Senate Hearings

Before the Committee on Appropriations

Power Program of the Tennessee Valley Authority

Fiscal Year 1981

96*th* CONGRESS, SECOND SESSION

SPECIAL HEARING

General Accounting Office
Tennessee Valley Authority
Nondepartmental Witnesses

POWER PROGRAM OF THE TENNESSEE VALLEY AUTHORITY

HEARING

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

SPECIAL HEARING

General Accounting Office
Tennessee Valley Authority
Nondepartmental Witnesses

Printed for the use of the Committee on Appropriations

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CONTENTS

	Page
Opening remarks of Senator Sasser	1
General Accounting Office	31
Submitted questions	25
Tennessee Valley Authority	47
Prepared statement of S. David Freeman, Chairman	49
October draft of economic outlook	119
Nondepartmental witnesses	167
Statement of Ron Fogel, chairman, Tennessee Valley Industrial Committee	167
Statement of Bill Troy, East Tennessee Energy Coalition	178
Statement of Martin Sir, lawyer, Fayetteville, Tenn	184
Statement of C. H. Dean, general manager, Knoxville Utility Board	188

POWER PROGRAM OF THE TENNESSEE VALLEY AUTHORITY

THURSDAY, DECEMBER 11, 1980

U.S. SENATE,
SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT
OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 10:15 a.m., in room 1114, Everett McKinley Dirksen Senate Office Building, Hon. James Sasser presiding.

Present: Senator SASSER.

OVERSIGHT ON POWER PROGRAM

OPENING REMARKS OF SENATOR SASSER

Senator SASSER. The hearings will come to order.

Today the Appropriations Subcommittee on Energy and Water Development will conduct an oversight hearing into the power program of the Tennessee Valley Authority. Now this subcommittee annually reviews TVA's appropriations budget, and while I recognize this morning that Congress has no jurisdiction over the day-to-day operations of TVA's power budget, I believe that it is incumbent upon Members of Congress, in particular Members of Congress from the Tennessee Valley area, to exercise some oversight into this most important area of TVA policy.

I am hopeful this morning, in fact I expect to be joined later on by the distinguished Senator from Mississippi, John Stennis, who is the former chairman of this subcommittee. And I might say that the Senate has a very busy schedule today. I have already had one floor amendment, I suspect we will have votes coming during the morning, so I may have to get up and leave to attend to business on the floor but I will return just as quickly as I can.

INCREASE IN TVA POWER RATES

Now this hearing this morning was called partly in response to the growing concern by residents of the Tennessee Valley about dramatic increases in electric rates in recent years, the most recent increase, a 13-percent increase just 3 months ago.

Now I think it is important that we put things in perspective this morning. In that context it is important to know that TVA's electric rates are still below the national average. My concern is that that gap is

closing rapidly. For the past 7 years TVA's industrial rates have increased at a rate almost twice as fast as the national average. Now this trend is extremely disturbing, not just to this Senator but to many others in the Tennessee Valley area, and I suspect also to the TVA Board of Directors. The higher electric rates have created a severe hardship for people who must pay an increasing proportion of their incomes to heat their homes. The same homeowners were encouraged to heat electrically some years ago by TVA and TVA-sponsored programs. These rate increases have always raised serious questions about our ability to attract industry to the Tennessee Valley with promises of cheap electricity, which we have been able to do in years past.

During today's proceedings we will examine a number of issues related to TVA's nuclear powerplant construction program, and how the cost of these construction programs impact on TVA's electric rates. I think the issues can be defined and simply stated. The issues briefly are these:

ISSUES RELATING TO TVA'S NUCLEAR POWER GENERATING CAPACITY

No. 1 is the Tennessee Valley Authority substantially overbuilding its nuclear power generating capacity? No. 2, if this is the case, should some of the nuclear power projects be canceled or should they be deferred for construction at a later date? No. 3 can exporting power to other utilities, other utilities around the country, offset the costs of building powerplants that will not be needed to generate power in the Tennessee Valley area? And No. 4, has TVA been using faulty methods of forecasting future needs for electricity in the Tennessee Valley area?

GAO INVESTIGATION OF TVA

Now I might say that I first became concerned that TVA was overbuilding its power generating capacity back in 1978 when the General Accounting Office first detailed deficiencies, or what they considered to be deficiencies in TVA's load forecasting procedures. I subsequently held a hearing under the auspices of the Senate Budget Committee in Knoxville, Tenn., in February 1979, and examined the General Accounting Office's findings in greater detail and concluded that there had been some serious misjudgments made in the past concerning the future power needs of the Tennessee Valley. Subsequently construction of four nuclear generating units was deferred until a later date. Since that time there had been improvements in TVA's load forecasting procedures. However, the question today which I will ask is whether the agency has done all that is necessary to cure the deficiencies in load forecasting methods.

OPTIONS TO TVA LIMITED

In preparation for this hearing, I have spent a great deal of time reviewing the entire situation. Experts that I have discussed the situation with, and who have analyzed TVA's operations, are of the opinion that reliable options now available to TVA are severely limited. It may be that the nuclear construction program has reached the point of no return, the point where it would not be economically feasible to cancel

any further nuclear construction or to defer construction of other nuclear generating power units. If this is true, TVA's best option may be to work out a profitable interchange of power, interchange agreements to sell excess power not needed in the Tennessee Valley area to other utilities in the United States.

Now I must say that I would only support the sale of power in this fashion if the power could be sold at a profit, and thereby reducing somewhat the pressure for future rate increases in the Tennessee Valley area. And I say this because one of my major concerns has been that TVA ratepayers have been burdened with paying for billions of dollars of nuclear plant construction and some of that construction may be unnecessary.

This situation in effect means that TVA ratepayers may be subsidizing electrical generating capacity which will be used to provide electricity to persons and industries in other parts of the United States in future years.

