who desire to be heard this morning, including Senators Hill and Sparkman and Senators Gore and Bass.

Representatives of the Tennessee Valley Authority are here and will give us the official position of that agency on the bills that are before us. The Honorable Aubrey J. Wagner, Chairman of the Board of Directors, is present. He is accompanied by the newest member of the Board, our old friend Don McBride, whom we recently confirmed as a director of TVA. Other members of the TVA family accompanying Mr. Wagner include Mr. G. O. Wessenauer, Power Financing Officer; Mr. Charles J. McCarthy, General Counsel; and Miss Marguerite Owen, TVA Washington representative.

Others who have requested an opportunity to testify on the pending legislation and are here this morning include Mr. Fred Paxton, president, Paducah Chamber of Commerce; Mr. W. J. Young, secretary, Western Kentucky AFL-CIO Council; Mr. Howard V. Reid, chairman, board of directors, Jackson Purchase Rural Electric Cooperative Corp.; and Mr. Hobart Adams, general manager of that company.

I understand that Mr. W. A. Duncan, president, Kentucky Utilities Co., is here and desires to be heard on this matter.

Representative Stubblefield of the First District of Kentucky is present. Senator Cooper calls my attention to his presence.

We welcome all of you.

Senator Hill, as you know, has been an ardent supporter of TVA since its early days. He sponsored the project when he was a member of the House, over 30 years ago. I might add that I also was a member of the House at that time and spoke in support of the creation of the corporation known as the Tennessee Valley Authority.

Now we will be pleased to hear from our friend and colleague Senator Hill.

#### STATEMENT OF HON. LISTER HILL, A U.S. SENATOR FROM THE STATE OF ALABAMA

Senator HILL. Thank you, Mr. Chairman. I appreciate the opportunity to be here this morning. I express my appreciation to the chairman and Senator Cooper.

In July of 1955, and again in June of 1959, I had the honor of appearing before this committee in support of the legislation which authorized TVA to issue revenue bonds to provide an additional source of capital for investment in power facilities. The dates themselves measure the span of years over which the pioneering legislation was considered. Many complex issues were involved. They were all considered and settled when the amending legislation was adopted by the Congress and signed by the President on August 6, 1959.

Today the situation is different. My colleagues—Senators Sparkman, Gore, Bass, Cooper, Eastland, Metcalf, Morton and Stennis—and I have introduced a single amendment to the 1959 legislation and a companion measure, as the distinguished chairman of the committee has said, has passed the House without opposition. We support the recommendation of the President to raise by a billion dollars the present limit of \$750 million on the amount of bonds which TVA may

have outstanding. Now the issue is not complex, the problem presented is simple. The \$750 million authorized originally is almost exhausted and the amendment to raise the limitation is essential to permit TVA to plan ahead, to order equipment, to design and build the facilities which will be needed to satisfy the electricity requirements of a growing region. May I say that the bonds are not guaranteed by the Government and they are not tax exempt.

Witnesses from TVA, as you have said, will testify about the agency's experience under the legislation of 1959. I shall not attempt that task, but I do want to record my personal satisfaction that the Board and management of TVA have not permitted the claims of a new kind of financing to dilute their dedication to the objectives this power system was created to promote. They have never faltered in allegiance to the purposes for which it was established. This is the only aspect of the subject before you on which I can offer credentials as an expert. I am not a specialist in financial matters, nor an authority in the field of power system management, but, as the chairman has said, I was one of the authors of the act creating TVA in 1933 and I sat on the committee of the conference which adjusted the differences between the two Houses and determined the final version of the act. I am the only conferee who is still a Member of the Congress, the only one who has had the opportunity to watch the progress of TVA over the years, to test achievements by expectations, and from personal knowledge to bear witness to legislative intent.

In creating TVA we were striving to establish a new kind of instrument to develop the resources of a region. TVA was instructed to see the job of resources development as a whole, to be concerned about the land as well as the water, the fish and the wildlife as well as the trees. Deliberately we determined that TVA should be independent of the old line agencies, reporting directly to the President and to the Congress. By statute we told the Board to establish its headquarters in the region close to the problems it would try to solve, rather than in the Nation's Capital, and we authorized it to work in cooperation with State and local agencies, public and private, in carrying out its many-sided program.

It was no ordinary utility operation that Congress intended TVA to initiate under the sections of the act relating to power. It was one part of the total program undertaken to develop the economy of an area then lagging behind the Nation, to promote the well-being of the people and enhance the quality of their lives. We told the Board to establish rates that would encourage electricity use, particularly on the farms and in the homes of the area and, at the same time, we directed TVA to recover the costs of power production. We did not say what the rates should be. We did not know. We left that decision to the management of TVA.

As the operation began we saw lines stretch through hollows and over hills, and, for the first time, electricity was brought to the farms of the region, and the lights came on in parlor and in kitchen when darkness fell. We saw wood-burning stoves replaced with electric ranges in farm kitchens, kerosene lamps retired to be sold as antiques, and washboards abandoned. Hand pumps and buckets were succeeded by running-water systems, refrigerators and freezers installed

to take the place of cellar cooling. Best of all, we saw green pastures begin to cover eroded acres, livestock introduced into the agricultural economy as, farm by farm, the system of management was changed. We saw backbreaking toil reduced, despair succeeded by hope, and productivity promoted.

Over the years the results have surpassed our hopes. Use has grown, costs have been held down, and the financial soundness of the high-use, low-rate pricing policy has been demonstrated to the benefit of power consumers everywhere.

When I testified in 1955 on proposed legislation to authorize TVA to issue revenue bonds, I was proud to report that 93 percent of the region's farms then had electric service. Now it is available to every farm. In 1955, I pointed out that the average consumer on farm and home used 5,000 kilowatt-hours of electricity a year. Now the figure has more than doubled. In a decade of rising costs, the trend of rates has been downward.

From the beginning the proceeds of power sales have covered all costs of operations including the in-lieu taxpayments to States and counties authorized by Congress, and have provided a surplus for investment in the system, and payments to the Treasury of the United States. I find it impressive to note that, including the retirement of some \$65 million of bonds issued prior to the 1959 legislation and held by RFC or the Treasury, TVA will have paid \$558,659,593 to the Treasury from power proceeds by the end of this fiscal year. Every obligation laid upon the agency has been met, the objectives of the act of 1933 have been honored, and the requirements of later legislation discharged.

My appearance here today is a reaffirmation of my pride and faith in TVA and my confidence in the probity and skill of its management. Approval of the legislation now before you will make no change in policies or procedures. It will simply permit the record of service to continue unbroken, and I urge your favorable consideration and action.

The CHAIRMAN. Thank you, Senator Hill.

This is an eloquent reaffirmation, I am sure you used the word very correctly. I do recall 30 years ago when we served in the House—

Senator HILL. Mr. Chairman, may I make one addition?

The CHAIRMAN. Yes, sir; Senator Hill.

Senator HILL. It was 33.

The CHAIRMAN. That is right.

Senator HILL. You and I were there together, sir, 33 years ago.

The CHAIRMAN. Yes. I inadvertently said 30 years ago, but the years do roll on.

Senator Cooper.

Senator COOPER. This must be a very happy moment for Senator Hill. I was not here in 1933, but he was. I understand that he introduced the TVA bill in the House.

I am sure you must be very proud to be able to come back after 33 years and introduce with others a bill which will enable TVA to continue its operation fully. I might comment, also, that after 33 years, Senator Hill is still here and many things have happened in those years. You have survived all of these events. I recall the story, someone asked after the French Revolution. Someone asked a

French philosopher for his comments on the French Revolution. His answer was, "I have survived." You have been here all these years.

Senator HILL. May I say one word? I appreciate the most generous words spoken by you, sir, and Senator Cooper. I think we ought also to remember Senator George W. Norris, who through the years, waged the battle that the great purposes and programs that we now see carried out by TVA might be carried out.

TVA really had its beginning in a sense, in the National Defense Act of 1916, section 124 of that act. We saw the war clouds of World War I getting closer and closer to the shores of our own country, and facilities to produce munitions were established at Muscle Shoals in Alabama. Senator Norris fought the battle to save those facilities for public use.

The CHAIRMAN. Senator, we are reminiscing. We will move from 1933 to 1958 when I was running for the U.S. Senate. My opponent was vigorous in his opposition to me. Of course, I called to the attention of the voters of West Virginia the fact that I had spoken and supported the Tennessee Valley Authority. This was in 1958. So, sometimes an issue is slow in dying, if there was an issue at that late date.

But I felt then, as I do now, that the legislation was constructive, that it helped an area of our country. I never have felt that we make a mistake in helping areas of our country. Because, if one area lags behind, as the Senators know who are here today, other areas lag behind. If we lift the level of one State or one region, another State or another region will be lifted, by and large. I think this is a prosaic statement to make, but by and large it is true. Today we are really privileged that the author of this bill is here before us.

Senator HILL. Thank you, Senator Randolph. I deeply appreciate your remarks. I again want to comment on the battle that through the years Senator George W. Norris waged in the Senate of the United States.

The CHAIRMAN. I believe there are only six Members over in the House now that were there in 1933 that voted either for or against the legislation. I am not sure how they voted, but I don't believe there are more than six or seven Members who are still there.

Senator HILL. Hawaii was not even a State then, Mr. Chairman.

Senator GORE. May I make one additional suggestion?

The CHAIRMAN. We are delighted to have you join in the colloquy.

Senator GORE. Congressman Hill was not exactly a neophyte in 1933. He was already chairman of an important committee there.

The CHAIRMAN. When did you come to the House, Senator Hill?

Senator HILL. Mr. Chairman, may I say this with reference to Senator Gore's comment? I came in 1923 and I was the baby Member of the House of Representatives when I came—the baby Member.

The CHAIRMAN. 1923?

Senator HILL. I came after a special election.

The CHAIRMAN. You said in 1933 you did something legislatively before Hawaii was a State.

Senator HILL. I said Hawaii was not a State at that time.

The CHAIRMAN. When you came to the House Senator Inouye was not around.

Senator HILL. It just shows the tremendous progress which has been made since I came to the House, Mr. Chairman.

Senator INOUE. Hear! Hear!

The CHAIRMAN. I hope our guests will understand that we are indulging ourselves this morning, and that you will accept our pleasantries in the spirit that they are offered. Our next witness will be the capable junior Senator from Alabama, Senator Sparkman.

#### STATEMENT OF HON. JOHN SPARKMAN, A U.S. SENATOR FROM THE STATE OF ALABAMA

Senator SPARKMAN. Thank you, Mr. Chairman, and gentlemen of the committee.

I appear here today to present a brief statement in support of the prompt passage of S. 3419, which I cosponsored. This bill will amend the Tennessee Valley Authority Act to authorize additional borrowing authority for TVA's power program.

My statement is brief because I believe the need for this legislation is so clear, and the wisdom of this proposal so obvious, that it speaks for itself. I urge this committee to give prompt approval to this measure.

In 1959 the Congress authorized the Tennessee Valley Authority to use revenue bond financing as an additional means of financing its power facilities. At that time Congress, after lengthy deliberations, made the major decisions about TVA's revenue bond authority. This year we have before us only the matter of extending the authorization which we made in 1959.

For those of us who supported self-financing for TVA at the time of the 1959 amendment to the TVA Act, it is gratifying to see how well it has worked. TVA has met the growing power needs of the area which Congress has directed it to serve without the need for large Federal appropriations for power program construction.

I understand that since 1959 TVA has paid more than \$308 million from power revenues into the U.S. Treasury, and that in the next few years TVA's cash payments to the U.S. Treasury may reach \$60 million a year.

The electric power consumption in the Tennessee Valley continues to increase substantially in every year. The household, industrial, and defense and space program requirements for electricity will certainly continue to rise rapidly.

The supply of TVA-generated electricity for the Tennessee Valley must continue to meet the needs of the area, and I strongly support this bill to give TVA the borrowing authority to enable it to finance needed generating and transmission facilities.

Mr. Chairman, I enjoyed the reminiscing engaged in by you and my colleagues and others. It brings back many thoughts to me. I grew up in the TVA area. I have lived all my life on the Tennessee River right near where TVA was born. I have seen these changes take place that my colleague so eloquently described. I have seen the growing needs. I remember one of the early bond issues that TVA was authorized after the original act. It was included in the \$65 million that my colleague spoke of. I remember the very difficult time we had in getting that

1939 authorization through Congress. As a matter of fact, if I recall correctly we could not get it up as a House bill separate and apart. The Senate passed it, and it was attached to an Internal Revenue measure, as an amendment, and was very ably handled on the floor of the House by our later friend and colleague, Jere Cooper, from Senator Gore's State. But we had a terrific struggle at that time. What a contrast with the passage in the House just a few days ago of this bill without opposition. I think it shows our recognition of the accomplishments of the TVA and our recognition of the increasing needs of power in the area when it was agreed back in that same act, more or less by gentlemen's agreement, on the division of the territory.

I think that today the American people recognize the tremendous job that the TVA has done and is capable of continuing to do. Therefore, I believe that this legislation is important and I urge the committee to act favorably and speedily on this measure to add \$1 billion to TVA's borrowing authority.

The CHAIRMAN. Thank you very much, Senator Sparkman.

You have associated yourself with this legislation through the years. You have given us a statement which is helpful this morning.

Senator Cooper.

Senator COOPER. I would like to reiterate what I said about Senator Hill. Mr. Sparkman helped very much in the development of all the bills which have affected TVA. Not only is this committee indebted to him, but his State is indebted to him.

The CHAIRMAN. Thank you very much.

Now I must recall that this mentioning of Hawaii causes me to believe that we may have some questioning or comment from Senator Inouye, who is a valuable member of our committee.

Senator INOUE. Mr. Chairman, I have no questions. I just would like to say that TVA is one of the Nation's greatest experiments in area development. I am certain that the people of the United States will be delighted to know that TVA is the model for the Mekong Delta development project. Many of the lessons we have learned in the Tennessee Valley Authority will now be applied in southeast Asia. This is how important TVA has been not only to your sector, but also to the Nation, and now to the world as a whole.

You can be sure that I will be voting in favor of this legislation.

Senator HILL. Thank you, Senator.

Senator SPARKMAN. Thank you, gentlemen.

The CHAIRMAN. Thank you, Senator Hill. And thank you, Senator Sparkman. We are delighted to have both of you.

The CHAIRMAN. Senator Gore.

We are very happy, Senator Gore, to have you present and to testify on this legislation.

#### STATEMENT OF HON. ALBERT GORE, A U.S. SENATOR FROM THE STATE OF TENNESSEE

Senator GORE. Thank you, Mr. Chairman, and members of the committee.

The distinguished Senator from Hawaii very generously commented about the success of the TVA. It has been so successful, as he has

said, that it has been used as a model for successful economic development in many other parts of the world. Visitors from many countries come into the United States and want to see, among the very first things, the TVA.

I will not undertake to review the history of the long struggle to obtain appropriations for the TVA and to secure enactment of the self-financing bill that has been reviewed by the distinguished Senators from Alabama. I had the privilege of making reference to that before this committee when Mr. McBride was before the committee for confirmation. So, to dispense with this, let me comment on the present situation. No longer are these struggles necessary. In these struggles, Senator Cooper, other Senators from the Tennessee Valley, and I have worked shoulder to shoulder for a goodly number of years.

TVA is so successful now that the bonds of the TVA sell at the premium rates. There is no lack of confidence, either on the part of the purchasers, of the people of the valley, or of businessmen who may desire to make an investment the future of which will depend on an adequate supply of electrical energy. In this regard, TVA is operating much as a private power company would operate. All of our regions are enjoying phenomenal growth. Of this, we are proud.

Electricity in its very nature is a monopoly business. It is uneconomic to have duplicating systems down each street or into each factory. So, by its very nature, an electric utility is monopolistic in character, whether publicly or privately owned. Therefore, whenever a utility, whatever the nature of its capital structure, has the responsibility of serving an area, then the people of that region have every reason to look to their government with confidence that this utility will be required, if requirement is necessary; that such utility will be enabled to serve the growing needs of that area. The Federal Power Commission exercises jurisdiction over the private power utilities, and the private power utilities have not been reluctant to make investments to meet the growing needs of their customers, the areas they serve.

This is proper. This, they should do. Perhaps they have not been quite as farsighted as the TVA in this regard, but this is beside the point. TVA, too, has been farsighted in anticipating the needs of the great valley which it serves.

I would like to suggest to the committee that the people of the valley who pay their electric rates are in fact paying for these new investments. But once paid for, debt free, they belong not to the people of the region, but to the U.S. Government. This is a very valuable investment for the U.S. Government. It is the largest integrated electric utility in the world. It has enormous value measured by any standard.

What we seek here is either a removal of the ceiling on indebtedness or the raising of the ceiling to a level which will permit a reasonable period of expansion and growth. Naturally, those of us from the TVA region feel that there is no necessity for a ceiling at all. But if the Congress wishes to exercise its surveillance and have a periodic review, then I would suggest a sufficient investment authority for at least a 7-year period of expansion.

Mr. Chairman, I do not wish to take further of the committee's time. I could speak at some length, about the TVA, but I thank you for the privilege of speaking thus.

The CHAIRMAN. Senator Gore, we are gratified that you have come today to testify and, in a sense, give your testament to the importance of this legislation and its productivity through the years.

I think you have stressed one point which I made by way of comment earlier, and that is that it is a program whose benefits are regional but the country as a whole progresses; is that right?

Senator GORE. Yes, indeed.

The CHAIRMAN. Thank you, Senator Gore, for your contribution this morning.

Senator Cooper.

Senator COOPER. I would like to say that I think that Senator Gore has made a very useful comment and a valid one. That is, that every utility, whether investor-owned or owned, as the TVA is, by the United States of America, faces increasing demands. And to serve the increased demands of the patrons in the area served, it must be able to borrow money to invest in facilities to meet that demand.

Isn't that correct?

Senator GORE. That is correct.

Senator COOPER. I would like to say to my neighbor on the Cumberland River we have had great pleasure working together on this proposition of TVA throughout the years.

The CHAIRMAN. Senator Inouye.

Senator INOUYE. I would like to say that Senator Gore's testimony has been helpful to me. As you know, I do not live in the valley, but I support this project. I have been supporting, for example, the war on poverty. I am happy to know that the war on poverty started a long time ago for I think TVA is one of the most successful war-on-poverty projects that we have ever had in our Nation's history. This is a type where it is a self-help program, a contributing program. It has been one that has brought much good to millions of people. I hope someday that we can have some sort of project of the same concept in the Pacific Ocean. I do not know what we will call it, but we are studying the TVA hoping to get some ideas from you as to how we can develop places like the trust territories, Samoa, Guam.

I thank you very much, sir.

Senator GORE. Thank you.

Could I make one further suggestion?

The CHAIRMAN. Yes, Senator Gore.

Senator GORE. The TVA has also been the greatest boon to private business and private industry that any region has ever known. Literally thousands of private businesses have thrived because of the TVA. Other thousands have been initiated because of the economic climate and the added opportunities brought into being by this vast program of integrated river valley development. It has been really a great thing, Senator. I will be happy to come to Hawaii at any time and go with you to Samoa, Tahiti, or any place you suggest.

The CHAIRMAN. Senator Gore, is there a degree of opposition yet within Tennessee to the original act?

Senator GORE. Degree of opposition?

The CHAIRMAN. Today, a degree of opposition to the original act in Tennessee?

Senator GORE. Well, we have a few fossils, not many.

The CHAIRMAN. It is not what you would call an issue in the State; is that right?

Senator GORE. Well, I yield to Senator Bass as to the issue question. He is more on the firing line than I, at this time.

The CHAIRMAN. Thank you, Senator Gore.

Senator Bass, we are privileged to have you present.

#### STATEMENT OF HON. ROSS BASS, A U.S. SENATOR FROM THE STATE OF TENNESSEE

Senator BASS. Thank you very much, Mr. Chairman, Senator Cooper, and Senator Inouye.

I want to first express my thanks for being here and to you for your interest and taking your time to hold hearings which I hope will bring about favorable approval of this important legislation.

I appreciate this opportunity to present my views on the proposed amendments to the Tennessee Valley Authority Act to change the authority for TVA to issue bonds to finance its power program.

In 1955, when I served in the other body, the Congress was first presented with the concept of self-financing for TVA. Even though it was obvious that additional methods of providing capital were required, it took the friends of TVA 4 long years of struggle to obtain passage of Public Law 86-137. This landmark legislation authorizing TVA to finance the construction of power facilities through the sale of bonds and notes has been of great benefit to millions of Americans.

The U.S. Treasury also has been enriched since the act provided that TVA must pay to the Federal Government an annual dividend or return on appropriations invested in power facilities. Last fiscal year TVA was required to pay \$10 million to the U.S. Treasury; however, revenue was high enough that \$52.6 million was actually paid. This is only one of several indicators of the great success of the TVA self-financing program.

The one major drawback in the TVA legislation passed in 1959 was the limitation on the authority to issue bonds. Congress placed a ceiling of \$750 million on the amount of bonds that TVA could have outstanding at any one time. Initially, this limitation did not present a significant problem, but today it is seriously hampering the effective long-range planning of TVA.

S. 2827, which I have introduced, is designed to remove this obstacle to progress. I have also joined several of my colleagues in cosponsoring S. 3419, introduced by Senator Hill and cosponsored also by my colleague, Senator Gore of Tennessee. However, I feel that this latter proposal does not provide a lasting solution to the problem, since the bond authority in this bill would only meet the anticipated needs of the next 7 years.

Earlier this year, TVA had \$340 million in outstanding bonds and notes. An additional \$160 million will be needed to complete generating units and transmission facilities under construction. Since TVA must commit funds at least 4 years in advance to keep pace with the

time needed for the manufacture and construction of powerplant equipment, careful planning is vital to a well-managed program.

It is presently estimated that TVA will need new borrowing authority before the end of fiscal year 1967. Since the power demands in the Tennessee Valley are expected to double in the next 10 years, it is essential that Congress act promptly to remove the present limitation on the amount of available capital. Without this congressional assist, TVA will find it impossible to meet the rapidly expanding needs of the people in its area of service during the next few years.

On April 10, 1933, President Roosevelt, in his message to the Congress recommending creation of TVA, described it as a corporation clothed with the power of Government but possessed of the flexibility and initiative of a private enterprise. I feel that this is still an apt description of TVA. And as a corporation, it must have within its power that management flexibility that will permit it to operate as it has in the past with commendable economy and efficiency. The Congress, which created TVA, can provide the necessary flexibility by placing the revenue bond authority on a permanent basis, without specific limitation, and at the same time hold TVA accountable for continued good performance.

I might add here, Mr. Chairman, that if there is any doubt about the TVA having an unlimited amount of bonding authority creating some fear that it might expand into other areas, I would like to remind you that the act of 1959, the initial act creating the bonding authority, sets a limitation or builds a fence, so to speak, around the TVA so that it is impossible for it to expand. This money, regardless of what amount it would be, would only be used to build those facilities necessary to provide the service within its own present area of operation.

TVA's outstanding record to date provides the best evidence to justify strong support and confidence in its program. As an active supporter of TVA, I am proud to call your attention to a few significant accomplishments.

TVA is a growing Federal asset that continues to require less Federal investment. During the period from 1959 to 1965 TVA's total net power assets grew by more than \$400 million. At the same time, the net U.S. Treasury funds invested in TVA declined by approximately \$45 million. In 1959 the U.S. Treasury investment was 70 percent of TVA's assets while in 1965 the Treasury funds represented less than 55 percent of that total. This reduction in Federal investment came about through TVA payments to the Treasury and to TVA's earnings. Hopefully, this trend will continue indefinitely.

TVA payments to the U.S. Treasury have soared over the last few years. From 1959 to June 30, 1966, TVA will have paid a total of \$308 million with \$65 million going as repayment for Government funds invested in TVA power, and the remaining \$243 million being paid as a dividend to the Government as owner. The dividend is based on the Government's average cost of money applied to the U.S. Treasury investment in TVA power.

Furthermore, in 1965 approximately 18 percent of TVA's total power revenue was paid into the U.S. Treasury. This is compared with the estimated 11 percent of gross revenue paid to the Federal Government by private power companies.

TVA self-financing bonds are sold in competition with the bonds of public utility companies and other private companies. Obviously,

they are considered to be a good investment because in 1965 bonds worth \$320 million were outstanding. This consisted of \$145 million in long-term bonds held by the public, \$80 million in short-term notes held by the public, and the remaining \$95 million held by the U.S. Treasury.

Thus the bond-purchasing public has clearly indicated its confidence and faith in TVA and the sound financial manner in which it is operated. This has happened even though TVA bonds are taxable securities.

There have been comments made that removing the ceiling on TVA bonds would create further competition with Treasury bonds. This, I believe, is false in that TVA will offer no more competition than any other bond issue—public or private. Natural restraints of our economic system will be exercised on TVA, irrespective of a ceiling, in that the corporate bond market will determine what TVA must pay in interest rates.

To those who fear that the TVA Board would not heed the rumblings from Wall Street as to the availability of purchasers of its bonds, I would note that the amendment of 1959 provides for the Secretary of the Treasury to delay the issuance of bonds by as much as 90 days.

Commonsense would indicate that the ceiling on the issuance of bonds has no correlation to their marketability. If the TVA were not financially sound, you could not find purchasers of bonds, regardless of how small a percentage or portion of the ceiling were being exercised.

There is every reason to expect that bond purchasers will continue to purchase TVA bonds—regardless of a ceiling—as long as they remain a good investment.

S. 3419, which I mentioned earlier, has a great deal of merit. However, it only provides temporary relief for a continuing problem. Since the bond authority in that bill is estimated to be adequate for only 7 years, it will undoubtedly be necessary to periodically go through the same procedures in which we are engaged now. This is especially important since TVA must commit funds at least 4 years in advance.

Mr. Chairman, I strongly urge this committee to report favorably S. 2827. I feel this bill provides the best solution to the problems facing TVA. The record is clear. TVA has done an outstanding job in resource and power development. It has earned the confidence and support of the Nation.

TVA is presently facing a grave crisis in attempting to serve the needs of the people in its service area due to the bond ceiling imposed by the Congress. This limitation should be removed and the authority to issue revenue bonds should be placed on a permanent basis. And, of course, TVA should continue to be held accountable for its performance. This is the road toward long-term progress that is in keeping with the highest traditions of our Nation.

Mr. Chairman, I would like to close by making this sort of remark, since it has been an hour of reminiscing. I am more than happy to be here today to insist and to ask the committee's tolerance in raising the ceiling, lifting the ceiling on the TVA's self-financing plan. While I was serving in the House of Representatives I had the privilege of presiding over the House during consideration of the first TVA self-financing plan. Those of you who have served in the House realize

it is a little different. In the Senate, presiding over the Senate is sort of a chore. Over in the House, it is quite an honor. When Sam Rayburn called on you to wield the gavel on an important piece of legislation, you felt highly honored. The first time I was called on by Speaker Rayburn to preside over the House on an important piece of legislation was a self-financing plan of 1959 at which time we were able to bring it to its favorable conclusion in the House of Representatives.

Also, Mr. Chairman, let me say this. My bill calls for elimination of the ceiling on the TVA bond issuing authority. I think this is as it should be over a long period of years, so that the Congress will not have to face this problem again, and, as I say, we have built in limitations and guarantees that it will be used wisely and will not expand into areas that will be competitive with private power production.

However, I will not be terribly upset if the committee, in its wisdom, as Senator Gore has stated, decides that it should have some review for the future and would adopt some ceiling. However, I think that the bill as introduced by Senator Hill, cosponsored by several of us, would certainly be a minimum amount if we should go the route of raising the ceiling rather than eliminating it.

I appreciate very much the courtesy of the committee.

The CHAIRMAN. Thank you, Senator Bass. You have made it very clear that although you have researched your subject and produced the bill which you have pending before the committee, that you do agree with the proposals of Senator Hill and others. Your measure will be given careful consideration, of course, by this committee. We are very happy to have the contribution which you have made to the hearing today.

Senator Cooper.

Senator COOPER. I associate myself with your remarks regarding the bill by Senator Bass. We are happy to have heard from him.

The CHAIRMAN. Senator Inouye.

Senator INOUE. Mr. Chairman, I would like to congratulate Senator Bass for his leadership in introducing Senate bill 2827.

I have one question, sir. With the elimination of the ceiling as called for by your bill, would the regulations and prohibitions set forth in the 1959 act be sufficient to set some appropriate controls over TVA activities?

Senator BASS. There would be no doubt that this 1959 act would give full authority to the Congress and would also be a restriction on TVA as far as expanding its power-producing facilities or its power-selling ability outside the area of operation that was outlined and clearly defined in the act of 1959.

As a matter of fact, if you will go back and read the act of 1959, you will find that the boundaries were described almost as clearly as if you were marking out a fence line between two pieces of farm property as determined by the engineers and surveyors. Because there are definite lines that confine the TVA's operations. So I don't think there would be any hazard involved in that whatever.

Senator INOUE. Is your bill supported by the TVA?

Senator BASS. I would have to let the TVA speak for itself. The Chairman of the Board of TVA and one of the other distinguished members are in the committee room. I understand they will testify

later. I would say that according to my personal knowledge at this time, they would not object to having the ceiling removed. But just what they recommend, I am not in a position to say at this time. But I do not think they would be unhappy if the ceiling were eliminated.

Senator INOUE. Thank you very much, sir.

The CHAIRMAN. Senator Young is intensely interested in this subject matter, as are other members of the committee. Even though you have not had the benefit of the testimony of other Senators, including Senator Bass, Senator Young, you might wish to ask some questions.

Senator YOUNG. I wish to express my appreciation to my distinguished colleague. I am just about to read in its entirety the statement that Senator Bass made. May I say in this connection that it is a happy personal recollection that as Congressman at large from Ohio serving my first term, I voted and spoke out in favor of the creation of the Tennessee Valley Authority, and I believe my record over the years of four terms in the House of Representatives and since 1959 in the Senate of the United States shows that on every rollcall I have supported the TVA. I am very proud of the great things that that wonderful project has accomplished for the United States.

Senator BASS. I want the Senator from Ohio to know that we in Tennessee and other areas of the valley certainly appreciate his support. Because without the support from Members of the Senate and the House with vision such as you, TVA would never have become a reality, because it did not cover enough of the area of the Nation at the time.

I would like to say to the Senator that the first speech that I really ever made about the TVA before I came to Congress actually was when I was invited to come to one of the civic clubs in Cincinnati and speak on TVA. I made some research and in the speech I remember I pointed out how important the Tennessee Valley Authority had been, not only to the people of the region, but also to the people of Ohio as an example in their ability to sell commodities in the valley area that would not have been sold without this great advancement made in the production of electric current and its use by the citizens of the area, and all of the household conveniences and many of the other appliances that were being produced in the great State.

So I might say to the Senator that his vision in helping us also paid dividends in goods sold and produced in his own State. This is true throughout the Nation, because not just we in Tennessee or in the other six States of the area receive benefits, but it has also been beneficial to every part of the Nation. At one time 55 percent of TVA production of power was being used by the Atomic Energy Commission at Oak Ridge, Tenn., which is the birthplace of the atomic bomb that brought about the end of World War II.

So I think we can all be justly proud of the record that has been made by the Tennessee Valley Authority. I certainly hope that the committee will give early and favorable approval to this legislation.

The CHAIRMAN. The committee will give prompt attention to the TVA bonding problem, because we realize its importance.

Senator Bass, we are helped by your testimony. We know that you have given careful consideration to your viewpoint. The committee, of course, will consider your bill with the bill presented by Senator Hill.

Senator Gore, to you and your colleagues we are appreciative. Thank you very much.

Senator GORE. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Cooper.

Senator COOPER. Mr. Chairman, I said a while ago I did not want to interrupt the proceedings. But I would like to make a short statement and present some background on the subject of the financing of TVA.

First I would like to say that my colleague, Senator Morton, of Kentucky, cosponsor of the bill before us which would authorize the TVA to issue an additional \$1 billion in revenue bonds, supports this legislation. I would like also to say that all the members of the Kentucky delegation in the House support this legislation. They have supported TVA in the past. I note that Congressman Stubblefield is with us today.

I also would like to recall one of the great supporters of TVA, the late Senator Kefauver. There were 4 years of deliberation concerning legislation granting to TVA self-financing authority. There were differences between the TVA and the Bureau of the Budget, and it took 4 years from 1955 to 1959 to enact that bill. I have always said that perhaps the major credit for the development of the bill in the committee on which you, Senator Randolph, and I served together, was probably due to the skillful work, the reconciliation and resolution of issues by the late Senator Kerr, chairman of the subcommittee.

I would like to say, not as a partisan matter, but as a fact that in 1954 when it became apparent that Congress would not continue to appropriate money for the generating facilities of TVA, I spoke on the floor of the Senate and proposed that TVA be authorized to issue revenue bonds to finance its additional generating capacity. I did so, (1) because I thought it was apparent that Congress would not provide appropriations for additional generating capacity, and (2) because I thought it correct that Congress should not authorize these appropriations.

I had the honor to make this recommendation to President Eisenhower. President Eisenhower was the first President who recommended to the Congress a bill, that TVA be authorized to issue its own bonds to provide for the needs of the people who lived in that area. While he opposed certain provisions which were later incorporated in the bill, he signed the bill. I simply want to say today that it was President Eisenhower who made the recommendation and it was he who signed the bill then it was passed by the Congress.

The CHAIRMAN. Thank you, Senator Cooper, for your statement. There have been many persons and more than one President who have given attention to the importance of the Tennessee Valley Authority. It is not the time for me to indicate, but I have felt that the Tennessee Valley Authority should be contained within its area. I so believe now. The benefits accrue, of course, to other areas, but not to have the Tennessee Valley Authority spread into every State in the Union.

Mr. Aubrey J. Wagner, Chairman of the Board of Directors, Tennessee Valley Authority.

Will you bring with you those associates you desire?

Chairman Wagner, if you will proceed in your way.

STATEMENT OF HON. AUBREY J. WAGNER, CHAIRMAN, BOARD OF DIRECTORS, TENNESSEE VALLEY AUTHORITY; ACCOMPANIED BY HON. DON McBRIDE, MEMBER, BOARD OF DIRECTORS; G. O. WESSENAUER, POWER FINANCING OFFICER; CHARLES J. McCARTHY, GENERAL COUNSEL; MISS MARGUERITE OWEN, WASHINGTON REPRESENTATIVE

MR. WAGNER. Thank you, Mr. Chairman and members of the committee.

I should like to say at the outset that the discussions which took place early in the hearing, these reminiscences about the early days of the TVA are most stimulating for us in TVA to hear. We have appreciated the opportunity which the Congress has given us to work in the area, and we hope that the results that we believe are evident in that region and in benefits to the Nation are as much a source of satisfaction and pride to you gentlemen and to other Members of the Congress as they are to us.

In 1959 Congress amended the TVA Act to authorize TVA to issue revenue bonds to assist in financing its power program. The bonds are not guaranteed by the Government. They are secured only by TVA's power revenues. They are not exempt from Federal taxation. The 1959 amendment limits the amount of bonds to \$750 million outstanding at any one time. At the time of enactment of the legislation it was recognized that this amount would be exhausted in a few years and that it would be necessary for TVA to return to Congress and ask for additional authorization. On May 20, 1966, the President recommended to the Congress that the ceiling be raised by \$1 billion. Senate bill S. 3419 was introduced on May 26, 1966, and on June 13 the House passed the companion bill, H.R. 15225, embodying the President's recommendation. The legislation is now before this committee.

To facilitate your consideration, I should like to discuss TVA's power program, to summarize its experience under the 1959 amendment, and describe the need for the requested increase in the bond ceiling.

TVA is the source of power supply for an area embracing about 80,000 square miles with a population of approximately 5.7 million. Within this area it supplies power to some 158 locally owned electric systems including 106 municipal electric systems, 50 rural electric co-operatives, and 2 small privately owned electric systems. TVA provides the generation and transmission systems; the local systems provide the distribution facilities and handle the resale of the power to the ultimate consumers. TVA also supplies power directly to 10 Federal establishments, including two large AEC plants and the NASA installations at Huntsville, and to 35 industries with very large or unusual power requirements. These include the phosphate operations of the Monsanto, Stauffer, and Hooker Chemical companies; the electrochemical operations of Air Reduction Co., American Potash & Chemical Corp., Diamond Alkali Co., and the Pennsalt Chemicals Corp.; the aluminum operations of Reynolds Metals Co., Consolidated Aluminum Corp., and the Aluminum Co. of America, including the power operations of its Nantahala subsidiary; and other industries with important national and defense significance.

The TVA power program is part of an overall program for the development of the natural resources of the area, as Senator Hill very completely described. Its general purposes are to promote the economic development and the welfare of the region, and to strengthen the national economy and the national defense. The act is specific about the policy to be followed in the sale of electricity. Electric power is required to be sold at the lowest possible rates and in such manner as to encourage increased use of electricity, especially in the home and on the farm (secs. 10, 11, 12, 15d(f), 15d(h)). The basic premise is that low electric rates encourage high levels of use, and that high use of electricity contributes importantly to an improved economy and a better life.

The increase in the use of electricity in the Tennessee Valley region since 1933 has been dramatic. In the area now supplied by TVA power, there were only 275,000 electric customers in 1933, and only 710,000 at the end of World War II. Today there are 1,900,000. A large part of the customer growth has resulted from rural electrification. In 1933 only 3 out of 100 had electric service, but today practically every farm in the region has service available.

In 1933 the average home in the area used 600 kilowatt-hours a year; today the figure is over 11,000 kilowatt-hours a year, which is about 2½ times the national average. More than a fourth of all the residential electric customers use electric heat; air conditioning is common and its use is increasing; practically every home has a refrigerator; and electric food freezers are an important factor in improved diet, especially in rural areas. More than three-fourths of the area's homes have electric ranges, and nearly as many have electric water heaters. High as these figures are, they leave ample room for growth, not only in the homes already served but in the 45,000 new homes that are being built each year.

Residential and farm use totaled 17.7 billion kilowatt-hours in calendar year 1965, more than double the 8.3 billion kilowatt-hours used in 1957, only 8 years ago. Commercial and industrial use almost doubled during the same period. The present growth in annual sales to residential customers is averaging between 7 and 8 percent a year and the same rate of growth is being experienced by commercial and industrial customers. If this rate of growth continues, as we believe it will, the power requirements of the region's basic customers will double again in the next 10 years.

The increase in power consumption has been accompanied by a steady improvement in the economy of the region. From 1960 to 1964, for example, nonfarm employment increased over 3 percent per year. For the same period, per capita income increased about 6 percent per year. In 1933 per capita income in the Tennessee Valley area was only 45 percent of the national average. The gap has not yet been closed but it is being narrowed; today per capita income is 70 percent of the national average.

The TVA power system presently supplies the region with the output of the generating capacity of 17.1 million kilowatts in 47 hydroprojects and 10 steamplants. The hydroprojects include 12 owned by the Aluminum Co. of America on the Little Tennessee River which are operated as part of the TVA system under a contract between Alcoa and TVA. Under this agreement and an industrial power contract TVA supplies to Alcoa the power used in its manufacturing operations and in the utility operations of Nantahala Power

& Light Co. The total also includes six hydroprojects built by the Corps of Engineers on the Cumberland River, all of whose power generation is purchased by TVA except for a small part retained by the Southeastern Power Administration. An additional 2.2 million kilowatts of capacity is under construction, mostly in two steam-electric generating units at TVA's Bull Run and Paradise plants.

The CHAIRMAN. Where are these located?

Mr. WAGNER. Bull Run is located in east Tennessee. Paradise is located in western Kentucky.

On June 30, 1965, the cost of power facilities in service and under construction totaled \$2.7 billion. Of this amount, \$1.2 billion—43 percent—represented the investment of appropriated funds, and \$1.5 billion—57 percent—the investment of corporate funds made up of retained earnings, depreciation, and borrowings.

In addition to authorizing the issuance of bonds, the 1959 legislation required TVA to make two types of payments from power proceeds to the Treasury each year. In reduction of the appropriation investment the schedule required \$10 million for each of the first 5 fiscal years; \$15 million for each of the next 5 years; and \$20 million a year thereafter until \$1 billion has been paid. TVA is also required to pay a return on the appropriation investment outstanding as of the beginning of each fiscal year. The amount is determined by applying to the appropriation investment the average interest rate payable by the Treasury on its total marketable obligations. By June 30 of this year TVA will have paid to the Treasury a total of \$309 million in accordance with these two requirements of the 1959 legislation, \$65 million in reduction of the appropriation investment, and \$244 million as a return on that investment.

Under the authority granted in the 1959 legislation, TVA has issued both long-term bonds and short-term notes. The bonds are issued under a basic bond resolution adopted by the TVA Board which constitutes a contract with purchasers. Three 25-year power issues have been sold, two for \$50 million each and one for \$45 million. These bonds, which carry the highest ratings of the principal rating agencies—Moody's and Standard and Poor's), were sold by competitive bidding to nationwide underwriting syndicates. The interest cost to TVA—4.44 percent, 4.69 percent, and 4.52 percent—compares favorably with the interest costs on the highest quality corporate bonds sold during the same periods. TVA has \$200 million in short-term notes outstanding, half payable to the Treasury and the balance to the public. TVA is selling \$40 million of additional short-term notes to the public today for delivery June 30.

TVA's obligations are not guaranteed by the Federal Government; the 1959 amendment provides specifically that the sole security for them is the revenues produced by the operations of the TVA power system. Such revenues cover all operating and maintenance expenses of the power system, payments in lieu of State and local taxes, debt service on borrowed funds, and payments to the Treasury. They also finance 35 to 40 percent of new construction.

The \$750 million borrowing authority is nearing exhaustion. In addition to the \$345 million of bonds and notes outstanding, \$155 million will have to be issued to finance completion of work already underway. This leaves only \$250 million to finance future power facilities, all of which will be committed to finance two new units just ordered. Generating plants now require a leadtime of 4 to 5 years

until they are placed in service. One of the recently ordered units will be in service in 1970, the other in 1971.

Looking to the near future, normal increases in power demands in the TVA area will require that TVA provide additional generating capacity of about 1½ million kilowatts a year. Over a 7-year period at current prices this would mean the investment of an additional \$2 billion for generating and transmission facilities. Of this total we estimate that power revenues will provide some \$0.8 billion, leaving about \$1.2 billion to be supplied through borrowings.

If the region TVA supplies with power is to continue to grow and to prosper it must have assurance that TVA can build the necessary generating and transmission facilities in time to meet its expanding requirements. Passage of the pending legislation increasing by \$1 billion the amount of bonds which can be outstanding will provide this assurance for an additional 6 or 7 years.