I think today and in subsequent days that we must explore other means by which we can finance the completion of TVA's nuclear powerplants, if it should be found they should be completed, other ways to finance their construction than by imposing the burden of construction and paying interest costs on TVA ratepayers in the Tennessee Valley area. If possible, the cost of construction should be borne by those who in future years may receive the surplus power.

I would like to leave the record open for a statement from Senator Stennis when he appears.

INTRODUCTION OF WITNESS

Our first witness today is Mr. Dexter Peach, the Director of the Energy and Minerals Division of the General Accounting Office.

Mr. Peach, I welcome you and say that the General Accounting Office first pointed to the TVA load forecast deficiencies in a report issued 2 years ago. The General Accounting Office has closely monitored TVA's load forecasting methods since the issuance of that initial report 2 years ago.

QUESTIONS ASKED OF GAO

In preparation for these hearings I have asked the General Accounting Office to address the following questions:

(1) What is the history of TVA's demand forecasting?

(2) What improvements has TVA made in demand forecasting;

(3) What in the General Accounting Office's opinion will be the magnitude of TVA's surplus capacity based on its most recent demand forecast;

(4) How long is this surplus expected to last;

(5) What effect will the surplus capacity have on future electric rates; and

(6) What effect will the surplus capacity have on the economic benefits of TVA's conservation program?

RELATED MATERIAL

At this point in the record I would like to insert a copy of TVA's forecasts by class of service which has been made available to me by TVA prior to my September statement. I would also like to include in the record a copy of a series of questions I directed to TVA during appropriations hearings earlier in the year.

[The documents follow:]

TVA FORECASTS BY CLASS OF SERVICE

Residential

Commercial

- Wholesale and retail trade
- Services
- Government
- Regulated industries
- Finance, insurance, and real estate

Manufacturing

- 16 manufacturing classifications
- Examine in detail large industries such as:

  Aluminum
  Chemicals
  Ferroalloys
  Paper

DOE uranium enrichment facilities

MAJOR FACTORS INFLUENCING LOAD

Economic activity

- National economic activity
- Regional economic activity
- Demographic factors

Conservation

- Rising price of electricity
- Home insulation
- Appliance efficiency

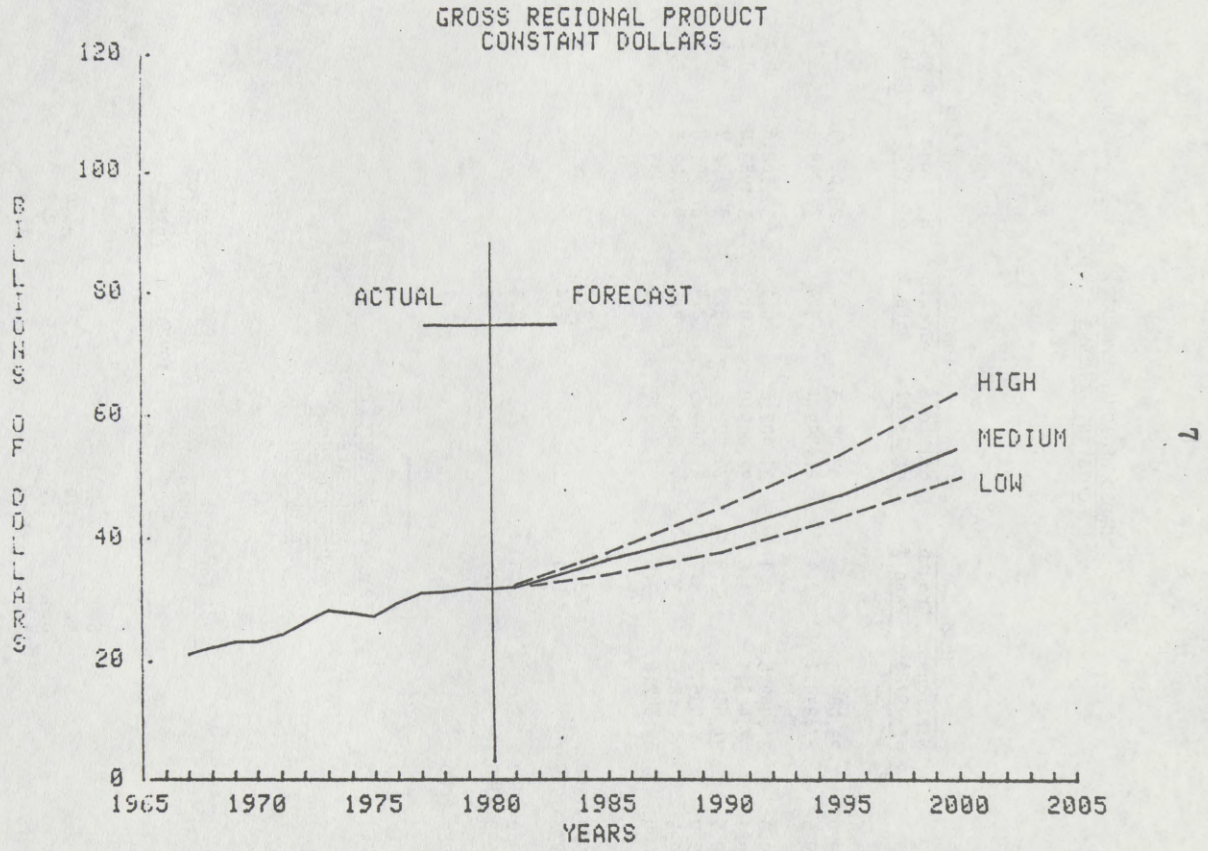
- Improved energy efficiency of commercial and industrial consumers