Mr. Chairman, that completes my prepared statement. I shall be glad to respond to any questions.

The CHAIRMAN. Thank you, Chairman Wagner.

I wish at this time to introduce for the record an editorial from the Herald-Dispatch of Huntington, W. Va., dated June 21, 1966, and certain portions of the editorial which I have marked which I will not read at this time.

(The editorial follows:)

[From the Huntington (W. Va.) Herald-Dispatch, June 21, 1966]

#### GOVERNMENT-SUBSIDIZED TVA KICKS COAL INDUSTRY IN TEETH

Each of the two nuclear units at Brown Ferry will be larger than any single atomic-fueled unit in the world; and the turbine generators alone will be larger than any fossil-fueled (coal, oil or gas) power makers anywhere.

The total contract for the new units will be approximately a quarter of a billion dollars. The first unit is expected to be operative by 1970.

Of great and ominous significance to the coal industry is the fact that the atomic-powered units of TVA will be located in one of the lowest-cost coal fields in the world. Yet TVA claims its studies show that it can save \$8 million a year on atomic power in comparison with coal-produced power.

The psychological effect of the decision is also considerable, since it will cause private power-producing utility companies to reexamine their cost figures—particularly with respect to future plants.

TVA's cost estimates may be questioned when they are released this week. The majority of power utility engineers has been insisting that the atomic plant is still not competitive with the fossil-fuel-powered plant, although most are agreed that the latter's advantage is gradually being reduced by experience with atomic fuel.

Investor-owned utilities and railroads have been badly hurt by this TVA decision—the former because of their large investments in conventional power plants, the latter because the electric power industry has become the largest single customer for coal and consequently one of the best customers of coal-hauling railroads.

To be sure, TVA's cost assessments cannot always be compared with those of the investor-owned utility group. The TVA, subsidized by the federal government, pays no taxes and of course enjoys the unlimited resources of a government to which budget deficits are a commonplace.

But it is late now to inveigh against this power colossus, which grew from a combination flood control and hydroelectric operation to its present expanded position without benefit of legislation or Congressional authorization of any kind.

In its rise to its present position in the power complex of the South, TVA has never hesitated to use any device it found profitable. Seeking the cheapest coal available, it bought heavily from stripminers who devastated large areas of states which did not have adequate laws requiring reforestation and other conservation measures.

Progress, of course, cannot be deliberately impeded for the sake of the coal industry or the railroad industry or any other industry. If atomic power has really become competitive with other fuels, and if all other factors—including an assured supply of nuclear fuel—are as represented by the TVA in its first announcements, the coal industry will have to meet this competition head-on with every resource and every research-recommended innovation at its command.

These resources are substantial. Coal has demonstrated its ability to bounce back by automation and streamlined production methods. It will not give up the fight for markets simply because a subsidized, government-owned operation has decided that nuclear fuel is the fuel of today as well as the fuel of the future.

The CHAIRMAN. Also from the Herald-Dispatch of Wednesday, June 22, 1966, I wish to introduce the Associated Press story, the heading of which is "TVA's Nuclear Plans Won't Exclude Use of Coal, Moody Declares."

Now the Mr. Moody referred to in the headline is Joseph E. Moody, president of the National Coal Policy Conference. I will read for the record that Mr. Moody said:

We are confident that TVA's long and satisfactory experience with coal fired generation will remain the overriding factor in future plant expansion.

Reading further, he said—

TVA has more than 2 million kilowatts of coal fired capacity on order and it anticipates that its coal consumption in the next five years will increase to about 30 million tons annually.

Also quoting Mr. Moody—

It seems probable that TVA's acceptance of the nuclear bid was predicated at least in part on the desire to obtain atomic power operation experience.

(The editorial follows:)

[From the Huntington (W. Va.) Herald-Dispatch, June 22, 1966]

#### TVA'S NUCLEAR PLANS WON'T EXCLUDE USE OF COAL, MOODY DECLARES

WASHINGTON.—Joseph E. Moody, president of the National Coal Policy Conference, said Tuesday the decision of the Tennessee Valley Authority to buy a nuclear plant does not mean TVA intends to exclude coal as a fuel in future operations.

TVA announced June 17 the award of a contract to General Electric Co. for construction of a nuclear power plant, TVA's first, near Decatur, Ala. The contract calls for two 1.1 million kilowatt generators.

TVA said it decided on a nuclear plant after a study showed it would be more economical than a coal-fired steam plant.

Moody said in a statement Tuesday that TVA's decision "by no means indicates that the . . . agency intends to 'go nuclear' to the exclusion of coal in the future."

"We are confident," he said, "that TVA's long and satisfactory experience with coal-fired generation will remain an overriding factor in future plant expansions."

He said TVA has more than two million kilowatts of coal-fired capacity on order "and it anticipates that its coal consumption in the next five years will increase to about 30 million tons annually."

"Undoubtedly," he said, "a major factor in TVA's decision was the guaranteed 12-year nuclear fuel price by the General Electric Co., and, of course, there is no way of knowing whether GE may eventually have to take a loss on this guarantee or not, although considerable concern has lately been expressed by both government and industry sources as to the long-term availability of low-cost uranium, if the current expansion of such relatively inefficient converters reactors continues.

"It seems probable that TVA's acceptance of the nuclear bid was predicated, at least in part, on a desire to obtain atomic power operation experience."

The CHAIRMAN. Now I would like you, Mr. Wagner, to comment on the Moody statements as read from the Associated Press.

Mr. WAGNER. First of all, Mr. Chairman, we have had satisfactory experience with the coal-fired plants. As Mr. Moody indicates, we

have 2 $\frac{1}{10}$  million kilowatts of capacity of coal-fired generating plants under construction now. We expect our coal purchases to rise from about 25 million tons per year at present to 30 million tons per year within the next few years.

Certainly we will continue to look into all sources of fuel for our thermal plants.

The CHAIRMAN. Chairman Wagner, will you be able to supply for our committee the studies that have been made by TVA which has to do with costs of coal-fired versus nuclear power? Also, would you supply for the record a memorandum on TVA long-term construction plans for coal-fired plants?

Mr. WAGNER. Yes, sir; we will be glad to do that.

The CHAIRMAN. This will be helpful to the committee.

(Subsequently the following exhibits were submitted:)

#### COMPARISON OF COAL-FIRED AND NUCLEAR POWER PLANTS FOR THE TVA SYSTEM

Office of Power, Tennessee Valley Authority, Chattanooga, Tenn., June 1966

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#### INTRODUCTION

Following a feasibility study completed in October 1965, TVA decided to invite bids for equipment and fuel for a light water nuclear power plant and for a conventional coal-fired power plant to be in service on its system in the fall of 1970. The bids, which were opened on March 29, 1966, have received intensive study and evaluation. This report describes the alternatives considered, based on the proposals of the suppliers, and the economic evaluation of the alternatives.

#### DESCRIPTION OF ALTERNATIVES

The 1965 feasibility study provided valuable guidance in selecting alternatives offering the most meaningful comparisons. It appeared that a two-unit plant of about 2,000 mw at a new site would provide a realistic basis on which to judge the relative merits of a nuclear plant and a coal-fired plant.

##### *Coal-fired plant*

With present system capacity and projected loads a site near Cumberland City in northwest Tennessee was determined to be the best location to consider for a new two-unit, coal-fired plant based on a comparison of that site with other sites on the Tennessee and Cumberland Rivers and in the western Kentucky coalfields.

The site is in Stewart County, Tennessee, on the left bank of Barkley Reservoir. It is about 50 miles northwest of Nashville and is well situated with respect to the large loads in the Nashville, Clarksville, and Calvert City areas. The Louisville & Nashville Railroad passes the site and no access railroad would be required. Coal for the plant would be delivered by rail but facilities could be

provided for barge delivery. The Barkley Reservoir would provide ample cooling water.

A description and drawings of the plant are contained in Appendix A.

As requested by TVA, the proposals offered coal and turbogenerators for coal-fired units: TVA has under option one Babcock & Wilcox boiler and some other equipment (from the Paradise unit 3 award). Some small amount of additional equipment would have to be obtained through further bids. Turbogenerator bids were received from General Electric, Westinghouse, and Brown Boveri. A number of alternatives ranging in size from 868 mw to 1,260 mw were proposed by the manufacturers, but, as requested, all offered units to match the B&W boiler. Brown Boveri was the low bidder, and the Cumberland City plant cost estimates are based on the Brown Boveri bid.

Some of the principal plant characteristics are as follows:

- Number of units: 2.
- Gross design output each unit, mw: 1,117.
- Net design plant heat rate, Btu/kwh: 8,946.
- Steam conditions at turbine throttle:
  - Pressure, psia: 3,500.
  - Temperature—Superheat/reheat—°F: 1,000/1,000.

#### *Nuclear plant*

From earlier studies, the Browns Ferry site near the large Decatur-Huntsville, Alabama, load center was chosen for the nuclear plant. The site is in Limestone County about 10 miles northwest of Decatur and 30 miles west of Huntsville. It is on the north bank of Wheeler Reservoir, which will provide a plentiful source of cooling water. A description and drawings for both the boiling water reactor (BWR) and the pressurized water reactor (PWR) are contained in Appendix A.

In undertaking the installation of its first nuclear plant, TVA considered the alternates of entering into a "turnkey" contract, or purchasing the major equipment as a unit with TVA doing the design and construction. While recognizing that the turnkey approach might offer some greater assurance of obtaining a nuclear station at a definite but somewhat higher price, TVA decided to utilize its experienced design and construction organization as architect-engineer and constructor for the project. It was felt that this would result in a less expensive plant and provide greater assurance to TVA as to the plant's reliability and operating convenience.

Responsibility for containment design and certain major responsibilities in designing and matching equipment and systems, as well as in providing major guidance and assistance in obtaining AEC licensing, would be placed on the supplier of the major equipment train. This important objective could only be achieved if turbogenerator, nuclear boiler, and auxiliary systems equipment were purchased as a package.

At the current state of development, the initial nuclear fuel to operate the reactor is supplied by the reactor manufacturer. TVA sought proposals for a fuel supply for a period extending through 1982 with a warranted cost of heat supplied by the reactor.

General Electric and Westinghouse met TVA's requirements for equipment and fuel as described above. Some principal features of their offerings are summarized below.

	Reactor	
	Boiling water— General Electric	Pressurized water— Westinghouse
Number of units	2	2
Gross generator unit output as guaranteed reactor rating, mw	1,098	1,033
Gross generator unit output at guaranteed turbine capability, mw	1,098	1,033
Net plant heat rate at design conditions, Btu/kwh	10,558	10,548
Steam conditions at turbine throttle:		
Pressure, psia	965	740
Temperature, °F	540	509

Initial rating 924 mw. Rating 1,033 mw within 6 months of commercial operating date.

## COMPARISONS OF COST

Since the characteristics of the nuclear and coal-fired plants differ widely, it is necessary to compare them on the basis of the total cost of the energy delivered to the system. The economic evaluations include the cost of plant investment; fuel; plant operation and maintenance; transmission investment, operation, maintenance, and losses; nuclear insurance; and other direct costs.

*Initial high-use period (through fiscal year 1982)*

Proposals TVA received from coal suppliers offer coal for terms ranging between 10 and 20 years. The nuclear proposals provided for a nuclear fuel supply with a warranted net cost of heat supplied by the reactor through fiscal year 1982. The first 12 years of operation of the new plant would be during a period of high use, since the plant would be utilized to supply base loads.

A comparison of the costs of energy from the nuclear and coal-fired plants during the 12-year period is shown in Table I.

The alternatives differ somewhat in plant capability. To allow a direct comparison, the investment costs and operating costs have been reduced to a \$/kw and mills/kwh base. The BWR and PWR values are based on the net plant capabilities corresponding to the nuclear reactor ratings guaranteed by the manufacturers without considering any stretch capability beyond that guaranteed. However, the PWR is not warranted to reach full rating (1,033 mw) until six months after the commercial operating date; this is accounted for in the evaluations.

*Investment cost.*—Plant construction cost estimates were prepared using the equipment cost data contained in the bids. The Cumberland City estimate includes the price of the turbogenerators as quoted by Brown Boveri, the evaluated low bidder for the conventional turbogenerators.

TABLE I.—*Energy cost comparison of coal-fired and nuclear plants initial 12-year period*

	Browns Ferry		Cumberland City
	BWR	PWR	
Net plant capacity two units, mw			
Net plant heat rate, Btu/kwh	2,129	1,989	2,206
Fuel cost, <sup>1</sup> cents per million Btu	10,558	10,548	8,946
Investment—Dollars/Kw:	11.86	13.17	18.90
Production plant			
Transmission	116.0	<sup>2</sup> 121.2	117.0
	1.4	1.5	6.0
Energy Cost—Mills/Kwh:			
Interest and depreciation on plant investment <sup>3</sup>			
Fuel cost	.89	.93	.90
Operation and maintenance	1.25	1.39	1.69
Nuclear insurance	.19	.18	.24
	.04	.04	
Total bus bar cost			
Interest and depreciation on transmission investment	2.37	2.54	2.83
Transmission O&M and losses	.01	.01	.05
	.01	.01	.02
Total cost	2.39	2.56	2.90

<sup>1</sup> Levelized for 12-year period (including inventory interest costs).

<sup>2</sup> Based on capacity guaranteed within 6 months of commercial operating date.

<sup>3</sup> Sinking fund depreciation for 35 years at 4½ percent interest.

Although a nuclear plant is new to the TVA system, there are at least two important factors lending assurance to the adequacy of the cost estimates for the nuclear plants. Approximately two-thirds of the estimated total direct cost of the nuclear plants is for equipment being supplied by the manufacturer under a firm contract price (not subject to escalation), whereas only about 14 percent (the turbogenerator price) of the estimated direct cost of the conventional plant is firm. The other factor is the size of the contingency allowance included in

the nuclear plant cost estimate. This allowance is about the same as the \$12.4 million allowed for the conventional Cumberland City plant, but, since only about one-third of the nuclear plant direct costs are subject to change, the nuclear contingency allowance is quite generous compared to that for the coal-fired plant. Additional information on plant investment costs is contained in Appendix A.

The annual cost of the investment is based on a 35-year sinking fund depreciation and 4½ percent interest.

Any of these new units would carry base load for a number of years. Different views have been expressed about the availability which can be attained by each type of unit, but there is no experience with either coal-fired or nuclear units of this size. For these comparisons an 85 percent annual capacity factor was used in all cases.

*Fuel cost.*—Because of advancing nuclear technology, the warranted nuclear fuel costs decline from year to year, so in the comparisons the nuclear fuel costs are leveled for both units for the period from initial operation through 1982.

The cost of the nuclear fuel for the first core loading of the first BWR unit (1970 operation) is \$33,479,000 plus about \$2,000,000 for the interest cost on progress payments. For the second BWR unit (1971 operation) the first core cost is \$32,894,000 plus a similar interest cost. For the BWR, the first core costs are \$24,944,700 and \$24,812,800 respectively, plus interest of about \$1½ million per unit. The BWR core loading, however, will produce more kilowatt-hours than the PWR; and, consequently, even though the initial core cost is higher for the BWR, the cost per unit of heat is lower.

The initial fuel loading will be paid for through progress payments before the fuel is delivered. As the fuel is consumed the costs will be gradually charged to operating expense. However, the fuel consumed must be replaced and there will always be a considerable investment in fuel inventory, but it will decline as the costs of successive fuel replacements decline. The suppliers have warranted the cost (including the interest cost on the fuel inventory) of the heat produced, and therefore the evaluations include the interest cost on the fuel inventory as part of the cost of the fuel.

Fuel costs for the BWR units range from 1.57 mills per kwh in 1970 to 1.09 mills per kwh by the end of the warranty period. The fuel costs for the PWR range from 1.78 mills per kwh in 1970 to 1.25 mills per kwh at the end of the warranty.

Full load coal requirements for the two coal-fired units are about 6.5 million tons a year. Four suppliers—Island Creek, Webster County, Peabody, and Pittsburg & Midway—submitted proposals for a coal supply for two units at Cumberland City for periods ranging from 10 to 20 years. Transportation companies were contacted, and their quotations for hauling the coal to the site were added to the coal proposals. Coal would be delivered to the plant by unit trains with fast unloading. The delivered cost of coal for the two units will average 18.90 cents per million Btu, including an allowance of 0.16 cent per million Btu for inventory interest.

The coal and the nuclear fuel costs are subject to change (but not to the same degree in each case) with changes in the economy, but this factor is treated separately later in the report; the basic bid prices are used in Table I.

*Operation and maintenance costs.*—Estimated operation and maintenance costs for the coal-fired plant are somewhat higher than for the nuclear plants. Such costs for the Cumberland City two-unit plant are expected to be about 0.24 mill per kwh as compared with 0.19 mill per kwh for the two-unit, BWR plant and 0.18 mill per kwh for the two unit, PWR plant.

TVA's annual operation and maintenance cost experience for the two 650-mw units at the Paradise Steam Plant was used as a base for estimating the coal-fired plant costs. These costs were adjusted where necessary to reflect plant differences, such as the larger capacity of the proposed units and plant.

The Paradise costs were also used as a basis for the nuclear plant estimates where the equipment and the operation are similar to both a nuclear and a coal-fired plant. In the case of the BWR, because of single cycle steam conditions, maintenance costs on certain similar equipment (turbine, boiler feed pumps, etc.) were estimated to be 15 percent higher.

The refueling time for the BWR and the PWR is expected to be about the same. Differences in maintenance materials and supplies for such things as control rods, waste disposal, and fuel channels, account for most of the difference in operation and maintenance costs between the BWR and the PWR.

The overall operation and maintenance costs are lower for a nuclear plant because there is no coal-handling and coal-burning equipment. This permits a sizeable reduction in the staffing for the nuclear plant, principally in the coal-handling and maintenance personnel. Otherwise, the nuclear plant staffing is expected to be about the same as for the coal-fired plant. The Cumberland City plant requires a staff of about 250 people, about 100 more than needed for either nuclear plant.

*Nuclear insurance.*—The principal insurance coverage is provided by the Price-Anderson Act. Its cost is based on a standard rate which is related to the thermal capacity of the reactor and is included in the economic evaluations. Insurance coverage provided by private insurers also may be required, and the costs of these premiums also are included in the evaluations.

*Transmission.*—As shown in Table I, the transmission system investment cost will be less for a two-unit nuclear plant at Browns Ferry than for a coal-fired plant at Cumberland City. For the Browns Ferry installation, short transmission connections will be made to the 500-kv transmission lines nearby. The Cumberland City plant would require one 500-kv transmission line for the first unit and two additional 500-kv lines for the second unit.

Because the Browns Ferry site is near the load centers of Huntsville and Decatur, transmission losses on the system during the winter peak load season, as well as average losses over the entire year, would be lower than for a plant at Cumberland City.

*Table I conclusion.*—It can be seen from Table I that the BWR would provide the lowest cost energy to the system in the initial 12-year period. It would be 0.17 mill/kwh lower than the PWR, and 0.51 mill/kwh lower than the coal-fired plant at Cumberland City. These advantages, expressed as total levelized annual cost differences for the output of the two-unit plant, are \$2.7 million and \$8.1 million respectively. The BWR has other advantages which are discussed later in this report.

#### *Present value comparisons of initial high-use period*

Whereas Table I compares levelized energy costs, Table II shows the sum of the present worth of all costs during each year of the 12-year period of warranted nuclear fuel cycle costs. This evaluation shows a total present worth saving for the two-unit BWR of \$13.7/kw over the PWR, and \$35.6/kw over the coal-fired plant.

Figure I presents graphically the year-by-year values that make up Table II. The curves, starting in 1971 with two units in service, show the present worth of the cumulative differences of all expenditures up to that time, including the operation and maintenance and fuel cycle costs for the first unit installed the year before. The coal-fired plant at Cumberland City is the base case. The effects of changes of one cent per million Btu in the cost of coal at that location also are shown.

#### *Future costs*

It is expected that the trends shown in Figure I will continue after the 12th year, and studies by TVA's staff and consultants indicate a continuing decline in the cost of nuclear fuel after 1982. Although the studies indicate a rising trend in the cost of uranium supplies, this is more than offset by decreases expected in the costs of fuel fabrication, spent fuel recovery, and other component costs.

Table III shows a 25-year evaluation using the best estimates available for fuel costs after 1982. The present worth of the saving for the BWR is shown to be \$19.2/kw as compared with the PWR, and \$71.1/kw when compared with the Cumberland City plant.

TABLE II.—*Cost comparisons of coal-fired and nuclear plants, investment cost plus present worth of production cost over first 12 years*

	Dollars per Kw		
	Browns Ferry		Cumberland City
	BWR	PWR	
Production plant investment.....	116.0	<sup>1</sup> 121.2	117.0
Summation of present worth of annual production costs (4½ percent interest) first 12 years:			
Fuel cost <sup>2</sup> .....	82.8	92.1	111.7
Operation and maintenance.....	12.8	11.8	15.8
Nuclear insurance.....	2.4	2.4	-----
Total bus bar cost.....	214.0	227.5	244.5
Transmission investment.....	1.4	1.5	6.0
Transmission O&M and losses.....	.7	.8	1.2
Total cost.....	216.1	229.8	251.7

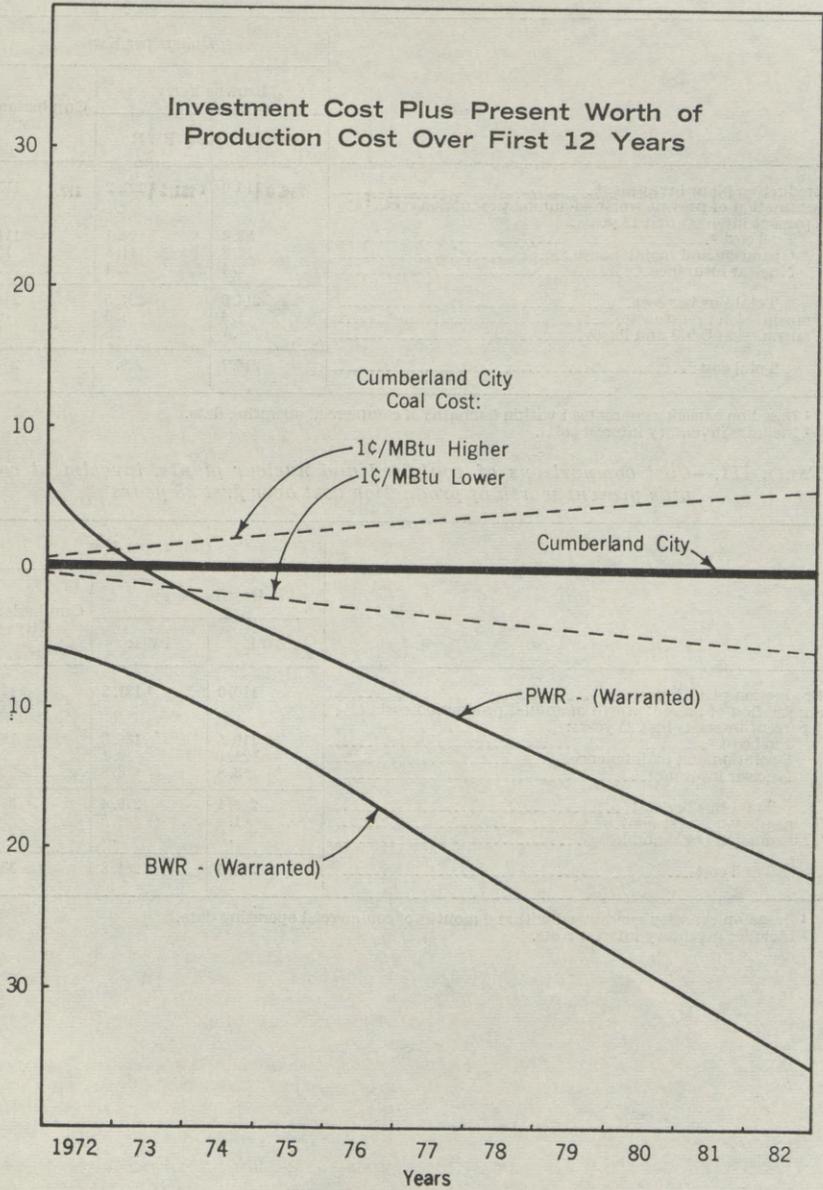
<sup>1</sup> Based on capacity guaranteed within 6 months of commercial operating date.<sup>2</sup> Includes inventory interest costs.TABLE III.—*Cost comparisons of coal-fired and nuclear plants, investment cost plus present worth of production cost over first 25 years*

	Dollars per Kw		
	Browns Ferry		Cumberland City
	BWR	PWR	
Production plant investment.....	116.0	<sup>1</sup> 121.2	117.0
Summation of present worth of annual production costs (4½ percent interest) first 25 years:			
Fuel cost <sup>2</sup> .....	119.5	135.3	184.4
Operation and maintenance.....	21.1	19.1	24.8
Nuclear insurance.....	3.8	3.8	-----
Total bus bar cost.....	260.4	279.4	326.2
Transmission investment.....	1.4	1.5	6.0
Transmission O&M and losses.....	.8	.9	1.5
Total cost.....	262.6	281.8	333.7

<sup>1</sup> Based on capacity guaranteed within 6 months of commercial operating date.<sup>2</sup> Includes inventory interest costs.

Figure 1  
Cost Differences of Coal-Fired and Nuclear Plants

Differences  
\$/KW



## OTHER CONSIDERATIONS

Other factors which may influence the decision in choosing between nuclear and coal-fired plants, and between a bwr and a pwr nuclear plant are discussed below. Most of these factors are difficult to evaluate in monetary terms, but they should be considered in reaching a final conclusion.

*Escalation*

Appraisal of the effect of escalation provisions in the proposals can be expressed in monetary terms, provided one can predict changes in the economy. During the short construction period, it is highly unlikely that equipment prices could change enough to affect the investment cost estimates. On the other hand, the fuel supply extends until 1982, and changes in the economy would have an effect on fuel prices.

Nevertheless, the difficulty in predicting such changes need not make the choice uncertain, since the relative effect on the alternatives is much the same. Price changes of bwr fuel, pwr fuel, and much of the coal offered are all related to changes in the Bureau of Labor Statistics Wholesale Price Index, All Commodities. While the application in each case differs somewhat, the relative effect of any possible changes would not change the rank order.

A discussion of the escalation provisions of the proposals follows.

*Equipment.*—The cost of the nuclear equipment for the first unit for operation in 1970 and the second unit for operation in 1971 offered by both manufacturers was quoted firm. General Electric made a firm offer also for the second unit for operation in 1972. Westinghouse equipment for the second unit for operation in 1972 is subject to escalation related to changes in specified labor and material indexes.

The cost of the turbogenerators offered by Brown Boveri for the coal-fired plant also is firm. The R&W boiler that TVA has under option is subject to escalation from the date of award of the Paradise 3 boiler (March 1965) in accordance with specified labor and material indexes.

*Fuel.*—The coal bids are subject to escalation beginning from the date of the bid. Several bids from various coal producers together make up the required amount of coal for the coal-fired plant; one producer indicated an escalation based on the Wholesale Price Index, and the others provided for escalation according to specified labor and material indexes. A projected advance in the Wholesale Price Index of 0.6 percentage point a year is estimated to add \$3/kw to the Cumberland City plant fuel cost in Table II.

The nuclear fuel cost for the bwr was quoted firm and is not subject to escalation for either unit until after 1974. The cost of any fuel installed after 1974 is subject to escalation based on the Wholesale Price Index. Over the 12-year evaluation period used in Table II, with the same increase in the Index as projected above, the present worth of the increase in nuclear fuel cost for the bwr is estimated to be about \$1.80/kw.

Westinghouse offered firm prices for the fuel for the first cores of the units to be initially operated in the fall of 1970 and 1971; however, the first core for the second unit, if delayed until 1972, and all refueling replacement batches for both units are subject to escalation in accordance with the Wholesale Price Index. Under the same assumption as to increases in the Index, the present worth of the increase in fuel costs taken over the same 12-year period would add about \$2.50/kw to the fuel cost shown in Table II.

The effect of the evaluation resulting from these projected escalated fuel costs favors the bwr installation. It would improve the advantage of the bwr over the Cumberland City plant in Table II by \$1.20/kw and over the pwr by \$0.70/kw.

*"Stretch" capacity*

During the months TVA was developing its invitation, there was considerable discussion with GE and Westinghouse of the "stretch" potential and what output capabilities would constitute the most advantageous match between reactor and turbine. As a result of these discussions, TVA decided to ask for a reactor and turbogenerator matched at reactor stretch capability, but the manufacturer was not asked to guarantee that the reactor stretch would be attained. This meant that the guaranteed turbogenerator capability would be some 10 percent greater than the guaranteed reactor capability. However, both manufacturers

chose to guarantee the reactor output at the turbogenerator guarantee point, with GE guaranteeing full capability by the date of commercial operation and Westinghouse reaching full warranted capacity within six months after the date of commercial operation.

Beyond the guaranteed rating, Westinghouse expects to achieve about 4 percent increase in reactor and turbogenerator output (up to the valves-wide-open point of the turbine). At this point, the gross unit output will be about 1,074 mw and, if achieved, would lower the pwr investment cost by \$4.8/kw. While this increase in capability is not guaranteed, TVA's engineering staff and consultants believe it is a reasonable expectation (Appendixes B and C).

General Electric also expects an increase of about 5 percent in reactor and turbogenerator capacity from 1,098 mw to about 1,152 mw at the valves-wide-open point. In addition, GE offered a turbine that can be operated with the top feed-water heater out of service, which gives an increase in turbine capability to 1,188 mw, or about 8 percent. This requires an increased heat output from the reactor greater than that guaranteed; however, the TVA staff and consultants feel that such an increase is reasonable to expect. If this 8 percent stretch is attained, the bwr investment would be lowered by \$8.8/kw.

To achieve these stretch amounts no physical changes would be required in the core structure. Such changes as better fuel distribution (axial zone enrichment) and turbulence promoters which make this possible appear to be feasible and could produce even further margins in future cores.

The Brown Boveri turbogenerator for the coal-fired unit has a maximum expected capability when operating with valves wide open of 1,123 mw—only ½ percent higher than the 1,117 mw guaranteed. However, the Brown Boveri unit, like the General Electric nuclear unit, can be operated with the top feed-water heater out of service to provide an increase to about 1,183 mw, 6 percent above the guaranteed output. If this capacity increase were achieved, it would reduce the Cumberland City investment cost by about \$6.6/kw.

#### *Availability*

The comparisons made in the two tables are based on 85 percent annual availability during the period of high-use operation for both the nuclear and the coal-fired units. TVA's experience indicates that this is about right for the coal-fired units. It may be a conservative estimate for the nuclear units (both GE and Westinghouse claim a higher nuclear plant availability).

#### *Extent of design extrapolations*

Considerable work has been done in examining the adequacy of the nuclear equipment designs with particular attention to the extent of the extrapolation of proven designs. It is the opinion of TVA's technical staff and consultants that the extrapolations with respect to equipment should cause no major problems in the construction or operation of either nuclear plant. TVA also has assurance from each manufacturer that all the equipment supplied for the nuclear plant would meet AEC's requirements for licensing and would operate properly at its guaranteed capacity.

#### *Fuel burnup*

The rated burnup for the fuel proposed for the bwr and the pwr is higher than burnups which have been achieved in power reactors to date. However, TVA's technical staff and the consultants have carefully reviewed the premises which support these higher burnups and are satisfied that they are achievable. The fuel costs are warranted on a heat output basis for the first 12 years of plant operation, and if the rated burnup is not achieved during this period, the cost of heat to TVA will not be affected. In this case, the yearly intervals between refuelings could be maintained by increasing fuel enrichments and refueling larger portions of the core each time.

The first time that a failure to achieve rated burnup could materially affect the cost of heat to TVA would be after the warranted fuel cycle cost provisions expire in 1983. That is 17 years from now and, with the advances that have been and are now being made in fuel design and exposure levels, it is highly unlikely that the rated burnups quoted by either manufacturer would not be achieved by that time.

#### *Operating assurance*

The nuclear bidders were requested to offer an optional assurance that the forced outage hours of the plant chargeable to delay in delivery or defects of

the nuclear fuel or certain critical equipment furnished, would not exceed 700 hours for each unit during the first 12 months following the contract commercial operating date. A failure of either of the nuclear units to operate on time (October 1 of the year installed) would constitute a chargeable forced outage. A penalty would be imposed at the rate of \$1,500 an hour for each forced outage hour in excess of 700 for each unit, with the total penalty limited to \$7 million for a two-unit plant (or \$3½ million for a one-unit plant).

Westinghouse did not include such an option in its nuclear proposal, but GE did. Thus in the BWR proposal TVA has the option of accepting or rejecting such an assurance. It will cost TVA \$850,000 for a two-unit plant, or \$500,000 if only a one-unit plant is purchased. This amount is included in the BWR investment listed in Tables I and II.

A similar operating assurance option was offered by Brown Boveri for the conventional turbogenerator at no change in price, with the maximum total penalty limited to 7½ percent of its one-unit or two-unit bid price, or about \$1 million per unit. The assurance provisions differ from those for the nuclear plant in recognition of a more limited contract scope (less equipment and a smaller amount of money involved). The penalty is \$1,000 an hour for forced outages in excess of 500 hours in the first year.

#### *Capacity guarantee*

The General Electric Company guaranteed that each unit of the BWR plant would be capable of a gross unit output of 1,098 mw and would be available on the scheduled date of commercial operation, that is, on October 1, 1970, for the first unit and October 1, 1971, for the second. GE's confidence of achieving this objective is reflected by its agreement to adjust the contract price to charge TVA only at the bid price per kw for capacity actually demonstrated. Further, the price for any capacity output which is realized within the second or third year after the scheduled date of commercial operation will be discounted by varying amounts up to \$10/kw.

#### *Nuclear safety and ability to obtain AEC licenses*

One of the basic differences between a coal-fired and a nuclear plant is the license requirement. The construction of a nuclear plant cannot proceed until a license or construction permit is granted by AEC. The time required to obtain a construction permit is influenced by the number of design advancements which may require examination from a safety standpoint, and possibly the workload of the AEC and the Advisory Committee on Reactor Safeguards at the time an application is submitted. Recent experience indicates that a construction permit can be expected 6 to 12 months after an application is submitted to AEC.

In evaluating the BWR and PWR plants, nuclear safety considerations have been investigated with emphasis on the ability to meet AEC's requirements for licensing of the plants and the time schedule. Plants of both types have been licensed by AEC in which plant parameters and systems are generally similar to but at lower performance levels than those proposed for the TVA plant. The safeguards proposed for the Browns Ferry site have proved to be adequate for other plants which have been licensed by AEC. There is no reason to expect that either plant proposed to TVA could not be licensed.

The major part of the application for a construction permit involves technical and general information related to the plant design and safety evaluation. The PWR plant Westinghouse has proposed to TVA is essentially the same as Indian Point, Unit 2, which is already before the licensing board at its nominal rating (873 mw); however, the operating level proposed to TVA is higher and there has been no submittal based on the higher rating.

The BWR plant has a number of changes from the latest BWR plant proposed to AEC (the 752-mw Dresden Unit 3). Therefore, it is clear that the design of both plants represents an extrapolation beyond plants already licensed. Nevertheless, as pointed out in the attached appendixes, it is the considered opinion of the TVA technical staff and consultants that either plant can be licensed. This specific characteristic of the designs has been evaluated. It has been concluded that no new engineered safeguards are required, particularly at the Browns Ferry site which meets the AEC site criteria very well. The specific differences between these offerings and prior designs will be accommodated in the safety analysis and the AEC staff supplied with all necessary data to permit evaluation. Both suppliers have anticipated the need for early submittal of an application in preparing material for a design and analysis report. It appears that an application for either the BWR or PWR can be completed in July 1966.

*Fund requirements*

The investments in plant and transmission facilities for the two-unit, coal-fired plant at Cumberland City and the two-unit, nuclear plants at Browns Ferry are not greatly different. Cumberland City, with its slightly higher capacity, would cost about \$271 million. Browns Ferry would cost about \$250 million for the BWR and \$244 million for the PWR. For a nuclear plant, however, a large initial expenditure is required to fuel the reactor the first time; two initial cores come to \$66 million for the BWR and \$50 million for the PWR.

*Competition in nuclear fuel*

An important question to be resolved in any nuclear plant undertaking is the degree to which the owner becomes a captive fuel customer of the reactor supplier. TVA explored this question in considerable detail with both GE and Westinghouse, and they agreed to provide TVA all the necessary information for taking competitive fuel bids for subsequent fuel replacement.

The fuel proposals give TVA the right to cancel the fuel contract effective in 1975 or later, and presumably TVA could take advantage of such a circumstance should it find other qualified suppliers with lower cost fuel. Cancellation of the PWR fuel, however, involves a charge equal to \$58,400 multiplied by the number of months left in the contract.

## CONCLUSIONS

It is evident from the results of the evaluation that the nuclear alternatives have a decided advantage over the coal-fired plant and that either a BWR or a PWR nuclear plant at Browns Ferry would be a decided economic choice over a coal-fired plant at Cumberland City. Comparing the present values of the investment cost plus the total production costs for the first 12 years of plant operation of each of the alternatives indicates the amount of this saving is \$21.9/kw for a PWR plant and \$35.6/kw for a BWR over the coal-fired plant. Although the capacities of these plants are not identical, an indication of the magnitude of this saving in total dollars is helpful in appraising the alternatives. The dollars per kw saving above amounts to about \$43 million if a PWR is installed instead of a coal-fired plant, and \$76 million, if a BWR is installed. These represent annual savings of about \$8 million for the BWR and \$5 million for the PWR. In addition, the nuclear plants have firm prices covering all the equipment (for 1970 and 1971 operation), and firm prices for a longer period on the fuel supply.

There are no technical or other reasons to believe that either a fully operable plant of the BWR or PWR type cannot be successfully licensed and built. The choice then lies between the BWR and PWR. The PWR plant has a \$13.7/kw economic advantage over the PWR; based on the capacity of the BWR plant the saving over the PWR has a present value for the first 12 years of about \$29 million, or about \$3 million annually, for the two-unit plant. In addition to this evaluated advantage over the PWR are GE's offers of a capacity guarantee, an operating assurance, better fuel cancellation terms, and a longer firm fuel supply.

## APPENDIXES

## A. Design of Plants and Basis for Estimates.

Table I.—Plant Ratings and Heat Rates (Single Units).

Table II.—Nuclear and Coal-Fired Power Plants—Comparative Cost Estimate Summary.

## Exhibits:

47W001—Equipment Plan—PWR Nuclear Plant.

10SN1—General Plan—Cumberland City Steam Plant.

## B. Technical Evaluation of Proposal for a Two-Unit, 2,000 MWe BWR Nuclear Power Plant.

## C. Summary of Findings of Consultants, S. M. Stoller Associates.

## ADDENDIX A. DESIGN OF PLANTS AND BASIS FOR ESTIMATES

*Nuclear plants*

For several years TVA has been engaged in an active study program to evaluate nuclear power generation for meeting load growth on its system. Since January 1965 an intensive study has been made of the design and cost of nuclear power stations. In addition to the studies in TVA offices, this has involved many meetings and discussions with manufacturers of nuclear plant equipment, with operating utilities, and with other Government agencies.

Over the past several months investigations have been carried out in depth with the General Electric Company and the Westinghouse Electric Corporation to develop plant specifications and proposals meeting TVA's requirements for a nuclear power station with two units, each in the 1,000-mw size.

Proposals received on March 29, 1966, from GE and Westinghouse offering nuclear power plant equipment in answer to TVA's invitation have been examined in detail. Considerable work was done in preparing specifications and developing plant layouts to assure reliable cost estimates and sufficient understanding of the complexities of this type of plant to be confident of its applicability to the TVA system. TVA has reached the conclusion that there are no technical reasons why nuclear plants as proposed by GE and Westinghouse cannot be successfully constructed, licensed, and operated.

The cost estimates were based on installation of the plant at the Browns Ferry site. The foundation conditions are known at this site. The site plans were developed for both the bwr and pwr over a period from January 1965 to May 1966. Several plant arrangements were tried before deciding on those used in the final cost estimates. The following considerations were used in developing the nuclear plant plans and estimates.

1. The estimates were based on facilities with characteristics similar to those provided for the coal-fired plant, where applicable, with commercial operation of the first unit in the fall of 1970 and the second unit a year later.

2. Nonrestricted heat rejection to the river was assumed.

3. Rail access was not necessary.

4. The boiling water reactor estimate reflects the installation of two reactors in a single building.

5. Net plant output and net plant heat rates were based on the turbine guaranteed rating at expected conditions.

6. The major equipment package bids of March 29, 1966, were used, with the bid price for the operating assurance option included. It is not practical to list in detail all the items included in the equipment package bids; however, the following partial list indicates the magnitude of the bid.

- a. Reactor and its auxiliary equipment and controls.

- b. The steel portion of the primary containment, including erection and testing.

- c. The turbogenerator and its auxiliaries and controls.

- d. Condensate, radwaste, and makeup demineralizers.

- e. Special radwaste equipment and controls.

- f. Fuel-handling equipment.

- g. Control room instrument panels.

- h. Computer.

- i. Feed-water heaters.

- j. Feed-water pumps and drives.

- k. Condenser circulating-water pumps and drives.

- l. Condensers and air removal equipment.

- m. Condensate pumps.

- n. Switchgear.

- o. Switchboards.

- p. Large electrical station service equipment.

- q. Motor-generator sets and diesel generators.

#### *Coal-fired plant*

Plans and estimates were based upon installation of two units in a new plant at Cumberland City. The following items were used as the basis for the plans and estimates for the coal-fired plant.

1. The Brown Boveri turbogenerator bid of March 29, 1966 was used and the turbine building sized to contain this unit.

2. Paradise unit 3 option prices were used where applicable for major pieces of equipment, such as boilers, precipitators, condensers, heaters, and pumps.

3. The estimates were based on commercial operation of the first unit in the fall of 1970 and the second unit a year later.

4. The boilers were assumed to be pulverized-coal-fired, single-furnace, with pulverizers on each side of the furnace.

5. Nonrestricted heat rejection to the river was assumed.

6. Electrostatic precipitators were provided.

7. The estimates reflect the use of outdoor boilers; minimum, but enclosed turbine room; minimum coal-handling facilities; less than full automation, re-

taining only performance monitoring, scanning, logging, and alarm functions; and a minimum of spare equipment and service facilities.