Substitution

- Natural gas shortage
- Increased prices of fossil fuels
- Uncertainly as to supply of fossil fuels

End-use technologies

- Solar
- Cogeneration
- Electric cars


GROSS REGIONAL PRODUCT
CONSTANT DOLLARS
120
100
80
60
40
20
0
BILLIONS OF DOLLARS
ACTUAL
FORECAST
HIGH
MEDIUM
LOW
1965
1970
1975
1980
1985
1990
1995
2000
2005
YEARS

GROSS REGIONAL PRODUCT
CONSTANT DOLLARS

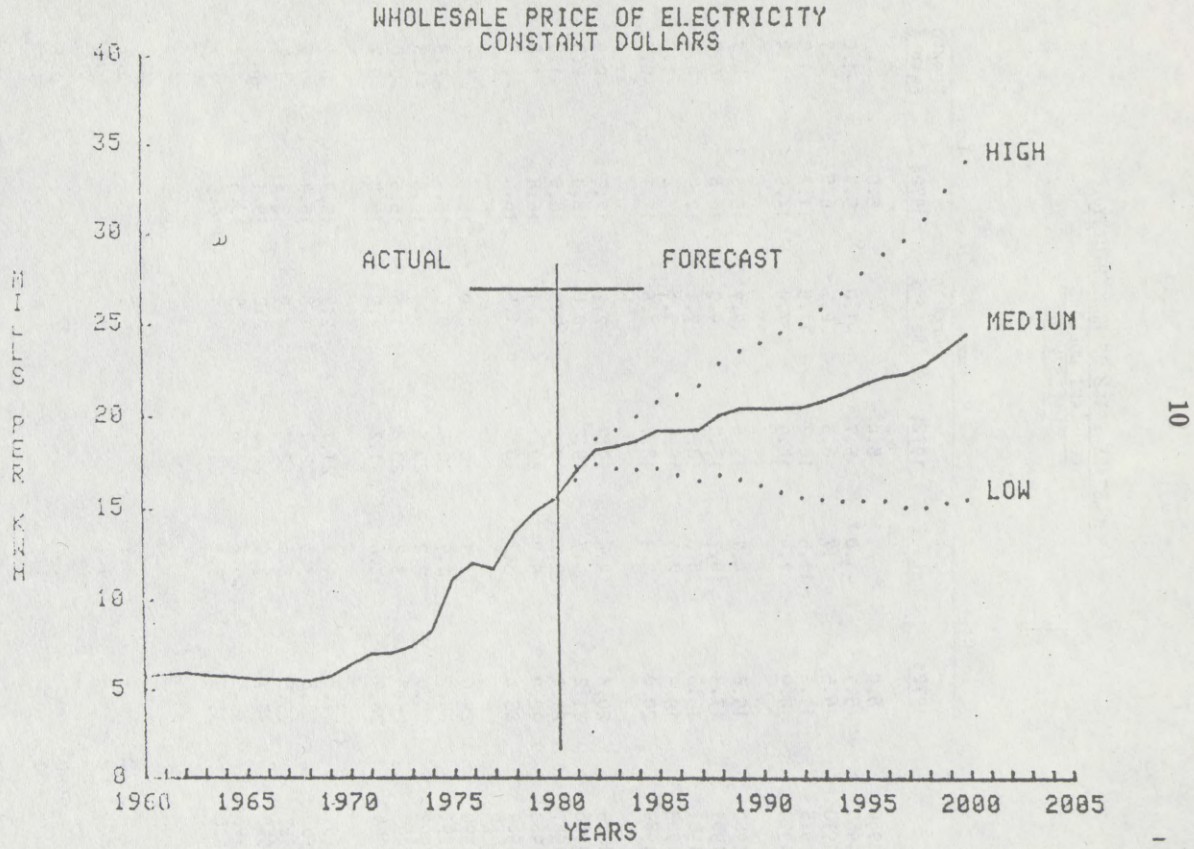
	High		Medium		Low	
	Millions of 1972$	Growth Rate %	Millions of 1972$	Growth Rate %	Millions of 1972$	Growth Rate %
1970	23,085.3	-	23,085.3	-	23,085.3	-
1975	27,344.1	3.4	27,344.1	3.4	27,344.1	3.4
1980	31,902.6	-0.1	31,902.6	-0.1	31,902.6	-0.1
1981	32,408.1	1.6	32,009.0	0.3	31,983.0	0.2
1985	37,587.5	3.3	36,400.4	3.3	34,182.7	1.4
1990	45,035.5	3.7	41,009.5	2.4	37,857.3	2.1
1995	53,478.6	3.5	47,035.2	2.8	43,402.5	2.8
2000	63,647.6	3.5	54,350.9	2.9	49,483.7	2.7
1970-1980		3.3		3.3		3.3
1973-1979		2.0		2.0		2.0
1980-1990		3.5		2.5		1.7
1990-2000		3.5		2.9		2.7
1980-2000		3.5		2.7		2.2

PRICE OF ELECTRICITY
WHOLESALE
CONSTANT DOLLARS
MILLS/kWh

	1981 Forecast		1980 Forecast	
	1972$	Growth Rate %	1972$	Growth Rate %
1960	6.0	-	6.0	-
1965	5.7	-1.0	5.7	-1.0
1970	6.5	2.7	6.5	2.7
1975	11.2	11.5	11.2	11.5
1980	15.6	6.9	15.8	7.1
1981	17.0	9.0	16.0	1.3
1985	19.2	3.1	16.8	1.2
1990	20.4	1.2	17.8	1.2
1995	21.7	1.2	18.8	1.1
2000	24.4	2.4	19.8	1.0
1960-1970		0.8		0.8
1970-1980		9.2		9.3
1980-1990		2.7		1.2
1990-2000		1.8		1.1
1980-2000		2.3		1.1

WHOLESALE PRICE OF ELECTRICITY
CONSTANT DOLLARS
MILLS/kWh

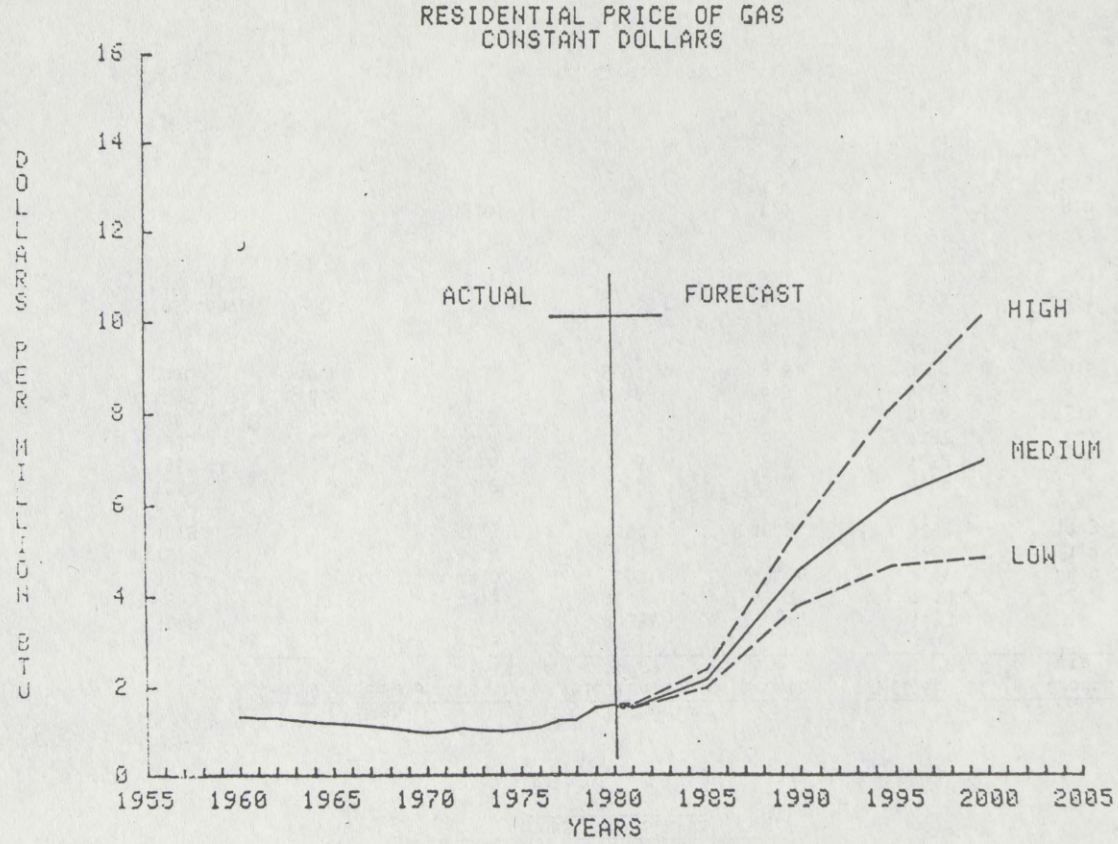
	High		Medium		Low	
	1972$	Growth Rate %	1972$	Growth Rate %	1972$	Growth Rate %
1960	6.0	-	6.0	-	6.0	-
1965	5.7	-1.0	5.7	-1.0	5.7	-1.0
1970	6.5	2.7	6.5	2.7	6.5	2.7
1975	11.2	11.5	11.2	11.5	11.2	11.5
1979	14.9	7.4	14.9	7.4	14.9	7.4
1980	15.6	4.7	15.6	4.7	15.6	4.7
1981	17.3	10.7	17.0	9.0	16.6	6.7
1982	18.8	8.8	18.2	7.1	17.4	4.8
1983	19.3	2.8	18.4	1.1	17.2	-1.2
1984	20.0	3.3	18.7	1.6	17.1	-0.7
1985	20.8	4.4	19.2	2.7	17.2	0.4
1986	21.2	1.7	19.2	0.0	16.8	-2.3
1987	21.7	2.2	19.3	0.5	16.5	-1.8
1988	22.9	5.8	20.1	4.1	16.8	1.8
1989	23.6	3.2	20.4	1.5	16.6	-0.8
1990	24.0	1.7	20.4	0.0	16.3	-2.3
1991	24.5	1.7	20.4	0.0	15.9	-2.3
1992	25.0	2.2	20.5	0.5	15.6	-1.8
1993	25.8	3.2	20.8	1.5	15.5	-0.8
1994	26.7	3.6	21.2	1.9	15.4	-0.4
1995	27.8	4.1	21.7	2.4	15.4	0.1
1996	28.8	3.5	22.1	1.8	15.4	-0.5
1997	29.5	2.6	22.3	0.9	15.1	-1.4
1998	30.7	3.9	22.8	2.2	15.1	-0.1
1999	32.3	5.2	23.6	3.5	15.3	1.2
2000	33.9	5.1	24.4	3.4	15.5	1.1
1960-1970		0.8		0.8		0.8
1970-1980		9.2		9.2		9.2
1980-1990		4.4		2.7		0.4
1990-2000		3.5		1.8		-0.5
1980-2000		4.0		2.3		-0.03


WHOLESALE PRICE OF ELECTRICITY
CONSTANT DOLLARS
MILLS PER KWH
40
35
30
25
20
15
10
5
0
ACTUAL
FORECAST
HIGH
MEDIUM
LOW
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
YEARS