8. Foundation conditions are known.

9. Net plant output and heat rate were based on the guaranteed turbogenerator output with rated steam conditions and expected exhaust pressure.

10. Coal delivery by rail was assumed.

TABLE I, APPENDIX A.—*Plant ratings and heat rates (single units)*

	Coal-fired plant	Nuclear plant	
		BWR General Electric	PWR Westinghouse
Guaranteed gross generator output at reactor rating, mw.....		1,098	1,033
Guaranteed gross generator output at turbine rating, mw.....	1,117	1,098	1,033
Expected output, valves wide open, mw.....	1,123	1,152	1,074
Expected output, valves wide open, No. 1 heater bypassed, mw.....			( <sup>2</sup> )
Generator rating, mva.....	1,183	1,188	
Estimated auxiliary power use, turbine rating, percent.....	1,444	1,280	1,194
Design back pressure, turbine rating (yearly average), inches Hg.....	2.0	3.1	3.7
Rated makeup, percent.....	2.0	2.0	1.79
Expected net plant heat rate, turbine rating at design back pressure, Btu/kwh.....	0	0	0
Expected net unit capacity, turbine rating at design back pressure, mw.....	8,946	10,558	10,548
	1,103	1,064.5	994.5

<sup>1</sup> Initial rating 924 mw. Rating 1,033 mw within 6 months after the commercial operating date.

<sup>2</sup> No bid.

TABLE II, APPENDIX A.—*Nuclear and coal-fired power plants—Comparative cost estimate summary*

[Thousands of dollars]

	Nuclear plant				Coal-fired plant estimate <sup>1</sup>
	BWR		PWR		
	Estimate	Bid	Estimate	Bid	
<b>Production plant:</b>					
Land and land rights.....	600		600		700
Structures and improvements.....	23,152	4,000	20,909	2,381	25,283
Reactor plant eqpt/boiler plant.....	83,940	64,915	82,422	64,891	109,938
Turbogenerator unit.....	61,908	50,129	61,119	49,278	40,158
Accessory electric equipment.....	8,503	3,654	9,451	3,650	13,070
Miscellaneous power plant equipment.....	2,245		2,090		2,723
Communication equipment.....					284
<b>Total production plant.....</b>	<b>180,348</b>	<b><sup>2</sup> 122,698</b>	<b>176,591</b>	<b><sup>2</sup> 120,200</b>	<b>192,156</b>
<b>Transmission plant:</b>					
Structures and improvements.....	1,000		1,000		1,161
Station equipment.....	8,608		8,608		7,365
<b>Total transmission plant.....</b>	<b>9,608</b>		<b>9,608</b>		<b>8,526</b>
<b>Total direct construction cost.....</b>	<b>189,956</b>		<b>186,199</b>		<b>200,682</b>
General expenses and overheads.....	26,520		26,520		26,800
Startup costs.....	1,600		1,600		1,600
<b>Subtotal.....</b>	<b>218,076</b>		<b>214,119</b>		<b>229,082</b>
Contingency allowance.....	12,924		11,681		12,418
Interest during construction.....	16,000		15,200		16,500
<b>Total capital cost.....</b>	<b>247,000</b>		<b>241,000</b>		<b>258,000</b>
Total net mw.....	2,129		1,989		2,206
Cost per kw.....	116.0		121.2		117.0

<sup>1</sup> Based on bid of Brown Boveri for turbogenerators.

<sup>2</sup> General Electric and Westinghouse bid proposals; the breakdowns of these totals are TVA estimates.

APPENDIX B. TECHNICAL EVALUATION OF PROPOSAL FOR A TWO-UNIT, 2,000 MWE BWR  
NUCLEAR POWER PLANT

The General Electric proposal was reviewed to assess the basis for confidence in GE's ability to meet the requirements. The review was concentrated on critical areas where there appeared to be extrapolations beyond proven designs. In these areas, it was necessary to base judgments on the results of experiments and calculations, and discussions with GE's technical staff and other informed people. The review was concerned primarily with the following subjects.

1. Ability of the reactor cores to sustain the required power output
2. Operational stability and control characteristics
3. Reactor safety and licensing
4. Factors affecting operating costs
5. Developmental potentialities

The results of the analysis of economic and technical feasibility reveal good overall agreement with the conclusions reached by GE. Some differences exist, but none so significant as to suggest adverse features, poor operating conditions or unwarranted extrapolations of established data.

*Core power capability*

The most significant feature of the GE proposal is the 30 percent higher output, as compared with previous reactor designs having the same size core. This results from a number of important changes over BWR plants previously offered. The changes represent a general tightening of design margins, and the contributions of experimental and operating data to refinements in design.

The main areas of development have been improved power distribution and relaxation of critical heat flux limitations. The first of these—the improvement in power distribution—has been accomplished by using an on-line computer for control rod programming and flux shaping; by employing three different fuel enrichments in individual fuel assemblies to achieve localized power flattening; and by applying the experience of operating BWR plants to reduce margins from those previously used. The overall result of these improvements has been a reduction of the peak-to-average power ratio and an increase in specific power of about 15 percent.

The second major improvement has been the development of a new heat flux correlation through an extensive experimental development program. Thus, more accurate information has been obtained regarding the heat transfer characteristics of fuel elements under various reactor conditions, leading to higher power ratings of the fuel without greatly increasing risk of burnout. The new correlation is based upon several hundred data points which appear to have been rigorously established and conservatively applied. As a result of its review of the data and the experimental methods, TVA considers the new correlation to be reliable.

*Fuel performance*

The operating reliability of the Zircaloy-2 clad fuel in the large BWR cannot be predicted conclusively. Zircaloy oxidation and hydriding, fission gas release into the clad accompanied by internal pressure buildup, fuel-cladding mechanical interactions, loss of clad ductility, and central melting, each a potential problem area, have been investigated and exposure data from other reactors have been reviewed.

Similar fuel assemblies in statistically significant quantities now in service in other boiling water reactors have already been exposed without significant problems up to about 50 percent of the proposed burnup. Unless some unexpected long-term irradiation effect develops which does not conform to established trends, the proposed fuel should be reliable to the end of its design life, and the design objectives for burnup should be achievable.

One limiting criterion is that all of the reactor fuel be kept below the melting temperature. A review of the vendor's calculations and assumptions leads to the conclusion that central melting of the fuel pellets would not occur at any of the proposed power levels.

*Core nuclear characteristics*

The BWR core proposed for TVA employs a lower enrichment for the corresponding burnup than do previous BWR systems. The reduced enrichment results from GE's adoption of recent International Atomic Energy Authority recommendations on cross sections of fissile nuclides, especially plutonium cross sec-

tions and eta values; a reduction in the maneuvering allowance at the end of core life; and the use of zirconium spacers in fuel assemblies. Together, these three factors reduce the required enrichment by about 10 percent, and result in a 3 percent reduction in fuel costs.

TVA's studies and review of GE's calculational methods provide reasonable assurance that the proposed core characteristics are realistic, and that the reactor offered would be capable of achieving the rated power.

#### *Kinetics and stability*

With extrapolation to larger cores and higher specific powers, the problem of achieving and holding a stable power distribution is amplified. TVA's calculations show that the void coefficient is effective in rapidly damping the xenon-produced power oscillations in the proposed core. On the other hand, the presence of voids makes it difficult to maintain a good power distribution, since the control rods must be inserted to varying heights in the core, depending on the void distribution. However, smooth control of power changes can be achieved with concurrent rod manipulation using the digital computer in conjunction with the in-core detectors.

#### *Plant instrumentation and control*

As the BWR core size and power density are increased, the core becomes more sensitive to poison perturbations. These perturbations may arise from the control rod movement, void distribution changes, or xenon level changes.

There will be a definite control rod pattern for each void distribution to obtain a good power distribution. Adjusting the control rod pattern to match the void distribution will demand prior calculation with a digital computer to obtain a target value, along with a readout of the actual power distribution for confirmation.

The nuclear instrumentation system provided by GE includes neutron level monitoring from source range to full power. The arrangement is similar to that for Dresden 3, and the extrapolation to larger size and power density should present no new problems. The nuclear instrumentation system offered appears adequate to protect the reactor.

#### *Safety shutdown system*

A safety system is provided to shut down the reactor automatically if an unsafe condition should occur. The same plant parameters are used for scram functions as in Dresden 2 and 3. This system employs the established principles of coincidence and redundancy to assure reliability and avoid spurious shutdowns.

Dual scram channels are employed, with power supplied to each from separate motor-generator sets, which in turn are supplied from separate power sources. Also, periodic testing from a central control room is provided.

#### *Nuclear safety and ability to obtain AEC licenses*

Before construction of the nuclear plant can begin, a construction permit must be obtained from AEC. Later, various operating licenses will be required.

The basic considerations affecting the schedule are whether (1) a plant of the type and rating proposed can be licensed; (2) there are likely to be delays in obtaining a license which might seriously delay the scheduled operation; (3) the license is likely to restrict the plant output to a value below rated or expected capability; and (4) safety requirements might cause increased outages after the plant goes into operation. Although the plant proposed by GE includes some significant variations from those previously licensed, the changes are considered to have a sound technical basis, and it is believed that a construction permit can be obtained in time to meet the construction schedule.

#### *Developmental potentialities*

Although many of the previously anticipated developments for increasing BWR output capability have already been incorporated in the proposal, there still remains some possible margin for future increase in BWR output. These potential improvements, perhaps in the range of 5 percent to 10 percent, depend upon later refinements based on operating experience and fuel design improvements in early years of operation. Examples are increases in critical heat flux and development of higher performance fuel. It is important to note that nuclear

reactors (in contrast to coal-fired plants) are capable of improving in performance as they grow older, as improvements are incorporated in successive fuel loadings.

## APPENDIX C. SUMMARY OF FINDINGS OF CONSULTANTS

S. M. STOLLER ASSOCIATES,  
New York, June 6, 1966.

Mr. G. O. WESSENAUER,  
Manager of Power,  
Tennessee Valley Authority,  
Chattanooga, Tenn.

DEAR MR. WESSENAUER: I have prepared the enclosed summary of our findings which we first presented to you at our meeting of May 13th. I believe that we have covered each of the important points.

It has been a pleasure working with the Tennessee Valley Authority on this important evaluation and we look forward to working with you again.

Very truly yours,

S. M. STOLLER.

## SUMMARY OF FINDINGS

Since mid-April, S. M. Stoller Associates have been assisting the Tennessee Valley Authority in their evaluation of bids received from General Electric and Westinghouse for a two-unit nuclear power station. The warranted unit output rating of 1075 Mwe net for the GE design and 1005 Mwe net for the W design represent the largest units sizes yet offered commercially. Our assignment was principally focused on offering a judgment as to whether the plant designs were on sound technical ground and as to whether achievement of the warranted power production goal as regards both schedule and capability was reasonably assured.

We have performed what we would characterize as a technical "audit" of the designs by examining the data which the vendors have submitted in their proposals to the TVA, supplemented for the purposes of our review by additional data obtained in meetings and in personal correspondence with both vendors. Our review has included: (a) the experimental techniques and the results obtained in specific R&D programs conducted by the vendors; (b) measurements taken at operating reactors; (c) the input values and the computational techniques employed by each design organization in setting the final design itself.

Our detailed analysis of the material available, including the heat transfer limitations, power peaking factors, transient allowances, etc., was reviewed with the TVA Operating and Engineering Departments during the middle of May. As a summary of that presentation we are able to state our findings as follows:

(1) We conclude that both plants appear capable of achieving their warranted output power levels and of otherwise meeting TVA's system requirements. Both plants represent important advances in reactor core performance over any prior offering that we have seen. This is particularly true in the case of the GE design for which a significant increase in reactor power density has been made. In the case of the W proposal, although there is no notable change in power density relative to prior PWR designs, the manufacturer has extended the range of operating conditions covered by his warranty.

In each case these advances have been achieved mainly through reduction in design allowance. However, we are of the opinion that the reductions which have been made are adequately supported by experimental data and do not compromise or materially affect the overall safety margin of the core.

We should note that on the particular basis now offered neither design appears to have much room left for further increase of power output capability. Further core design changes would have to be made in the replacement fuel load and/or in the design correlations and allowances if it is found in service that the balance of the plant could accommodate even further extensions of output capability than is now contemplated. The procedure for making such future changes appears straightforward. This represents a considerable inherent protection of nuclear plants against technical obsolescence, namely: the core in which these improvements would originate (and also which sustains the most rigorous conditions in the plant) is periodically replaced and hence advanced versions would be routinely installed.

(2) Our studies indicate that either plant will maintain low fuel costs over their nominal 30 year lifetime. Based on a series of fuel cycle cost studies conducted by SMSA for utilities over the past several years, we are confident that when all fuel cycle factors are taken into account, the average fuel cost over the lifetime of the units contemplated herein would not exceed the average fuel cost warranted by the vendors for the first 12 years.

(3) Our analysis seems to us to permit the choice between these offers to be made by the TVA on traditional economic grounds. Although these designs cannot be compared directly inasmuch as they represent different reactor types, they each are judged to be capable of meeting the TVA performance requirements and we see no need for special weighting or debiting of either offer as a result of technical limitations.

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#### COMMENTS ON TVA'S LONG-TERM CONSTRUCTION PLANS FOR ADDITIONAL GENERATING CAPACITY

The Bull Run coal-fired unit No. 1 (950,000 kw) is scheduled for commercial operation this summer; the Paradise coal-fired unit No. 3 (1,150,000 kw) is scheduled for commercial operation in the fall of 1969; and Browns Ferry nuclear units Nos. 1 and 2 are scheduled for 1970 and 1971, respectively. The growth in TVA system demand after 1971 is expected to require about 1,500,000 kw of new capacity each year.

TVA, in choosing the type of unit to be installed in 1972, and for those units after that, would follow its usual practice of making an engineering and economic investigation of the various alternatives available; the choice would be made on the basis of the unit providing the lowest cost power supply to the system.

Coal-fired units will continue to be one of the major alternatives to be considered. With the possibility of additional improvements in its production and transportation, coal will continue to offer strong competition in the energy market; and TVA in making economic comparisons will explore both coal-fired and nuclear alternates each time a new unit is considered for the TVA system. In some instances of system needs, other alternatives such as pumped storage, would be considered. TVA does not expect all of its future generating capacity to be in any one single type of generating capacity.

The CHAIRMAN. You have recently announced your purpose to let a contract for a nuclear power generating plant; is that correct?

Mr. WAGNER. This contract has been awarded.

The CHAIRMAN. Actually awarded?

Mr. WAGNER. It has been awarded, Mr. Chairman.

The CHAIRMAN. When was the award made?

Mr. WAGNER. It was made on Friday, June 17, Mr. Chairman. The bids were taken in February and opened, as I recall it, the 29th of March.

The CHAIRMAN. I would like the record to reflect that on Thursday afternoon of this week I am going to discuss in the Senate at some length the lack of parity between coal research and nuclear power research. Also, I will point out that the converting of coal into electric power merits a program equal to the priority that is given to nuclear power. I will urge that the Congress look into this situation.

I will disclose the lack of parity that we have been coal research and nuclear power research.

Senator COOPER. The TVA Act, as amended by the self-financing act of 1959, provides in section 15d(f) as follows:

The Corporation shall charge rates for power which will produce gross revenues sufficient to provide funds for operation, maintenance, and administration of its power system; payments to States and counties in lieu of taxes; debt service on outstanding bonds, including provision for maintenance of reserve

funds and other funds established in connection therewith; payments to the Treasury as a return on the appropriation investment pursuant to subsection (e) hereof.

Then the section gives more detail about reserves and other factors.

May I ask if all of these obligations required by section 15d(f) of the act have been met?

Mr. WAGNER. Yes, sir; they have.

Senator COOPER. Has it been necessary for the TVA to increase its power charges in order to meet the obligations provided by this subsection?

Mr. WAGNER. No, sir; it has not.

Senator COOPER. The TVA Self-Financing Act provided that repayment should be made by TVA on the Federal investment, as you have noted, \$10 million for the first 5 years, \$15 million for the second 5 years, and \$20 million thereafter. As I remember, it was anticipated that in a period of 50 to 53 years the investment up to \$1 billion would be repaid. Is that correct?

Mr. WAGNER. That is correct; yes, sir.

Senator COOPER. Those obligations have been met?

Mr. WAGNER. Yes, sir; they have.

Senator COOPER. It also provided for the first time, as concerns TVA, that TVA should pay to the Federal Treasury interest on the Federal investment in power facilities at a rate equal to the average rates paid by the Federal Government on its own obligations. Is that correct?

Mr. WAGNER. A return which covers interest costs, that is correct; yes, sir.

Senator COOPER. Will you repeat again how much TVA has paid on the principal of the investment, and how much interest on the investment?

Mr. WAGNER. As of June 30, this year, Senator, we will have paid \$65 million in reduction of the investment and \$244 million as a return on the investment, a total of \$309 million since 1959.

Senator COOPER. As I remember, a section in the act prior to its amendment by the Self-Financing Act provided for repayment of the power investment.

Mr. WAGNER. That is correct; yes, sir.

Senator COOPER. Is it fair to say, then, that because of the Self-Financing Act, \$244 million has been repaid to the Treasury that was not required before the enactment of the Self-Financing Act, as interest on the investment?

Mr. WAGNER. I think that is essentially correct. The return on the appropriation investment covers the Government's interest costs; yes, sir.

Senator COOPER. Then TVA has issued \$345 million of its obligations to finance additional generating facilities?

Mr. WAGNER. That is correct.

Senator COOPER. Would it be fair to say that but for the TVA Self-Financing Act this would have been a charge upon the general appropriations of the Congress, if they had appropriated such sums?

Mr. WAGNER. Yes, sir; that is correct.

Senator COOPER. So \$345 million represented by the issuance of your obligations, and \$244 million represented by interest payments represent a saving to the Federal Government?

Mr. WAGNER. I think that is essentially correct, Senator. There may be some arithmetic involved here that escapes me.

Senator COOPER. I noted in your statement that the TVA has issued bonds in a total of \$145 million and sold short-term notes in the sum of \$200 million. Is that correct?

Mr. WAGNER. That is correct.

Senator COOPER. You have said that the three issues of bonds carry maturities of 25 years each, and an interest rate of 4.44, 4.69, and 4.52, respectively?

Mr. WAGNER. Those are the interest costs to TVA, Senator.

Senator COOPER. You have noted that \$200 million of short-term notes have been issued as payable to the Treasury. What interest rates do the short-term notes carry?

Mr. WAGNER. Those rates have varied over a period of time. Mr. Wessenauer, who serves as our power financing officer, is here. I might ask him to comment on that.

Senator COOPER. Are they substantially lower interest rates than the interest rate on bonds that have been issued?

Mr. WESSENAUER. No, sir. At the present time they are not, because the bonds were issued back in 1960, 1961, and 1962. We are currently paying the Treasury  $4\frac{3}{4}$  percent on the notes that are issued to the Treasury and those we have sold to the public range somewhat in the order in which the Government bill market ranges, although somewhat higher.

On our last issue, we had to pay around 5.7 percent.

Senator COOPER. Will you file with the committee a statement showing the total issues of short-term obligations, and the interest rate payable on each of the issues?

Mr. WESSENAUER. Yes, sir. It will be possible to supply a tabulation which will show that.

(Subsequently the following tabulations were submitted:)

Up to June 28, 1966, short-term obligations of TVA sold to the public on a discount basis are as follows:

No.	Issue date	Term	Amount	Interest cost to TVA	Total outstanding
		<i>Days</i>		<i>Percent</i>	
1.....	July 25, 1963	127	\$25,000,000	3.589	\$25,000,000
2.....	Nov. 29, 1963	118	35,000,000	4.025	35,000,000
3.....	Mar. 26, 1964	126	35,000,000	4.109	35,000,000
4.....	July 30, 1964	120	35,000,000	3.960	35,000,000
5.....	Nov. 27, 1964	118	45,000,000	4.352	45,000,000
6.....	Mar. 25, 1965	126	45,000,000	4.349	45,000,000
7.....	May 27, 1965	126	35,000,000	4.364	80,000,000
8.....	July 29, 1965	120	45,000,000	4.314	80,000,000
9.....	Sept. 30, 1965	119	50,000,000	4.568	95,000,000
10.....	Nov. 26, 1965	125	45,000,000	4.691	95,000,000
11.....	Jan. 27, 1966	119	50,000,000	5.064	95,000,000
12.....	Mar. 31, 1966	119	50,000,000	5.391	100,000,000
13.....	May 26, 1966	126	50,000,000	5.770	100,000,000

Up to June 28, 1966, short-term obligations issued to the Treasury under provisions of Section 15d (c) of the TVA Act are as follows:

Issue date	Term	Amount	Total outstanding	Interest cost to TVA <sup>1</sup>	
				Date	Percent
Oct. 15, 1962-----	Years 1	\$25,000,000	\$25,000,000	October 1962----	3.125
				November 1962--	3.125
				December 1962--	3.125
Feb. 15, 1963-----	1	25,000,000	50,000,000	January 1963----	3.125
				February 1963--	3.125
				March 1963-----	3.125
				April 1963-----	3.125
				May 1963-----	3.125
				June 1963-----	3.125
				July 1963-----	3.125
Sept. 24, 1963-----	1	25,000,000	50,000,000	August 1963-----	3.250
				September 1963--	3.250
				October 1963--	3.250
				November 1963--	3.375
Jan. 28, 1964-----	1	25,000,000	50,000,000	December 1963--	3.500
				January 1964----	3.500
				February 1964--	3.625
				March 1964-----	3.625
May 27, 1964-----	1	35,000,000	85,000,000	April 1964-----	3.625
				May 1964-----	3.750
				June 1964-----	3.750
				July 1964-----	3.750
				August 1964-----	3.750
Sept. 15, 1964-----	1	35,000,000	95,000,000	September 1964--	3.750
				October 1964--	3.750
				November 1964--	3.750
				December 1964--	3.750
				January 1965--	3.875
Jan. 27, 1965-----	1	25,000,000	95,000,000	February 1965--	3.875
				March 1965-----	4.000
				April 1965-----	4.000
				May 1965-----	4.000
				June 1965-----	4.125
May 26, 1965-----	1	35,000,000	95,000,000	July 1965-----	4.125
				August 1965-----	4.000
				September 1965--	4.000
				October 1965--	4.125
				November 1965--	4.125
				December 1965--	4.125
Jan. 27, 1966-----	1	25,000,000	100,000,000	January 1966----	4.250
				February 1966--	4.375
				March 1966-----	4.500
				April 1966-----	4.625
				May 1966-----	4.750
May 26, 1966-----	1	35,000,000	100,000,000	June 1966-----	4.750

<sup>1</sup> This rate of interest cost applies to the net amount withdrawn of the total outstanding.

Senator COOPER. Now the act of 1959 authorized the TVA to issue short-term notes to the Treasury, but upon certain conditions. It also directed the Secretary of the Treasury to buy such short-term notes. The conditions established in the act are predicated upon an emergency, in that the TVA was not able to sell its bonds at reasonable rates. Has that provision been followed? Did you sell these short-term notes to the Treasury because you could not sell bonds at a reasonable rate?

Mr. WAGNER. The provision has been followed, Senator, and the short-term notes to the Treasury were sold by agreement that the rates available in the market at the time would not be reasonable.

Senator COOPER. Were the sales of short-term obligations used to

secure lower interest rates than you would have been required to pay had you issued bonds?

Mr. WESSENAUER. Initially that was correct, Senator. We found with the amount of work we had under construction and the rate which short-term notes carried at the time we initiated the program that the short-term rates were more favorable to TVA than the rates on long-term bonds.

Senator COOPER. I know perfectly well now that if you sell your short-term obligations at present interest rates you are probably not going to obtain any advantage, because of the increased going rate. I don't know what you paid on the old issue of short-term obligations, but it would appear to me that if they were sold to the Treasury you would obtain the advantage of lower interest rates. It was not the contemplation of the Congress when we passed this bill that you should do that.

The standard we enacted was whether the rates of your bonds were reasonable; in other words, whether they were reasonable rates in the bond market at that time.

Mr. WESSENAUER. One section of the act provides that the Treasury shall pass upon the timing and the rate of our long-term bond issues and if they are not acceptable, the Treasury was authorized to buy the issue. That provision has not been used, because in each of the long-term issues the timing and the rate were acceptable as far as the Treasury was concerned.

Other provisions of the act contemplate that if there are other circumstances under which we could not get reasonable terms the Treasury could buy some of our short-term notes. It was under that provision that we have used this arrangement which has been useful both to us and to the Treasury.

Senator COOPER. If you could go to market and sell your bonds at an interest rate comparable to the issuance of other bonds, would you then believe that you had the authority to sell your short-term notes to the Treasury at a lower rate of interest?

Mr. WESSENAUER. I think, Senator, you have to recognize that the term of the issue has a great deal to do with the interest rate. Our bonds were sold on a 25-year basis. The short-term notes are for less than 1 year. Of course, the cost of money on borrowings of 1-year duration are quite different from those of a long-term duration.

Senator COOPER. Do you interpret the directive of the act relative to the sale of short-term obligations to the Treasury to mean that you could sell your short-term obligations to the Treasury to secure a lower rate of interest than the rate you could secure by issuing bonds?

Mr. WAGNER. May I ask our general counsel, Mr. McCarthy, to respond?

Senator COOPER. If you could continue to sell short-term obligations to the Treasury at any time at lower rates of interest, it would be as though you were obtaining appropriations from the Congress.

Mr. WAGNER. May I ask Mr. McCarthy, our General Counsel to respond to that question. It is a matter of legal interpretation. I would like to have him do it.

Senator COOPER. I might say it was not the intent of the Congress that you continue to finance yourselves out of the Treasury, just as you were doing before.

Mr. WAGNER. I think we are not doing that, Senator. May Mr. McCarthy respond?

Mr. McCARTHY. The act provides that in case the corporation determines that a proposed issue of bonds hereunder cannot be sold on reasonable terms, it may issue interim obligations to the Treasury. Now that "reasonable terms" is not limited to interest rate. You must bear in mind that the word "bonds" in this act is broad enough to cover any kind of an obligation. The notes which have been issued to the Treasury take the place not of long-term or short-term notes that would normally be sold to the general public, but rather they take the place of bank financing. When we investigated bank financing, we found that we would be required not only to pay a fairly high rate but also to leave 20 percent of the amount of the loan on deposit.

Since the Treasury acts as TVA's banker, that arrangement would have been unsatisfactory, both to TVA and to the Treasury which preferred this arrangement.

I might also add that the amount which we can finance through the Treasury is limited to \$150 million.

Senator COOPER. I understand that. And they must not have maturity longer than 1 year.

Mr. McCARTHY. That is correct.

Senator COOPER. What was the Treasury's objection to the TVA's securing these funds by the issuance of bonds rather than by selling your notes to the Treasury?

Mr. McCARTHY. The Treasury did not object to our obtaining the money through the issuance of bonds. But the Treasury preferred that we not borrow from commercial banks and leave deposits with the banks. The Treasury acts as our banker. So that this method of financing fitted in with the manner in which we operate.

Senator COOPER. I think one of the purposes of the Self-financing Act was to enable the TVA to secure revenues to finance needed facilities for generating capacity. I believe one of the purposes was to put the TVA in the same position as private utilities are in that TVA should go into the markets and secure funds at comparable rates that investors are willing to pay.

Don't you believe that if the TVA should continue to finance a part of its operations year after year by selling its notes to the Treasury, then the TVA is not following the provisions of the act?

You borrow from the Treasury at lower rates of interest than you would be required to pay if you sold the bonds to the public; you could do this year after year, could you not, and finance in part from the Treasury?

Mr. WAGNER. Let me say as a member of the Board that I understood this section of the act, which as you indicate is limited both to the length of time that borrowings can be made and the amount of borrowings—I have understood it as providing a degree of flexibility to permit operation on a financially sound basis, both for TVA and for the Government as a whole. And we are a Government agency, of course.

It does not permit the financing of all capacity additions to the power system, of course. It is used as a temporary device from time to time. It apparently has worked well, both from our standpoint and from the Treasury's, which means from the Government's standpoint.

To repeat, I have understood this as providing a measure of flexibility to permit us to carry out a sound financial operation from the Government standpoint. I believe it has worked that way, sir.

Senator COOPER. I hope the committee will pardon me if I spent some time in raising these questions which I do because of the presence of officials of the TVA; I might not have another opportunity at least this year.

Mr. CHAIRMAN. Yes, Senator.

Senator COOPER. Could you file with the committee a statement showing the coal holdings of the TVA, giving the acreage and locations, and whether they are of ownership in fee simple or leases? Do you have leases of coal property?

Mr. WAGNER. We will be glad to do that; yes, sir.

(Subsequently the following information was supplied:)

#### COAL RESERVE ACQUISITION PROGRAM

TVA owns about 129,000 acres of coal reserves. No other mineral rights have been purchased and surface rights are limited to those necessary for recovery of the coal. TVA has acquired the coal mining rights to the following tracts:

1. *Red Bird Timber Corp.*—Located: Bell, Harlan, Leslie, and Clay Counties, Ky., 40,220 acres.

2. *Koppers.*—Located: Campbell and Scott Counties, Tenn., 52,914 acres.

3. *Franklin County Mining Co.*—Located: Franklin County, Ill., near Benton, Ill., 5,000 acres.

4. *Camp Breckinridge.*—Location: Union County, Ky., 30,590 acres.

TVA's basic objective in acquiring these reserves is to make certain that it can continue to supply all power requirements of the area it serves. TVA's total coal reserves are small when considered in the light of its coal requirements. Acquisition of coal reserves under these circumstances appears to be an essential step in meeting TVA responsibilities and protecting the investment of the Government and the bondholders in the power system. Many private utilities have similarly acquired coal reserves in recent years. TVA's purchase of coal reserves does not influence the size of the coal market or the number of miners employed.

Senator COOPER. Will you file also a full statement relating to your coal purchasing procedures?

Mr. WAGNER. Yes, sir; we will be glad to do that.

(Subsequently the following information was supplied:)

#### TVA COAL PURCHASING PROCEDURES

TVA's coal purchasing objective is to provide an adequate and economical fuel supply for its plants. TVA's practice, in accordance with the TVA Act, is to invite competitive bids from all suppliers and to make coal contracts with the lowest responsible bidders whose bids meet TVA's specifications.

TVA encourages all mines within economical reach of its steam plants to compete for coal purchase contracts. As a result, the mines which furnish coal to TVA range from small "Family" operations to some of the country's largest. Some sell most or all of their output to TVA.

TVA buys coal on the basis of its heat content. TVA compares the bids received in terms of cost of heat delivered to the steam plants. Each bidder quotes a price per ton for his coal delivered to TVA or f.o.b. mine or river loading point. He also guarantees the analysis of his coal, including a guarantee as to its heat content. TVA then adds to the producer's quoted price any remaining cost of transportation to each steam plant within economic reach, computes the cost of heat delivered to each plant, and makes an adjustment for ash and sulfur content in excess of specified standards.

Term contracts are the backbone of TVA's coal supply, furnishing above 90 percent of the total tonnage. The terms of such contracts range from six months to seventeen years. Bids are normally invited two or three times a year; thus, the suppliers have full and frequent opportunity to bid in accordance with their judgment of probable future market conditions and to offer such part of their production and at such prices as they wish.

Spot purchases comprise a minor but important part of TVA's coal supply. These contracts run for a term up to four weeks selected by the bidder and may be for varying quantities from a single load to very large tonnage. Bids are received weekly. Spot coal purchases have offered new suppliers and TVA convenient ground for gaining experience with each other and for TVA to learn about the abilities of prospective term coal suppliers. Some of the suppliers now holding term contracts first sold TVA spot coal. Spot purchases have also been useful for adjusting TVA's coal intake to short-term fluctuations in need for coal. Similarly, they provide the suppliers with a market for temporary excesses of production.

Senator COOPER. May I ask if the TVA has any intention of operating coal mines and producing coal?

Mr. WAGNER. We have no present intentions to do that; no, sir.

Senator COOPER. Do you have any future intention?

Mr. WAGNER. I am not sure how you have a future intention.

Senator COOPER. You must have discussed it at some time.

Mr. WAGNER. Yes; we have discussed this. We have concluded that if we should ever find it necessary to secure the coal from reserves which we have purchased, we would contract for the mining operation. We have no intention of getting into the coal-mining business.

Senator COOPER. I wish to call attention to another situation which I note in my own State, and particularly in Muhlenberg County, Ky., where a generating plant is located and where great purchases of coal are made from several companies, including the Peabody Coal Co. You probably purchase also for use at that plant coal produced in other counties in the area. I know I have had inquiries from people who live in Ohio County, which is near this plant. The Kentucky Legislature recently passed a comprehensive act requiring the restoration of coal land which has been stripped. The Kentucky Legislature passed this act, I think, almost unanimously. I note also that in section 22 of the TVA Act, that the TVA is required to further the property use and conservation and development of the national resources of the Tennessee River Range Basin and such adjoining territory as may be related to or materially affected by the development conditions to this act.

Section 22 continues and develops this theme in more detail. If one flies over Muhlenberg County he will see it bears a resemblance to shots taken of the moon and you would see great craters, and great pools of water. I am informed that strip-mine operations have affected the water level and have made a great deal of water in that area unpalatable. At this point very little has been done toward reclaiming that land.

Does the TVA feel that it has a responsibility in making contracts with the coal producers, to require in its contracts provisions which would carry out section 22 of the act, and conserve and protect the land?

Mr. WAGNER. Senator Cooper, we do place such provisions in our contracts. We do require reclamation of lands that are stripmined to produce coal for our contracts.

Let me say that we believe very firmly that strip-mining areas should be reclaimed. As early as the 1940's, before TVA was even a purchaser of coal, we undertook to work with mine operators in southwest Virginia, which was in the Tennessee Valley, on a program of voluntary reclamation. We have pushed this for a long time. Subsequently, realizing that voluntary reclamation was not adequate, we began working with the States to try to secure legislation which would regulate strip mining. This has been provided in Kentucky. The original law was passed quite early, 1954 I believe, and it has been amended five times since then.

As you say, it is a good law, a strong law, and will provide reclamation. Virginia recently passed a law. Tennessee does not have one. Illinois has had one for several years. Alabama has none.

The CHAIRMAN. What about West Virginia, since you are talking about States?

Mr. WAGNER. Yes, sir, I did not mention it because unfortunately we do not buy any coal in West Virginia. It is outside of our purchase area.

The CHAIRMAN. I will get around to that.

Mr. WAGNER. I believe the coal we buy in east Kentucky makes markets available for West Virginia coal that would otherwise not be available.

We believe State action is essential to regulate strip mining, and that TVA contract provisions alone will be ineffective, because while we purchase large amounts of coal, we buy only 15 percent of the strip-mined coal in the five States in which we buy. So even if land mined to produce coal for TVA were reclaimed beautifully, 85 percent of the land stripped would still remain unreclaimed. Because the State of Tennessee particularly was slow to adopt legislation—incidentally we hope it will be adopted in the next legislature—we did put into our contracts starting last September a requirement for the reclamation of land which supplies coal for TVA.

We also, Senator, have developed and provided a number of demonstrations of the reclamation of strip mines in our area, some of them to reclaim lands which were mined long ago; others to carry on the reclamation in conjunction with the mining. We believe these demonstrations are being helpful in the current move to secure adequate reclamation of these areas.

Senator COOPER. I know that many States, as you noted, have enacted legislation on conservation measures in this field. I call attention to the fact also that the Federal Government is very much concerned, as is the Congress. We have enacted legislation to consolidate all conservation measures. The Appalachian Act has a provision for conservation. Has the TVA as an agency of the Federal Government and an agency which purchases the largest volume of coal of any industry or any utility in the United States, if not the world—and which under the original act is required to conserve the land—has the TVA written into its contracts any requirements that coal companies should reclaim and reforest, or reclaim in whatever the proper way, the land which is torn up to supply coal for TVA?

Mr. WAGNER. Yes, sir; we do put that requirement in our contracts.

Senator COOPER. Have you any possibilities of putting that requirement in the long-term contracts, which have already been made and

which I think will apply specifically to Muhlenberg County in my State, and other counties in that area?

Mr. WAGNER. Senator Cooper, in Kentucky the State, as you have indicated, has an excellent law. And the coal that is mined for TVA must comply with that law, whether it is under a new contract or a contract entered into in the past.

Senator COOPER. I have studied it in detail, and I doubt very much if it could require coal companies, which have completed their operations prior to the enactment of the act, to do anything about reclamation.

The CHAIRMAN. May I interrupt at this point to say that in many of these States, as Chairman Wagner knows, the coal company stripping the land has found it better, to use that word, to pay the penalty or fine than to restore the land. This is happening in many States. They pay the fine and move on to another location, doing nothing about reclaiming the land.

Senator COOPER. I feel very strongly that the TVA as the chief purchaser of coal in the United States should write into its contracts provisions which would insure that these coal companies reclaim the land. It may be a large charge. You might have to pay more for your coal, but I think it would be proper to do this. I wish you would furnish to the committee all information and any details relating to specific companies, and all of the steps that you have taken with respect to contracts to assist in the reclamation of this land.

Can you do that?

Mr. WAGNER. Yes, sir; we will be glad to do that.

(Subsequently the following memorandum was submitted:)

#### RECLAMATION REQUIREMENTS

TVA has included the following provisions in term coal contracts for strip or surface auger production awarded after August 24, 1965:

\* \* \* As part of the consideration for the award of this contract the Contractor agrees to perform in accordance with the following standards and to the satisfaction of TVA reclamation and conservation work upon all the lands which are affected by the strip mining (including surface auger) of any coal supplied under this contract.

a. Contractor shall, as closely as practicable following the mining operation, cover coal faces and bury all toxic materials including coal wastes and strongly acid shales.

b. Contractor shall seal off any breakthrough to former underground mines.

c. Contractor shall conduct the mining in such a manner as to keep the drainage free of spoil.

d. Contractor shall control water from the mines and haul roads by:

(1) Channeling runoff into drainages either naturally non-eroding or made that way through construction of checks, or

(2) By impoundments, or

(3) A combination of (1) and (2)

e. Contractor shall cover all holes at the face that have been made by augers.

f. Contractor shall grade the spoil banks as necessary to provide for the reestablishment of vegetation.

g. Contractor shall revegetate the disturbed area with trees (but with TVA's approval grasses, legumes, and shrubs may be substituted) so as to ensure that the disturbed area will be covered by vegetation well distributed throughout the entire area.

h. To the maximum extent practicable, the foregoing work shall be performed at the same time the mining operation is taking place, and all the above work shall be completed no later than 24 months after the delivery of all the coal supplied under this contract unless TVA agrees to a longer period of time.

TVA shall have the right to inspect the Contractor's mining operation and the lands involved from time to time to determine the Contractor's compliance with the foregoing standards. TVA shall at all times be the sole judge as to whether Contractor is complying with the standards above set out. TVA, in its discretion, may accept as fulfillment of the requirements of this contract compliance by the Contractor with applicable reclamation laws having standards comparable to the foregoing.

The following coal producers have been awarded contracts containing reclamation provisions:

Contractor	County	Mine
TENNESSEE		
Abe Cofer Coal Co. ....	Campbell.....	Abe Cofer.
Lueking Coal Co. ....	Morgan.....	Lueking.
W. R. Coal Co. ....	Morgan and Anderson.....	W. R.
Tedder Coal Co. ....	Morgan.....	Tedder.
Crass Coal Co. ....	Anderson.....	Crass.
Radar Coal Co. ....	do.....	Radar.
Wolf Ridge Coal Co. ....	do.....	W. & S.
L. P. Phipps & Sons.....	Grundy.....	Commando.
Allen Bros. Coal Co. ....	Van Buren, Sequatchie.....	No. 7.
Walden Ridge Coal Co. ....	Van Buren.....	No. 1.
C.R. & B. Coal Co. ....	do.....	No. 11.
Waters Coal & Const. Corp. ....	Van Buren, Sequatchie.....	R-8.
KENTUCKY		
Kirkpatrick Coal Co. ....	Muhlenberg.....	Caney Creek.
Adventure Coal Co. ....	Bell.....	No. 1 a/o No. 2.
Carbon Coal Co. ....	Ohio.....	Carbon.
Burge Coal Co. ....	do.....	Burge.
Hazel Creek Coal Mining Co. ....	Muhlenberg.....	Hazel Creek.
Royal Fuel Corp. ....	Hopkins.....	Arel.
Pittsburg & Midway Coal Mining Co. ....	do.....	Colonial.
Kirkpatrick Coal Co. ....	Muhlenberg.....	Wright.
ALABAMA		
Farco Co., Inc. ....	Jackson.....	Fies No. 1.

Mr. WAGNER. Senator Cooper, I feel that TVA has done more to try to get the problems of strip mining cured than any other agency I know. We made a comprehensive study of strip mining in our region in 1962, and published in 1963 what I believe was the first factual appraisal of the coal strip mining problem published by any Federal agency.

The CHAIRMAN. We would like to receive it as a committee exhibit. Some portions of it could be helpful in our discussion.

Senator COOPER. I won't pursue it further at this time.

(The exhibit presented by Mr. Wagner is as follows:)

#### AN APPRAISAL OF COAL STRIP MINING

Tennessee Valley Authority, Knoxville, Tenn., February 1963

#### THE ISSUES AND THE FACTS

As a resource development agency, TVA has had a continuing interest in the reclamation of strip mined areas. At the same time rapid economic growth of the region calls for huge coal consumption in electric power production, and about half this coal comes from strip mines.

Because strip mining leaves scars, some of them on scenic landscapes, the question of what to do about it frequently arouses more emotional reaction than sober appraisal. This tends to obscure the real issues: how useful strip mining is to the economy, whether the problems it causes can be satisfactorily alleviated, and whether there are effective and practical ways to assure that mined land is restored for future productive purposes.

In 1962 TVA set up a four-man team to look at strip mining in the two fields from which it buys coal, the Appalachian and the Midwestern. This team in-

cluded a forester, a hydrologist, an aquatic biologist, and a mining engineer. Their job was to inspect mined areas, appraise the effects of strip mining, and evaluate reclamation efforts.

Survey findings alone cannot answer all the questions raised by strip mining in the eastern United States, particularly about reclamation techniques. Research and demonstrations now in progress will provide more of these answers. Meanwhile, survey findings presented in this report offer pertinent background information which the reader may use in forming his own judgments.

Some of these facts in brief:

Strip mining for coal in the Tennessee Valley Region began about the time of World War I. Through 1961, strip mining in the eastern United States had involved about 500,000 acres.

About 14,700 acres have been stripped in the Tennessee Valley (roughly one two-thousandth of total area). Current stripping in the Valley is at the rate of about 1,000 acres a year. Coal production the past decade totaled over 1½ billion tons in the five states where TVA buys coal. TVA purchases accounted for about 10 percent of this total production.

Strip mining recovers 90 to 95 percent of the coal deposit, deep mining gets 35 to 85 percent. Strip mining in and near the Tennessee Valley includes contour stripping around mountainsides in the Appalachian field (Alabama-Tennessee-Virginia) and area stripping of the flatter Midwestern field (western Kentucky-Illinois).

Contour stripping in mountainous areas, such as east Tennessee, may yield from 2,400 to 8,000 tons of coal per acre. Area stripping, as in western Kentucky, may yield over 20,000 tons per acre. In a typical Appalachian mining county, where most land is in forest, annual forest growth is worth about \$8.50 an acre as logs and pulpwood delivered to market. Gross value of coal mined there averages about \$9,000 per acre of land affected by stripping.

In a typical west Kentucky mining county, the average annual gross value of agricultural products is \$18 per acre of farmland, and only half of the land is in farms. Gross value of coal averages \$18,000 an acre. Coal mining causes local acid pollution in some streams (this is not limited to strip mining), but natural alkalinity quickly neutralizes acidity in most larger Tennessee Valley streams. Only the Emory River is consistently acid.

A contour strip mine survey in Tennessee showed one mine in four draining water and sediment directly to live streams. This sedimentation can be avoided by better control of water on mines and haul roads. Stripped land now represents about one-fourth of one percent of the area in the Eastern mining states, and would cover about one percent if all known recoverable reserves are ultimately mined.

Land values in the local tax base are reduced by strip mining unless assessment practices are designed to avoid this. Reclamation of spoil banks left by stripping poses problems, but about half the 500,000 acres stripped for coal in the eastern U.S. has been reclaimed as required by state laws (mostly by reforestation).

Seven Eastern states have reclamation laws, generally requiring permits and performance bonds from mining firms, periodic operating reports, varying degrees of grading and revegetation of affected areas after mining. Only one Tennessee Valley state, Kentucky, has such a law. TVA has taken part since 1945 in various reclamation demonstrations and research, now is planning much larger demonstrations.

Typical revegetation costs average about \$50 an acre, depending on the use to which the land is to be put when restored. Any reclamation requirements must take into account the fact that revegetation must be delayed on many spoil banks until major settling has ended, and on a few until they lose excessive acidity.

Where appropriate and practical, strip mine areas can be reclaimed for various recreation and wildlife uses.

#### COAL STRIP MINING

Originally all commercial coal mining in this country was underground. Vertical or horizontal shafts were driven into the coal seam; the surface of the ground was not disturbed. But as early as 1866 a new kind of mining called surface or strip mining began in Illinois. Both terms apply because it is a surface operation which strips off the overburden of soil and rock to expose the coal seam.

At first, stripping was practical only where the coal was close to the surface, but improvements in machinery and methods now make it economical to remove a hundred feet or more of overburden.

The first stripping in Tennessee came about the time of World War I. It began in western Kentucky in the early twenties and in eastern Kentucky about 1939. The U.S. Bureau of Mines first reported coal production by this method in 1914. That year, coal from strip mines totaled 1.3 million tons and accounted for three-tenths of one percent of total U.S. production. Rapid expansion came during World War II, and by 1961 strip mining accounted for more than 30 percent of total coal production.

#### *Extent of Stripping*

The Bureau of Mines reported 1,477 operating bituminous strip mines in the country in 1961. They produced 122 million tons of coal and provided about 5 million man-days of employment. Heavy equipment at these mines included 2,400 power shovels, almost 800 draglines, 2,300 bulldozers, 150 scrapers, 1,000 power drills, and 4,400 trucks. Equipment continues to grow in size and efficiency. A new 115-cubic-yard shovel put into service this year will strip as much as 140 feet of overburden on the level at the rate of 3 million cubic yards per month. The largest walking dragline, now under construction, has an 85-yard bucket and a 275-foot boom.

In 1961 some of the top coal producers in the country were also big strippers. The largest operator produced 29.5 million tons, of which 25 million tons was strip coal. Another producer in the top ten had 5.5 million tons of strip coal in its total of 7.1 million tons.

In the Appalachian and Midwestern coal fields, strip mining has involved something over 500,000 acres. Estimates on future stripping vary; but if the higher ones are accepted, 2 million or more acres will eventually be stripped. Not much of the 500,000 acres stripped to date is in the Tennessee Valley.

Coal has been produced by stripping in 27 of the 125 Valley counties (table 1). The area involved through 1961 was close to 35,000 acres, 7 percent of the eastern United States total. Stripping in these counties is progressing at the rate of about 3,000 acres a year. For the Tennessee Valley proper—20 of the 27 counties are only partially in the Valley—the stripped area is about 14,700 acres. The increase inside the Valley is about 1,000 acres a year.

The percentage of coal produced by strip mining will continue to increase so long as it is more economical than underground mining. This will be determined primarily by strippable reserves and production costs in underground mines. Strip mining recovers 90 to 95 percent of the coal while deep mining gets 35 to 85 percent. Production per man-day averages 25 tons by stripping, a little over 11 tons by deep mining. Average value of coal in 1961 was \$3.67 per ton f.o.b. strip mines and \$5.02 at deep mines. Fatal accidents in strip mines average one per 2.5 million tons mined, just one-twelfth the rate in deep mines.

#### *Major coal buyers*

In the five states where TVA buys coal—Kentucky, Tennessee, Illinois, Virginia, and Alabama—utilities purchased half the coal produced in 1961. While TVA bought 18.5 million tons, some fifty other utilities bought 56 million tons from a total production of 157 million tons. TVA that year bought about 62 percent of Tennessee's production, 17 percent of Kentucky's, 7 percent of Illinois', 4 percent of Virginia's, and 0.2 percent of Alabama's. Over the past ten years TVA purchases in the five states have accounted for less than 10 percent of total production.

During this same period slightly more than one-fourth of the coal produced in these states came from strip mines (table 2). From 1952 to 1961, inclusive, less than 408 million of the 1,561 million tons produced was strip coal. The proportion has climbed rather steadily from 21 percent in 1952 to 31 percent in 1961.

TVA's coal purchases do not follow this over-all ratio, and this is probably true of other utilities as well. Whereas strip-mine production in 1961 accounted for 31 percent of total in the five states, TVA's purchases ran about 50 percent strip-mine coal. According to the best estimates available, some 25,000 acres have been stripped to supply TVA steam plants, 5 percent of the total area stripped in the Appalachian and Midwestern coal regions.

*Stripping methods*

Stripping varies with topography. In mountainous areas where the coal seams lie high up on mountain slopes, strip mining takes the form of contour benches and is appropriately called contour stripping. Where the topography is flatter, stripping is continuous over large areas and is called area stripping.

In the mountains of the Appalachian coal field, contour stripping predominates. Bulldozers excavate a footing for power shovels which remove the overburden and deposit it at the outer edge of the cut. Much of this spoil, as it is called, slides down the slope, some of it immediately, more as it is loosened by rain and the freezing and thawing of winter.

Width of cut varies from 30 to 100 feet, depending on the steepness of slope and the amount of rock in the overburden. The worked out pit consists of a relatively level floor bounded on the uphill side by a vertical cliff (the high wall) and on the downhill side by a ridge of spoil which tails off down the slope. In some areas there may be several of these contour strips on the same mountain-side, one above the other, like so many highway cuts. In such cases the spoil from one strip may extend to the next strip below.

Contour stripping is sometimes followed by auger or punch mining. Augers up to 7 feet in diameter drill holes into the exposed face of the coal seam to a depth of some 200 feet, removing more of the coal. Punch mining involves narrow-seam cutting machines—some remotely controlled—that can penetrate a thousand feet or more into the coal seam.

In Indiana, Illinois, and western Kentucky where topography is smoother and the depth of overburden is not affected much by slope, area stripping is the general rule. The overburden, which may be more than a hundred feet thick, is loosened with explosives and then removed by power shovels, draglines, or other types of excavators. The first cut is a long trench stretching across the area to be mined. After the coal has been removed an adjacent cut is made, the spoil from it being dumped in the previous cut. The resulting landscape is a series of more or less parallel ridges of spoil 30 to 100 feet high, depending on depth of overburden. The last cut in the area is usually left open and often fills with water.

An acre of coal one foot thick contains about 1,800 tons. Contour stripping in east Tennessee, where coal seams range from 18 to 60 inches, therefore yields 2,400 to 8,100 tons per acre (with 90 percent recovery). In western Kentucky where the several seams may add up to a total thickness of 15 feet, stripping may yield in excess of 20,000 tons per acre.

*Type of land stripped*

Practically all of the land already stripped for coal, as well as that which may be stripped, is in private ownership. Operating coal companies may own the surface and the minerals or they may own mineral rights only. Then again they may own neither and pay a royalty for coal. These royalties commonly range from 25 cents to 35 cents a ton, so a landowner receives about \$550 for each acre-foot of coal removed.

The geology and topography of the coal regions are such that very little stripping is done on high-grade agricultural land; in most cases it is confined to relatively low-value land. Some good farm land is involved in Illinois and Indiana, but only rarely is average or better farm land stripped in the Appalachian region. In Tennessee and eastern Kentucky well over 90 percent of the land stripped is forest land of about average timber-producing quality.

In Wise County, Virginia, the Valley county with the highest proportion of stripped land, practically all of the stripping is in forest land. Average forest growing stock here is 2,800 board feet of sawtimber and 6 cords of pulpwood per acre. Growth is 120 board feet and 0.26 cord per acre per year. At present prices this annual growth—the harvestable yield under management—has a value of about \$8.50 per acre in terms of logs and pulpwood delivered to market. Average coal production by strip mining is about 2,600 tons per acre of disturbed area (in contour stripping two to three acres are affected for each acre of coal mined). Gross value of coal per acre is therefore about \$9,000.

In Muhlenberg County, which is fairly typical of coal-producing counties in western Kentucky, only half of the land is on farms and less than 30 percent of this is cropped (1959 census). Average gross value of agricultural products sold is \$18 per acre of farm land. Average gross value of an acre of coal in Muhlenberg County is \$18,000.

## EFFECTS OF STRIPPING

Such mining leaves an unsightly landscape, and much criticism stems from this fact. Given time, however, Nature heals her wounds, and with help the revegetation process can be speeded up. Some coal operators have proved this, and in seven of the states where coal is stripped, regulatory legislation has been enacted requiring reclamation.

*Stream pollution*

Whether stripping results in serious acid steam pollution depends on the geology of the region and mining methods. Acid pollution is a serious problem in Pennsylvania and West Virginia, for example, but not in the Tennessee Valley. In the Valley region the acid sandstones, shales, and coal associated with the Pennsylvanian period of geologic time are only a few hundred feet thick. Farther north they may be several thousand feet thick. The Pennsylvanian formation is underlain by the Mississippian and older formations which are largely limestones and dolomites, and therefore alkaline. In the Tennessee Valley most of the larger streams are in these alkaline formations and whatever acid may be in the water is quickly neutralized. Emory River is the only sizable Tennessee tributary that drains extensive sandstone areas and it is the only one that is consistently acid. Even the Clinch and Powell Rivers, which drain extensive mining areas in southwest Virginia, are strongly alkaline before they cross the Virginia-Tennessee state line.

Acid pollution, where it exists, is further complicated by the fact that it is not limited to strip mining. Coal mining, by whatever method, produces sulphuric acid. And in some parts of Pennsylvania, West Virginia, and eastern Kentucky an estimated 75 percent of stream acidity comes from deep mines and the refuse associated with them. States that have strip-mine legislation have not solved this deep-mine pollution problem. The West Virginia law exempts deep mining and auger mining. Pennsylvania classifies about half the streams in the state as previously polluted—usually by deep mining—and exempts them. Acid pollution is a coal-mining problem, not a strip-mining problem.

Sulphuric acid is toxic to aquatic plants and animals. For example, an acid-water lake in West Virginia has less than three ounces of fish per acre. Beaver Creek in eastern Kentucky, with a strip mine in its drainage, yielded no fish in a mile of sampling, while comparable sampling on an unpolluted branch nearby yielded 736.

Acid water inhibits bacterial growth to such an extent that domestic sewage is not readily decomposed. The acid also works on soil and rock, dissolving iron, aluminum, and manganese in quantities that may be toxic to fish. The same Beaver Creek mentioned above has 15 times more dissolved solids than the comparison stream. Acid water is corrosive to metals and must be treated before it can be used in industrial processing.

Even in limestone areas like the Tennessee Valley, acid water from mines exacts a certain penalty. Neutralization of the acid increases the permanent hardness of the water by increasing its sulphate content. Calcium sulphate is a source of "boiler cake" in teakettles and industrial boilers.

Another source of stream pollution is the turbidity and sedimentation resulting from spoil bank erosion. This can be a problem where strip mines drain into live streams.

*Erosion*

Some erosion is inevitable on all fresh spoil banks, as it is on all bare soil. The extent depends on the character of the spoil, steepness and length of slope, the extent of freezing and thawing, and of course the amount of precipitation and volume of water acting on the spoil.

Erosion is not a serious problem in area stripping. Here most of the soil movement is internal—between spoil banks—and little soil and rock actually leave the stripped area. Such erosion is detrimental only when it is severe enough to prevent revegetation. It is beneficial to the extent that it contributes to leveling.

Erosion can be much more serious in contour stripping, primarily because of topography. Contour strips usually lie on steep mountainsides where water volume and velocity may combine to create an erosive force of considerable magnitude. In 1959 TVA and the Tennessee Department of Conservation and

Commerce sampled strip mines in eastern Tennessee to determine as objectively as possible the facts of the case. Investigators studied 18 mines, statistically selected as representative of the 250-odd in Tennessee.

Erosion was evident in practically every mine examined, but it was less serious than generally supposed. Most of the mines were high up on mountain slopes and there was little water involved other than that which fell as rain directly on the distributed soil. Evidence of drainage from higher elevations was slight. Sheet erosion was universal, of course, as it is in every case where sloping soil is exposed to rainstorms. Gully erosion was found at 60 percent of the mines, but in most cases it resulted from restricted water flow and a buildup of volume—conditions which can be corrected in the mining process.

Soil and rock washed out of strip mines were found on the forest floor below some pits, but not all. And again in only some cases did these outwash deposits extend to live or intermittent streams in the valleys below. Water from only one-fourth of the contour strip mines flowed directly into live streams, and only in these was there evidence of sediment.

Access roads appeared to be responsible for just as much erosion as the mines themselves. Whereas the strip-mine floor is relatively flat, coal-haul roads usually involve long grades which accumulate water. Here again, a little better engineering could have dispersed the water and stopped erosion. As few as ten water turnouts per mile would have achieved adequate water dispersal in most cases.

#### *Land value*

One criticism of strip mining is that it takes land out of productive use. But generally speaking, the stripped land plus that which may be stripped is an insignificant part of the total land-use picture. In West Virginia, which has the highest proportion of land area stripped, the percentage is only 0.7. It is 0.5 percent in Ohio, 0.3 in Indiana and Illinois, 0.2 in Kentucky, and 0.1 in Pennsylvania and Tennessee. For all of these states, stripped area represents only slightly more than one-fourth of 1 percent of total land area. If stripping ultimately affects four times the present area, it will still involve only about 1 percent of the area of these coal-producing states, generally land of low productivity.

Stripping may reduce land values and ad valorem taxes. An Ohio study (1918-1937) showed tax decreases ranging from 13 to 53 percent following strip mining. Illinois coal strippers say the tax losses average about 68 cents per acre in that state. In one extreme case in eastern Kentucky the assessment on land being stripped rose from \$15 to \$150 per acre and then dropped to 75 cents after mining. Tax assessing methods vary county by county. One east Tennessee county, for example, assesses mountain land at the same rate before and after mining. Another bases assessment on the estimated value of recoverable coal and then reduces the rate to bare land value following mining. A southwest Virginia county bases reduced assessments on the tonnage of coal mined. A large coal company owning extensive land areas in western Kentucky has adopted the policy of retaining land after mining and paying taxes at the same rate as before mining.

#### RECLAMATION EXPERIENCE

Attempts at reclaiming strip-mine spoil banks preceded compulsory legislation by many years. The first attempts were probably in Indiana, where in 1918 a coal company planted fruit trees on spoil banks. Black locust trees were planted fairly extensively in Ohio as early as 1925. Members of the Indiana Coal Producers Association, an organization of strip-mine operators, agreed in 1926 to reforest five acres per year for each shovel in operation, and incomplete records show almost 5,000 acres reforested prior to 1940. Systematic investigation of strip-mine reclamation began with studies by the Central States Forest Experiment Station (U.S. Forest Service) in 1937. Pennsylvania and other states stepped up their research activities in the midforties. To date, an estimated 50 percent of the half-million acres stripped in the eastern United States has been reclaimed as required by state laws.

TVA's first action in the reclamation of strip mines dates back to 1945, when its foresters joined with the Virginia Division of Forestry and officials of several southwest Virginia coal companies to demonstrate reclamation through tree planting. These early demonstrations were followed by others and today some 2,500 acres have been reforested.

The 1959 cooperative survey in Tennessee, referred to previously, provided basic information on strip mining in mountain areas. This was the first systematic look at strip mining in this state even though it had been going on since World War I and had been quite extensive after 1953.

TVA has maintained a constant surveillance of water quality in the Tennessee Valley, and in late 1961 published a report on the potential acid mine drainage problem. Much of the information presented earlier in the Stream Pollution section came from that report.

Also in 1961 TVA joined the Kentucky Department of Conservation and Peabody Coal Company in an extensive reforestation test near TVA's new Paradise steam plant in western Kentucky. Here the objective is to test five pine species on sandstone and limestone spoils that were graded, ungraded, one year old, and two years old. The last of the test plantings on some 80 acres was made in the spring of 1962. Comparison of species and sites will be possible in three to five years.

In search of faster and cheaper methods of revegetating spoil banks, TVA foresters have also established extensive direct seeding tests—that is, planting tree seed instead of seedlings—in Tennessee, Georgia, and Virginia. Loblolly pine was the principal tree species. Straw, sawdust, wood chips, fescue, and short-lived grasses were used as ground cover. Loblolly seedlings were also planted in some cases for comparative survival and growth.

Under discussion now are plans for large-scale demonstrations of strip-mine methods and reclamation in eastern and western Kentucky. The one in eastern Kentucky will involve contour stripping, the other one area stripping. Both will illustrate the best known practices. They will be located where they will be readily available for inspection.

#### *Problems*

Spoil-bank reclamation is fraught with difficulties. The major problem is high acidity, and if it is too high, revegetation is impossible. In such cases there is nothing to do but wait until some of the acid leaches out through natural weathering processes. But less than 5 percent of the spoils exhibit this acid toxicity; the great bulk of them will grow something. This being the case, the real need is to develop methods that will achieve reclamation quickly and economically.

Spoil banks are like nothing found in nature. As the shovels chew away at the high wall they thoroughly mix the various layers of soil and rock above the coal seam. The resulting mass is not soil as we normally think of it, but a porous agglomeration bearing no resemblance to its previous layered structure.

This of course makes for extreme variability. No two strip mines are the same and rarely are two parts of the same mine identical. The proportions of stone and soil vary greatly, and for any particular spot the proportions change with weathering and erosion. Acidity varies sharply within short distances. Soils with a pH of 2.5 and a total acidity of 3,000 parts per million may lie adjacent to limestone mixes with a pH of 8.5.<sup>1</sup> Soil texture varies from sand, to clay, to loam, and this in turn varies the amount of moisture available for plant growth. On the other hand, plant nutrients are usually adequate to support vegetation. Nitrogen may be in short supply, but the available quantity of this element improves with time.

To further complicate matters, spoil banks are not stable. They may be expected to settle as much as 3 feet the first year and settling continues for ten years and more. In contour stripping this slippage or settling may take on the proportions of a small landslide. Erosion, too, constantly changes the contour of spoil banks. Vegetation is washed out on slopes and covered with silt in low places. Revegetation must often be delayed until the worst of this rapid shifting is over.

Because spoil banks are exposed, high soil temperatures develop under the summer sun. This coupled with unrestricted wind flow dries out the surface soil to such an extent that seed germination and seedling survival are drastically retarded.

In addition to problems generated by the physical character of spoil banks, landowners in general show little interest in doing anything to reclaim strip-mined areas. Early in 1962 a TVA forester talked with 46 owners of stripped

<sup>1</sup> pH refers to a hydrogen ion concentration scale ranging from 1 to 14. In this scale 7 is neutral; below 7 is acid, above alkaline. The optimum range for plants is 4.5 to 7.5.

land in Virginia, Tennessee, and Alabama. Together they own about three-quarters of a million acres, of which 10,000 acres has been stripped. Sixteen have taken some steps to reclaim the land; the others have done nothing and have no plans to do anything. Most are opposed to reclamation requirements that would increase coal costs.

#### *Grading*

Some grading is required by all of the state laws regulating area stripping, but this is still the most controversial aspect of reclamation. The Ohio law requires that spoil banks be graded to a gently rolling topography. In Kentucky, grading means simply striking off the ridge tops with a bulldozer. Reported costs range from 1¼ to 43 cents per ton of coal mined.

Some experiments indicate that trees grow better on ungraded spoil while other tests seem to prove the reverse. Detailed measurements have shown that graded spoils absorb less than one inch of water per hour while ungraded spoils absorb four to five inches. The chief argument against grading is that it compacts the soil, but there are simple ways to prevent or correct this.

Since there is no clear evidence that grading is essential to successful reclamation, it would seem reasonable to let future land use decide the issue. Where the land is suitable for cultivated crops then there should be enough grading to permit the use of farm machinery. If pasture is the best post-use, less grading is required. If the land is to be reforested, grading contributes little or nothing and might well be eliminated. About the only thing that seems to make economic sense in the case of reforestation is to strike off a ridge top every quarter-mile or so to make the area more accessible.

#### *Reforestation*

In most cases tree planting is the most practicable way to reclaim strip-mine spoil banks. Best estimates indicate about 200,000 acres reforested to date of the 500,000 acres stripped in the eastern United States. Ohio has planted 18 million trees and reports 95 percent survival; West Virginia has planted 40 million with about 75 percent success. Seventy-seven percent of the stripped area in Indiana has been reclaimed by reforestation, another 10 percent through pasture development.

Some 40 tree species have been used. Black locust, the favorite species in the early plantings, provides ground cover in three to five years, but its susceptibility to insect attack makes it a poor risk. It is no longer used alone but is still planted in mixture with other species.

The newest promising species in European black alder. It grows well on acid soils, offers other species less competition than locust, and seems relatively immune to insect and disease attack. Reports from Indiana show it growing well on spoil banks that have a pH of 4.5 to 6.0. It survives but grows only half as fast when the pH is down to 3.5. The species mixture now favored in some quarters for acid spoil is alder, river birch, sweetgum, red oak, and sycamore. If the spoil is not acid, yellow poplar and white oak are included. Other hardwoods used extensively are cottonwood, walnut, and ash.

In general, conifers do not do as well on spoil banks as hardwoods, but in the North, white pine, Scotch pine, and Japanese larch have been planted successfully on high-quality spoils. In the South, loblolly pine outperforms other native conifers.

Today, Pennsylvania has the most extensive strip-mine reforestation program. The state forestry agency produces specially conditioned planting stock and state crews do the planting. In West Virginia most of the planting is done by soil conservation districts. Coal operators are responsible for doing the planting in Kentucky, Illinois, Indiana, and Ohio.

Only in Alabama has direct seeding met with much success.

#### *Recreation and wildlife*

Strip-mine areas can also be used for recreation or wildlife or both. And here again, prevailing conditions usually determine which it shall be. In northern Illinois where land is at a premium and population pressures are high, some 5,000 acres of lakes and 8,000 acres of recreation sites have been developed on strip mines. Here where conditions warrant it, operators can substitute lakes and roads for the normal reforestation requirements called for by law.

The long narrow contour strips of eastern Kentucky and Tennessee offer a different kind of recreation possibility. Some of them make ideal sites for

planting game food. Some traverse beautiful mountain terrain and offer scenic vistas that compare favorably with those along the Blue Ridge Parkway. These can be planted to trees and game-food plants and the roads maintained for jeep or horseback travel.

Where topography is favorable, and where acid-forming material is not extensive enough to make the water toxic, strip-mine impoundments are just as productive of fish as natural lakes.

#### *Agriculture*

Restoring spoil banks for production of cultivated crops is not common. Most such reclamation is in flat or gently rolling topography, where the soil is rich and relatively rock-free. On the other hand, some 50,000 acres of strip-mine spoil has been reclaimed for pasture and hay production. If hay is to be harvested, enough grading is required to permit the use of machinery, but if harvesting is to be left to animals, little or no grading is necessary.

Records from Illinois show cattle on spoil-bank pasture gaining an average of 1.5 pounds per day, which is comparable to gains on unmined areas nearby. Alfalfa on such land has yielded 2.5 tons of hay and 50 pounds of seed per acre. Where pH is above 6.0, alfalfa grows better on spoil banks than on undisturbed land, probably because of deeper root development. Birdsfoot trefoil has also been used extensively and crown vetch is growing in popularity because of its tolerance to acid conditions. Standard seeding practice on acid spoils in Kentucky is a mixture of Kentucky 31 fescue, Korean lespedeza, and annual ryegrass.

#### *Reclamation costs*

Tree planting costs range from \$15 to \$35 per acre, and the minimum grading required by state law may add as much as \$45. Total cost estimates vary from a low of \$45 in Virginia to a high of \$70 in Illinois. The per-acre cost most commonly quoted is \$50.

This same \$50-per-acre is also reasonable for land to be used for recreation, provided the work includes nothing more than tree planting and roads. If lakes and intensive site development are included, costs are much higher.

If more than minimum grading is required for the development of pasture, costs are estimated at \$150 to \$250 per acre. Complete leveling in Indiana has cost as much as \$1,000 per acre.

The above costs apply generally to area stripping. If we assume here that coal seams average 3 feet in thickness, then production would be about 5,000 tons per acre. Assuming further that reclamation cost is \$50 per acre, the cost per ton of coal is one cent.

The State-TVA survey of strip mines in eastern Tennessee, mentioned earlier, showed the average contour mine to be 4 miles long, with a disturbed area of about 95 acres. Reclamation cost on the 4-mile-long strip was estimated as follows:

Tree planting (95,000 seedlings)-----	\$1,250
Additional water outlets (21 at \$10)-----	210
Check dams (25 at \$5)-----	125
Access road erosion control (1 mile at \$40)-----	40
Total-----	1,625

This means a little over \$400 per mile or about \$17 per acre. Coal production for this average 4-mile mine would be between 55,000 and 65,000 tons. Reclamation cost per ton, therefore, would be less than 3 cents.

#### LEGISLATION

Since West Virginia enacted legislation requiring reclamation of strip-mined areas in 1939, six other states have followed suit: Illinois, Indiana, Kentucky, Maryland, Ohio, and Pennsylvania. Although they differ in detail, all of these laws follow the same basic pattern. They require the operator to (1) obtain a permit or license prior to mining, (2) post a bond for the faithful performance of the requirements of the statute, (3) make reports on the progress or extent of operations, and (4) grade and revegetate the affected areas.

Application for a permit or license to strip mine must be accompanied by full information on the area and scope of the planned operation and on ownership of the property. A map of the area is also required in most cases. In some

states the permit fee is a flat sum, but generally it varies with the number of acres involved. For example, Pennsylvania charges a flat fee of \$100, whereas in Kentucky the fee is \$50 plus \$15 per acre. In most cases, the permit is good for one year only and the fee must be paid with each renewal.

One of the most important features of all reclamation statutes is the requirement of a bond, which is conditioned upon the operator's performance of all reclamation work required under the statute and applicable regulations. The amount varies from \$100 per acre in Kentucky to \$500 per acre in West Virginia. Most of the states require a corporate surety on the bond, but the operator may pledge an equivalent amount of cash or acceptable securities in lieu of the surety bond.

All of the state laws require reports of one kind or another. In general, the operator must file an annual progress report plus a completion report on each permit.

While all laws require some grading of spoil banks, they differ in detailed specifications. The Illinois law, for example, requires that ridges be struck off to a minimum width of 10 feet and that isolated peaks be graded to a minimum width of 15 feet. In Ohio the operator must grade the area to a gently rolling topography. All of the states require that the coal seam in the final cut be covered with earth, spoil material, or water. The creation of ponds or lakes in the final cut is permitted (required in Illinois and Ohio) if they will not interfere with other mining operations or damage adjoining property.

Except for the Maryland law, each requires revegetation of the strip-mined area, unless planned future use makes revegetation in appropriate. Most laws or regulations issued under the law, require a planting plan before the work is started and approval by the state administrative agency upon its completion. In some cases (Illinois for example) the reclamation plan is included as part of the operator's annual report. Where planting is deferred for a considerable time after grading is completed, provision is made for a partial release of the bond.

The statutes provide that planting stock may be obtained from the State conservation agency, or from commercial sources if the stock is approved by the state. In some cases, the operator may be relieved of the planting work by special arrangements with the state agency. In Pennsylvania, for example, the operator may forfeit \$50 per acre under his bond and the state will do the work. In West Virginia, the operator is relieved of planting if he pays the local soil conservation district the estimated cost of the work. Most of the states also permit the operator to substitute acreage—that is, he need not reclaim land he is legally obligated to reclaim if he reclaims an equal stripped area for which he has no such obligation.

The time limit on reclamation work is one year in West Virginia. Kentucky sets no time limit but the Conservation Department administratively aims at completion within a year. Illinois, which has one of the more recent statutes, requires that reclamation be completed within three years, except where soil conditions are not satisfactory for planting, in which case the work may be deferred up to ten years.

All of the statutes prescribe penalties for violation with fines varying from \$50 to \$5,000. In most cases, responsibility for administration of the law is vested in the state conservation department or its counterpart, but in Maryland and Pennsylvania, state mine departments have jurisdiction. In either case, however, coordination is called for between conservation and mine departments. Provision is made for necessary administrative regulations and for appeals from administrative actions. Moneys collected from fees, forfeited bonds, and fines are generally put in a special fund for administering the law, and in some cases for reclaiming areas that were mined before the law was enacted.

#### CONCLUSIONS

This review of strip mining in the Appalachian and Midwestern coal fields leads to the inescapable conclusion that this is a matter for state action. Each state involved should develop a policy on strip mining and reclamation tailored to its own unique combination of geologic, topographic, economic, and social conditions, and give that policy substance through legislation. TVA therefore recommends that states having no strip-mine legislation consider its enactment, and too, that existing legislation be objectively evaluated and revised to meet current needs.

Many interests share in the benefits of coal strip mining and should therefore share the responsibility for seeking solutions to the problems it raises. Land and mineral owners are intimately involved; so are mine operators and employees. Operators of railroads, truck lines, and other common carriers also have a stake in coal production policy, as do the manufacturers of mining equipment. The coal buyer is interested because mining methods affect cost, and if reclamation is required, its cost is included in the price of coal. Everyone who consumes electric power is affected because coal purchases account for a large part of total power operating expense.

Other groups are involved because of effects of strip mining on the landscape and on water quality.

All of these interests should be considered in the formulation of state policy and implementing legislation. The range of involvement is wide, of course, and many of the interests are in conflict. But this is part of the problem and the conflict of interests must be reconciled in the public interest.

State legislation in force is summarized in an earlier section of this report. All of these laws have some things in common yet differ in detail. Generally speaking, strip-mine legislation should define and ensure certain fundamental objectives. Its provisions should be dictated by prevailing topographic, geologic, and economic conditions, and it should be flexible enough to fit the widely varying character of strip-mine spoil banks.

Listed below are some desirable provisions of strip-mine legislation:

1. It should provide a system of permits or licenses for conducting strip-mining operations and require the posting of a surety bond conditioned upon compliance with reclamation requirements.
2. It should require a fairly detailed plan for each operation, including character of overburden, post-use of mined area, location and specifications of haul roads, and a description of mining methods to be used.
3. It should cover not only coal mining but all kinds of surface mining that create conditions similar to coal stripping.
4. It should recognize the interrelationships between all methods of coal mining, especially insofar as stream pollution is concerned.
5. It should encourage modification of mining methods to fit conditions.
6. It should not set a hard and fast time limit on reclamation. Where successful revegetation is impossible because of acid toxicity, reclamation deadlines should be left to administrative determination, with provision for proportional bond release as work progresses.
7. It should take into account land previously stripped and set up arrangements for its reclamation.
8. It should provide for continuing evaluation of the law's adequacy.

TABLE 1.—Area stripped for coal in Tennessee Valley counties through 1961

State and county	Total acres	Acres in valley	State and county	Total acres	Acres in valley
Alabama.....	5, 189	165	Tennessee—Continued		
Blount.....	3, 572		Cumberland.....	262	131
Cullman.....	405		Fentress.....	214	
DeKalb.....	188	150	Grundy.....	2, 316	1, 486
Etowah.....	18		Hamilton.....	350	350
Jackson.....	15	15	Marion.....	515	515
Marion.....	429		Morgan.....	3, 059	2, 731
Winston.....	562		Sequatchie.....	478	478
			Van Buren.....	349	
Georgia.....	165	165	Virginia.....	14, 021	7, 413
Dade.....	25	25	Dickenson.....	3, 630	
Walker.....	140	140	Lee.....	186	186
Tennessee.....	15, 554	6, 931	Russell.....	1, 474	1, 474
Anderson.....	2, 510	677	Scott.....	2	2
Bledsoe.....	61		Tazewell.....	358	226
Campbell.....	3, 674	563	Wise.....	8, 371	5, 525
Claiborne.....	1, 766		27 counties.....	34, 929	14, 674

TABLE 2.—Coal production in selected States and TVA deliveries from those States, 1952 to 1961, inclusive

State	Production			TVA deliveries	
	Total	Strip	Percent strip	Thousand tons	Percent of total production
	(1,000 tons)	(1,000 tons)			
Kentucky.....	665,382	158,197	23.8	69,870	10.5
Tennessee.....	65,505	15,784	24.1	42,197	64.4
Illinois.....	455,399	196,080	43.1	25,655	5.6
Virginia.....	252,927	15,564	6.2	8,764	3.5
Alabama.....	122,263	22,191	18.2	550	0.4
Total.....	1,561,476	407,816	26.1	147,036	9.4

Mr. WAGNER. Senator, I would like you to visit the areas I referred to and see some of the work we have done.

Senator COOPER. I know they are terribly concerned about it.

Mr. WAGNER. We are concerned about it, and we are doing something about it.

The CHAIRMAN. At this point, because of the discussion which has been many faceted, I would like to place in the record the supplemental views which I gave in 1959 when the revenue bond financing by the Tennessee Valley Authority was before the Senate. Senator Kerr made the report on behalf of the committee on July 2. I would ask unanimous consent to have my supplemental views on H.R. 3460 printed at this point in the record.

I stated then that my efforts had been pointed in the direction of having incorporated in this legislation the substance of the gentlemen's agreement between the TVA and private enterprise utilities which has permitted orderly growth of both the investor-owned companies and the TVA for many years.

Unwarranted extension of the facilities and services to meet TVA normal growth requirements for its basic customer area has heretofore been controlled by (1) appropriations by the Congress, (2) a gentlemen's nonencroachment agreement between TVA and the investor-owned power companies.

Since TVA expansion would no longer be controlled through the appropriation procedure, it is essential that limitations compatible with the gentlemen's agreement now existing should clearly be established in this legislation.

Do you recall the legislation, Chairman Wagner?

Mr. WAGNER. The 1959 legislation; yes, sir. The territorial limitations.

The CHAIRMAN. That is right.

Mr. WAGNER. I recall that. The gentlemen's agreement that you refer to must have been before my time. I am not acquainted with that.

The CHAIRMAN. There are still gentlemen in TVA as there were then?

Mr. WAGNER. We hope so.

The CHAIRMAN. I wish to have these views placed in the record at this point because they are pertinent to our discussions. I don't want to occupy the time of the committee, because of the hour.

(The excerpt from the report is as follows:)

[S. Report 86-470]

SUPPLEMENTAL VIEWS OF MR. JENNINGS RANDOLPH ON H.R. 3460

The so-called territorial limitation or service area restriction provisions of H.R. 3460 have been the principal ones which have involved the Senate Committee on Public Works in protracted discussions.

It is to this phase of the legislation that attention is directed in these supplemental views.

The major differences of opinion within the Senate committee stemmed from the question of whether or not the language of (H.R. 3460) which passed the House actually would establish area limitations within which the Tennessee Valley Authority would be required to confine its power supply services.

Divergent views on the effectiveness of the House bill language to accomplish the purpose of service area restriction persisted throughout the period during which it was under consideration by the Senate Committee on Public Works.

The degree to which alternative proposals would liberalize or restrict the so-called service area of TVA was another factor.

But there still seems to persist a question as to whether or not the language of the House bill as it relates to TVA area limitation, or the provisions of the amended version of the bill as reported by the Senate committee, would be the most effective in accomplishing these objectives:

1. Permit TVA to perform its functions and meet its responsibilities without, at the same time, doing violence to the investor-owned power companies by encouraging TVA encroachment. There is and there can continue to be a place in the country for both free enterprise power systems and public power without overlapping.

2. Provide TVA with self-financing capacity and capability, but, in so doing, not excessively impair the ability of the private electric utilities contiguous to TVA to maintain themselves and provide financing for their own operating areas and customer expansion needs. In other words, there must be a recognition that both TVA and free enterprise utility systems have comparable problems in practically every respect except taxpaying obligations. Hence, in seeking to solve the problems of TVA the Congress has an obligation to be sure it is not compounding the problems of the investor-owned power companies.

The committee report, under its "Discussion" section, makes the point that "In 1939, the Congress enacted legislation authorizing TVA to purchase the facilities owned by private power systems in the Tennessee Valley region." Not only was I a Member of the Congress which enacted that legislation, for which I voted, but, also, I served in the House of Representatives and militantly supported the original TVA Act of 1933. Accordingly, I have a knowledge of the fundamentals under which the Congress acted in establishing TVA, and of the intended policy to not encroach upon the investor-owned private enterprise power systems.

The 1939 enactment, whereby the facilities owned by private power systems were acquired, actually did much to define what the committee report refers to as the TVA service area being a "nebulous" quantity.

The record shows that TVA has expanded its service area very little in recent years and I understand that its spokesmen have publicly denied it has desire to do anything other than develop its existing territory, including that of its distributors.

It is also true that discussions within the committee, which led to the approval of a provision respecting expansion different from that adopted by the House, indicated that clear intention on the part of the committee not to authorize, by its general language, any expansion other than that occasioned by the normal growth of TVA's existing territory.

But the language used to spell out this desired result is, in my opinion, susceptible of interpretations which—at some time in the future, when memories have dimmed and new faces have come upon the scene—might lead to the subsequent assertion that powers not now intended to be conferred actually have been made legal.

Not only am I concerned lest the Congress should take steps to destroy much of the stability and serviceability of investor-owned power systems which have served their areas and their customers well, but, too, I am deeply troubled by

the size of TVA and the powerful bargaining position it has achieved with respect to its purchase of coal, as well as by the manner in which it has used that bargaining power.

The economy of West Virginia and of contiguous areas is vitally affected by the condition of the bituminous coal industry, which is now in considerable difficulty. Unemployment is high and much distress prevails in the coal producing areas. We heard in the hearings from the miners, the producers, and the sellers of coal as to how TVA has operated to create depressed conditions for bituminous coal on a basis of its buying practices and its subscribing indirectly to inadequate safety standards in coal mines.

Because of TVA's tremendous geographical coverage and enormous purchasing power, it has been, to a very large degree, in a position to enforce upon the coal industry its coal-purchasing policies and practices. Further geographical expansion of TVA's service area would seriously worsen this situation to which I have alluded.

It has been said—and I certainly subscribed to the declaration when I supported the original TVA Act—that at the time TVA commenced its operations in its original area, private enterprise lacked the resources to develop fully the power system needs of that vast and then underdeveloped valley area. However, this has not been nor is it now true of the peripheral area beyond the present points which represent the outer limits of the so-called service area of TVA. It is surely not true in West Virginia.

The investor-owned public utilities of our State have been and continue to be efficient producers of an abundant supply of electric power generated from bituminous coal mined within the State.

Public utility powerplants there have regularly been rated higher in performance than TVA plants and are among the most efficient in the United States.

It would be inadvisable to permit excessive competition by TVA to encroach on the areas served by these and other investor-owned public utilities, to siphon off their customers and to destroy the value of their properties.

The committee has undertaken to restrict TVA authorized expansion to those States in which it now provides services, but the language of the committee amendment limits only the "making of contracts" by TVA and does not purport to place any limitation or restriction whatever upon the resale or use of TVA power by its distributors.

Thus, so long as transmission, distribution, and use of TVA power is by its distributors and not by TVA itself, there actually is no limitation whatsoever upon the transmission, distribution, resale, or use of TVA power outside of its existing service area. The committee amendment further provides that TVA can make contracts unlimited in nature, scope, or extent with any State, county, municipality, corporation, partnership, or individual with which it had a contract of any kind on July 1, 1957. Thus these conditions could prevail:

Subject only to the overall restriction of 500 square miles in any one State and an aggregate of 2,000 square miles of additional territory outside that area for which TVA was the primary source of power on July 1, 1957, it can, by contract, become a power supplier, in any State within which it is now serving, for cities having a population of 5,000 or less. TVA may also serve any city with a population up to 10,000 population in any State now served which owned its own distribution system on July 1, 1957.

The permitted expansion of TVA is not required to be in territory contiguous to the area now served. Hence, TVA transmission lines could be extended anywhere in the peripheral States now receiving service from TVA. Thus, it could add to recipients of its service hundreds of municipalities, as well as industrial customers, without exceeding the 500-square-mile limitation, even though such municipalities or industrial customers are already receiving efficient service from investor-owned utilities or are capable of being served by them.

Frankly, my efforts have been pointed in the direction of having incorporated in this legislation the substance of the gentlemen's agreement between TVA and the private enterprise utilities which has permitted an orderly growth of both the investor-owned companies and TVA for many years.

The Senate committee amendment, being completely devoid of restrictions upon expansion by present TVA customers and lacking any curb on resale of TVA power at wholesale to any other supplier of power, could have this effect:

By the device of contracting with a customer of TVA, rather than with the Authority itself, any distributor of power—however remote from the area in which TVA power presently is being used—could obtain and sell TVA electric

energy in any area it might choose. This would seem to negate the territorial restriction intent of the House bill.