RESIDENTIAL PRICE OF NATURAL GAS
CONSTANT DOLLARS

	High		Medium*		Low	
	$/Million Btu's 1972$	Growth Rate %	$Million Btu's 1972$	Growth Rate %	$/Million Btu's 1972$	Growth Rate %
1960	1.33	-	1.33	-	1.33	-
1965	1.19	-2.2	1.19	-2.2	1.19	-2.2
1970	.97	-4.0	.97	-4.0	.97	-4.0
1975	1.04	1.4	1.04	1.4	1.04	1.4
1979	1.54	10.3	1.54	10.3	1.54	10.3
1980	1.59	3.2	1.59	3.2	1.59	3.2
1981	1.58	-0.6	1.55	-2.5	1.52	-4.4
1985	2.38	10.8	2.17	8.8	1.97	6.7
1990	5.39	17.8	4.50	15.7	3.76	13.8
1995	8.03	8.3	6.10	6.3	4.64	4.3
2000	10.06	4.6	6.94	2.6	4.79	0.6
1960-1970		-3.1		-3.1		-3.1
1970-1980		5.1		5.1		5.1
1980-1990		13.0		11.0		9.0
1990-2000		6.4		4.4		2.5
1980-2000		9.7		7.6		5.7

*Source: Data Resources Energy Review, Spring 1980

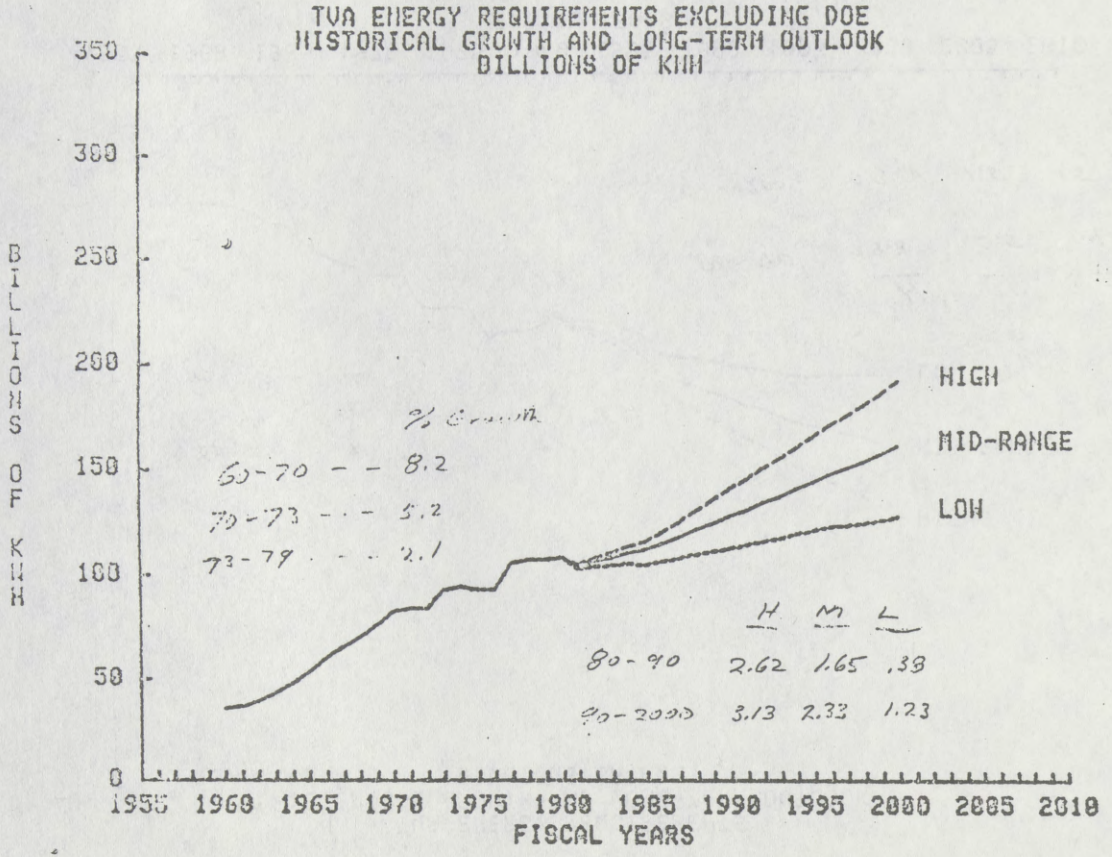

RESIDENTIAL PRICE OF GAS
CONSTANT DOLLARS
DOLLARS PER MILLION BTU
16
14
12
10
8
6
4
2
0
ACTUAL
FORECAST
HIGH
MEDIUM
LOW
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
YEARS