Inasmuch as the expansion which would be authorized by the Senate committee's recommended amendment is not required to be in areas contiguous to the present TVA territory, such expansion could penetrate the entire service area of any utility in any one of the authorized States.

Bearing in mind that a transmission line extended 100 miles along a right-of-way 100 feet wide would consume only 2 square miles, it is not difficult to visualize the extent to which existing investor owned power systems would be placed under a condition of serious potential disruption and instability, even with a 500-square-mile limit on the authorized expansion in any State now served by TVA.

There are some who believe that the Senate committee's proposed version of area limitation would invite unrestricted TVA invasion of the territory of neighboring public utilities and unlimited raiding of customers now being adequately served by such investor-owned systems. I do not share the view that the situation would grow into such a monstrosity of confusion. It is not difficult, however, to visualize that litigation to seek judicial answers to loopholes in the Senate committee version of H.R. 3460 would be extensive. Especially would this be true if the authorized expansion is not required to be contiguous.

Unwarranted extension of facilities and service to meet normal TVA growth requirements for its basic customer area has heretofore been controlled by:

- (1) Appropriations by the Congress; and
- (2) A gentlemen's nonencroachment agreement between TVA and the investor-owned power companies.

Since TVA expansion would no longer be controlled through the appropriation procedure, it is essential that limitations compatible with the gentlemen's agreement now existing should clearly be established in this legislation.

Of course, consistent with this view TVA should be encouraged to serve any "islands" which now exist within the geographical operating area as it existed on July 1, 1957.

JENNINGS RANDOLPH.

The CHAIRMAN. Are there further questions?

Chairman Wagner, we are grateful to you and your associates.

Senator COOPER. I would like to say I am glad to see Mr. Don McBride sitting before us.

The CHAIRMAN. Yes, Mr. McBride.

Mr. McBRIDE. I am delighted to be here and concur in everything that our chairman has said.

The CHAIRMAN. When Mr. McBride was nominated and his nomination was pending before our committee, we voted unanimously to send that nomination to the Senate floor. I presume, if Don has been reading the record, he will find it indicated he was well thought of by the members of the committee.

Mr. McBRIDE. Mr. Chairman, I am having one of the most delightful experiences in my life. I thought I knew something about TVA until I got down there. I hope I am an apt student. I hope that the committee will take heed of our needs down there and act upon this with haste.

The CHAIRMAN. I am sure you were an apt student and collaborator with Senator Kerr. I am sure you will carry forward this search for the truth and give to TVA the administrative leadership which we expect without violating the intent of the original act.

Mr. WAGNER. Mr. Chairman, I should like to say that we are delighted to have Don McBride as a member of our Board and also that we appreciate this opportunity to come before your committee and present our views on this legislation which is so important to us.

The CHAIRMAN. Thank you very much.  
Senator Cooper?

Senator COOPER. I wish to make a statement which might be of some help to the committee in its consideration of the testimony of the next witness. I am familiar with the subject. As you know, I was a member of this committee in 1959 when the TVA Self-Financing Act was enacted. I would like to submit for the record my prepared statement.

(Subsequently, Senator Cooper submitted the following prepared statement:)

STATEMENT OF SENATOR JOHN SHERMAN COOPER

The Subcommittee on Flood Control—Rivers and Harbors is now holding hearings on H.R. 15225 as passed by the House on June 15 and related bills. This bill amends Section 15(d) of the Tennessee Valley Authority Act of 1933, by increasing the amount of bonds which may be issued by the TVA from \$750 million to \$1,750,000,000. I should like to note at this point that I am a cosponsor of the companion Senate bill, S. 3419.

I was a member of this Committee in 1959 when the 86th Congress enacted H.R. 3460 authorizing the TVA for the first time to finance needed additions to its power system by the issuance of its own revenue bonds in a maximum amount of \$750 million. In granting TVA this new authority, Congress at the same time wrote into the bill provisions establishing geographical limitations on any further extension of the TVA service area as it existed on July 1, 1957. The geographical limitations established by H.R. 3460 are contained in Section 15(d) (a) of the present Act and read as follows:

"Unless otherwise specifically authorized by Act of Congress the Corporation shall make no contracts for the sale or delivery of power which would have the effect of making the Corporation or its distributors, directly or indirectly a source of power supply outside the area for which the Corporation or its distributors were the primary source of powers supply on July 1, 1957, and such additional area extending not more than five miles around the periphery of such area as may be necessary to care for the growth of the Corporation and its distributors within said area: *Provided, however,* That such additional area shall not in any event increase by more than 2½ per centum (or two thousand square miles, whichever is the lesser) the area for which the Corporation and its distributors were the primary source of power supply on July 1, 1957: *And provided further,* That no part of such additional area may be in a State not now served by the Corporation or its distributors or in a municipality receiving electric service from another source on or after July 1, 1957, and no more than five hundred square miles of such additional area may be in any one State now served by the Corporation or its distributors.

"Nothing in this subsection shall prevent the Corporation or its distributors from supplying electric power to any customer within any area in which the Corporation or its distributors had generally established electric service on July 1, 1957, and to which electric service was not being supplied from any other source on the effective date of this Act."

To ease the hardship on particular communities bordering on the TVA service area, which had already entered into negotiations for TVA power, and to provide for some flexibility in local adjustments to the new geographical boundaries, both the House and Senate authorized in H.R. 3460 certain specified exceptions which are set forth in paragraph 3 of Section 15(d) (a) and excepted the six Kentucky communities of Paducah, Princeton, Glasgow, Fulton, Monticello, and Hickman; the two Georgia communities of Chikamauga and Ringgold; and the four Tennessee communities of Oak Ridge, South Fulton, Dyersburg, and Covington. Certain other exceptions, to provide for defense and military needs, were also included.

The actions taken by the House and the Senate with respect to these exceptions may be summarized as follows: The House Public Works Committee excepted the Kentucky communities of Paducah, Princeton and Glasgow; the Senate Public Works Committee added Fulton and Monticello; Hickman was added on the floor by an amendment I offered. The House Committee excepted the two Georgia towns of Chikamauga and Ringgold and no additional Georgia towns were added by the Senate. The House Committee excepted the three Tennessee towns of South Fulton, Dyersburg and Covington, and the Senate Committee added Oak Ridge. I might point out that, as of this date, all of the above

Kentucky towns are now receiving TVA power except Princeton; and Princeton will begin receiving TVA power in a few months.

It may be helpful to review briefly the basis upon which the House and Senate committees granted the exceptions and thus provided TVA power for these communities.

The House Committee held hearings on March 10 and 11, 1959. Representatives of several Tennessee, Georgia and Kentucky communities, including the Kentucky communities of Paducah, Princeton and Glasgow, filed statements requesting exemption from the proposed territorial limitations of the Vinson amendment. In exempting several of these communities, the House Committee, in its report of April 14, 1959, pointed out that "the committee added language making clear that it is not intended to prevent TVA from continuing service to two communities which it began serving after July 1, 1957. The committee also provided expressly that the provision should not prevent TVA from supplying power to six communities which advised the committee directly, or through their representatives, that they had already taken steps to qualify themselves to receive power from TVA. A further amendatory provision permits TVA to transmit power to the Department of Defense or any agency thereof on certification by the President that an emergency need for such power exists."

The Senate Public Works Subcommittee held hearings on H.R. 3460 on June 9 and 10. During the course of these hearings, representatives of the Kentucky communities of Paducah, Princeton and Glasgow appeared and testified before the Committee urging that the Senate Committee retain their exemptions as authorized by the House. In addition, representatives from Monticello and Fulton, Kentucky, appeared before the Committee and offered evidence to support their contention that the Senate should grant exemptions to these communities, which exemptions the House failed to provide. This Committee, later in executive session, adopted an amendment I offered and added these two towns to the list of exceptions.

In filing its report of July 2, 1959, this Committee stressed the basis upon which the exemptions were granted:

"The committee recognizes the problems inherent in an attempt to establish a rigid boundary for limitation of power service. The House evidently encountered these problems also and included several exemptions in H.R. 3460. Specific problems of individual communities were brought to the attention of the committee and several additional exemptions were included. Passage of the bill would not require these communities to complete their efforts to receive power from TVA. The exemptions save to those communities the right and opportunity they have under existing law and which they were believed to be in the process of exercising."

At this point I would like to note that on the closing day of the Senate hearing, I received a telegram from the president of the Jackson Purchase cooperative requesting to be included among those areas authorized to receive TVA power. However, no request was made either to me or to the Chairman by the cooperative to have representatives testify before this Committee.

Representatives of the Jackson Purchase cooperative are appearing today requesting that their service area be added to the Kentucky communities (named in paragraph 3 of Section 15(d) (a) which are entitled to TVA power) as they would have done in 1959 if they had thought it necessary at that time to testify.

Jackson Purchase is an REA distribution cooperative with some 10,000 members. It serves a rural area in Western Kentucky just south of the Ohio River between TVA's Kentucky Dam and the junction of the Ohio and the Mississippi and includes the following counties: Marshall, Ballard, Carlisle, and parts of McCracken, Livingston, and Graves Counties. The cooperative began negotiations with TVA in 1946 to obtain TVA power and has been seeking TVA power ever since. Early in 1959, just prior to passage of H.R. 3460 by the House, Jackson Purchase was actively seeking a wholesale power contract with TVA. Negotiations were suspended at the request of TVA during the Congressional debate on the bill and Jackson Purchase was not included among the communities listed in the statute.

You will note from their testimony that the area served by Jackson Purchase is one of the most intensive centers of TVA interest and development. Here is located Kentucky Dam, TVA's largest hydro project and the key to its navigation and flood control program on the Tennessee River. Here also on the Ohio River is located the Paducah Steam Plant, one of TVA's largest generating stations, entirely surrounded on the land site by the service area of Jackson Purchase.

Immediately adjacent thereto is the AEC's nuclear plant which consumes over 50 times as much TVA power as all of Jackson Purchase's consumers would need. Entirely surrounded by Jackson Purchase is the jagged service area of the City of Paducah with Jackson Purchase and Paducah facilities interweaving and dovetailing with each other. In an enclave entirely surrounded by the Jackson Purchase service area is the Calvert City industrial complex, one of this country's largest electrochemical and electrometallurgical centers. Here the major industries (B.F. Goodrich, Air Reduction, Penn Salt, and a number of others) are served directly by TVA while a commercial and residential section is served by another cooperative distributing TVA power. In another enclave within the Jackson Purchase area is the industrial plant of the New York Mining Company which TVA began serving recently under one of the exceptions to the territorial limitation which permits service within five miles of the TVA service area as of July 1, 1957. In sum, TVA is the dominant economic force in this area, none of which is more than a few miles from major TVA installations or existing points of service.

I support the request of the Jackson Purchase representatives and I urge the Committee to give favorable consideration to their proposed amendment.

In concluding, I would like to bring to the Committee's attention two important observations. First, no proposal will be made here today by them to modify or extend the geographical limitations of paragraphs 1 and 2 of Section 15(d) (a) of the Act so as to authorize a general expansion of the TVA service area beyond its present boundaries. Secondly, all they request is that the Committee correct an inequity and hardship situation that should have been resolved in 1959 an inequity that involves unique circumstances based on local conditions of their area.

Senator COOPER. The committee knows that section 15d(a) of the Self-Financing Act placed a limitation upon the area which TVA could serve.

I am not going now into the provisions of that section. I will ask that Public Law 86-137 be incorporated in the record at this point.

The CHAIRMAN. That will be done.

(Public Law 86-137 containing section 15d(a) referred to follows:)

Public Law 86-137  
86th Congress, H. R. 3460  
August 6, 1959

AN ACT To amend the Tennessee Valley Authority Act of 1933, as amended, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the last three paragraphs under the subtitle "Independent Agencies and Corporations" in title II of the Government Corporations Appropriation Act, 1948 (61 Stat. 576-577), are hereby repealed; and the Tennessee Valley Authority Act of 1933, as amended, is hereby amended by inserting immediately after section 15c thereof (16 U.S.C. 831n-3) the following new section:

"SEC. 15d. (a) The Corporation is authorized to issue and sell bonds, notes, and other evidences of indebtedness (hereinafter collectively referred to as 'bonds') in an amount not exceeding \$750,000,000 outstanding at any one time to assist in financing its power program and to refund such bonds. The Corporation may, in performing functions authorized by this Act, use the proceeds of such bonds for the construction, acquisition, enlargement, improvement, or replacement of any plant or other facility used or to be used for the generation or transmission of electric power (including the portion of any multiple-purpose structure used or to be used for power generation); as may be required in connection with the lease, lease-purchase, or any contract for the power output of any such plant or other facility; and for other purposes incidental thereto. Unless otherwise specifically authorized by Act of Congress the Corporation shall make no contracts for the sale or delivery of power which would have the effect of making the Corporation or its distributors, directly or indirectly, a source of power supply outside the area for which the Corporation or its distributors were the primary source of power supply on July 1, 1957, and such additional area extending not more than five miles around the periphery of such area as may be

necessary to care for the growth of the Corporation and its distributors within said area: *Provided, however*, That such additional area shall not in any event increase by more than 2½ per centum (or two thousand square miles, whichever is the lesser) the area for which the Corporation and its distributors were the primary source of power supply on July 1, 1957: *And provided further*, That no part of such additional area may be in a State not now served by the Corporation or its distributors or in a municipality receiving electric service from another source on or after July 1, 1957, and no more than five hundred square miles of such additional area may be in any one State now served by the Corporation or its distributors.

"Nothing in this subsection shall prevent the Corporation or its distributors from supplying electric power to any customer within any area in which the Corporation or its distributors had generally established electric service on July 1, 1957, and to which electric service was not being supplied from any other source on the effective date of this Act.

"Nothing in this subsection shall prevent the Corporation, when economically feasible, from making exchange power arrangements with other power-generating organizations with which the Corporation had such arrangements on July 1, 1957, nor prevent the Corporation from continuing to supply power to Dyersburg, Tennessee, and Covington, Tennessee, or from entering into contracts to supply or from supplying power to the cities of Paducah, Kentucky; Princeton, Kentucky; Glasgow, Kentucky; Fulton, Kentucky; Monticello, Kentucky; Hickman, Kentucky; Chickamauga, Georgia; Ringgold, Georgia; Oak Ridge, Tennessee; and South Fulton, Tennessee; or agencies thereof; or from entering into contracts to supply or from supplying power for the Naval Auxiliary Air Station in Lauderdale and Kemper Counties, Mississippi, through the facilities of the East Mississippi Electric Power Association: *Provided further*, That nothing herein contained shall prevent the transmission of TVA power to the Atomic Energy Commission or the Department of Defense or any agency thereof, on certification by the President of the United States that an emergency defense need for such power exists. Nothing in this Act shall affect the present rights of the parties in any existing lawsuits involving efforts of towns in the same general area where TVA power is supplied to obtain TVA power.

"The principal of and interest on said bonds shall be payable solely from the Corporation's net power proceeds as hereinafter defined. Net power proceeds are defined for purposes of this section as the remainder of the Corporation's gross power revenues after deducting the costs of operating, maintaining, and administering its power properties (including costs applicable to that portion of its multiple-purpose properties allocated to power) and payments to States and counties in lieu of taxes but before deducting depreciation accruals or other charges representing the amortization of capital expenditures, plus the net proceeds of the sale or other disposition of any power facility or interest therein, and shall include reserve or other funds created from such sources. Notwithstanding the provisions of section 26 of this Act or any other provision of law, the Corporation may pledge and use its net power proceeds for payment of the principal of and interest on said bonds, for purchase or redemption thereof, and for other purposes incidental thereto, including creation of reserve funds and other funds which may be similarly pledged and used, to such extent and in such manner as it may deem necessary or desirable. The Corporation is authorized to enter into binding covenants with the holders of said bonds—and with the trustee, if any—under any indenture, resolution, or other agreement entered into in connection with the issuance thereof (any such agreement being hereinafter referred to as a 'bond contract') with respect to the establishment of reserve funds and other funds, adequacy of charges for supply of power, application and use of net power proceeds, stipulations concerning the subsequent issuance of bonds or the execution of leases or lease-purchase agreements relating to power properties, and such other matters, not inconsistent with this Act, as the Corporation may deem necessary or desirable to enhance the marketability of said bonds. The issuance and sale of bonds by the Corporation and the expenditure of bond proceeds for the purposes specified herein, including the addition of generating units to existing power-producing projects and the construction of additional power-producing projects, shall not be subject to the requirements or limitations of any other law: *Provided*, That, with the budget estimates transmitted by the President to the Congress, the President shall transmit the power construction program of the Corporation as presented to him and recommended by the Corporation, together with any recommendation he may deem appropriate.

"Neither bond proceeds nor power revenues received by the Corporation shall be used to initiate the construction of new power producing projects (except for replacement purposes and except the first such project begun after the effective date of this section) until the construction program of the Corporation shall have been before Congress in session for ninety calendar days. In the absence of any modifying action by a concurrent resolution of the Congress within the ninety days, such projects will be deemed to have Congressional approval."

Senator COOPER. Notwithstanding this general limitation the House of Representatives exempted from this section three communities in Kentucky—Paducah, Princeton, and Glasgow. Paducah is a large city. Princeton and Glasgow are, I would think, cities of 5,000 to 12,000. When the bill came to the Senate, upon my amendments, three additional communities were included: Fulton, Ky., which is on the border between Kentucky and Tennessee; Hickman, the county seat for that county; and Monticello. Monticello owned its own generating plant and, as I remember, had a contract with Kentucky Utilities, terminable at will. It had engaged in negotiations with TVA for some time for TVA Service.

At that time representatives of these cities, with the exception of Hickman, came before the committee and gave testimony to support their position that they should be included in TVA's service area.

The Jackson Purchase Cooperative, which is here today and is seeking to be included in the TVA service area, sent to me and to Senator Morton the day before the hearings were to be concluded a telegram, asking that we take steps to include the Jackson Purchase area in the bill. However, no testimony was presented at the time nor was any request made to me or to the committee chairman by their officers for an opportunity to appear and to testify.

It was the view of the committee that they would not give consideration to this request as the hearings were over.

After the hearings had been completed and after the bill had been enacted, the attorney and representatives of this co-op visited me, and Senator Morton, and Representative Stubblefield in the House and talked about this matter.

We consulted at that time with Senator Kerr. Both Senator Kerr and I advised them that the course they should follow would be to present their position when the TVA returned to the Congress for additional self-financing authority. Their statement at the time was that they had been negotiating with TVA and, in fact, had been negotiating with TVA for a number of years so as to be included in the TVA service area. Jackson Purchase had not been able to be included at the time during the war because of their inability to secure facilities and the materials in war time.

After the war, they renewed their negotiations with TVA. I was told that the reason the cooperative did not appear before this committee in 1959 was that as a result of conversations with some TVA officials thought they had been advised to await the action of the Congress on the TVA self-financing bill.

Jackson Purchase, in its talks with me and in its proposals, has felt that the inequity of their situation would have been recognized by the committee at that time in 1959 had they presented their testimony.

The inequity of their present situation is shown by these factors: First, under the original TVA Act a portion of the area served by

the Jackson Purchase Cooperative is in the watershed of the Tennessee River.

Second, the areas which surround the Jackson Purchase area are served by TVA and the cooperative finds itself in an enclave bounded by areas on the south and east which are served by TVA, and on the west by the Ohio and Mississippi Rivers. In this area are located many of the important facilities of TVA, including the AEC plant and the TVA generating plant. For these reasons and others they have wanted to submit and will submit to the committee the basis for their request to be included in the TVA service area.

I make this preliminary statement, because, having been familiar with this subject for several years, I thought it might be helpful to the committee in its deliberations.

The CHAIRMAN. Senator Cooper, you are familiar and I also am familiar with the discussion in 1959 on this subject.

I wish to have the consent of the committee to place in the record at an appropriate place telegrams from investor-owned utility companies in opposition to the expansion of the territorial limits of TVA. We will place those in the record at the appropriate place.

Senator COOPER. Might I ask that the record be held open for a few days, until such time as the chairman thinks appropriate, so that all communications may be included?

The CHAIRMAN. Yes. That is appropriate. Let us say June 30.

Senator COOPER. What is the date today?

The CHAIRMAN. The 28th.

Senator COOPER. That does not give much time. June 30 will be all right.

The CHAIRMAN. Let us make it July 1.

(The telegrams referred to by Senator Randolph are as follows:)

ATLANTA, GA., June 28, 1966.

Senator JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

We have been advised that the Senate Public Works Committee will consider H.R. 15225 and similar bills to increase the authorization for TVA revenue bonds on June 28. We do not object to the bill in the form passed by the House of Representatives. We further understand that the committee will hear a request for an amendment to the territorial boundaries of TVA and will also hear testimony from Mr. W. A. Duncan, president of Kentucky Utilities, responding to this request. We have read Mr. Duncan's statement and concur in his position regarding the maintenance of the territorial limitations. Any effort to amend the present territorial limitations will seriously affect our company since investors have placed millions of dollars in our enterprise on the assurance that the TVA boundary had been established by the Congress in 1959. If your committee plans to consider any action to change the present boundaries of TVA we urgently request that we be so advised and afforded an opportunity to appear in person and testify in opposition thereto.

HARLEE BRANCH, Jr.,  
President, The Southern Co., Atlanta, Ga.

PLAINFIELD, IND., June 27, 1966.

Hon. H. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

I am advised that, on June 28, 1966, the Senate Public Works Committee will commence hearings on H.R. 15225 which relates to an increase in TVA's authority to borrow capital funds. While I do not subscribe to the philosophy of public

power projects which as TVA, I do not oppose this bill as it is presently written however, if this bill is amended so as to expend the territory that TVA is now authorized to serve under the 1959 amendment to the TVA act, I shall be unalterably opposed to this bill as so amended. If TVA is permitted to enlarge its territory at any point on the periphery of its present territory, a precedent will be established and Congress will be requested again to enlarge the TVA territory at the expense of taxpaying investor owned utilities. TVA should be confined to its present territorial limits and should be required to devote its efforts and funds to developing that territory.

I respectfully request that this statement be made a part of the record of the hearings on H.R. 15225.

CARROOL H. BLANCHARD,  
*President, Public Service Co. of Indiana, Inc., Plainfield, Ind.*

RICHMOND, VA., June 27, 1966.

HON. JENNINGS RANDOLPH,  
*Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:*

In connection with H.R. 15225 (increasing the borrowing authority of TVA from \$750 million to \$1,750 million) scheduled for hearings before your committee on public works tomorrow (June 28), an attempt may be made to alter the territorial limitations posed on the TVA service area by the original TVA bond financing act. This territorial limitation was the essential factor in the compromise between the public and investor-owned segments of the electric utility industry at the time of the passage of the original act. Any violation of those limitations, however small they may appear, would cause apprehension among investors in utilities operating throughout the South, East, and Midwest, and have adverse, unsettling effects through the industry. This company and many others would be menaced by renewal of controversy over territorial expansion of TVA.

I respectfully request that this telegram be included in the record of proceeding before your committee.

A. H. McDOWELL, JR., *President.*

BIRMINGHAM, ALA., June 27, 1966.

HON. JENNINGS RANDOLPH,  
*Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:*

On behalf of Alabama Power Co., I concur fully in the prepared statement of W. A. Duncan, on H.R. 15225 relative to the significance and importance of the boundary line provision contained in the 1959 TVA Act and in opposition to any change in it. This geographic provision is of utmost importance to all investor-owned utilities bordering the area served by TVA. This company is not opposed to H.R. 15225 as passed by the House. However, if the committee intends to consider amendments to the boundary line provision, I respectfully request that the hearing time be extended and that a witness from this company be permitted to testify in opposition to such an amendment.

WALTER BOULDIN,  
*President, Alabama Power Co.*

LITTLE ROCK, ARK., June 27, 1966.

HON. JENNINGS RANDOLPH,  
*Senate Public Works Committee,  
New Senate Office Building,  
Washington, D.C.:*

Arkansas Power & Light Co., an investor-owned electric utility serving more than 339,000 customers in Arkansas submits this statement in connection with H.R. 15225, a bill to increase the borrowing authority of the Tennessee Valley Authority, which is now before the Senate Public Works Committee. We have reviewed the statement to be presented to the committee by Mr. W. A. Duncan, president of Kentucky Utilities Co., on June 28, 1966, with reference to H.R. 15225.

Arkansas Power & Light Co. concurs in the statement of Mr. Duncan, particularly with reference to the objections presented to any possible modifica-

tion of TVA's authorized service area. We strenuously urge that your committee not approve any amendment to H.R. 15225 or any other bill which would expand the TVA service area beyond the limits defined in the TVA Revenue Bond Act of 1959.

In passing the 1959 act Congress acted decisively to put the TVA territorial expansion issue to rest. Any move now to grant a single exception to the territorial limitation would inevitably lead to a succession of other such requests and would reopen the whole battle which was resolved with the provisions of the 1959 act.

It is respectfully requested that the opposition of Arkansas Power & Light Co. to any amendment of H.R. 15225 which would expand the existing boundaries of TVA's service area be entered into the record of hearings before the Senate Public Works Committee. It is further requested that if the committee decides to give consideration to such amendments or to other bills which would accomplish the same purpose, Arkansas Power & Light Co. be given an opportunity to appear before the committee and testify.

Respectfully submitted.

REEVES RITCHIE,  
*President, Arkansas Power & Light Co.*

RALEIGH, N.C., June 27, 1966.

Re H.R. 15225.

Hon. JENNINGS RANDOLPH,  
*Chairman, Public Works Committee, U.S. Senate,  
New Senate Office Building, Washington, D.C.:*

Carolina Power & Light Co. respectfully but urgently requests that the Senate Public Works Committee reject any amendment to H.R. 15225 which would authorize expansion of TVA service area to include territory now being served at retail by Jackson Purchase Rural Electric Cooperative Corp. or any other area not now included in the TVA Act as amended in 1959.

I concur in the statement which will be presented at the June 28 hearing of your committee by Mr. W. A. Duncan, president, Kentucky Utilities Co., and I hereby request that this telegram be made a part of the hearing record.

Our company was a party to extensive discussion preliminary to adoption of the so-called TVA Revenue Bond Act of 1959 and thus gained first-hand knowledge of the countless considerations which went into the Revenue measure in the form in which it was finally adopted.

I drafting language clearly delimiting the TVA service area, the Congress considered a request by Jackson Purchase that TVA service area not be limited to exclude this co-op from the area which could be served by TVA.

After due deliberation Congress declined to make any exception for Jackson Purchase. Since that time, the position of Jackson Purchase has not changed.

I respectfully submit that the territorial restrictions agreed upon in 1959 constitute a trust which the Congress should not now abrogate in special consideration of a petitioner who obviously desires the advantage of a power rate differential consisting of exemption from Federal and State income taxes and other concessions available to TVA.

There always will be pressures along the periphery of TVA service area for the preferential treatment inherent in federally subsidized power supply. Expanding TVA service area to accommodate even one new distributor merely would create more problems in a new and larger area.

Amendment of the pending bill would not serve any purposes enumerated in the creation of the Tennessee Valley Authority. On the other hand, firm adherence to the service limits established in 1959 would constitute a welcome reassurance that the Congress respects the service areas of periphery power companies and honors the commitment made in the Revenue Bond Act.

Recognizing the growing needs of TVA for capital, our company supports H.R. 15225 strictly as a means of increasing the ceiling under which TVA may raise capital by the issuance of bonds to the public. However, we oppose any amendment expanding TVA territory and would be compelled to oppose the bill with all possible vigor if any such amendment is incorporated by action of this committee.

Respectfully yours,

SHEARON HARRIS,  
*President, Carolina Power & Light Co.*

NEW YORK, N.Y., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

I have just read and fully endorse the statement on H.R. 15225 being submitted to your committee by W. A. Duncan. Remembering your part in the original enactment of the Tennessee Valley Authority territorial limitation, I urge you to resist any erosion of it.

J. LEE RICE, Jr.,  
President, Allegheny Power System Inc.

LOUISVILLE, KY., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.

DEAR SIR: In the absence of Mr. B. Hudson Milner, president, this is to advise that the Louisville Gas & Electric Co. concurs in the statement regarding H.R. 15225 (TVA financing bill) to be made by Mr. W. A. Duncan of the Kentucky Utilities Co. before your committee on June 28.

We particularly agree with that part of his statement giving the background of the 1959 TVA Financing Act, and in his prediction that any enlargement of the area as then established, would at this late date merely lead to an endless series of similar requests in an ever-widening circle. We respectfully request that H.R. 15225 be adopted without amendment and that this communication be made a part of the hearing record.

LOUISVILLE GAS & ELECTRIC CO.,  
F. W. RUSSELL, Vice President.

ST. LOUIS, MO., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

Union Electric Co concurs in and endorses the statement of Mr. W. A. Duncan, president of Kentucky Utilities Co., in opposition to the proposed amendment to H.R. 15225, the effect of which would be to authorize the expansion of the service area of TVA and its distributors.

Such an amendment is unnecessary and unwarranted because there is in fact no need for such expansion. The investor-owned electric utilities are presently providing adequate and dependable service in territory adjacent to TVA's service area and they are ready, willing, and able to meet the future power needs of all consumers in such territory. Further, we believe that it is contrary to the American free enterprise system to expand federally subsidized power programs into areas which are adequately served by investor-owned utilities and thereby put the Government in direct, major, and unfair competition with the voluntary investments of private citizens.

We respectfully request that our objections to the proposed amendment to H.R. 15225 be inserted in and made a part of the record in the hearing on H.R. 15225.

CHARLES J. DOUGHERTY,  
President, Union Electric Co.

CHARLOTTE, N.C., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Public Works Committee,  
U.S. Senate, New Senate Office Building, Washington, D.C.:

This is to concur in the statement of W. A. Duncan, president of Kentucky Utilities Co., to be presented to the Senate Public Works Committee at its June 28, 1966, hearing on H.R. 15225, a bill to amend the Tennessee Valley Authority Act of 1933 to increase the limitations on the authority to issue bonds. We concur in Mr. Duncan's opposition to any amendment of this bill which would enlarge the TVA service area. Any enlargement of the TVA service area would be contrary to the expressed will of Congress when it enacted the TVA Revenue Bond Act of 1959 and settled the TVA territory issue in what all interested parties thought to be a permanent manner.

Regret that I cannot be present personally at the June 28, 1966, hearing, but respectfully request that my objection to any further amendment to H.R. 15225 be entered into the record of the hearing.

Respectfully submitted.

W. B. MCGUIRE,  
President, Duke Power Co.

ATLANTA, GA., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

I have read the testimony of W. A. Duncan, present of Kentucky Utilities Co., prepared for presentation before Senate Public Works Committee on June 28, which testimony is in opposition to any amendment to H.R. 15225 that would further enlarge TVA territory.

Georgia Power Co. heartily concurs with this testimony, as any further expansion by TVA would be of serious consequence to our company.

We respectfully request if the committee proposes to consider such an amendment that we be advised and afforded an opportunity to be heard.

E. I. HATCH,  
President, Georgia Power Co., Atlanta, Ga.

SPRINGFIELD, ILL., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

Central Illinois Public Service Co. concurs with the testimony to be presented June 28 to your committee by W. A. Duncan, president of Kentucky Utilities Co., in opposition to any amendments to H.R. 15225. Our company is an investor-owned utility serving areas contiguous to the present boundaries of the TVA service area. The 1959 TVA Act placed limitations on the service area of that organization. Any changes in those boundary limitations could have considerable adverse effect on our customers, investors, and employees. Extension of the TVA service area to include the Jackson Purchase Rural Electric Cooperative Corp. in Kentucky would open the door to requests for similar special privileges by other tax-subsidized and Federal income tax-exempt electric suppliers. We feel that no changes are necessary to H.R. 15225, which would increase the borrowing authority of TVA, and respectfully request that this bill be adopted by your committee without amendment.

M. S. LUTHRINGER,  
President, Central Illinois Public Service Co.

GULFPORT, MISS., June 27, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

I understand your committee will hold hearings beginning June 28 on H.R. 15225 relating to the increase in TVA's borrowing authority. I do not object to H.R. 15225 as passed by the House; however, if the committee anticipates any consideration of modifying in any respect the territorial boundaries established in the 1959 TVA Act, my company would be most seriously affected. Should such action be contemplated, I request a continuance of the hearings and notification to allow time for preparation of testimony and an opportunity to appear in person and be heard in opposition to territorial expansion. I have examined the proposed testimony of Mr. W. A. Duncan, president, Kentucky Utilities Co., and am in complete accord with his stated reasons in opposition to any expansion of the TVA service area and especially with reference to investor relationships and encouragement of similar action along the entire periphery.

A. J. WATSON, JR.,  
President, Mississippi Power Co.

JACKSON, MISS., June 27, 1966.

Hon. JENNINGS RANDOLPH,  
*Chairman, Senate Public Works Committee,*  
*New Senate Office Building, Washington, D.C.:*

Mississippi Power & Light Co. is an investor-owned electric utility which serves over 200,000 customers in an area which comprises the western one-half of Mississippi. This service is rendered in 45 of the 82 counties of Mississippi and in 125 municipalities. While our company does not oppose H.R. 15225, it vigorously opposes the proposed amendment initialed H.R. 14833 which would enlarge the TVA service area as fixed in the 1959 act.

We wish to concur in the statement of W. A. Duncan, president of Kentucky Utilities Co., which will be submitted to your committee on June 28, 1966.

The boundary lines between our company and TVA area from end to end on a direct line is about 200 miles. This involves 15 of the counties which we service; however, as this line meanders and includes numerous islands, peninsulas, and pockets, its actual length is at least 400 miles. Along this boundary there are numerous situations similar to those which exist with reference to Jackson Purchase Rural Electric Cooperative Corp. Literally hundreds of customers of the respective suppliers are in direct proximity to each other. We seriously oppose any breach of the TVA service area as such breach, as is provided in the amendment mentioned above, would inevitably open the gate to a rash of further breaches. This could only lead to the eventual breakdown of the 1959 area limits.

Should further hearings on the proposed amendment become necessary we respectfully request an opportunity to be heard. We further respectfully request that this objection be logged in the hearing record.

R. BAXTER WILSON,  
*President, Mississippi Power & Light Co.*

CINCINNATI, OHIO, June 28, 1966.

Hon. JENNINGS RANDOLPH,  
*Chairman, Senate Public Works Committee,*  
*New Senate Office Building, Washington, D.C.:*

We concur in W. A. Duncan's proposed statement to be delivered on June 28, 1966, on H.R. 15225 re TVA borrowing authority. We see no need or warrant for expanding TVA service area. Please record our objection to any such expansion in the hearings.

WM. H. ZIMMER,  
*President, Cincinnati Gas & Electric Co. and*  
*Union Light, Heat & Power Co.*

AMERICAN ELECTRIC POWER CO., INC.,  
*New York, N.Y., June 28, 1966.*

Re H.R. 15225.

Hon. JENNINGS RANDOLPH,  
*Chairman, Public Works Committee,*  
*U.S. Senate, Washington, D.C.:*

Following submitted on behalf of Appalachian Power Co., Kentucky Power Co. and Kingsport Power Co., each of which is an electric utility operating company in the American electric power system and each of which operates in areas contiguous to Tennessee Valley Authority. We have no objection to H.R. 15225 as passed by House of Representatives on basis of our understanding that it is deemed necessary to assist TVA in financing facilities required to supply areas now being served by TVA and its distributors; but we would strongly oppose such bill if it were to include any provision to open up service area boundaries which were so carefully worked out in 1959 legislation and to authorize expansion into additional areas. Respectfully request that this statement be included in record of hearings on H.R. 15225.

DONALD C. COOK, *President.*

INDIANAPOLIS POWER & LIGHT Co.,  
Indianapolis, Ind., June 29, 1966.

Hon. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

I concur with the statement of W. A. Duncan, president of Kentucky Utilities Co., submitted to your committee yesterday, June 28, 1966: Hearing on H.R. 15225. The question of territorial expansion of the TVA was resolved by Congress in 1959 and I see no reason for this matter to be considered at this time. If such territorial expansion is permitted and this first exception granted the clear-cut policy established by Congress in 1959 will be completely nullified.

O. T. FITZWATER, *President.*

ILLINOIS POWER Co.,  
Decatur, Ill., June 29, 1966.

Hon. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.:

Concessions bestowed upon TVA and which are not available to investor-owned electric utilities result in substantial rate differences. These in turn create pressures from municipalities, cooperatives and large power users for expansion of TVA service area to permit their securing TVA's subsidized electric service. Congress wisely solved this problem in 1959 by limiting geographic expansion of TVA. Savers, investors and people who believe in American industry applauded that action. Without that limitation on expansion utilities adjacent to TVA would not have been able to raise capital at reasonable costs to meet their electric loads. I respectfully urge your committee to turn down any amendment to H.R. 15225 which would relax the present limitations on geographic expansion to TVA and ask if possible that you relay my feelings to the members of this committee.

E. A. SCHULTZ, *Vice President.*

SOUTHERN INDIANA GAS & ELECTRIC Co.  
Evansville, Ind., June 29, 1966.

Re H.R. 15225 being considered by Public Works Committee.

Hon. JENNINGS RANDOLPH,  
Chairman, on Public Works,  
U.S. Senate Office Building, Washington, D.C.:

This company not opposed to TVA bond issued but strongly opposes any territorial expansion of TVA as being detrimental to taxpaying private enterprise companies now serving areas in question and is contrary to original purpose and concept of TVA.

A. B. BROWN, *President.*

The CHAIRMAN. Mr. Reid, will you come forward, please, and the gentlemen who are with you.

You gentlemen may proceed in any way you find helpful to the committee to present your statement.

**STATEMENT OF HOWARD V. REID, CHAIRMAN, BOARD OF DIRECTORS, JACKSON PURCHASE RURAL ELECTRIC COOPERATIVE CORP.; ACCOMPANIED BY HOBART ADAMS, GENERAL MANAGER**

Mr. REID. Mr. Chairman and members of the committee, my name is Howard Reid, and I am president of the Jackson Purchase Rural Electric Cooperative with headquarters at Paducah, Ky. We are most appreciative of the opportunity to appear before you today.

I am accompanied by all of my fellow board members, C. H. Arnett, R. L. Bailey, Louis Bradley, Willard Carneal, Stanley Jones, O. W. Stagner, Harvey Sanders, J. E. Wilkins, our general counsel, Julian

Carroll, and Joe Swidler, who has been acquainted with our problem for about as many years as we have been working on it, and by Hobart Adams, the cooperative's general manager. I should like to introduce Mr. Adams at this time to present our testimony to the committee. Mr. Adams.

Senator COOPER. Mr. Adams, I would like very much if the members of the board of this cooperative, and counsel, will stand, so that their presence can be more clearly noted.

The CHAIRMAN. I think that is appropriate, Senator Cooper, that you identify those who are here today as well as the witnesses who will give the presentation.

If you will, proceed.

#### STATEMENT OF HOBART ADAMS, GENERAL MANAGER, JACKSON PURCHASE RURAL ELECTRIC COOPERATIVE CORP.

Mr. ADAMS. Mr. Chairman and members of the committee, the Jackson Purchase Rural Electric Cooperative deeply appreciates this opportunity to appear before you. We have been waiting a long time for this privilege. This appearance is the culmination of years of efforts to obtain TVA power for some 40,000 people in our area. The purpose of our testimony is to explain why we believe an amendment should be added to H.R. 15225 to clarify the right of TVA to serve Jackson Purchase and thus eliminate a gross injustice to these 40,000 rural people that we serve.

Jackson Purchase is a distribution cooperative bringing electricity to member-families in six counties in western Kentucky. The Tennessee River flows through the heart of the Jackson Purchase service area and TVA powerplants and TVA power customers are located throughout our service area. The power supply needs of our cooperative members are relatively small, amounting to less than one-tenth of 1 percent of TVA's generation. In fact, TVA generates and sells over 100 times as much electricity to industries right in our service area as would be needed to supply our rural consumers with TVA power.

I believe each member of the committee has before you a brochure which describes the Jackson Purchase RECC and summarizes our efforts to obtain TVA power. I call your attention to the map opposite page 8 of the brochure which shows the Jackson Purchase service area. Inspection of this map reveals that Jackson Purchase serves an area that is already TVA territory. Making TVA power available to Jackson Purchase would not constitute an expansion of TVA's service area but would merely make TVA power available to the rural cooperative members, the only group in the area now being deprived of its benefits.

As this committee is well aware, when Congress authorized TVA to finance its future investment in power facilities with revenue bonds in 1959, it placed a service area limitation on TVA. With certain exceptions, TVA power was limited to the area where TVA and its distributors "were the primary source of power supply on July 1, 1957."

Mr. Chairman, in 1957 TVA was without question the primary source of power supply in the geographical area served by Jackson Purchase. TVA was supplying over a million kilowatts of power to the

Atomic Energy Commission at its gaseous diffusion plant near Paducah from TVA's Shawnee steam plant, both of which were located right in the middle of our service area. TVA was also supplying power to the Calvert City industrial complex which is one of this country's largest electrochemical and electrometallurgical centers.

Any one of these industries consumes more electricity than would all the 11,000 rural members of Jackson Purchase. At the eastern end of our service area near the mouth of the Tennessee River was located Kentucky Dam and hydroelectric plant, TVA's largest hydro project and the key to its navigation and flood control program on the Tennessee River. TVA transmission lines connecting these TVA facilities crisscrossed the Jackson Purchase area in 1957.

Since the enactment of the territorial limitation in 1959, TVA power has been made available to the city of Paducah which is in the center of our service area. Paducah's distribution facilities interweave and dovetail with those of Jackson Purchase so that a TVA transmission line and a TVA customer may be located on one side of the street and Jackson Purchase customers are located across the street and in many instances even next door to each other. Other industrial customers have since located in our service area and are receiving their power supply directly from TVA, even though we supplied the power at the site during construction of the plant.

The fact of the matter, Mr. Chairman, is that TVA power is available to just about everyone in our service area except the customers of Jackson Purchase made up predominantly of some 11,000 rural families who are supposed to be the primary beneficiaries of the TVA power program. We feel very strongly that Congress did not intend that TVA should make its low-cost power supply available to the large industries in our service area while denying its benefit to the rural inhabitants of the area. Congress made this point very clear by stating in section 11 of the original TVA Act that:

\* \* \* the projects herein provided for shall be considered primarily as for the benefit of the people of the section as a whole and particularly the domestic and rural consumers to whom the power can economically be made available, and accordingly that sale to and use by industry shall be a secondary purpose, to be utilized principally to secure a sufficiently high load factor and revenue returns which will permit domestic and rural use at the lowest possible rates and in such manner as to encourage increased domestic and rural use of electricity.

Our inability to obtain TVA power is almost impossible to explain to our members, many of whom can see TVA customers right next door, TVA transmission lines across the street and a TVA steam plant and TVA hydroelectric plant on the horizon. These circumstances are pictured in the brochure before you. A goodly number of our members have moved into the Jackson Purchase area as a result of TVA acquiring their land and homesites in order to build Kentucky Dam and the Shawnee steamplant. Many more of our members work at TVA installations which generate millions of kilowatts of electricity and yet somehow we have been unable to persuade TVA that the law permits them to bring TVA electricity to these people's homes.

This injustice is costing the consumers we serve upward of \$200,000 a year in their electric power bills. If TVA rates were available, a Jackson Purchase rural consumer who now pays a monthly bill of

\$14.15 for 800 kilowatt-hours of electricity could buy double that amount, 1,600 kilowatt-hours for almost the same price, \$14.60. Under existing rates if a Jackson Purchase consumer used 1,600 kilowatt-hours a month it would cost him \$25.55. Needless to say, few of them purchase that amount because they simply cannot afford it. The consumers served by Jackson Purchase are therefore buying only about one-half as much electricity as those served by TVA distributors. I need not tell this committee of the benefits which an abundant supply of low-cost electricity can bring to a farmer.

The absence of TVA power is causing people who are working in our service area to buy homes outside the Jackson Purchase area where they can obtain TVA power. This is causing uneconomic and distorted development of the area. Our service area is thus becoming an underdeveloped island. Instead of serving as a unifying development force in the five-county area where TVA and Jackson Purchase facilities exist side by side, TVA and its power program is a distorting factor which is the cause of hardship and discrimination.

TVA is the dominant economic force in the Jackson Purchase area, all of which is within a few miles of major TVA installations or existing points of service. In this respect Jackson Purchase is unique among cooperatives which have been cut off from TVA power by the terms of the 1959 bond amendment as interpreted by TVA. We cannot believe that Congress intended that the rural consumers of Jackson Purchase should constitute an island of high-cost electricity while TVA power customers and TVA powerplants virtually stare them in the face.

Mr. Chairman, we are not Johnny-come-latelies in our efforts to obtain TVA power. TVA power was not available anywhere in our area in 1938 when we undertook the task of bringing electricity to the rural inhabitants of our area. TVA first expanded into our area of western Kentucky during World War II to supply power for a defense plant. As soon as the wartime restrictions on materials were lifted in 1946, we initiated talks with TVA seeking to obtain TVA power. I shall not recite all of the details of the history of our efforts, but for one reason or another we were still trying to obtain TVA power in 1959, just prior to the time the TVA self-financing bill was passed. Negotiations were suspended until Congress completed action on the then pending revenue financing bill. The delay has proved a costly one to Jackson Purchase because 7 years have gone by and we are still without TVA power.

Mr. Chairman, I would like to offer at this time two exhibits reciting some of the history of our efforts of our cooperative to obtain TVA power.

The first document is the 1961 annual report of the board of directors to the members. I invite your attention to the summary report of the president beginning on page 3.

The second document contains two excerpts from our board minutes. We would like to offer these two exhibits for the committee's consideration.

Senator COOPER (presiding). What was the second document?

Mr. ADAMS. It contains two excerpts from our board minutes.

Senator COOPER. The minutes of the board?

Mr. ADAMS. Yes, sir.

Senator COOPER. Without objection, the summary report and the excerpts from the minutes will be received and incorporated in the record.

(The exhibits referred to follows:)

HISTORICAL INFORMATION JACKSON PURCHASE RURAL ELECTRIC COOPERATIVE CORPORATION

Your Board of Directors feels that a report should be made to you concerning the question of TVA power for the Cooperative, to review what has transpired over the years, and what the present situation is.

First, let us say that we can readily understand the desire of every member to get electricity as cheaply as possible, and each of us shares that desire with you for your board is made up of your fellow members.

This Cooperative was organized in 1937 and the first wires were energized on April 16, 1938. At that time, TVA power was not available in this area and Kentucky Utilities was the only available source.

It was not until late in World War II that TVA extended its service into our area. It was done then to supply the shell loading plant at Viola in Graves County in 1943. In order to do this, TVA purchased the facilities of the Kentucky Tennessee Light and Power Company, and TVA, of course, had a wartime priority for materials and supplies necessary to permit it to supply Viola.

Meanwhile, late in 1941, our Cooperative was, for all practical purposes, deprived of any material for further expansion, and this continued until 1946, when wartime restrictions were lifted and we were again able to buy wire, transformers, etc.

In 1946 and 1947, we initiated talks with TVA relative to obtaining TVA power. This culminated in TVA offering power at two principal sources, one in Livingston County and another near Massac to serve everything west of the Tennessee River. This proposal by TVA was not accepted for two reasons. One was that the REA in Washington did not think the plan was feasible for the Cooperative and would not lend us the money with which to build the transmission lines that would be required. The other reason, a very important one, was the fact that TVA could not give us the service until 1950, some three years later.

Because we could not get material during World War II, we came out of that war with an accumulated backlog of some 7000 applications for service. We are sure that those of you who were here then can well remember this situation, and how great was the desire of the people to get electricity. At that time no one would have advised that these applicants be denied power while we waited on TVA. To supply it the alternative was further integration with the Kentucky Utilities system of transmission lines. The directors pursued that course and we now have nine substations receiving power from Kentucky Utilities. The use of numerous substations can appreciably reduce the cost of electricity, for shorter distribution lines can be built more cheaply and they reduce line loss. Our line loss (that is electricity which we buy from Kentucky Utilities and lose in getting it to your meter) averages about 12%, whereas the average line loss for cooperatives is about 18%.

By 1950, we had nearly caught up with the back log of applications for service, and this meant that we had averaged the cutting over of three new customers per day, seven days per week and 52 weeks per year in 1946, 1947, 1948 and 1949.

In 1950 the Korean War brought severe curtailment of materials again which lasted until 1953. If we could have changed to TVA it would have been necessary to largely revamp our distribution system, both because of the increased consumption that would be expected and because of any changes that might be required by changing from Kentucky Utilities delivery points to TVA delivery points. This would have been most difficult if not impossible under wartime restrictions.

TVA has been confronted with a power shortage practically since AEC plants and industrial installations such as the plants at Calvert City have contributed its inception to this shortage. After President Eisenhower was inaugurated in 1952, TVA was granted no further appropriations for adding to its generating capacity. In 1952 and 1953 appropriations were made for completing work already in progress, but that was all. In 1954 TVA requested appropriations for more than 800,000 KVA of generating capacity which it said would be necessary by 1957. Not one dollar of these appropriations has even been granted. As a

result it was about 1955 that TVA lost the city of Memphis, which it had previously served. This was because it did not have sufficient generating capacity to serve Memphis any longer.

A cordial relationship has always existed between JPRECC and TVA. During the fifties it had been understood that TVA would advise JPRECC when they would be in a position to serve us.

In 1959, we requested a meeting with TVA because we had information that we could probably get a contract. Correspondence concerning this meeting is attached hereto as Exhibits 3, 4 and 5. Prior to April 2, 1959, TVA requested that the meeting be postponed until after Congress acted on TVA's request to sell revenue bonds. There was nothing that we could do except to agree to the postponement. When Congress did act it permitted the sale of the bonds, but at the same time said, in effect, that TVA cannot serve us.

Except for the action by Congress in prohibiting TVA from serving us, which was not anticipated by us, the Cooperative was in excellent condition to make the change from Kentucky Utilities as its power source to TVA, and when the meeting was arranged in 1959, we had no thought but that the meeting would accomplish this end.

Except for four (4) cooperatives that are supplied by TVA, we have had the lowest rates of any cooperative in Kentucky since 1947. We have made a larger reduction in the debt owed to REA than has been made by any other Kentucky cooperative. This will be a wonderful help if we do get TVA and thereby incur the additional expense it will involve, for we would start out with our status of indebtedness to REA in excellent condition. We intend to give you a more detailed report of our progress over the years, but because of the length of this report, we will make it under a separate letter.

We are advised and believe that we cannot obtain TVA power unless we can get the Congress which meets in January to enact a bill permitting it. This effort will be made, but we know that it will not be an easy task. When the time comes, we will need the help of every one of our members. We will keep you posted on how you can help.

We apologize for the length of this letter, but we hope that it will prove informative to you.

Sincerely yours,

HORACE HARTING,  
President, Board of Directors,  
Jackson Purchase Rural Electric Cooperative Corporation.

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EXCERPTS FROM MINUTES, BOARD OF DIRECTORS MEETING, JACKSON PURCHASE RECC, PADUCAH, KENTUCKY

*March 7, 1959*

The regular monthly meeting of the board of directors of Jackson Purchase Rural Electric Cooperative Corporation was held March 7, 1959 at the office of the Cooperative, 124 North Fourth Street, Paducah, Kentucky.

"\* \* \* Mr. Harting then reported to the board that on *February 9th, 1959 he wrote a letter to Mr. Arthur P. Brazelton, Tennessee Valley Authority, Jackson Tennessee*, for the purpose of discussing the possibility of supplying power to the Cooperative and that on *February 16, 1959, he had a reply from Mr. Brazelton* stating that as soon as he had an opportunity to discuss this with other TVA personnel, he would give us a more definite date. On March 4th Mr. Brazelton called Mr. Harting by long distance and asked that he advise the board that he had discussed the matter with TVA personnel and they were ready for a meeting at our earliest convenience at their office in Jackson or Chattanooga, Tennessee. After a general discussion the motion was made by Mr. Wood and seconded by Mr. Foster that Mr. Odea Evans, Field Engineer for Rural Electrification Administration of this district, Mr. Andrew Connors, CPA Auditor, for the cooperative, T. W. Threlkeld, Attorney, C. D. Harris, Project Manager and as many directors attend this meeting as possible. The directors proposed the meeting held the week of March 29th at any day most convenient to everyone."

*April 4, 1959*

The regular monthly meeting of the board of directors of Jackson Purchase Rural Electric Cooperative Corporation was held April 4, 1959 at the office of the Cooperative, 124 North Fourth Street, Paducah, Kentucky.

"\* \* \* Mr. Harting then read a letter to the board dated March 17, 1959 from Tennessee Valley Authority, Jackson, Tennessee, advising that they would be pleased to meet with the officers and directors of the Cooperative on Thursday, April 2, 1959 at 1:00 p.m. in Mr. A. P. Brazelton's office in Jackson, Tennessee. However, prior to that date TVA phoned us suggesting the meeting be postponed until more was known about the action Congress would take affecting TVA."

Mr. ADAMS. Mr. Chairman, while we believe that Jackson Purchase comes within the TVA service area under the existing law, we are aware that a question may exist as to our status. We do not blame anyone but ourselves for being omitted from the list of those TVA was specifically authorized to serve in the 1959 bond financing legislation, but we have been trying ever since to overcome our failure and clear up any doubt as to our right to TVA power.

I have been manager of the Jackson Purchase Cooperative since 1961, and I can assure this committee that obtaining TVA power has been my No. 1 task during that entire period. TVA agrees with us that Jackson Purchase is equitably entitled to receive TVA power. They say that it is only the question of interpretation of the 1959 law that stands in the way. TVA service would require no appreciable expenditure of funds since TVA power and transmission lines already interlace the area. Jackson Purchase is the only distributor in TVA territory which was actively seeking TVA power at the time the 1959 amendment was passed and which is being denied it by TVA. It is also the only applicant, so far as we know, whose territory is totally dominated by TVA power service to other distributors and to industries.

We think the law should now be clarified. We are, therefore, proposing an amendment to clarify what we are sure Congress intended—namely, that the rural consumers served by Jackson Purchase be treated the same as the industries and citizens of Paducah in the same area. All that is needed is to add Jackson Purchase to the list of those which TVA is specifically authorized to serve in the third paragraph of subsection (a) of section 15d of the TVA Act. This amendment would leave intact the limitations on the TVA service area now in the law but would make clear that Jackson Purchase is within that area and is entitled to TVA power.

Mr. Chairman, we have come before this committee because it is the appropriate body to give us relief. We believe our requested amendment is germane to the bill before you because the area limitation, which we believe needs clarification, was imposed by Congress as an integral part of the original TVA financing measure. Any necessary clarification of the area which TVA is entitled to serve, therefore, seems to us to be appropriately a part of this measure to increase the TVA financing authority. We know of no other practical way to bring this matter to the attention of Congress.

The amendment we propose to eliminate the discrimination against the rural consumers of Jackson Purchase would not create any new area of friction. Most of the Jackson Purchase service area boundaries are fixed by nature. On the north and west it is bounded by the Mississippi and Ohio Rivers which are also State line boundaries. On the south no problems would be created because it is bounded by the Hickman-Fulton RECC, West Kentucky RECC, and Pennyryle RECC, all of which are existing TVA power distributors. On the east about half of its boundary is the broad Cumberland River and

for a few miles in the northeast corner its service area is contiguous with the territory of Henderson-Union RECC, a cooperative that obtains its power from a G. & T. cooperative. The operating zones in this northeast corner are well established.

Jackson Purchase at no place in its service area has a land boundary with the service area of any private power company. We are surrounded by water and the service areas of cooperatives that are supplied by TVA or other cooperatives. Jackson Purchase presently obtains its wholesale power supply from Kentucky Utilities Co. Kentucky Utilities sales to us represent only about 1 percent of their revenues, which are growing at six or seven times that amount each year. Service by TVA to Jackson Purchase would therefore have no disruptive effect.

In conclusion, I want to emphasize that our amendment will leave intact the territorial limitations which Congress imposed on TVA in 1959. We are merely seeking clarification of the law which will eliminate any doubt as to TVA's right to eliminate a pocket of discrimination in the TVA area. Jackson Purchase is so located as to be uniquely entitled to become a TVA power distributor and is willing to take on all the responsibilities that go with the TVA program of bringing electricity to the consumers of the area at the lowest possible price.

We respectfully urge the committee to adopt the amendment to H.R. 15225 which we propose. It would merely add Jackson Purchase to the list of power distributors which TVA is specifically authorized to serve in the third paragraph of subsection (a) of section 15d of the TVA Act.

Mr. Chairman, thank you for this opportunity.

Senator COOPER. Mr. Adams, when was the Jackson Purchase Cooperative formed?

Mr. ADAMS. In 1938, sir.

Senator COOPER. Since that time has it been securing its power from the Kentucky Utilities Co.?

Mr. ADAMS. Yes, sir.

Senator COOPER. Do you have a contract at present to secure power from the Kentucky Utilities Co.?

Mr. ADAMS. We have a contract that has run out. We are operating on a 6-month agreement at present.

Senator COOPER. I note from your map that the Jackson Purchase Cooperative area embraces several counties and parts of several counties. Is Livingston County served by Jackson Purchase Cooperative?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is any part of that county served by TVA?

Mr. ADAMS. Yes, sir. Between the lakes, Lake City and Grand River—no, we serve that.

Senator COOPER. Is part of McCracken County served by Jackson Purchase?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is any part of McCracken County served by the TVA?

Mr. ADAMS. They serve the city of Paducah and they in turn serve in the county, itself.

Senator COOPER. Is Ballard County served by Jackson Purchase?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is any portion of Ballard served by TWA?

Mr. ADAMS. They have no service area in Ballard County, sir.

Senator COOPER. Is Carlisle County, served by Jackson Purchase?

Mr. ADAMS. We serve in Carlisle County.

Senator COOPER. Is any part of that county served by TVA?

Mr. ADAMS. TVA distributor, Hickman-Fulton RECC, and West Kentucky.

Senator COOPER. Is any part of Graves County served by Jackson Purchase?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is any part of Graves County served by TVA?

Mr. ADAMS. Yes, sir, West Kentucky RECC.

Senator COOPER. Is part of Marshall County served by Jackson Purchase?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is any part of Marshall County served by TVA?

Mr. ADAMS. Yes, sir, West Kentucky RECC and direct by TVA to the chemical complex.

Senator COOPER. When you say that parts are served by other cooperatives, are you also saying that those cooperatives receive their power from TVA?

Mr. ADAMS. Yes, sir.

Senator COOPER. Calvert City is located in Marshall County, is it not?

Mr. ADAMS. Yes, sir.

Senator COOPER. Is the entire Calvert County served by TVA?

Mr. ADAMS. Calvert City was purchased by Jackson Purchase, at a cost of over a hundred thousand dollars. We serve about two-thirds of it. The TVA cooperative has now moved in and picked up about a third of it because of the rate differential.

Senator COOPER. There are a number of large industries to which you have referred as being located in the Calvert City area. Can you identify these industries?

Mr. ADAMS. They are electrochemical and electrometallurgical plants, Goodrich, Pittsburgh Metallurgical, Pennsalt, and General Aniline.

Senator COOPER. Are they served by TVA?

Mr. ADAMS. Yes, sir; direct.

Senator COOPER. Has any of these industries been added to the TVA service area since the enactment of the 1959 act?

Mr. ADAMS. Yes, sir. The New York Mining & Manufacturing Co., was added in about 1961.

Senator COOPER. Now where is the AEC plant located?

Mr. ADAMS. It is located west of Paducah on the Ohio River, in McCracken County.

Senator COOPER. Do you know who furnishes the power for this AEC plant?

Mr. ADAMS. TVA furnishes it from the Shawnee steamplant.

Senator COOPER. Is there a TVA steamplant located in—McCracken County?

Mr. ADAMS. It is in McCracken County on the Ohio River west of Paducah.

Senator COOPER. Downstream from Paducah?

Mr. ADAMS. Yes, sir.

Senator COOPER. How is its power furnished or from what source?

Mr. ADAMS. It is coal operated.

Senator COOPER. Is there any other TVA facility which you have not mentioned which is located in what I would say this general area near the area served by Jackson Purchase?

Mr. ADAMS. We have large transmission lines criss-crossing our service area. We also have a large Kentucky Dam, hydroelectric TVA plant. We serve on both sides of this. We serve the little town right under the dam, Gilbertsville. We serve Lake City on the other side of the river just above the dam and also Grand River on up the lake above the dam.

Senator COOPER. How many customers does your cooperative serve?

Mr. ADAMS. Approximately 11,000 at the present time.

Senator COOPER. Are you able to tell the committee the volume of electrical energy that was consumed the last year by your patrons?

Mr. ADAMS. 77 million kilowatt-hours was consumed by the members last year. However, our average consumer rate is about 420 each month. You heard Mr. Wagner testify that the average is over 11,000 a year, which is double our rate.

Senator COOPER. You were not manager of the Jackson Cooperative prior to or at the time the TVA Self-Financing Act was enacted by the Congress?

Mr. ADAMS. I was not the manager.

Senator COOPER. Do you have control of the records of the cooperative?

Mr. ADAMS. Yes, sir.

Senator COOPER. Have you examined the records made prior to the enactment of the act for the purpose of ascertaining whether or not the Jackson Purchase Cooperative had been discussing with the TVA the proposition of TVA supplying Jackson Cooperative?

Mr. ADAMS. Very thoroughly, sir.

Senator COOPER. I believe you have introduced in the record copies of minutes of the cooperative and also a statement of the cooperative indicating the various steps that Jackson Purchase had taken to pursue this matter with TVA.

Mr. ADAMS. Yes, sir. We have all the records that there are of this. Also, if time would permit it, we could bring in a thousand members here who would testify that they had expected TVA power for the last 20 years.

Senator COOPER. I might say that Congressman Stubblefield who has been here all morning may have to leave. I assume he has to go over to the House. I think it will be proper to hear him now. Then we can resume and hear the other witnesses. So I will ask Congressman Stubblefield to come forward.

Did you plan to testify?

#### STATEMENT OF HON. FRANK A. STUBBLEFIELD, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF KENTUCKY

Representative STUBBLEFIELD. I did not plan to testify, Mr. Chairman. However, I would like to say that the purpose of these gentlemen appearing here before you today on behalf of Jackson Purchase

Cooperative is to correct an inequity and an intolerable situation that exists within these six counties whereby you have, as the TVA Chairman mentioned a few moments ago, Calvert City where part of the city is in the TVA area, part of it is out. This dictates where the development takes place, where a house will be built, where any business will be established, in order to come within the TVA rate structure.

This differential in rates has affected the whole economy of these six counties. In other words, the situation in one community is something like this: on one corner a fellow has a grocery store, and across the street is a blacksmith shop. They exist on two different rates.

The intolerable situation, which is the subject of our discussion, I think, was anticipated by the Senator from West Virginia in 1959 when he stated it was not the intention of Congress to leave these little islands deprived of TVA power as a result of that 1959 act.

Certainly, Jackson Purchase Cooperative is a victim of being precluded from obtaining TVA power inasmuch as they are within the Tennessee Valley, in fact the town of Gilbertsville just mentioned here is within sight of the largest dam in the TVA chain and yet they are deprived from receiving the benefits of TVA power.

Thank you, Mr. Chairman.

Senator COOPER. Thank you, Congressman.

(Subsequently Congressman Stubblefield transmitted the following letters and enclosures:)

HOUSE OF REPRESENTATIVES,  
Washington, D.C., June 29, 1966.

HON. JENNINGS W. RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.

DEAR SENATOR RANDOLPH: It is my understanding that the record in the hearing on H.R. 15225 and related bills is being held open until July 1, 1966. Therefore, I would appreciate your including the attached report from the Tennessee Valley Authority on my bill, H.R. 14833, which states its position on the amendment to the bills before your Committee.

My amendment, as set out in H.R. 14833, would benefit the Jackson Purchase Rural Electric Cooperative Corporation; and the attached letter from TVA Chairman Aubrey J. Wagner emphatically states that in TVA's opinion the Jackson Purchase Cooperative has a meritorious case. Chairman Wagner adds that we (TVA) would be glad to supply its power requirements and that the Bureau of the Budget has no objection to this report's presentation from the standpoint of the Administration's program.

Thank you for your kind consideration of H.R. 14833 as an amendment to the subject legislation.

Sincerely yours,

FRANK A. STUBBLEFIELD,  
Member of Congress.

TENNESSEE VALLEY AUTHORITY,  
OFFICE OF THE BOARD OF DIRECTORS,  
Knoxville, Tenn., May 20, 1966.

HON. GEORGE H. FALLON,  
Chairman, Committee on Public Works,  
Rayburn House Office Building, Washington, D.C.

DEAR MR. FALLON: This is in response to your letter of May 4 requesting our views with respect to H.R. 14833, a bill "To amend the Tennessee Valley Authority Act of 1933 in order to authorize the Tennessee Valley Authority to supply power within certain Kentucky counties."

The bill would amend section 15d(a) of the TVA Act to permit TVA to supply electric power to the Jackson Purchase Rural Electric Cooperative Corporation for resale within the counties of Carlisle, Ballard, McCracken, Graves, Marshall, and Livingston in the State of Kentucky. With certain exceptions not pertinent

here, section 15d(a) of the Act limits TVA power service to the area for which it was the primary source of power supply on July 1, 1957. As we construe this restriction it prevents TVA from supplying power to most of the area served by the Jackson Purchase Cooperative.

The statement made by Representative Stubblefield at the time he introduced the bill (Cong. Rec. May 3, 1966, p. 9238) provides a good explanation of the case for the proposed legislation. TVA is not seeking an expansion of the area to which it can supply power. We do feel, however, that Jackson Purchase Cooperative has a meritorious case and we would be glad to supply its power requirements.

The Bureau of the Budget advises that it has no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

AUBREY J. WAGNER, *Chairman.*

HOUSE OF REPRESENTATIVES,  
Washington, D.C., June 29, 1966.

Hon. JENNINGS W. RANDOLPH,  
*Chairman, Senate Public Works Committee,*  
*New Senate Office Building, Washington, D.C.*

DEAR SENATOR RANDOLPH: After just getting a letter off to you concerning the report received from the Tennessee Valley Authority on my bill, H.R. 14833, I have now received the attached report from the Secretary of Agriculture which states even more emphatically that the enactment of H.R. 14833 would be looked on with favor.

I agree with Secretary Freeman that the passage by Congress of H.R. 14833 would effectively clarify and establish the eligibility of the cooperative—the Jackson Purchase Cooperative—to be served by TVA. I do hope, therefore, that your Committee will see fit to include the provisions of H.R. 14833 as an amendment to the TVA legislation now under study; that is, H.R. 15225 and related bills.

Thank you for your kind attention to this request.

Sincerely,

FRANK A. STUBBLEFIELD,  
*Member of Congress.*

DEPARTMENT OF AGRICULTURE,  
Washington, D.C., June 28, 1966.

Hon. GEORGE H. FALLON,  
*Chairman, Committee on Public Works,*  
*House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: This is in reply to your request of May 10, 1966, for report on H.R. 14833, a bill "to amend the Tennessee Valley Authority Act of 1933 in order to authorize the Tennessee Valley Authority to supply power within certain Kentucky counties."

This Department recommends enactment of the bill.

H.R. 14833 would amend the Tennessee Valley Authority Act, as amended, so as to permit the Authority to supply power to Jackson Purchase Rural Electric Cooperative Corporation for resale within six-named Kentucky counties.

This cooperative, which is a borrower from the Rural Electrification Administration, an agency of this Department, renders electric service to rural consumers in the counties of Carlisle, Ballard, McCracken, Graves, Marshall, and Livingston, the six counties named in the bill. At present, its wholesale energy is furnished it by the Kentucky Utilities Company, which during the fiscal year ended June 30, 1965, charged the cooperative an average of 8.1 mills per kilowatt hour. REA-financed cooperatives in Kentucky serving territory adjoining that served by the Jackson Purchase cooperative obtained their wholesale power supply from TVA during the same year at an average cost of 4.9 mills per kilowatt hour, or 40 percent less than the cost to Jackson Purchase. Municipalities within the counties served by Jackson Purchase are receiving wholesale power supply from TVA and are serving rural establishments outside their city limits and in some cases immediately adjacent to premises served by Jackson Purchase. Municipal service is furnished at retail rates below those charged by Jackson Purchase. This poses a serious competitive problem to the Cooperative which can be solved by giving the cooperative access to TVA power.

It should also be noted that the service areas of the cooperative are in close proximity to and surrounded by many TVA facilities.

When the 1959 amendment of the Tennessee Valley Authority Act was enacted authorizing TVA to finance new power facilities by issuance of bonds in the private money market, the legislation included restrictions on the area which TVA could serve. Although the Jackson Purchase cooperative has taken the position that its service areas are included within the area which TVA is permitted to serve at wholesale, TVA has taken the position that they are not so located and that it may not furnish the cooperative the desired service.

The cooperative is entitled to preference in the sale of TVA power under the Tennessee Valley Authority Act. H.R. 14833 would effectively clarify and establish the eligibility of the cooperative to be served by TVA.

These circumstances, in our opinion, establish a strong case for the enactment of H.R. 14833.

The Bureau of the Budget advises that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

ORVILLE L. FREEMAN.

Senator COOPER. Mr. Adams, do you know whether any part of the area served by Jackson Cooperative lies within the watershed of the Tennessee River or its tributaries?

#### STATEMENT OF HOBART ADAMS—Resumed

Mr. ADAMS. Yes, sir; a great deal of the area lies in the Tennessee River watershed. We have members who live on both sides of the Tennessee River from the Kentucky Dam to Paducah. We have them up the hollows and streams and branches that go out. In fact, this is our concentration of our membership, as you might well know, that they are building near the lake and around the lake and between the lakes where we serve.

We serve around the large Cumberland River Dam now right to the canal that connects both these lakes. We serve around the area of the Shawnee steamplant. We serve around this where our members had to withdraw and give up their homes and go out into the area and still cannot receive TVA power.

Senator COOPER. Mr. Royce is here, who is counsel for the committee. I think we can say he represents Senator Randolph, although he also represents all of us.

Do you have any questions you would like to ask?

Mr. ROYCE. Yes, Senator Cooper.

Mr. Adams, you referred to 11,000 customers of Jackson purchase Co-op.

Mr. ADAMS. Yes.

Mr. ROYCE. Last year a total annual consumption of approximately 77 million kilowatt-hours?

Mr. ADAMS. That is correct.

Mr. Royce. That would come out to approximately an average of 7,000 kilowatt-hours per customer.

Mr. Adams. This is counting all of the small industrials that we use also. I was merely stating the rural members average.

Mr. ROYCE. What is the average domestic consumption of your rural customers?

Mr. ADAMS. 420.

Mr. ROYCE. 420?

Mr. ADAMS. Yes, sir.

Mr. ROYCE. And for the immediately contiguous area served by TVA what is the average consumption of a comparable rural domestic user?

Mr. ADAMS. It is about 11,000 a year which would be about twice more than we have.

Mr. ROYCE. 11,000, and you said 420?

Mr. ADAMS. 420 a month, I am sorry. Which is around 5,000 a year.

Mr. ROYCE. Around 5,000 a year for your customers. Now 11,000, is that the average for all TVA rural consumer or for the rural consumer in the area immediately contiguous to yours?

Mr. ADAMS. Frankly, I think it is the members right next to us in the adjacent counties that use this much.

Mr. ROYCE. Could you determine that and supply that information for the committee, please?

Mr. ADAMS. Yes, I can. I haven't had TVA power. I am not acquainted with this.

Mr. ROYCE. Mr. Wagner, perhaps TVA can supply it for the record.

Mr. WAGNER. The average for TVA residential and rural users is 11,278 kilowatt-hours per year.

Mr. ROYCE. Thank you, Mr. Wagner.

Just one other question, Senator Cooper.

On page 14 of your brochure, Mr. Adams, you refer to, and I quote, "The value of our property, both residential and commercial, has decreased appreciably."

You refer to contiguous areas in Calvert City served by TVA and by Jackson Purchase. Could you supply for the committee record any documentation of property value depreciation in the area shaded yellow on the map?

Mr. ADAMS. Yes, sir. We can supply you pictures where some lots on ours cannot be sold and across the street, TVA, there are rows of houses.

Mr. ROYCE. I mean material that you could supply to supplement this. It would be helpful.

(Subsequently, the following communication and affidavit were supplied:)

CARROLL & WALTON,  
ATTORNEYS AT LAW,  
Paducah, Ky., July 6, 1966.

Hon. RICHARD ROYCE,  
Chief Clerk and Staff Director, Senate Public Works Committee, New Senate  
Office Building, Washington, D.C.

DEAR MR. ROYCE: During the testimony of Mr. Hobart Adams before the Committee on June 28, 1966, you asked Mr. Adams to submit evidence concerning a statement which appeared on Page 14 of our Brochure.

Mr. Adams asked that I secure such a statement for you and forward the same.

I asked Mr. Robert Arnold of Calvert City, Kentucky, who probably is most familiar with this situation, to make such a statement. I am enclosing his statement pursuant to your request.

Very truly yours,

CARROLL & WALTON,  
By JULIAN M. CARROLL.

## STATEMENT

I, Robert Arnold, certify that I am a licensed Real Estate Broker in the State of Kentucky, and engage in the business as such in the City of Calvert City, County of Marshall, Kentucky.

I have actively engaged in the purchase, sale, evaluation, development and financing of real estate in the Calvert City area for some fifteen (15) years.

Upon starting my business in this area some years ago, I learned early that it was advisable to develop real estate in that area served by TVA. As a factual matter, some eighty (80%) percent of our new homes and sales are now in areas in Calvert City served by TVA. That area of our City presently served by Jackson Purchase Rural Electric Cooperative Corporation is very slow in development and sales are also very slow.

The difference in the value of property in that area served by TVA and that area served by Jackson Purchase Rural Electric Cooperative Corporation has continued to increase; thereby, causing in effect the value of property in the Jackson Purchase service area to decrease.

One of the most important factors in selling homes in the Calvert City area, and one which is used by other real estate brokers and by me, is that TVA is available at the particular location of the property being sold.

ROBERT ARNOLD.

Senator COOPER. Do you have any other statement, Mr. Adams, that you have not covered in your prepared statement?

Mr. ADAMS. I would like to further say that by act of Congress, Jackson Purchase Rural Electric Cooperative is a preferred customer for TVA power. I don't feel we have any obligation to Kentucky Utilities. We see no reason why we should not have freedom to select the best possible wholesale power supply. We see no reason why we cannot leave Kentucky Utilities as the other 19 cooperatives have done that were once served by Kentucky Utilities.

Lastly, we see no reason why our people in the heart of the Tennessee River country and for generations to come should be forced to receive the high cost of KU power with low-cost TVA power all over us.

Thank you again.

Senator COOPER. Thank you, Mr. Adams.

The next witness is Mr. Fred Paxton, president of Paducah Chamber of Commerce.

Mr. Paxton, will you proceed.

#### STATEMENT OF FRED PAXTON, PRESIDENT, PADUCAH CHAMBER OF COMMERCE

Mr. PAXTON. Mr. Chairman and members of the committee, my name is Fred Paxton. I am here representing the Greater Paducah Chamber of Commerce of which I am the president. We appear today in support of the efforts of Jackson Purchase Rural Electric Cooperative Corp. to secure clear authority to purchase power from TVA.

While we have supported these efforts of Jackson Purchase for some years as individuals, at a recent meeting of our board I was authorized and instructed to appear here today before this honorable body and express the strong support of our chamber for the amendment which Jackson Purchase is seeking to H.R. 15225.

I am the vice president of Paducah Newspaper, Inc., which owns and operates the Paducah Sun-Democrat and WPSD-TV at Paducah.

As the associate editor of the Paducah Sun-Democrat and in recent years as managing director of WPSD-TV, I have closely observed the plight of the people in our area and their efforts to rectify the situation which has denied them TVA power. I have been in position to observe the great damage to the growth and development of our area due to the inability of Jackson Purchase to obtain TVA power.

Our chamber not only represents the business community in the city of Paducah, we also represent the businesses in the Greater Paducah area. As a matter of fact, many of our members outside Paducah are being served by TVA, and some are served by Jackson Purchase. Our chamber is deeply interested in working toward an orderly development of the entire area.

I am sure Mr. Adams has adequately covered the many severe problems we have encountered due to having TVA power all around us and now in Paducah and yet being unable to obtain it in our basic rural area.

Mr. Chairman, our problem is that many of the people in the Greater Paducah area have TVA power, yet many do not and are thus at a great disadvantage because their community is not experiencing the same growth. The sad fact is that those who are not receiving TVA power are perhaps the people who could benefit the most from its availability. I refer to the rural inhabitants of our community served by Jackson Purchase.

Since Paducah is the hub of our economy in western Kentucky, we are obviously concerned with an orderly development from this hub into our outlying community. Presently we are faced with a crazy quilt pattern of development keyed primarily to who supplies the particular area—a TVA distributor or Jackson Purchase. Instead of TVA and its power program serving as a unifying developmental factor in the five-county area in which TVA and Jackson Purchase facilities are intertwined, it is a divisive factor.

We believe that Congress never intended that the Jackson Purchase Cooperative should be excluded from purchasing power from TVA. We respectfully urge this committee to add clarifying language to the measure before it that will rectify this injustice that is creating serious economic problems not only for the Paducah area but for the outlying areas as well.

Mr. Chairman, I thank you.

Senator COOPER. Mr. Paxton, what is the population of Paducah?

Mr. PAXTON. It is approximately 35,000 people.

Senator COOPER. It is the largest community—

Mr. PAXTON. That is correct, there are 56,000 to 58,000 people in the county.

Senator COOPER. How many in the county?

Mr. PAXTON. 56,000 to 58,000 people.

Senator COOPER. It is the largest community in the First Congressional District?

Mr. PAXTON. Yes, sir.

Senator COOPER. Paducah now receives its power from TVA?

Mr. PAXTON. Yes, sir.

Senator COOPER. Prior to that it received its power from Kentucky Utilities?

Mr. PAXTON. That is correct. It now receives its power as a result of a special exemption which was obtained.

Senator COOPER. Is there a defined boundary of Paducah by which it can be determined what area in Paducah or Greater Paducah is served by TVA?

Mr. PAXTON. I beg your pardon. I did not understand the question.

Senator COOPER. I know that the city of Paducah has city limits. Are the people living within the city limits served by TVA?

Mr. PAXTON. Yes; they are.

Senator COOPER. Outside the city limits they are served by Jackson Purchase.

Mr. PAXTON. There are a certain number of citizens who live outside the city limits but are served by the municipally owned power system in Paducah. There are other residents outside the city limits but in McCracken County that are served by Jackson Purchase.

Senator COOPER. In other words, the TVA now serves the same areas and consumers that have been previously served by Kentucky Utilities, whether or not they live within the city limits of Paducah or outside?

Mr. PAXTON. That is correct.

Senator COOPER. Do you have a situation where beyond the city limits some individuals are served by TVA and some individuals in adjacent areas are served by Jackson Purchase?

Mr. PAXTON. Yes, sir. In some cases they live across the street from each other.

Senator COOPER. I note the last sentence on the first page of your statement:

I have been in a position to observe the great damage to the growth and development of our area due to the inability of Jackson Purchase to obtain TVA power.

Can you give any examples to illustrate that statement.

Mr. PAXTON. It would be hard to give a specific example except there is this crazy quilt pattern of development. As Mr. Adams has indicated there are certain areas where the growth and development is pronounced and there are certain vacant areas.

Senator COOPER. Mr. Royce, do you have any questions?

Mr. ROYCE. No, Mr. Chairman. Thank you.

Senator COOPER. Is there any other statement you would like to make which you have not included in your prepared statement?

Mr. PAXTON. No, sir.

Senator COOPER. Do you have any knowledge of any negotiations or talks which were held by representatives of the Jackson Cooperative and TVA prior to the enactment of the TVA Self-Financing Act?

Mr. PAXTON. I have no direct knowledge of that. I believe there has been testimony relating to it here today.

Senator COOPER. Were you connected with the Paducah newspaper, Sun-Democrat, prior to the enactment of the Self-Financing Act?

Mr. PAXTON. Yes.

Senator COOPER. Were you also connected with the radio and TV station there at that time?

Mr. PAXTON. Yes, sir. I have never been connected with a radio station. I am now currently connected with a TV station.

Senator COOPER. Were you connected with the TV station prior to the enactment of the Self-Financing Act?

Mr. PAXTON. No, sir.

Senator COOPER. In your capacity as the vice president of the Paducah Sun-Democrat prior to the time of the enactment of the act did you in that capacity have any information about negotiations?

Mr. PAXTON. Yes, the information available at that time that Jackson Purchase was attempting to secure TVA power.

Senator COOPER. Was it a matter of public knowledge?

Mr. PAXTON. Yes, sir; it was general knowledge.

Senator COOPER. Do you know of any articles in your paper during that period which discussed these negotiations?

Mr. PAXTON. That would be testing my memory rather severely.

Senator COOPER. Thank you very much, Mr. Paxton.

Now, the next witness is Mr. W. C. Young, secretary of Western Kentucky AFL-CIO Area Council.

**STATEMENT OF W. C. YOUNG, SECRETARY, WESTERN KENTUCKY  
AFL-CIO AREA COUNCIL**

Mr. YOUNG. Mr. Chairman and members of the committee, my name is W. C. Young. I am here today as the representative of the Western Kentucky AFL-CIO Area Council with offices at Paducah, Ky. My position with the council is executive secretary. I am also a member of the State board of the AFL-CIO. Our council represents all of western Kentucky and has some 10,000 actual dues-paying members.

Our council has long supported the efforts of Jackson Purchase to secure TVA power. My appearance here today is to emphasize that this is a matter of concern to the workers in the area.

We understand that Congress has imposed limits on the territory TVA can serve but we cannot believe that Congress meant to leave Jackson Purchase out of the TVA area. TVA is all around us. TVA powerplants, dams and transmission lines are all over our area and TVA power customers are the biggest industries in our area. It just does not make sense to deprive the household consumer of TVA power when just about everyone else has it available.

Our working people simply cannot understand why after moving from their homes to make way for TVA powerplants and dams, seeing TVA transmission lines built on their land, and seeing TVA power generated in their community that they cannot obtain TVA power in their homes. This is even harder to explain when their neighbors next door or across the street are TVA customers.

Many of our members work at TVA's Kentucky Dam and Shawnee steam plant located right in the Jackson Purchase service area where they help TVA generate electricity and it's awfully hard for them to understand why they cannot buy TVA power in their homes within walking distance of these plants.

We know that the inability of the Jackson Purchase Cooperative to receive TVA power is costing the working people of western Kentucky hundreds of thousands of dollars a year and this is depriving them of the convenience and advantages which are available to power consumers all around us.

We plead with the members of this committee to correct this injustice and accept the amendment suggested by Jackson Purchase to the measure presently pending before you.

Thank you, Mr. Chairman.

Senator COOPER. Mr. Young, in your capacity as secretary of the Western Kentucky AFL-CIO Area Council can you state whether or not the workers in that area or some workers in that area are employed at various TVA installations in the area?

Mr. YOUNG. Yes, sir.

Senator COOPER. And some of these live in the Jackson Purchase area?

Mr. YOUNG. Yes, sir. In fact, some of them had to move from their community to other communities within this particular area in order to make way for TVA installations. These same people are being denied the use of TVA power now. We have members in the same local unions, some working in TVA installations, living in the same community, looking across the street and seeing their neighbors being supplied power by TVA.

Senator COOPER. Thank you very much, Mr. Young.

Mr. ROYCE. Mr. Adams, your period of contract with Kentucky Utilities is for how long, that is the basis on which you are served by Kentucky Utilities?

Mr. ADAMS. We are operating on a 6-month agreement now.

Mr. ROYCE. On a 6-month agreement?

Mr. ADAMS. Yes. It was a 2-year contract when we originally signed. When we sign a new substation we will have a new contract for that. All our substations but one have run out.

Mr. ROYCE. That 6-month period is at your election, that is you could have a longer term contract.

Mr. ADAMS. Yes.

Mr. ROYCE. But you have chosen not to?

Mr. ADAMS. Yes, we have chosen not to take a long-term contract because we have been expecting to get TVA over the years. We did not want to be hooked with a long-term contract.

Mr. ROYCE. Are the rates the same for long-term as for short-term; that is, for 6 months.

Mr. ADAMS. The rates would be lower. We are still operating under the original contract.

Mr. ROYCE. I have no other questions.

Mr. ADAMS. But it would be a 5-year contract.

Senator COOPER. May I ask Mr. Wagner a question?

Mr. Wagner, you were not the Chairman of the Board of Directors of the Tennessee Valley Authority in 1959 or prior to that time?

Mr. WAGNER. That is right.

Senator COOPER. When did you become Chairman?

Mr. WAGNER. In 1962, Senator.

Senator COOPER. You were with the TVA though prior to 1959?