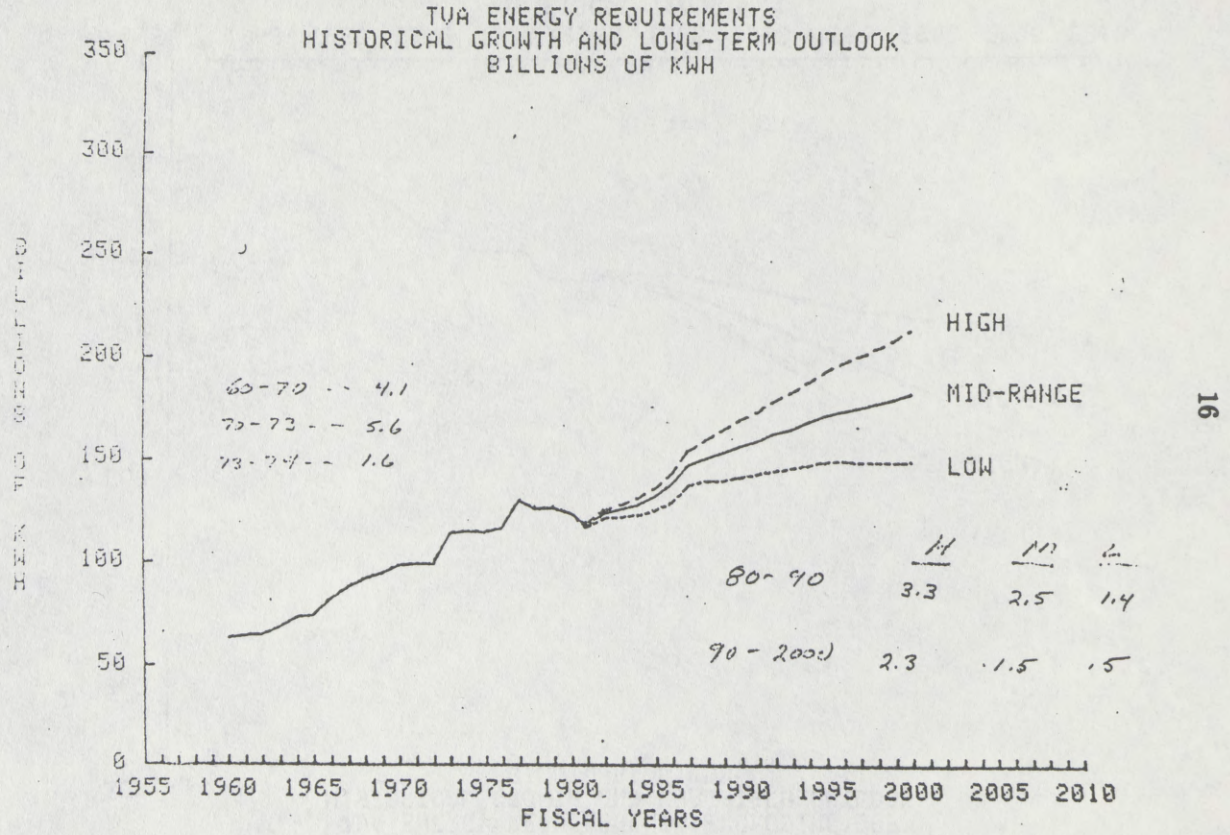
TVA CONSERVATION PROGRAM IMPACTS OVER 1980 LEVELS

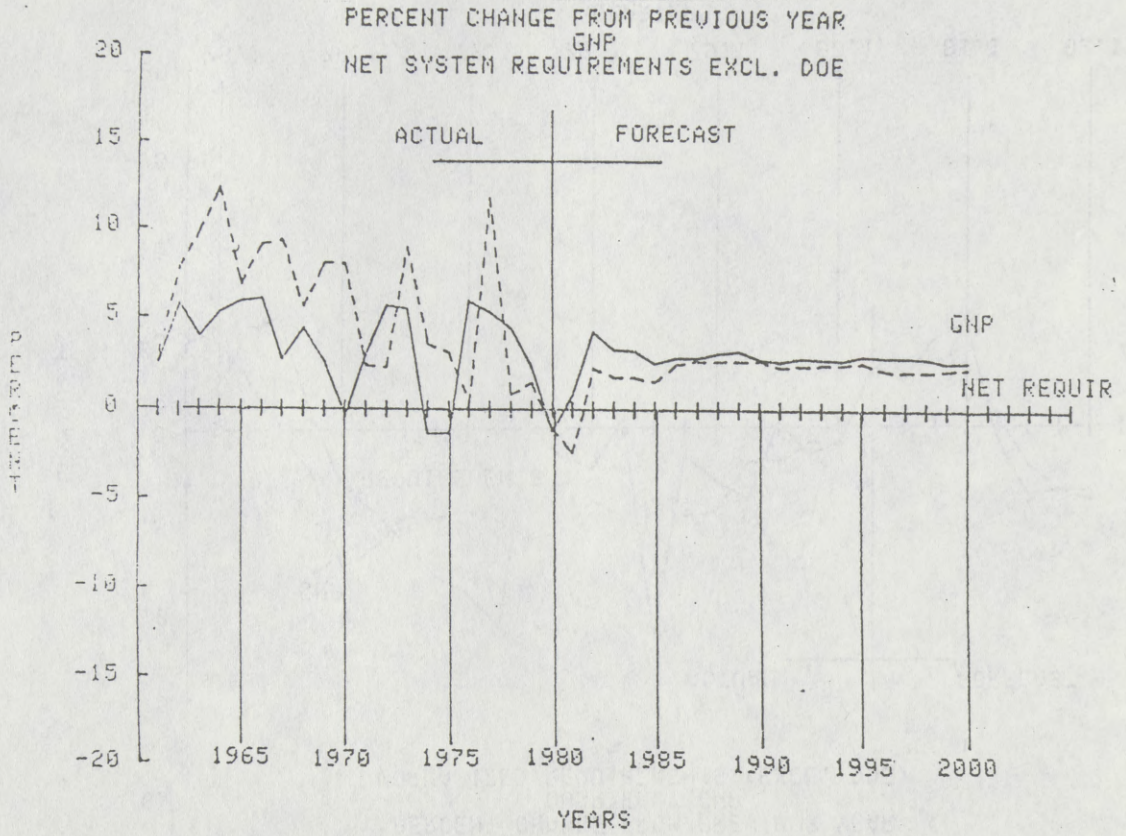
	Energy Savings-Millions of kWh		
	Low	Medium	High
Residential Programs Total Energy			
1980	-	-	-
1985	1,307	1,910	2,365
1990	2,002	3,652	7,472
1995	3,253	7,363	11,506
2000	4,381	11,073	15,622
Commercial & Industrial Total Energy			
1980	-	-	-
1985	2,267	2,267	2,613
1990	3,779	3,779	5,633
1995	5,234	6,508	8,266
2000	6,781	9,837	11,291
Total Conservation Programs Energy Savings			
1980	-	-	-
1985	3,574	4,177	4,978
1990	5,781	7,431	13,105
1995	8,487	13,871	19,772
2000	11,162	20,910	26,913

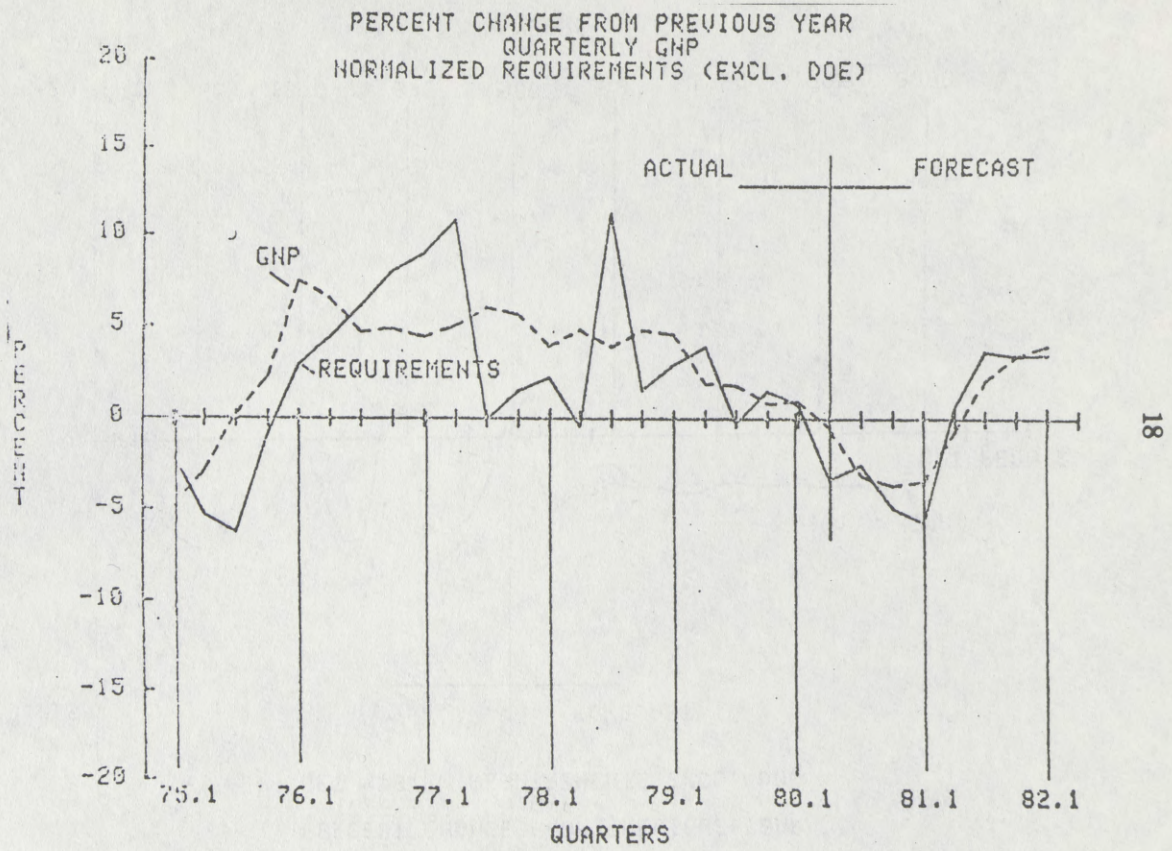
TVA ESTIMATES
ENRICHMENT POWER SUPPLY TO DOE

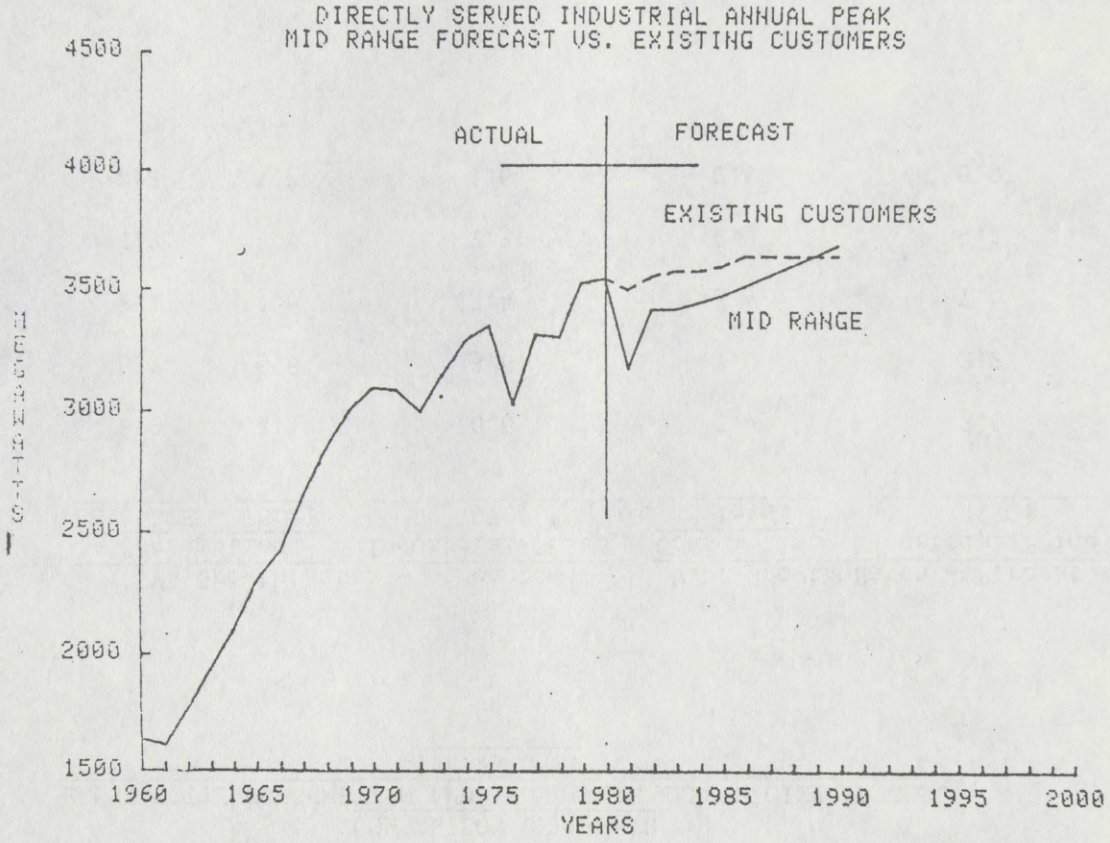
Fiscal Year	Expected		Contract	
	Demand Megawatts	Energy Millions of kWh	Demand Megawatts	Energy Millions of kWh
1981	2,340	13,787	2,340	17,192
1982	2,000	17,346	3,165	27,448
1983	2,000	17,345	3,165	27,448
1984	2,000	17,392	3,560	32,892
1985	2,314	20,068	4,485	38,896
1986	2,628	22,791	4,485	38,896
1987	3,383	29,339	4,485	38,896
1988	3,383	29,419	4,485	39,002
1989	3,326	28,844	4,485	38,896
1990	3,326	28,844	4,485	38,896
1995	3,182	27,595	4,485	38,896
2000	2,480	21,566	4,485	39,002
2020	2,116	18,402	4,485	39,002