Mr. WAGNER. Yes, I was.

Senator COOPER. What was your position in the Tennessee Valley Authority during the period to which we have been referring?

Mr. WAGNER. From 1954 until 1961 I was TVA's General Manager. For 3 years prior to that I was Assistant General Manager.

Senator COOPER. You heard Mr. Adams testify that certain TVA facilities are located in this general area. Is that correct?

Mr. WAGNER. That is correct.

Senator COOPER. Has he named all of them?

Mr. WAGNER. I believe he has, yes, sir.

Senator COOPER. He testified, and I am not saying this to question Mr. Adams, but simply to complete the record, that co-ops which surround or partly surround the area served by Jackson Cooperative receive their power from TVA. Is that correct?

Mr. WAGNER. That is correct, yes, sir.

Senator COOPER. Do you know how long those co-ops have been securing power from TVA?

Mr. WAGNER. I don't know the exact time but it has been for some time.

Senator COOPER. Was it prior to 1959?

Mr. WAGNER. Yes, sir.

Senator COOPER. Is it correct that at some time during World War II TVA began to supply a shell-loading plant in the general Jackson Purchase area?

Mr. WAGNER. I am not familiar with the exact loads, Senator.

Senator COOPER. Were you there during the war?

Mr. WAGNER. Yes, sir.

Senator COOPER. Was TVA limited—

Mr. WAGNER. Senator, I understand we did serve a shell-loading plant in the Viola area during the war.

Senator COOPER. During the war period did the shortage of materials prohibit TVA from attempting to supply areas additional to that which it had?

Mr. WAGNER. Yes, that is true; both the shortage of materials and equipment and the urgent need to devote our generating capacity to the supply of defense loads limited our capacity to take on additional loads.

Senator COOPER. After the war did a power shortage or an anticipated power shortage develop in the area served by TVA which made it impossible or at least impracticable to attempt to serve additional areas?

Mr. WAGNER. After the war there were years when we were pressed for power production, yes; particularly when the atomic energy loads developed and there was a time when power was short.

Senator COOPER. In fact, that was the reason which directed Congress to consider the TVA Self-Financing Act to provide for TVA power needs in the service area. There was a shortage in the area you were serving.

Mr. WAGNER. The areas we were serving had expanding loads. Our revenues were not sufficient to take care of all the additional generating capacity needed and appropriations were not forthcoming. The revenue bond financing legislation was enacted consequently.

Senator COOPER. Did the factors that I have mentioned have any weight in any consideration you gave to the possibility of furnishing power to Jackson Purchase?

Mr. WAGNER. Yes; I think that is correct, sir. I did not take part in those negotiations.

Senator COOPER. Do you know from your knowledge of the operations of TVA over a period of time prior to 1959 whether the representatives of the TVA and representatives of Jackson Purchase discussed the possibility of TVA supplying power to Jackson Purchase?

Mr. WAGNER. Yes, sir; there were intermittent discussions over a period of several years.

Senator COOPER. Thank you very much.

Mr. ROYCE. Mr. Wagner, has the position of the TVA in not servicing Jackson Cooperative been based on the interpretation that the Congress has limited the service area by statute and that it is not a matter of administrative discretion for TVA?

Mr. WAGNER. We interpret the territorial limitation of the 1959 amendment to the TVA Act as prohibiting our serving Jackson Purchase; yes, sir.

Senator COOPER. To make the record complete I think it is only fair to say that for some time the parties have been in litigation. I am not familiar in detail with this litigation. I have heard about it and I have read the petition. There has been litigation initiated by Jackson Purchase against the TVA and in which the Kentucky Utilities intervened. I am not familiar with the nature of the suit but I understand it is to secure an interpretation of the meaning of the limitation as to whether or not TVA was the principal supplier of power. I thought this litigation should be noted for the record.

Does the Jackson Purchase Cooperative have any other evidence it would like to present?

Mr. ADAMS. You raised the question about being in court. We believe that the Congress is the proper forum to clarify the act of Congress. TVA claims that the courts must accept the findings of the TVA Board and that we are not entitled to a full hearing in court.

Senator COOPER. I understand. I raised this question so that the record from my viewpoint at least would be complete. I think also it is quite evident that no matter what litigation is pending in the courts, Congress could act if it so desired.

Is there any other evidence that Jackson Purchase would like to offer?

Mr. ADAMS. That is it.

Senator COOPER. We thank you for your presentation.

Mr. REID. Thank you, Senator Cooper.

(Subsequently, Mr. Reid transmitted the following communication:)

JACKSON PURCHASE RURAL  
ELECTRIC COOPERATIVE CORP.,  
Paducah, Ky., June 29, 1966.

HON. JENNINGS W. RANDOLPH,  
U.S. Senate,  
Washington, D.C.

DEAR SENATOR RANDOLPH: Several matters concerning Jackson Purchase Rural Electric Cooperative Corporation were raised at the June 28 Senate Public Works Committee hearing on H.R. 15225 and companion bills on which we believe the record should be clarified.

Mr. Duncan of Kentucky Utilities Company in his testimony placed great emphasis on the fact that Jackson Purchase could have saved \$335,065 in its power bill from Kentucky Utilities if Jackson Purchase had signed a long-term contract.

Mr. Duncan stated that this lower rate and long-term contract was offered to Jackson Purchase in 1957 but was refused by the Co-op. Mr. Duncan was thus documenting the fact that Jackson Purchase had paid \$335,000 in excess profits to Kentucky Utilities from 1957 to 1965 in order to be free to take TVA power if its efforts were successful. Mr. Duncan's testimony is the clearest proof of the fact that Jackson Purchase was seeking to obtain TVA power in 1957 before the territorial limitations were imposed in 1959 and has been paying large sums of money to KU each year just in order to be free to become a TVA distributor. It is also ample proof that Kentucky Utilities has already been generously rewarded for whatever investment it has made in service to Jackson Purchase.

Mr. Duncan suggested to the Committee that Jackson Purchase was no different than many other power systems not presently receiving TVA power located on the periphery of the TVA service area. The fact of the matter, however, is that Jackson Purchase is unique.

1. Jackson Purchase is the only power distributor actively negotiating with TVA for power supply prior to 1959 which is being denied power by TVA.

2. Jackson Purchase is the only power distributor not receiving TVA power which has a service area in which TVA is the primary source of electricity.

3. Jackson Purchase is the only power distributor cut off from TVA power which has its principal urban center (Paducah) already served by TVA.

4. Jackson Purchase is the only power distributor with a service area in which all the large industrial loads are receiving TVA power, and only the rural consumers are excluded.

5. Jackson purchase is the only cooperative in Kentucky which does not either receive TVA power or generate power for its own needs.

6. Jackson Purchase is the only power distributor cut off from TVA power which has TVA dams, hydroelectric plants, a giant steam plant, substations, transmission lines and other facilities permeating its entire area.

We believe that the facts in the record show that Jackson Purchase is truly unique. It is also significant that no other power distributor is suggesting to the Committee that it is in any way comparable to Jackson Purchase. Indeed, no other candidate for an exemption has appeared. The claim that for the Congress to eliminate an injustice to Jackson Purchase would start a stampede is without support. We cannot believe that the Congress will permit this argument to foreclose it from appraising the merits of Jackson Purchase's position.

The fact that every cooperative in Kentucky not served by TVA has abandoned service from Kentucky Utilities Company in favor of self-generation suggests that if Congress should deny Jackson Purchase's plea the result would not necessarily be to preserve Jackson Purchase as a KU customer. The result might equally be to force Jackson Purchase to self-generation, which would be preferable to buying from KU, but would be wasteful and uneconomic as compared with TVA service, and which would continue the present discrimination.

We are informed that in its report on the Stubblefield bill, H.R. 14833, which would permit service to Jackson Purchase, TVA stated that Jackson Purchase has a meritorious case.

During the course of the hearing it was suggested that it was not sufficient to simply add Jackson Purchase to the list of communities expressly entitled to TVA power in the third paragraph of Section 15d(a), but rather that certain language of the first paragraph of Section 15d(a) must also be amended. This suggestion is not well founded because the third paragraph would make clear Jackson Purchase's right to be served by TVA notwithstanding any language which may appear elsewhere in the Act.

Sincerely,

HOWARD V. REID,  
Chairman, Board of Directors,  
Jackson Purchase RECC.

Senator COOPER. Now the next witness is Mr. W. A. Duncan, President of the Kentucky Utilities Co.

Mr. Duncan, would you identify those who accompany you.

**STATEMENT OF W. A. DUNCAN, PRESIDENT, KENTUCKY UTILITIES CO.; ACCOMPANIED BY HARRY M. BLANTON, VICE PRESIDENT, AND JAMES WELCH, COUNSEL**

Mr. DUNCAN. Yes, sir, I will be glad to, Senator.

I have with me Mr. Harry Blanton, vice president of Kentucky Utilities Co., and our counsel, Mr. James Welch of the firm of Ogden, Robertson & Marshall, Louisville, Ky.

Senator COOPER. You may proceed as you please and take as much time as you desire.

May I say that although there are other members who could not be here, they will certainly see all the evidence which has been introduced.

You are president of Kentucky Utilities Co.?

Mr. DUNCAN. That is correct.

Senator COOPER. You may proceed.

Mr. DUNCAN. First, if the Senator would indulge me I would like to comment that there are a number of representatives from other power companies present in the room. May I identify them?

Senator COOPER. Yes.

Mr. DUNCAN. Mr. Ralph Foreman, American Electric Power Service Corp.; Mr. Jack Riley, Carolina Power & Light Co.; Mr. L. D. Gray, Louisville Gas & Electric Co.; Mr. Richard Rhein, Cincinnati Gas & Electric Co.; Mr. Charles O. Shaw, Central Illinois Public Service Co.; Mr. Charles Beverage, Virginia Electric Power Co.

First I want to thank the Senator for his personal indulgence in continuing this hearing and giving us an opportunity to be heard today.

I prepared a statement that with your permission I would like to incorporate in the record, and in the interest of time I will attempt to hurry through it.

Senator COOPER. May I say that we have spent a good deal of time on this but you can take all the time you desire, reading the full statement and making such comment as you desire.

Mr. DUNCAN. Thank you, sir.

I am William A. Duncan, president of Kentucky Utilities Co., an investor-owned electric utility that supplies electric energy to 230,000 consumers in 75 of the 120 counties in Kentucky. My company has 24,400 stockholders, one-third of whom are Kentucky people.

Senator COOPER. Where is the home office?

Mr. DUNCAN. Our headquarters is in Lexington, Ky. I appreciate the opportunity of appearing before you in connection with H.R. 15225, which would increase the borrowing authority of the Tennessee Valley Authority from \$750 million to \$1,750 million.

At the outset, I hope you will understand that I am not appearing for the purpose of opposing the legislation as passed by the House of Representatives on June 13. My sole reason for being here is to oppose any amendment to this bill which would authorize the expansion of the TVA service area, as defined in the 1959 TVA Act, to include an area now being served at retail by Jackson Purchase Rural Electric Cooperative Corp., which corporation is a wholesale customer of our company. Such an amendment (H.R. 14833) has been introduced in the House of Representatives and, we are advised, will be proposed

to this committee, and I believe the amendment to which Mr. Adams has referred is essentially accidental. We are unalterably opposed to this amendment or to any amendment which would expand the service area of TVA and its distributors.

Jackson Purchase RECC was organized in 1937 and energized its first line in April 1938. Ever since that date it has purchased its entire power requirements from Kentucky Utilities Co. It currently operates over an area of approximately 1,000 square miles in the six Kentucky counties of Ballard, Carlisle, Graves, Livingston, McCracken, and Marshall, and on December 31, 1964, served 10,572 customers.

Throughout much of this same area Kentucky Utilities Co. presently serves about 2,500 customers, including the incorporated communities of Wickliffe, Barlow, LaCenter, Kevil, and Salem.

During this period the company has adequately and dependably supplied the entire power requirements of this cooperative and we stand ready to continue this service as required. During 1965 Jackson Purchase RECC purchased from Kentucky Utilities Co. more than 77,500,000 kilowatt-hours, for which service Kentucky Utilities Co. received about \$626,000.

In authorizing TVA under the 1959 act to raise capital by the issuance of bonds to the public, Congress recognized the expanding needs of TVA for capital and was willing to surrender some of the control it previously exercised over TVA operations through the annual appropriations process. At the same time Congress recognized that it was not in the national interest to permit the unlimited expansion of the geographic area in which TVA electric service could be supplied and thereby inflict ruinous competition on investor-owned utilities operating in the areas adjacent to the existing TVA area.

The language of the 1959 TVA Act was arrived at after extensive hearings and debate in both Houses of Congress, which extended over a period of several years. In the course of those hearings, Jackson Purchase expressly requested, in a telegram to Senator Cooper appearing in the record of this committee's hearing, that the TVA service area not be limited in such a manner as to exclude this co-op from the area which could be served by TVA. Congress did not see fit to make any exception in the case of Jackson Purchase RECC.

No condition exists today which should cause Congress to modify the act and now authorize expansion of the TVA service area so as to include in the TVA area more than 1,000 square miles now being adequately supplied by Kentucky Utilities Co.

Jackson Purchase was in 1959, and is today, in the same position as any other distributor of electricity on the periphery of the TVA area. If, at this late date, an exception were to be made in the case of Jackson Purchase, it would certainly result in a host of similar requests from existing distributors and even municipalities not now engaged in supplying electric service, not only around the TVA periphery but elsewhere.

The problem of geographic expansion of TVA and the resulting competition with investor-owned power companies was resolved in 1959. In doing so, Congress recognized TVA as a utility in position to provide for the needs of its consumers at rates which do not include Federal and State income taxes and other cost components which

investor-owned utilities necessarily must provide for in establishing their rates. The resulting rate differential between TVA and the organizations operating around the periphery of TVA's service area was, and always will be, most substantial. This rate differential cannot be eliminated so long as investor-owned utilities are obliged to pay Federal and State income taxes and are not afforded the other concessions available to TVA in its operation. Therefore, there will always be pressure on the part of municipalities, cooperatives, and large power users located adjacent to the TVA service area for expansion of this area to permit their securing TVA's subsidized electric service.

It is evident that the proposal of Jackson Purchase stems largely from its desire to obtain a reduction in its power cost through the expansion of the TVA service area to include its service area. It is obvious that many existing organizations similarly situated, and others not now in existence, but which could be readily organized for the purpose, can and will make the same claims for special consideration should there be any change in the presently prescribed TVA service area.

Jackson Purchase seeks to differentiate its position from that of other distributors on the TVA periphery on the basis that this co-op's service area is intertwined with that of TVA to such an extent that next door neighbors are on different systems, and pay different rates. Similar situations exist all around the periphery of TVA and, in fact, at the interface between any two utilities regardless of locations. Expanding the TVA service area would merely create more problems in a new and larger area.

It has been claimed that continued exclusion of Jackson Purchase from the TVA area "strikes at its ability to survive." This cooperative's rate of growth certainly belies this contention. During the period 1958 through 1965, this co-op has increased its annual purchase of energy from my company from some 45 million to 77,500,000 kilowatt-hours—an increase of 70 percent in 7 years.

In addition, an analysis for 1964 of the financial status of all distribution cooperatives in the State of Kentucky discloses that Jackson Purchase has greater financial strength, by a wide margin, than any other, including the four presently within the service area of TVA and purchasing power from TVA. For example, the ratio of long-term debt to net utility plant for Jackson Purchase at December 31, 1964, was 35.5 percent and the 1964 operations from a financial standpoint shows that net income (operating plus nonoperating margin) was sufficient to cover interest on debt for the year by 9.3 times. No other cooperative in Kentucky even approached these ratios. These ratios for TVA-supplied, Kentucky co-ops are listed below:

Distribution cooperative	Served by—	Percent long-term debt to net utility plant	Percent interest coverage
Pennyrite.....	TVA.....	87.0	2.8
Warren.....	TVA.....	90.3	2.3
Hickman-Fulton.....	TVA.....	99.6	1.1
West Kentucky.....	TVA.....	62.7	3.7
Jackson Purchase.....	Kentucky Utilities.....	35.5	9.3

As you see, they range from 62.7 to 99.6 in terms of percentage of long-term debt to net utility plant as compared to Jackson Purchase's 35.5. The TVA-supplied co-ops range from a minimum of 1.1 times to up to 3.7 times its annual interest coverage as compared to Jackson Purchase's 9.3 percent. Certainly this comparison definitely indicates that the exclusion of Jackson Purchase from the TVA does not strike at its ability to survive, since its economic position today is stronger than any Kentucky co-op now within the TVA area.

One further comment should be made with respect to the rates at which Jackson Purchase Rural Electric Cooperative Corp. purchases power from our company as compared to the rates at which it could purchase power from TVA. While it is true, as noted above, that neither our company nor any other investor-owned electric utility could reasonably expect to sell power at rates equivalent to those of TVA, it should be noted that Jackson Purchase could, if it so desired, purchase power from our company at a lower rate than it presently does. Since it was organized, this cooperative has purchased its power requirements from our company on rate NPR, which rate first became effective in 1937 and has subsequently been reduced from time to time. In 1950 our company offered a lower rate to co-ops in Kentucky, including Jackson Purchase. This offer was accepted by the other two cooperative customers of our company but, although the offer remains open to this day, it has not been accepted by Jackson Purchase. This lower rate is identified as rate 61 and is based on a 5-year initial contract, cancelable on a year-to-year basis thereafter. If Jackson Purchase had accepted this offer, during the 8 years through 1965, it could have saved the sum of \$335,065, or some 8.2 percent of the amount it actually paid us for service. During the year 1964 these savings amounted to more than \$51,000, or \$4.85 per customer, based on the average of 10,524 customers served by the co-op during that year.

It is also claimed that natural boundaries (rivers) of Jackson Purchase's service area should preclude any demands for expansion of TVA sales to even wider areas. The fact that rivers do not constitute natural boundaries between utility service areas is, perhaps, most clearly evidenced by the fact that the service of Jackson Purchase itself extends across two major rivers; namely, the Cumberland and Tennessee Rivers. Any such claim also completely disregards the fact that, throughout a large part of the six county area of this co-op's operation, on both sides of the rivers mentioned, Kentucky Utilities Co. presently supplies some 2,500 consumers, other than Jackson Purchase, both at retail and wholesale.

Both Senator Cooper and Senator Gore have commented on the necessity for any utility to borrow money to finance its expansion and its operations. Many holders of our securities and others with responsibility for advising the investing public applauded the 1959 act limiting the service area of TVA. They continue to evidence interest in the permanency of this limitation. A firm stand by this committee on this issue will reassure them on this point. In the final analysis, increased cost of service to our customers must necessarily result from an expansion of TVA's service area to include the area in question here, or in any other area, since any such expansion will

most adversely affect our ability, and the ability of other companies similarly situated, to raise necessary capital at reasonable cost.

Mr. Chairman, I respectfully request this committee to adopt H.R. 15225 without amendment.

I certainly appreciate the opportunity of presenting my views to the committee.

Senator COOPER. Mr. Duncan, when did you become president of Kentucky Utilities?

Mr. DUNCAN. 1964.

Senator COOPER. You succeeded Mr. Watt?

Mr. DUNCAN. Yes, sir; Mr. R. M. Watt.

Senator COOPER. You have been associated with Kentucky Utilities prior to that time?

Mr. DUNCAN. Yes, sir; since 1935.

Senator COOPER. During the time that you have been associated with Kentucky Utilities were you aware from any discussions that you had with the managers of Jackson Purchase or with TVA that there had been discussions between TVA and Jackson Purchase relative to the supply of power to Jackson Purchase by TVA?

Mr. DUNCAN. I first became aware of any such discussions with TVA about the time the 1959 TVA Act was being hammered out. Contrary to what has been indicated here before, I did have reports from our representatives in the area extending over quite a number of years prior to 1959 that the then present manager of Jackson Purchase was very well satisfied with the service and rate he was receiving from our company. I believe he subsequently was replaced perhaps some time after the enactment of this act. My impression is, and this is an impression, that his attitude on that particular point may have had some bearing on the termination of his services as manager and Mr. Adams' election to this position.

The point I am trying to make here is that it is my information that this attempt on the part of Jackson Purchase to secure TVA power certainly did not extend very many years, if at all, prior to the enactment—well, prior to 1959.

Senator COOPER. Mr. Adams placed in the record minutes of the directors' meeting which would indicate that for a period of years they had discussions and negotiations had been taking place. I think Mr. Adams also generally testified to that point. On pages 4 and 5 of your prepared statement you call attention to the very favorable ratios of debt to utility plant which Jackson Purchase enjoys. Do you know whether or not that is true because of the rapid repayment to the Federal Government of loans which had been made to Jackson Purchase?

Mr. DUNCAN. I don't know the facts but I would assume there are a combination of factors. That might well be one. Another might be the generally favorable economic situation in which Jackson Purchase has found itself down through the years.

Senator COOPER. Is it correct, as has been testified to by representatives of Jackson Purchase that in certain areas which they serve and you serve that there is an unusual intertwining of the areas?

Mr. DUNCAN. Between my company and Jackson Purchase?

Senator COOPER. No, between TVA and Jackson Purchase.

Mr. DUNCAN. I don't have the facts on that. It is logical to assume that there is a boundary between Jackson Purchase consumers and TVA-supplied consumers at any point where the two systems come together, yes, sir.

Senator COOPER. Does Kentucky Utilities purchase power from TVA on an exchange basis?

Mr. DUNCAN. We have an interchange arrangement with TVA under which a number of services are ordinarily provided. The continuing year-to-year portion of that arrangement is what we class as an interchange transaction under which we supply certain TVA load centers located within and immediately adjacent to our transmission lines and in return the TVA supplies some load centers located near their lines. Every year since the inception of that arrangement there have been these interchange transactions in which each party supplies to the other certain load centers located nearest its facilities and returns the energy so supplied to the supplying party at other points of interconnection. In addition, this contract we have with TVA provides for other types of service. During the year 1965 the only purchases of energy by Kentucky Utilities from TVA were classed as emergency deliveries. The only transactions of this sort were emergency transactions between us in which Kentucky Utilities supplied TVA substantially more energy than TVA supplied us on that basis.

Senator COOPER. Does Kentucky Utilities buy power to serve directly its own customers or is this simply a purchase of power to use when there are shortages of power?

Mr. DUNCAN. Here again you are talking about our arrangements with TVA?

Senator COOPER. Yes.

Mr. DUNCAN. Ordinarily when there is an emergency on the system of either party, if Kentucky Utilities had an emergency loss of a generator on our system, TVA among others stands ready to supply energy to make up for the emergency loss of that generator until we can make other arrangements. Similarly if an emergency exists on TVA's system, Kentucky Utilities stands ready to similarly supply that service to TVA. As I indicated, during the past year the net energy flow was some million three hundred thousand kilowatt hours to TVA under that arrangement.

Senator COOPER. When you purchase power from TVA do you purchase it at rates which they ordinarily supply power to their chief customers and when you return power to TVA do you supply it at the rates at which you ordinarily supply it to your own customers?

Mr. DUNCAN. No, sir. This type of transaction that I have described ordinarily is on a split-the-savings arrangement if any money at all changes hands. In most instances there is no money actually changing hands between the parties at all.

In the situation where Kentucky Utilities supplies TVA emergency energy it is classed as energy TVA owes us and is returned under similar circumstances at another time. So, so far as these emergency transactions between us, very seldom if ever is a cash sum involved.

Now, so far as purchase of capacity and energy to supply the needs of our consumers, our arrangements with TVA do not include any such purchase at the present time.

Senator COOPER. Can you state whether or not there is a relative balance maintained in this exchange of power or is TVA required to call on Kentucky Utilities more than Kentucky Utilities is required to call on TVA?

Mr. DUNCAN. There is no substantial difference. In the long run I would assume the emergency transactions would pretty well balance out. The reason for that is that if at the present time, or at any time, the net balance in the emergency account indicates that Kentucky Utilities owes TVA some energy, TVA will be inclined to call on Kentucky Utilities rather than on some other adjacent company to assist in meeting a particular emergency with the result that over a period of time this emergency arrangement will pretty well balance out.

Senator COOPER. I believe Mr. Wagner testified that the power demands of TVA, doubled every 8 years.

Mr. WAGNER. We expect them to double every 10 years, it is about 7 or 8 percent a year.

Senator COOPER. Is that about the rate that the demand for Kentucky Utilities power increases? Is that the normal situation for any utility, whatever type it is.

Mr. DUNCAN. That is pretty close to the national average. If you look at a particular time variations will be noted, particularly in our case where we have undergone some trying times at the hands of public power in recent years and our growth has not been as great as it otherwise would have been. Generally speaking the national average increase of utility loads is somewhere in the vicinity of 8 percent per year; yes, sir.

Senator COOPER. Mr. Royce, do you have any questions?

Mr. ROYCE. Yes, Mr. Chairman, I do. Thank you.

Mr. Duncan, what is the rate you offer to Jackson Purchase as referred to on page 5 as rate "NPT"?

Mr. DUNCAN. That was a rate which was made available to all co-operatives in 1937 pursuant to an order of the Kentucky Public Service Commission in which, it is my understanding, the Kentucky Commission recognized that rural cooperatives were entitled to rates that produce something less than normal profit for the supplier. What I am saying is that this was a somewhat lower level of rates than was available to other consumers, wholesale consumers of KU at the time.

Mr. ROYCE. You state on page 5 and on page 6 of your prepared statement following that: "This offer was accepted,"—an offer to reduce rates—"by the other two cooperative customers of our company." When was this offer accepted by the other two co-ops mentioned on page 6?

Mr. DUNCAN. I don't have the precise dates. I will be glad to supply them. Generally my recollection was that it was accepted immediately upon being offered in 1950.

Mr. ROYCE. If you would supply that for the record, please.

Mr. DUNCAN. Yes.

(Subsequently the following information was supplied:)

Both Henderson Union RECC and Green River RECC accepted this rate 61 under contracts dated February 3, 1950.

Mr. ROYCE. What are the names of those other cooperatives mentioned?

Mr. DUNCAN. There are two cooperatives, Henderson Union Rural Electric Cooperative Corp. and Green River Rural Electric Cooperative Corp., both of whom have since terminated their service from our company.

Mr. ROYCE. Are their service areas contiguous to the TVA area?

Mr. DUNCAN. In part, yes, sir. TVA generally supplies service to cooperatives extending along the southern boundaries of these two co-ops that I have mentioned.

Mr. ROYCE. These two co-ops are now served by TVA?

Mr. DUNCAN. No, sir. They are now supplied by their own generating and transmission cooperative, Big Rivers Rural Electric Cooperative Corp. It began its initial operation the latter part of 1965.

Mr. ROYCE. Could you supply for the record the percentage of their long-term debt in relation to their net utility plant as you have supplied for the other cooperatives and also the relation of their net income to the interest on their debt, that is, comparable figures for those two cooperatives, as have been supplied for the other five cooperatives.

Mr. DUNCAN. Yes, sir, I may have that before me. Henderson Union, percent long-term debt to net plant in 1964 was 95.7 percent. Its interest coverage was 2.7 times.

Mr. ROYCE. Then they are in roughly a comparable position to the Warren and the Hickman-Fulton Co-ops with respect to the relation between income and long-term debt.

Mr. DUNCAN. Green River RECC in 1964 the long-term debt to net plant was 85 percent and interest coverage was 3.1 times.

Mr. ROYCE. Thank you, Mr. Duncan.

Now, do you know who operates in the area bounded on the west by the Jackson Purchase, on the east by the Tradewater River, and on the south by the TVA service area in this brochure presented by the Jackson Purchase people?

Mr. DUNCAN. Will you describe it again?

Mr. ROYCE. That little triangular area east of the Jackson Purchase on page 7.

Mr. DUNCAN. Kentucky Utilities Co. operates throughout that area, as does Henderson Union RECC.

Mr. ROYCE. There is another rural co-op operating in that area?

Mr. DUNCAN. Yes, sir.

Mr. ROYCE. And they are served by Kentucky Utilities?

Mr. DUNCAN. They were until the end of 1965. They began receiving service from the G. & T. Co-op around the first of the year.

Mr. ROYCE. Then, relevant to the proposed amendment, that area would be on pretty much the same grounds as the Jackson Purchase area, would it not?

Mr. DUNCAN. Yes, sir.

Mr. ROYCE. To your knowledge, is this interweaving of TVA and Jackson Purchase transmission lines a unique situation, or is this pattern in existence elsewhere and possibly in the area to which we have just referred?

Mr. DUNCAN. Frankly, I don't know the extent to which interweaving exists in the area to which Jackson Purchase has referred. But I am confident that with some 98 percent of the farms in Kentucky already supplied by some supplier, that irrespective of any new limits established for TVA service, there are bound to be numerous instances in which the facilities of a TVA supplier intersect or approach very close to the facilities of a non-TVA-supplied distributor.

Mr. ROYCE. Now, referring back to your previous interchange with Senator Cooper regarding the relations of Kentucky Utilities with TVA, these are just on an emergency power exchange basis; that is you do not purchase for resale from TVA except in relation to an emergency situation?

Mr. DUNCAN. That is rather generally the case. As I understand it, there is a real good reason for that. Ordinarily, any utility desiring to purchase a block of capacity of energy from another source does so on the basis that provided it has an opportunity to take advantage of that sort of arrangement over an extended period of years. At the present time it is my understanding that TVA is not in a position to supply a wholesale service to another utility on a basis that does not give TVA authority to regulate rates of that utility. So, from a practical standpoint there are few if any opportunities, for us at least, to purchase power from TVA over an extended period of time—the type of power that we could generate in our own plants or purchase from other investor-owned utilities.

Now, as I have indicated the interchange arrangement that we have with TVA does have a continuing component in which we each supply the other load centers and that takes place every day of the year and it has for a number of years. For energy we supply to TVA at a particular load center, TVA supplies us a corresponding energy at another location. Basically we do not have the type of purchase power arrangements with TVA that we have entered into with others.

Mr. ROYCE. One more question. Mr. Duncan, would you describe the role of Kentucky Utilities as intervenor in the pending litigation to which Senator Cooper made earlier reference between Jackson Purchase and TVA?

Mr. DUNCAN. I would like for Mr. Welch to respond to that. He is counsel in that case.

Mr. WELCH. This action was filed in July of 1962 I believe by Jackson Purchase in the State court, the McCracken circuit court in Paducah, Ky. Jackson Purchase filed a suit against TVA requesting a declaratory judgment that TVA could serve it power as I recall. Shortly after that Kentucky Utilities asked permission of the court to intervene as an additional defendant in the action. Since Jackson Purchase was Kentucky Utilities' customer, an adverse decision perhaps would have resulted in our losing that customer. We felt we had standing to intervene and we did intervene. I believe somewhat prior to the time we intervened, but it may have been afterward, the case was removed to the Federal court, the U.S. District Court for the Western District of Kentucky where it is now pending.

Mr. ROYCE. It is now pending in the Federal court?

Mr. WELCH. Yes.

Mr. ROYCE. Thank you, Mr. Chairman.

No further questions.

Senator COOPER. Do you have any other evidence you would like to present, Mr. Duncan, other than what you have presented?

Mr. DUNCAN. No; I would like to again express my thanks to the committee and to you personally for the opportunity to appear here today.

(Subsequently Mr. Duncan transmitted the following communication:)

KENTUCKY UTILITIES Co.,  
Lexington, Ky., June 30, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
New Senate Office Building, Washington, D.C.

DEAR SENATOR RANDOLPH: During the June 28 hearing of the Senate Public Works Committee on H.R. 15225, I was requested to supply the dates on which Henderson-Union Rural Electric Cooperative Corporation and Green River Rural Electric Cooperative Corporation first accepted Kentucky Utilities Company's Rate 61.

I am particularly happy to supply this information since it gives me an opportunity to correct an error appearing on pages 5 and 6 of my prepared statement presented to your Committee on June 28. Our rate 61 first became effective with its filing with the Kentucky Public Service Commission on January 20, 1950 instead of late in 1957. Both Henderson Union RECC and Green River RECC accepted this Rate 61 under contracts dated February 3, 1950.

Since this rate was initially offered to the Cooperatives in 1950 instead of 1957, the savings which could have accrued to Jackson Purchase RECC by its early acceptance thereof would have substantially exceeded the \$335,065 to which I testified before your Committee on June 28.

Since the hearing on June 28, I have had an opportunity to examine certain documents filed with the testimony of Mr. Hobart Adams, Manager of Jackson Purchase Rural Electric Cooperative Corporation, and respectfully request your Committee's consideration of the following comments relative to these documents.

On pages 23 and 24 of the booklet introduced by Mr. Adams, Jackson Purchase attempts to state, on page 23, and depict graphically, on page 24, "Direct Kilowatt Hour Sales of TVA in the Service Area of Jackson Purchase Rural Electric Cooperatives Corporation." Jackson Purchase has incorrectly included in this data sales by TVA to industries, including most substantial sales to the Atomic Energy Commission, which I respectfully insist do not constitute sales "in the service area" of Jackson Purchase. Jackson Purchase has also included substantial sales by TVA to its distributors in Carlisle, Graves, Marshall and Lyon Counties. Similarly, these sales by TVA distributors are not properly classified as "sales of TVA in the service area of Jackson Purchase."

Even on the patently incorrect theory that TVA sales to certain industries might constitute sales in the service area of Jackson Purchase, we further suggest that this tabulation and graph are misleading.

Jackson Purchase RECC expressly includes sales of TVA to the Atomic Energy Commission but do not include 6.5 billion annual kilowatt hour sales by Electric Energy, Inc. to the Atomic Energy Commission project at Paducah, which is jointly supplied by TVA and Electric Energy Inc. Kentucky Utilities Company is one of four Sponsors of, and owns a 20% interest in, Electric Energy, Inc.

Mr. Adams presented certain exhibits in connection with his testimony at the June 28 hearing. Among these is the document he referred to as "the 1961 Annual Report of the Board of Directors to the Members." Examination of this report, as well as the excerpts from certain minutes of the Jackson Purchase Board of Directors meeting clearly indicates that the first serious negotiation for TVA to supply Jackson Purchase took place early in 1959. The only negotiation prior to 1959 took place in 1946 and 1947 and was not consummated at that time; first, because "REA in Washington did not think the plan was feasible—and would not lend us (Jackson Purchase) the money to build the transmission lines that would be required." The report further notes that TVA could not supply Jackson Purchase with service until 1950. This being the case, it is evident that, as I indicated at the hearing in response to Sen. Cooper's questions, Jackson Purchase was, prior to 1959, quite satisfied with its arrangement with

Kentucky Utilities Company and did not, in fact, press any negotiation for service from TVA during a period of approximately twelve years prior to 1959.

On page 2 of his prepared statement, Mr. Adams says that making power available to Jackson Purchase would merely make TVA power available to the Rural Cooperative Members, the *only group* in the area now being deprived of that service. In addition, on page 3 of his statement, Mr. Adams states as a fact that TVA power is available to just about everyone in his service area except the customers of Jackson Purchase. Since Kentucky Utilities Company now serves approximately 2,500 consumers in this same area, Mr. Adams' statements are incorrect.

On Page 9 of his prepared statement, Mr. Adams claims that at no place in his service area does Jackson Purchase have a land boundary with the service area of any private power company. The presence of 2,500 consumers of Kentucky Utilities Company located throughout the area served by Jackson Purchase certainly constitutes a land boundary between his service area and that of Kentucky Utilities Company.

On page 9 of his statement, Mr. Adams indicates that he is "merely seeking a clarification of" the 1959 Amendment to the TVA Act. It is evident that the amendment he has proposed cannot be properly classified as a "clarification" of the law but instead constitutes a fundamental change in the TVA service area boundaries, which were so carefully worked out in the 1959 legislation, and would authorize TVA's expansion into an additional one thousand square mile area.

I respectfully request the Senate Public Works Committee's consideration of my additional comments set out in the foregoing.

Very truly yours,

W. A. DUNCAN, *President.*

Senator COOPER. May I make an announcement?

Chairman Randolph stated that the record would be opened through July 1. Anyone who wants to file any statement on this subject of course is authorized to do so. Also, if you wish to file a statement which goes to the testimony that has been given on either side, in answer or rebuttal or explanation, you are at liberty to do so. I do recommend that if you intend to file any material that you do it promptly so that the record will be available when the committee considers this matter.

I want to thank all of you for bearing with us. I thought it would be better to continue and complete the hearings rather than come back later this afternoon.

We will recess until Chairman Randolph orders us to convene again. (Subsequently the following statements were ordered printed:)

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION,  
Washington, D.C., June 24, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Senate Public Works Committee,  
U.S. Senate,  
Washington, D.C.

DEAR CHAIRMAN RANDOLPH: At the 1966 annual meeting of the National Rural Electric Cooperative Association, delegates representing our 980 member rural electric systems in 46 states unanimously passed a resolution in support of legislation to grant to the Tennessee Valley Authority additional revenue bond-financing authority; to remove the existing prohibition against interconnections with and exchange of power between TVA and other power systems; and to permit wholesale power service by TVA to those additional rural electric cooperatives within economic transmission distance who desire such service. Similar resolutions have been passed by the NRECA membership in previous years.

Your committee is currently considering bills which would assure the continued effective operation of the TVA power system by increasing the total amount of bonds which may be issued by TVA to finance necessary expansion of its facilities. We wholeheartedly support this proposal, but we strongly

urge that it be amended to permit the Jackson Purchase Rural Electric Cooperative Corporation of Paducah, Kentucky, to purchase TVA power.

Such an amendment would rectify the present glaring inequity which exists in this area. The Jackson Purchase Cooperative has repeatedly requested wholesale power service from TVA, only to be refused because of an alleged prohibition in the TVA Act. The plight of this rural electric cooperative, whose service area is crisscrossed with TVA transmission lines and dotted with TVA facilities, represents to us a complete frustration of the intent of the TVA Act and the entire Federal power program. Many of Jackson Purchase's consumer-members have had to relocate to make way for TVA facilities; others have TVA lines running past their homes and businesses.

There is no logical reason for the exclusion of Jackson Purchase from TVA service. Jackson Purchase is certainly within the TVA region, and the outer limit of the system is marked by the Ohio River—a convenient geographical boundary.

Further, in view of the interchange of power agreements entered into by TVA with investor-owned utility systems in surrounding states, which will move TVA power as far south as the Gulf Coast, it would appear to be reasonable to request that this rural electric cooperative system located within the TVA service area be permitted to obtain TVA power.

We respectfully urge you to end the present serious inequity which prevents Jackson Purchase from being served by TVA by appropriately amending the TVA financing bill which is now being considered by your Committee.

Sincerely yours,

CLYDE T. ELLIS,  
*General Manager.*

STATEMENT OF KENTUCKY RURAL ELECTRIC COOPERATIVE CORPORATION TO THE SENATE PUBLIC WORKS COMMITTEE IN SUPPORT OF AMENDING THE TVA SELF-FINANCING ACT TO INCLUDE JACKSON PURCHASE RURAL ELECTRIC COOPERATIVE CORPORATION AS A CONSUMER OF WHOLESALE POWER PROVIDED BY TVA

Mr. Chairman and members of the committee, the Kentucky Rural Electric Cooperative Corporation is the State Association of Rural Electrics, representing the rural electric cooperatives in Kentucky which serve approximately 265,000 users. In this statement, we are particularly interested in the welfare of Jackson Purchase Rural Electric Cooperative Corporation and its 11,000 member-owners.

We are grateful for this opportunity to provide a statement in support of the position taken by Jackson Purchase Rural Electric Cooperative Corporation (Jackson Purchase RECC) that the rural electric system should be included among those which receive their wholesale power supply from the Tennessee Valley Authority. We wish to go on record as urging this Committee to amend the TVA Self-Financing Act to include Jackson Purchase RECC as a consumer of TVA wholesale power.

Jackson Purchase REC is a rural electric cooperative in the Tennessee Valley with offices at Paducah, Kentucky. The Cooperative serves some 11,000 member-families, which include approximately 40,000 persons, residing in six Western Kentucky counties.

Jackson Purchase RECC includes an area located entirely within the geographical service area of TVA. It is surrounded by the TVA service area and at several points, TVA transmission lines cross the Jackson Purchase RECC service area. A TVA dam, a TVA steam plant, a large city that receives TVA power, and many TVA consumers are located within the Cooperative area.

It is difficult for the Jackson Purchase RECC members to understand why after so many years of effort they are still denied TVA power when they can stand at their homes and see so many TVA installations nearby. They fish and swim in TVA lakes \* \* \* TVA dams and steam plants are within easy view of their homes \* \* \* TVA transmission lines traverse the Jackson Purchase RECC area in every direction \* \* \* TVA lines reach into the Jackson Purchase RECC area to serve consumers \* \* \* their friends in Paducah, a city located entirely within the Jackson Purchase RECC service area, enjoy TVA service \* \* \* and yet in spite of years of continuous effort, they have been unable to obtain their wholesale power supply from TVA.

There are many instances in which the Jackson Purchase RECC member is denied TVA power and his neighbor who lives just across the street enjoys lower

power rates because he is served by TVA. TVA transmission lines may cross his property and in some cases he has had to move away from his home to make room for a TVA installation, yet he cannot enjoy the benefits of TVA power.

This is a difficult situation to explain to the general membership of Jackson Purchase RECC. It is inconceivable to them that with TVA power surrounding them and with TVA lines crossing through their service area, and often through property they own, why they should not enjoy equal benefits as others who live near them.

We believe that the request being made by Jackson Purchase RECC and its members is a reasonable one. The Cooperative and its members are victims of circumstances which have imposed unfair and unreasonable conditions upon them. We believe these conditions can only be cleared up by Congressional action.

To the members of Jackson Purchase RECC and to us, it is only reasonable that with the Jackson Purchase RECC service area located entirely within the TVA area—a small island, completely surrounded—the Cooperative should have TVA power.

With the exception of Jackson Purchase RECC, all rural electric cooperatives in Kentucky have met and solved their problem of an adequate wholesale power supply. Eighteen of the rural electrics receive their wholesale power from East Kentucky RECC, a generation and transmission cooperative with headquarters in Winchester, Kentucky; three receive wholesale power from Big Rivers RECC, a generation and transmission cooperative with headquarters in Henderson, Kentucky, and four receive wholesale power from TVA. A Tennessee rural electric, Tri-County REC, that serves more than 10,000 members in Kentucky, also receives TVA wholesale power. This leaves only Jackson Purchase RECC with the problem of unsatisfactory wholesale power supply.

All this has worked an undue and unjust hardship on Jackson Purchase RECC and its member-owners.

We believe that the amending of the TVA Self-Financing Act to permit Jackson Purchase RECC to purchase TVA power would eliminate an unreasonable situation that threatens the future growth and development of the Cooperative and the economic well being of its members. We strongly urge the members of this Committee to include this amendment in the TVA Self-Financing Act.

In support of this position, we are attaching a resolution which was passed at a regular meeting of the Board of Directors of Kentucky Rural Electric Cooperative Corporation which represents the viewpoints of the Rural Electric Cooperatives of Kentucky in regard to securing wholesale power for Jackson Purchase RECC from T.V.A.

We shall appreciate your consideration of this important problem.

J. K. SMITH,  
General Manager, Kentucky Rural  
Electric Cooperative Corp.

Excerpts from minutes of the Board of Directors meeting of Kentucky Rural Electric Cooperative Corporation (State Association of Rural Electric Cooperatives). In official meeting held Tuesday, June 16, 1964, the following resolution was adopted:

Whereas the Tennessee Valley Authority has refused to provide power to Jackson Purchase Rural Electric Cooperative and their approximately 10,000 members because of their interpretation of the T.V.A. Act, as relates to service areas, as amended by Congress in 1959, thus developing a disagreement between the Cooperative and T.V.A., and

Whereas Jackson Purchase Rural Electric Cooperative and its members desire clarification of the Act by Congress and that this can be accomplished through the adoption of an appropriate resolution by the U.S. Senate

Be it therefore resolved that we, the Rural Electric Cooperatives of Kentucky, acting through our State Association of Rural Electric Cooperatives, do hereby pledge our support to the Jackson Purchase Rural Electric Cooperative in this effort and request the support of our Senators, Senator John Sherman Cooper and Senator Thruston B. Morton in aiding the Jackson Purchase RECC to secure passage of the needed resolution.

/s/ W. E. GEVEDON,  
President.  
THOMAS BARKER, Jr.,  
Secretary.

NATIONAL COAL ASSOCIATION,  
Washington, D.C., June 30, 1966.

HON. JENNINGS RANDOLPH,  
Chairman, Committee on Public Works,  
New Senate Office Building, Washington, D.C.

DEAR CHAIRMAN RANDOLPH: Enclosed is a statement which we believe should be given serious consideration by you and the members of your Committee in your deliberation on H.R. 15225, which would increase the borrowing authority of Tennessee Valley Authority. We respectfully request that it be made a part of the record of the hearings on H.R. 15225.

In substance, we believe that TVA should be directed not to waste the scarce supplies of low-cost atomic fuel by using them in low-efficiency atomic plants in areas of the country where coal is abundant and low-cost. Otherwise, we believe, the Government will be improperly accentuating the problems of Appalachia while at the same time depriving high-cost fuel areas of an opportunity to reduce power-cost differentials.

We do not seek to apply this rule to the recently-announced TVA atomic plant, since TVA is already committed to this plant. However, the situation should not be made worse for Appalachia and for high-cost fuel areas by further decisions of this type, unless and until there are discoveries of sufficient supplies of low-cost uranium to meet requirements for a reasonable period of time.

Sincerely,

STEPHEN F. DUNN.

STATEMENT OF STEPHEN F. DUNN, PRESIDENT, NATIONAL COAL ASSOCIATION,  
WASHINGTON, D.C.

Mr. Chairman, Tennessee Valley Authority has recently decided to construct a 2-unit atomic power plant, with a projected net capacity of 2,129,000 kilowatts, at a cost of nearly \$250 million. This plant was selected instead of a coal-fired plant which would have cost about the same amount and which would have used about \$6,500,000 tons of coal per year.

TVA issued a 36-page document entitled "Comparison of Coal-Fired and Nuclear Power Plants for the TVA System." We understand this document is being made available to your Committee, and therefore will not quote it in detail. If the atomic plant works as well as expected, TVA figures it will save some \$8 million a year.

Much of this saving, we believe, is due to the fact that TVA does not have to pay Federal income taxes and can therefore use low-cost money on invested capital. The difference on fuel inventory alone accounts for about \$3 million of this saving. Savings of this type are not true savings to the national economy, since the burden thus "saved" must be passed on to tax-paying portions of the economy.

On the other hand, the atomic "savings," if realized, would be much greater for the national economy if this atomic fuel were utilized in a high-cost fuel area of the country rather than wasted in a low-cost fuel area. The reason for this is simple and basic: Coal is a low-cost bulk commodity, which suffers severely in cost comparisons when it must be transported great distances. Atomic fuel, on the other hand, has a relatively small transportation cost.

From the standpoint of the national economy, it makes good sense to conserve the limited supplies of low-cost uranium for those areas of the nation which, because of transportation costs, have the highest fuel costs. And the known supplies of low-cost uranium are extremely limited.

Early this month we published a "special report" entitled "Atomic-Fuel Reserves; How Serious is the Shortage?" A copy of this report is attached; we hope it will be made a part of the record of the hearings on H.R. 15225. Based upon published statements from official sources, the report shows the reserves of low-cost uranium are so small that:

(1) There is not enough low-cost uranium ore in the United States to assure fuel for the lifetime of the atomic power plants expected to be built by 1975. In all the world, the *known* reserves of low-cost uranium would produce the same amount of electricity as about one per cent of the 330-billion-ton U.S. coal reserves.

(2) The "breeder" reactor, when it is developed, will alleviate but will not eliminate the problem of a shortage of low-cost uranium. Only the unexpected discovery of vast quantities of low-cost uranium would substantially affect this problem.

(3) Construction of non-breeders, like the plant recently ordered by TVA, constitutes an economic waste—a "feeding of the seed corn to the hogs"—which is doubly undesirable since it has the effect of depriving high-cost fuel areas of the opportunity to use atomic fuel.

There are, of course, other considerations which should be taken into account also. The Government is spending large sums of money trying to cure the economic ills of Appalachia. It seems paradoxical that Government should deliberately deprive Appalachia of the job opportunities involved in the production and transportation of 6,500,000 tons of coal per year.

Then, too, we have the curious spectacle of Government, through AEC, bringing into existence an atomic power industry; Government, through TVA, building an enormous atomic power plant which the AEC says conceivably could cause billions and billions of dollars worth of damage in the event of an accident; and Government, through the Price-Anderson Act, saying that members of the public cannot collect more than \$560 million even if the damages caused by an accident exceed that amount by ten times ten.

We believe TVA's construction of the recently-announced atomic power plant is inimical to the national interest. However, we recognize that Congress has relinquished its control over the \$750 million bond authorization which will be used, in part, to pay for this plant. We therefore do not ask that you try to make TVA cancel commitments for this plant. On the other hand, TVA will be adding to its generating capacity each year about 1,500,000 kw—financed in part from power revenues and in part from the additional \$1 billion bond authorization provided in H.R. 15225.

We therefore urge that you amend H.R. 15225 to provide for cancellation of the additional \$1 billion bond authorization if TVA uses any part of that amount or any revenues from power to construct any additional atomic power plants (other than the one recently announced), *unless and until the AEC shall find and proclaim that additional supplies of low-cost uranium (\$10 per pound of yellowcake or less) have been discovered in quantities sufficient to supply the plant lifetime needs of atomic power plants projected to be placed in operation in the next 20 years.*

In making this suggestion, we are of course motivated by concern for the coal industry. Nevertheless, we believe that this course of action is consistent with the public interest. It would further the Government's desire to help the economy of Appalachia. It also would redound to the benefit of the high-cost fuel areas of the Nation.

Without recycling of plutonium (which should be saved to start the breeder system of the future), the TVA atomic plant will use about 17,000 tons of uranium concentrates during its 35-year life, if operated at 85 per cent plant capacity. This represents about 11 per cent of the 145,000 tons of uranium concentrates known to be available in U.S. reserves as of January 1, 1966. If everything goes as well as expected, and this fuel is cheaper than coal—then it should be conserved for uses most beneficial to the nation. It is contrary to the national interest to waste it in the lowest-cost coal area of the country, and not to conserve it for use in high-cost fuel areas like New England, California and Florida.

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NATIONAL COAL ASSOCIATION,  
Washington, D.C., June 9, 1966.

Memo to: Persons interested in the future of the coal industry.

From: Stephen F. Dunn.

Subject: Shortage of uranium reserves.

Recently official information has become available enabling translation of uranium reserves into terms of power output. Using this information, we have prepared a comprehensive analysis, in the form of a special report, of the extent to which atomic power growth will be limited by shortage of uranium.

A copy of the special report is enclosed. We believe it contains factual information which is extremely reassuring with respect to the future growth of the coal industry. Additional copies are available upon request.

Because of the complexity of the subject, we are summarizing in this memorandum some of the conclusions which can be drawn from the data set forth in the special report.

There is not enough low-cost uranium ore in the United States to assure fuel for the atomic power plants expected to be built by 1975. In all the world, the assured reserves of low-cost uranium would produce the same amount of electricity as about one per cent of the 830-billion-ton U.S. coal reserves.

Coal will not lose the utility market to atomic power; there isn't enough low-cost uranium for that to be possible. In fact, substantially increased tonnages of coal will be required for the foreseeable future.

Utilities now must face the question of whether to invest \$60 million to \$100 million in an atomic power plant without assurance that it will have fuel to operate more than 10 years. Advancing technology has made the projected cost of atomic power competitive with coal-fired power in some areas, and the number of atomic plants announced for construction has spurted ahead this year faster than most experts predicted. This, in turn, has greatly increased the demand for uranium.

An electric utility can sign a contract dedicating coal reserves for the entire life of a new power plant, generally 30 years. If it does the same with fuel for atomic plants now forecast, the known supplies of low-cost uranium will be completely tied up in the near future.

Utilities have already announced plans to build 10 million kilowatts of atomic plant capacity by the end of 1970. If only 10 per cent of the new steam-driven electric plants after 1970 use atomic power, all the reasonably assured reserves of low-cost uranium ore (\$5 to \$10 a pound of concentrate) will be committed by 1975. If 60 per cent of expected new power capacity after 1970 uses nuclear energy, it would require commitment by 1986 of all known U.S. reserves costing to \$30 a pound, including those classified as "possible additional reserves."

The European Nuclear Energy Agency believes that most U.S. uranium found in the future will be deeply buried and more costly. A leading producer of uranium in the United States told Congress this year that he believes "a very high percentage" of the uranium ore in this country "has been already discovered."

As for importing uranium, Rafford L. Faulkner, AEC director of raw materials, said in a recent speech that foreign production facilities are limited and the rest of the free world will need more uranium than the U.S., "so that we ought not to place substantial reliance on meeting domestic needs through imports."

AEC is working to develop a "breeder" reactor, which in theory would form more new fissionable material than it would consume. Expert witnesses told Congress this year that breeder reactors—and the power they produce—may be more costly than in the case of the present reactors. Furthermore, they will not cure the uranium shortage. Most authorities predict a breeder reactor will require 15 to 25 years to replace its own fuel load and produce enough to start another reactor of the same size—but the electric power industry is doubling its output every 10 years.

AEC still has uranium in the stockpile, but how much of this might be available for utility consumption is unknown at this time. Certainly a comfortable reserve should be maintained in stockpile to take care of future weapons needs, including technological developments, and to take care of the power needs of the nuclear navy of the future.

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[Special Report by the National Coal Association, Washington, D.C., June 1966]

#### ATOMIC-FUEL RESERVES

##### HOW SERIOUS IS THE SHORTAGE?

Proponents of atomic power frequently state that atomic fuels represent an inexhaustible reserve of low-cost energy, one that will supply mankind for thousands of years to come. But many knowledgeable persons, including representatives of the Atomic Energy Commission, warn of an impending atomic fuel shortage unless substantial new reserves of uranium are found in the near future. What is the situation?

After studying publicly-available authoritative information, the NCA staff has concluded that *known* reserves of low-cost uranium and thorium are very limited and that atomic power cannot replace coal as the major utility fuel for decades to come, unless unexpected large discoveries are made very soon. The basis for our conclusion is set forth in this report.

#### BACKGROUND

Many authorities speak of "uranium ore" when they really mean "concentrates resulting from uranium ore." There is a great difference. To provide better

understanding of the relationship between atomic fuel reserves and consumption presented in this report, an explanation of the differences between the as-mined uranium ore and the material used as fuel in the atomic power plant is appropriate.

Uranium-235 is the "burnable" fuel in light water reactors—the sort now being built for commercial power production. While only a small quantity of this fuel is needed to produce the heat energy at a power plant, many tons of uranium ore must be processed to produce it. The uranium rock is mined, crushed and the resulting powder is leached twice in acid baths, and uranium oxide ( $U_3O_8$ ) is precipitated in concentrate form known as "yellowcake." One short ton of raw uranium ore yields about five pounds of yellowcake; or stated another way, it is necessary to mine 400 tons of uranium ore to produce one ton of yellowcake.

Yellowcake is then converted to a "feed material" through another chemical process; 100 pounds of yellowcake produce about 85 pounds of "feed material," which contains only 0.7 per cent of "burnable" fuel, uranium-235 (U-235). The remaining 99.3 per cent of the feed material is uranium-238 (U-238), a "fertile" rather than a "fissionable" isotope.

Since the reactors now being used for power generation in the United States require enriched uranium, that is, fuel in which the percentage of U-235 is about 2.5 per cent, a fourth processing, enrichment, is necessary. In this enrichment step, performed in one of three billion-dollar plants owned by the Government, the uranium is converted to a gaseous compound and pumped through a series of porous barriers, or sieves, which gradually enrich the mixture to the required 2.5 per cent of burnable U-235.

While uranium ore is the beginning and uranium-235 is the final fuel, uranium reserves are specified in terms of one of the intermediate products of the processing—yellowcake. The extent of the reserves on a world-wide basis has been published and will be discussed later in this report. But, in order to be able to compare the reserves with the fuel requirements of future atomic plants, it is necessary first to establish the amount of atomic fuel, in terms of yellowcake, required for some unit of electric generation, say, per megawatt. The necessary data to make this determination are not readily available from published literature.

However, Rafford L. Faulkner, director of the Atomic Energy Commission's Division of Raw Materials, said in a speech at Moab, Utah, May 6, 1966, that on the average each electrical megawatt (1,000 kilowatts) of installed atomic generating capacity requires about one short ton of yellowcake for the initial loading; and without plutonium recycling, 0.20 ton of yellowcake is required per megawatt per year as additional fuel. If the plutonium is recycled, the additional yellowcake requirements after start-up amount to about 0.15 ton per megawatt per year, Mr. Faulkner stated.

What is "plutonium recycling"? When the enriched fuel, described previously as a mixture of 2.5 per cent U-235 and 97.5 per cent U-238, is used in a light water reactor (the kind being sold today—Oyster Creek, Dresden 2, etc.), the U-235 is the burnable fuel. But in the "burning" process, a small amount of the mixture is converted to plutonium, which can be recovered through chemical reprocessing of the used fuel element. Since this plutonium, like U-235, is burnable, it theoretically can be substituted for part of the new U-235 required to keep the atomic power plant going. The technology to do this is not available today, but is expected to be in the near future; therefore we have assumed in all our calculations on the availability of reserves, that such recycling will be practiced. From Mr. Faulkner's figures, then, and assuming plutonium recycling, we determine that over the expected 30-year life of an atomic power plant, operating at 80 per cent plant factor, 5.5 tons of yellowcake will be required per megawatt of capacity.

#### FUEL DEMANDS VERUS KNOWN RESERVES

Using this estimate of 5.5 tons of yellowcake required for each megawatt of generating capacity, we can evaluate the known reserves of atomic fuel as expressed in tons of yellowcake.

The European Nuclear Energy Agency (ENEA) made an exhaustive study of the uranium and thorium reserves and in August, 1965, published its findings under the title "World Uranium and Thorium Resources." ENEA listed the reserves under categories of "reasonably assured" and "possible additional"

reserves in three price ranges: \$5 to \$10 per pound of yellowcake, \$10 to \$15 per pound, and \$15 to \$30 per pound. The uranium reserves, as estimated by ENEA, are shown in Table 1 of this report.

However, while the ENEA study shows the U.S. uranium reserves of reasonably assured yellowcake at \$5 to \$10 per pound to be 195,000 tons, the Atomic Energy Commission's most recent annual report shows that as of January 1, 1966, the United States had such reserves amounting to only 145,000 tons. The difference is probably accounted for by the substantial quantities of ore which have been mined since the data were obtained by ENEA plus the fact that ENEA included 20,000 tons possibly recoverable as a "by-product from phosphate operations."

Another atomic fuel, thorium, like uranium, occurs in nature and is fissionable (i.e., it will burn in an atomic reactor). At present, it is used only as a fuel for research reactors which are either built and operated by the AEC or largely subsidized by the Government. While thorium has not yet been found suitable for use in commercial atomic plants, the reserves are of possible importance, and the ENEA study of these reserves is summarized in Table 2.

How do the known reserves of atomic fuel compare with the future demand based on the estimated growth in electric power generation, and assuming this growth will be shared by fossil and atomic fuels? The situation on uranium is illustrated graphically in Table 3, wherein we have (a) assumed that the total atomic generating capacity will be 10 million kilowatts<sup>1</sup> by 1970, and (b) that each year thereafter the atomic share of new generating capacity<sup>2</sup> will be 10, 20, 40, or 60 per cent of the total new thermal generation installed each year. The horizontal lines on the chart indicate some of the more significant levels of reserves of uranium shown in Table 1. The points at which the sloping growth lines cross the reserves lines indicate the year in which the reserves reach full commitment.

Examination of the chart indicates the following:

a. Even if the capacity of atomic plants installed after 1970 amounts to only 10 per cent of the total new thermal plants estimated, all the "reasonably assured" reserves of low-cost uranium ore (between \$5 and \$10 per pound of yellowcake) will be committed by 1975.

b. If the atomic installations amount to 20 per cent of the new plants, all the "reasonably assured" reserves available at less than \$15 per pound of yellowcake will be committed by the year 1978.

c. The claim by some experts that new plant installations will be "taken over" by atomic fuel after 1970 is refuted by the line showing that if the take-over amounts to 60 per cent, *all known* uranium reserves (including reasonably assured and "possible additional" reserves) in the United States, available at *less than \$30 per pound of yellowcake*, will be committed by about 1986.

As is indicated in Table 2, the "reasonably assured" reserves of low-cost thorium in the United States are less than uranium. While the ENEA report indicated that the "possible additional" thorium reserves may be greater than now known, the usability of thorium in the type of power plant now being built is dependent upon the development of technology unknown today. Therefore, since they cannot now be used, no attempt has been made to chart the exhaustion of thorium reserves.

The problems involved in utilizing thorium are illustrated by the following statement taken from FCP's 1964 National Power Survey:

"Thorium available in a natural state is mostly composed of thorium isotope 232 (Th-232), which generally does not fission but which is fertile and can be converted to uranium isotope 233 (U-233), which can fission and release energy. However, considerable time and effort may be needed to develop processes to cope with the radioactivity which accompanies U-233 before that material can be utilized at low cost."

#### HOW MUCH MORE URANIUM WILL BE FOUND?

It is sometimes said that vast new quantities of uranium will be found with a resumption of efforts to find it. Is this assumption a reasonable certainty?

<sup>1</sup> If announced construction schedules are maintained, there will be slightly over 10 million kilowatts of nuclear capacity in operation by the end of 1970.

<sup>2</sup> Private communication from leading equipment manufacturers. The computations were based on FPC predictions, corrected for replacements.

The European Nuclear Energy Agency, in its 1965 study of world reserves, made this statement:

"As surface prospecting has already been extensive in the Western United States, it is doubtful that many outcropping uranium deposits remain to be discovered. In the future, new districts will be more difficult to find, exploration will be deeper and more costly and mining costs will be generally higher, because of the greater depths of the deposits."

Speaking before the Joint Committee on Atomic Energy this year, Richard D. Bokum II, president of United Nuclear Corp., said:

"If our projections are correct and the utility companies continue to buy reactors on the basis that they bought them for the last nine or ten months, sometime in the mid 1975's if you give a thirty year life of these reactors, all the reserves that this country now has including the Government stockpile will have been committed \* \* \*

"I am not trying to consider myself just as a mining company, looking at it from a narrow point of view. I am looking at it from the utility industry point of view, through the utility industry eyes to where they are not putting up a hundred million dollars worth of money and are not assured of a supply for thirty years \* \* \* I don't really see any problem with Government stockpiles. I think we will need all the uranium we can get hold of. Anybody who does not believe this is not realistic in the face of what has happened in the last nine years."

Questioned as to his opinion on how much additional ore might be found in the United States, Mr. Bokum replied:

"I say that a very high percentage of the ore in this country I believe has been already discovered."

#### WILL WE IMPORT URANIUM?

The "reasonably assured" reserves of low-cost uranium in the free world, as reported by European Nuclear Energy Agency, have been noted previously. The U.S. has about 30 per cent of the total; Canada about 32 per cent; South Africa (which cannot speed up production because uranium is a by-product of gold mining) about 21 per cent.

While Canada has large supplies of uranium in excess of its own needs, it is the only country in that position, and its supplies will hardly be adequate to take care of European and Japanese needs for a long period. The combined uranium needs of the rest of the free world are expected to exceed those of the United States. Again quoting Mr. Faulkner of AEC:

"Although substantial reserves of uranium are known abroad, production capacity is limited. This is particularly true of South Africa which has almost one-third of the known non-Communist world reserves. Furthermore, taking into account reactors using both natural and enriched uranium, foreign needs (excluding Communist countries) are expected to exceed U.S. requirements, so that we ought not to place substantial reliance on meeting domestic needs through imports."

The "Financial Post," published in Toronto, Canada, carried in its issue of April 30, 1966, an article titled "Great Uranium Hunger May be Bigger than Expected." After quoting Eric H. Smith of General Electric Co. as saying, "We are not concerned with a possible uranium shortage," the article discussed the contrary view of D. H. L. Buntain, of Burns Bros. & Denton, Ltd., Toronto. Mr. Buntain's view can be summarized as follows: If utilities building atomic power plants insist on dedication of a 20-year supply of fuel, then by 1978 the free world will need to find additional atomic fuel supplies equal to about half of the "reasonably assured" reserves presently believed to exist.

The following excerpt from "Nuclear Industry" for May, 1966, further indicates that there is a growing world-wide awareness of the impending shortage:

"Reports to *Nuclear Industry* from abroad confirm that organizations who have been testing the uranium market in the U.S., and in Canada and South Africa as well, have found that price quotations have risen sharply in the last year, particularly in the last six months, and that in general, producers are reluctant to enter even moderately long-term fixed price contracts except at prices that would have been considered high a year or so ago."

#### URANIUM FROM THE SEA

Sometimes the claim is made that uranium in unlimited quantities will be available from the sea at \$20 a pound. This arises out of a study published by

some British scientists. The ENEA report discusses the British study in the following terms:

"It has been shown that uranium can be extracted from sea water, and research carried out in the last few years in the United Kingdom, at and under the auspices of the Atomic Energy Research Establishment at Harwell, has led to estimates of the cost of extraction of less than \$30 per lb. *Other estimates based on preliminary analysis of the Harwell work, however, indicate cost in excess of \$100 per lb.*" (Emphasis supplied)

#### GOVERNMENT STOCKPILE—WHAT HAPPENS TO IT?

From foreign and domestic sources, the AEC has purchased approximately twice as much uranium as is available from "reasonably assured" domestic sources. The purchases from foreign sources were made under contracts signed before enough domestic reserves were found to meet defense needs. Undisclosed amounts of the uranium purchased by the AEC have been used to make weapons and to fuel atomic-powered naval vessels. About 40,000 tons more will be purchased from domestic mines before the purchase program is over.

At present, utilities lease this material from the AEC and pay for the amount consumed at the government's purchase price (without any increase to cover the interest charge for years of Government ownership). In a few years, under the private-ownership law enacted two years ago, this leasing will end. The question then will be: Will the AEC continue to sell uranium from the stockpile to utilities, and if so—how much and at what price?

The latest published position of the AEC on this is Chairman Glenn T. Seaborg's statement during the 1964 hearings on private ownership of uranium:

"As I mentioned earlier, after toll enriching begins, the AEC plans to sell enriched uranium in a manner which does not jeopardize the uranium-producing industry and does not impose on the nuclear power business the historical cost (including interest) of material purchased for defense purposes. Nor should this material be sold at a price that could be called a subsidy for nuclear power. Furthermore, the AEC should neither hold indefinitely a large uranium inventory in excess of Government needs nor dispose imprudently of this valuable national resource. Beyond 1969, in the light of recent optimism regarding the cost of nuclear power and the resulting increased probability of rapid growth in uranium requirements in the 1970's, there are indications that the demand for uranium and the probable market price should support significant sales of AEC stocks, perhaps starting in 1975."

It is assumed that the AEC will retain enough uranium to meet foreseeable weapons needs—including a comfortable margin to cover technological developments. Presumably, also, the AEC will keep a long-term supply for existing atomic submarines and ships and for the nuclear-powered navy that Congress is insisting be built. Whether this will leave any uranium, over and above existing commitments to domestic and foreign power plants, only the AEC can say. If there is any left, it would seem that the AEC should add the carrying charge represented by the interest rate on the national debt, for the time between acquisition and sale; otherwise, the Government will suffer a net loss.

The question of mineral stockpiles has stirred controversies in the past. Whether the Government will make a profit or suffer the "interest" loss on uranium stockpiles is not known, but excerpts from the Joint Committee's report on the AEC's fiscal year 1967 appropriation authorization bill show the matter will receive attention:

"Since 1946, the AEC has spent approximately \$5.4 billion to purchase uranium from domestic and foreign sources. The vast bulk of this material has been used in connection with the military aspects of the atomic energy program. However, an increasing amount is being used for civilian applications, primarily in central station nuclear powerplants \* \* \*.

"During the course of the authorization hearings the committee received considerable testimony from the AEC and others concerning domestic reserves of uranium, and requirements for uranium stemming from the rapidly expanding civilian nuclear power program. Clearly, this subject deserves the closest scrutiny by the executive and legislative branches of the Government, as well as all segments of the nuclear industry \* \* \*.

"These statistics are obviously quite significant from the standpoint of our uranium reserves. A large expansion in these reserves is necessary in order to support the presently forecast requirements of the civilian nuclear power pro-

gram. However, the history of the uranium program illustrates how the operation of the law of supply and demand can result in the discovery of substantial new deposits of sought-after material, and its delivery to potential customers \*\*\*

"The authorization hearings also brought out the close relationship between the AEC's uranium procurement program and the AEC's plans for distributing enriched uranium to private industry, whether by lease, sale, or through a uranium enrichment service. Obviously, the AEC's uranium procurement and distribution policies can have a very significant impact within the uranium mining and milling industry itself. *The committee expects to inquire further into these and other subjects when the AEC submits its proposed criteria for furnishing uranium enrichment services, as required by law.*" (Emphasis added)

It would appear that now is the time for the coal industry to become active in the prevention of unwarranted government assistance to atomic-fuel-starved plants of the future rather than to wait until a shortage occurs which will force government rescue.

#### EFFECT OF ATOMIC FUEL PRICE ON THE COMPETITIVE POSITION OF COAL

In Tables 1 and 2, the reserves of atomic fuel are shown for various cost categories. The competitive position of coal is related to these costs.

In competition with atomic power, coal's delivered price is weighed against the sum of many factors: (a) capital cost advantage of a coal-burning plant compared to an atomic plant; (b) cost of the atomic fuel consumed; (c) cost of preparing the atomic fuel for use in a reactor, including enrichment and fuel element fabrication; (d) carrying charges (usually about 10 per cent per year, for an investor-owned utility) on the extra investment in fuel required for an atomic plant; (e) a coal plant's advantage in the cost of operation and maintenance, other than fuel; (f) cost of reprocessing the used atomic fuel; and (g) credit for the plutonium produced. The cost of uranium oxide (yellowcake) is, therefore, only one of the factors that must be considered in coal versus atomic power competition, but it is significant. Based upon current estimates of the cost of power which will be produced in atomic plants being ordered today, the "coal competitive" figure which represents the sum of all of these factors appears to be about 19 to 23 cents per million Btu—for simplicity, let's say 21 cents per million Btu.

In current light water reactors, the atomic fuel at \$8 per pound of yellowcake appears to represent about 5 cents per million Btu in terms of competitive coal cost. A price increase in yellowcake to \$16 per pound would therefore increase the total atomic fuel cycle cost an amount which would enhance coal's competitive position by about 5 cents per million Btu, or to a total of about 26 cents. A further increase in atomic fuel cost to \$24 per pound of yellowcake would improve coal's competitive position by about 10 cents per million Btu, to a total of about 31 cents; an increase to \$32 would improve coal's competitive position by about 15 cents per million Btu, to a total coal competitive cost of about 36 cents.

Improvements in atomic power technology, such as cost reductions in processing, fuel element fabrication, etc., could offset to some extent rising uranium prices, but it would appear safe to assume that atomic fuel costing more than \$30 per pound of yellowcake will not be used in light water reactors until the supply of low-cost coal is exhausted—a very remote possibility, considering U.S. coal reserves at more than 800 billion tons. For that reason, no consideration has been given here to the reserves of extremely high-cost atomic fuel, estimated by experts as being available in vast quantities throughout the world as uranium in common granite and other rock formations.

#### WILL THE BREEDER REACTOR ELIMINATE THE ATOMIC FUEL RESERVE PROBLEMS?

It is theoretically possible to obtain a great deal more energy from uranium than is now released in present types of atomic power plants with a "breeder" reactor. When, and if, a "breeder" is successfully developed, 80 to 100 times as much energy may be released from uranium by converting substantially more of the "fertile" uranium-238 into a fissionable material. This type of reactor is called a breeder because, in theory, it will form ("breed") more new fissionable material than is consumed in the operation of the plant. Because of this recog-

nized potential, the public is frequently assured that uranium reserves constitute no problem at all; that the shortage, if there is one, will disappear when breeder reactors come into operation. But it is not that simple.

A "breeder" will be *technologically* feasible within a relatively few years—perhaps 15, perhaps 30. The federal government can, and will, sponsor the research to bring this about. But the question of *economic* feasibility is something else. Extremely complex problems are involved in the "breeder" reactor concept, problems which may result in such high power cost that breeders will not be able to compete with non-breeder reactors or with conventional plants until near exhaustion of fuel reserves results in big fuel price increases.

To appreciate some of the problems involved in the development of a safe and economical breeder reactor, one need only to study the testimony presented to the Joint Committee on Atomic Energy in the hearings held this year on AEC authorizing legislation for fiscal year 1967.

Dr. Frederic de Hoffman, president of General Atomic Division, General Dynamics Corp., stated, in part:

"Discussions concerned with breeder reactors often tend to be misleading for two reasons: (1) It is often implicit in the discussion that the capital cost of fast reactor systems of any kind can be made as low as thermal reactors, which is not necessarily so. I personally believe this assumption is a very dangerous one to make as a generality for fast reactors. Fast reactors of necessity are likely to have greater safety problems associated with them—certainly during the early years of their existence. In fact, to my mind, the capital costs for fast reactors may well remain more expensive than thermal reactors for a good number of decades.

"(2) It is often assumed that better use of resources necessarily implies lower fuel cycle costs, which is by no means necessarily so. Fuel cycle costs are, of course, influenced by the cost of the fabrication and reprocessing of the fuel elements as well as by the cost and the credit for the fissionable material in the fuel cycle. For the near future, fabrication costs of fuel elements per kwh of electricity produced are likely to be lower for thermal reactor systems than for fast reactor systems \* \* \* I have merely touched upon the subject to make it clear that we cannot today legislate that fast reactors will indeed have a lower power cost than advanced converters."

In the same hearing, Dr. Walter H. Zinn, vice president of Combustion Engineering, Inc., stated:

"Fast breeder reactors basically have two kinds of problems—those that fall into the economic area and those which can be called safety problems. It is unfortunately true that both the economic and safety problems become easier to solve if the breeding performance or the fuel utilization performance of the reactor is allowed to deteriorate. It may be relatively easy to develop a reactor which nominally is a breeder—even one which shows a substantial breeding gain. But to solve the problem of a breeder with a high enough breeding gain and a low enough inventory requirement to make possible a rapidly expanding nuclear power industry without exhausting the supply of economical, usable, uranium is a very difficult technical problem \* \* \*

"It must be recognized that several generations of plants may be needed before achieving the goal of overall satisfactory economics and of making a real contribution to the resource question."

The possibility of breeder reactors multiplying the usability of known atomic fuel reserves is related to the degree of "gain" possible in such reactors. "Gain" is the expression used to designate the amount of fissionable material produced above that consumed, and as Dr. Zinn of General Electric pointed out (see above), the higher the gain the greater the problems related to safety and economics.

The gain of a breeder is often referred to in terms of "doubling time"; the period of time it will take the breeder to double the original amount of burnable material, thus permitting construction and fueling of another breeder of the same size. Most predictions by authorities at present center about a doubling time of 15 to 25 years. Since the predictions for future growth of electric power generation call for a doubling of capacity every 10 years, the "doubling time" of 15 to 25 years predicted for the early breeder reactors will not materially reduce the draw-down in atomic fuel reserves during this century.

The Atomic Energy Commission put it another way, in its 1962 Report to the President:

"Operating on plutonium or uranium-233, fast or thermal breeders will have respective net annual production rates of about 3 to 4% of their fuel inventory. This annual increase is less than the 6% per year required to provide the fuel needed for fast breeder construction to keep up with the growth projected for electrical power generation, and far less than that required to overtake it."

On the subject of the "breeder" and the uranium supply, AEC's Mr. Faulkner said:

"Concern has been expressed by some uranium producers over the effect on the market of the development of breeder reactors—reactors which produce more fissionable material than they consume. It does not appear that this is likely to have any major effect on uranium requirements during the time period under discussion. At some later date, however, their ability to breed fissionable material will have its effect upon the uranium market. Some very long-term projections have shown a leveling off and decline in uranium needs toward the end of the century. But trying to predict 35 years ahead is difficult, and it seems to me that predictions of a sweeping down-turn in requirements even that far in the future could turn out to be off the mark. In any event, it seems premature at this point to worry about a long term decline in requirements. Our concern now should be to demonstrate to the nuclear industry that an adequate supply of reasonably priced uranium will be available in time to meet the requirements of the next 15 years."

#### SUMMARY AND CONCLUSIONS

(1) Reasonably assured reserves of low-cost uranium are extremely limited. In the entire free world, these reserves are sufficient to produce the amount of electricity which can be produced by about 1 per cent of the coal reserves of the United States alone.

(2) The demand for uranium will be much greater in the near future than anyone thought it would be just two or three years ago.

(3) The shortage of low-cost uranium is sufficiently serious to cause real concern to a utility trying to decide between a coal-fired plant and an atomic plant.

(4) A utility today can enter into a contract dedicating coal reserves for the life of a power plant. If this same procedure is followed with respect to atomic plants, the known supplies of low-cost uranium will be completely tied up in the near future.

(5) Utilities now must face the question of whether to invest from \$60 million to \$100 million in an atomic power plant without assurance that it will have fuel to operate more than 10 years. Unlike a conventional fuel plant, which can be constructed to switch from coal to oil to gas and back again, atomic plants can't operate without atomic fuel.

TABLE 1.—Free world uranium resources

[In thousands of tons]

	At \$5-\$10 per pound U <sub>3</sub> O <sub>8</sub>		At \$10-\$15 per pound U <sub>3</sub> O <sub>8</sub>		At \$15-\$30 per pound U <sub>3</sub> O <sub>8</sub>	
	Reasonably assured	Possible additional	Reasonably assured	Possible additional	Reasonably assured	Possible additional
United States.....	<sup>1</sup> 195	325	150	200	170	440
Canada.....	210	290	130	170	100	200
South Africa.....	140	-----	-----	-----	-----	-----
Europe.....	60	51	366	106	150	460
Other free world.....	37	15	38	27	9	-----
Total.....	642	681	684	503	429	1,100

<sup>1</sup> AEC annual report shows U.S. reserves as of Jan. 1, 1966, to be 145,000 tons.

Source: "World Uranium and Thorium Resources," European Nuclear Energy Agency, August 1965.

TABLE 2.—Free world thorium resources

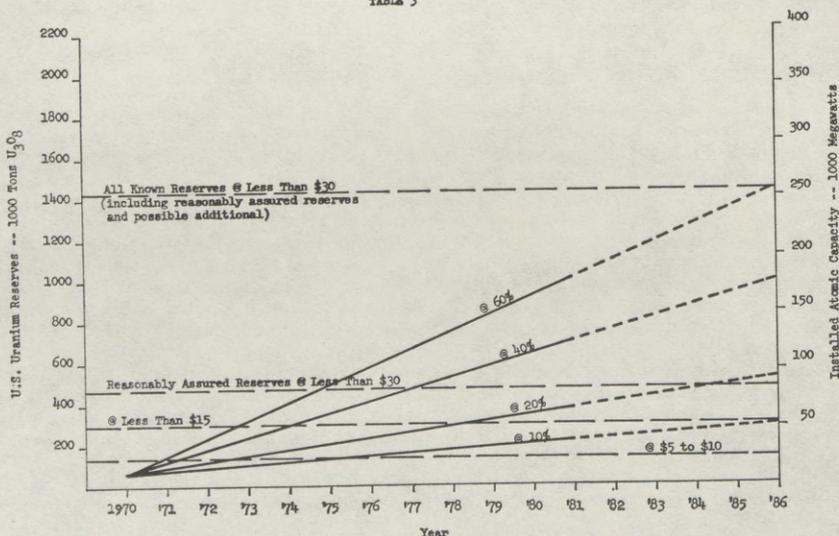
[In thousands of tons]

	At \$5-\$10 per pound ThO <sub>2</sub>		At \$10-\$15 per pound ThO <sub>2</sub>		At \$15-\$30 per pound ThO <sub>2</sub>	
	Reasonably assured	Possible additional	Reasonably assured	Possible additional	Reasonably assured	Possible additional
United States.....	100	500				
Canada.....	80	155				
South Africa.....	50	50				
Europe.....	15	-----				
Other free world..	320	270				
Total.....	565	1 975				

<sup>1</sup> The ENEA report states, "It is not unlikely that the total of the possible additional resources in all countries of the world exceeds by an order of magnitude that obtained simply by adding up the figures in the table."

Source: "World Uranium and Thorium Resources," European Nuclear Energy Agency, August 1965.

TABLE 3



RELATIONSHIP OF POSSIBLE GROWTH IN ATOMIC POWER TO KNOWN U.S. RESERVES OF URANIUM

(Whereupon, at 2 p.m. the subcommittee recessed, to reconvene subject to the call of the Chair.)

TABLE 2.—FIXATION OF BOND IN THE STATE

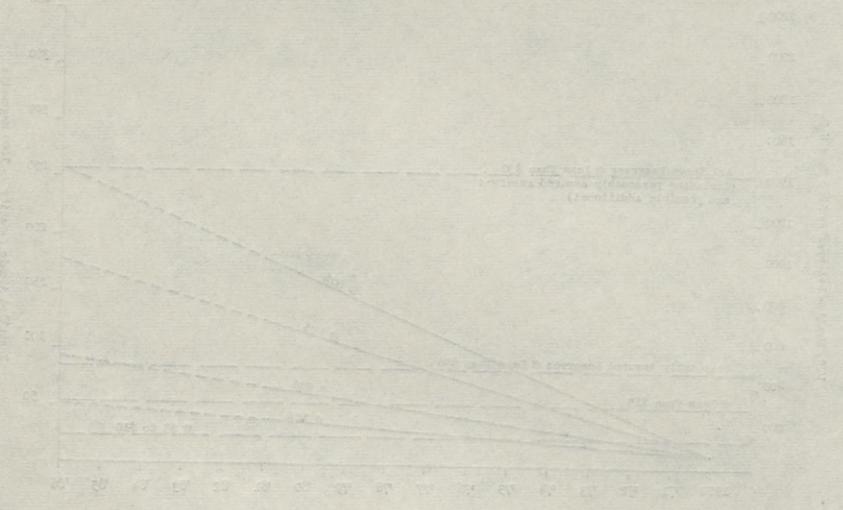
(In millions of dollars)

As far as possible, the figures in this table are based on the data furnished by the State Comptroller of the Treasury.

Year	Total amount of bonds fixed	Amount of bonds fixed by the State	Amount of bonds fixed by the municipalities	Amount of bonds fixed by the State and municipalities
1901	100	40	60	100
1902	100	40	60	100
1903	100	40	60	100
1904	100	40	60	100
1905	100	40	60	100
1906	100	40	60	100
1907	100	40	60	100
1908	100	40	60	100
1909	100	40	60	100
1910	100	40	60	100
1911	100	40	60	100
1912	100	40	60	100
1913	100	40	60	100
1914	100	40	60	100
1915	100	40	60	100
1916	100	40	60	100
1917	100	40	60	100
1918	100	40	60	100
1919	100	40	60	100
1920	100	40	60	100
1921	100	40	60	100
1922	100	40	60	100
1923	100	40	60	100
1924	100	40	60	100
1925	100	40	60	100
1926	100	40	60	100
1927	100	40	60	100
1928	100	40	60	100
1929	100	40	60	100
1930	100	40	60	100
1931	100	40	60	100
1932	100	40	60	100
1933	100	40	60	100
1934	100	40	60	100
1935	100	40	60	100
1936	100	40	60	100
1937	100	40	60	100
1938	100	40	60	100
1939	100	40	60	100
1940	100	40	60	100
1941	100	40	60	100
1942	100	40	60	100
1943	100	40	60	100
1944	100	40	60	100
1945	100	40	60	100
1946	100	40	60	100
1947	100	40	60	100
1948	100	40	60	100
1949	100	40	60	100
1950	100	40	60	100

The above table shows the amount of bonds fixed by the State and municipalities from 1901 to 1950. The total amount of bonds fixed is shown in the first column, the amount fixed by the State in the second column, and the amount fixed by the municipalities in the third column. The fourth column shows the total amount of bonds fixed by the State and municipalities combined. The amount of bonds fixed by the State is shown as a percentage of the total amount of bonds fixed in the fifth column.

TABLE 3



PERCENTAGE OF BONDS FIXED BY THE STATE FROM 1901 TO 1950

The above graph shows the percentage of bonds fixed by the State from 1901 to 1950. The percentage of bonds fixed by the State is shown on the Y-axis, and the year is shown on the X-axis. The percentage of bonds fixed by the State is shown as a solid line, and the percentage of bonds fixed by the municipalities is shown as a dashed line. The percentage of bonds fixed by the State is shown as a percentage of the total amount of bonds fixed in the fifth column of Table 2.