TVA ENERGY REQUIREMENTS EXCLUDING DOE
HISTORICAL GROWTH AND LONG-TERM OUTLOOK
BILLIONS OF KWH
BILLIONS OF KWH
350
300
250
200
150
100
50
0
1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010
FISCAL YEARS
HIGH
MID-RANGE
LOW
60-70 - - 8.2
70-73 - - 5.2
73-79 - - 2.1
H M L
80-90 2.62 1.65 .38
90-2000 3.13 2.33 1.23


TVA ENERGY REQUIREMENTS
HISTORICAL GROWTH AND LONG-TERM OUTLOOK
BILLIONS OF KWH
350
300
250
200
150
100
50
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
FISCAL YEARS
HIGH
MID-RANGE
LOW
60-70 -- 4.1
70-73 -- 5.6
73-74 -- 1.6
80-90
90-2000
3.3
2.3
2.5
1.5
1.4
.5


PERCENT CHANGE FROM PREVIOUS YEAR
GNP
NET SYSTEM REQUIREMENTS EXCL. DOE
ACTUAL
FORECAST
GNP
NET REQUIR
20
15
10
5
0
-5
-10
-15
-20
1965
1970
1975
1980
1985
1990
1995
2000
YEARS


PERCENT CHANGE FROM PREVIOUS YEAR
QUARTERLY GNP
NORMALIZED REQUIREMENTS (EXCL. DOE)
ACTUAL
FORECAST
GNP
REQUIREMENTS
PERCENT
20
15
10
5
0
-5
-10
-15
-20
75.1
76.1
77.1
78.1
79.1
80.1
81.1
82.1
QUARTERS


DIRECTLY SERVED INDUSTRIAL ANNUAL PEAK
MID RANGE FORECAST VS. EXISTING CUSTOMERS
ACTUAL
FORECAST
EXISTING CUSTOMERS
MID RANGE
MEGAWATTS
4500
4000
3500
3000
2500
2000
1500
1960
1965
1970
1975
1980
1985
1990
1995
2000
YEARS

COMPARISON OF GROWTH
ELECTRICITY CONSUMPTION AND INDUSTRIAL ELECTRICITY PRICES
TVA vs U.S.

Period	TVA Growth Rates - Percent			U.S. Growth Rates - Percent	
	Consumption		Industrial Price	Consumption	Industrial Price
	Less DOE	Total	1972$	Total	1972$
60-70	8.2	4.1	0.6	7.4	-3.0
70-73	5.2	5.6	3.8	7.0	2.2
73-79	2.1	1.6	13.4	3.4	7.6
80-90	1.9	2.6	2.3	2.3[a]	4.1[b]
90-2000	2.2	1.4	1.6	2.6[a]	0.9[b]

a. Wharton
b. DRI

GROSS NATIONAL PRODUCT and GROSS REGIONAL PRODUCT

	Gross National Product (Constant Dollars)				Gross Regional Product (Constant Dollars)			
	1981 Forecast		1980 Forecast		1981 Forecast		1980 Forecast	
	Billions of 1972$	Growth Rate %	Billions of 1972$	Growth Rate %	Millions of 1972$	Growth Rate %	Millions of 1972$	Growth Rate %
1970	1,075.3	-	1,075.3	-	23,085.3	-	23,085.3	-
1975	1,202.3	2.3	1,202.3	2.3	27,344.1	3.4	27,344.1	3.4
1980	1,414.7	-1.2	1,431.5	0.5	31,902.6	-0.1	31,566.6	0.4
1981	1,426.2	0.8	1,473.0	2.9	32,009.0	0.3	32,721.1	3.7
1985	1,611.4	3.1	1,651.5	2.9	36,400.4	3.3	37,548.2	3.5
1990	1,859.0	2.9	1,910.8	3.0	41,009.5	2.4	44,504.0	3.5
1995	2,134.3	2.8	2,204.4	2.9	47,035.2	2.8	52,116.1	3.2
2000	2,450.6	2.8	2,558.0	3.0	54,350.9	2.9	61,079.0	3.2
1970-1980		2.8		2.9		3.3		3.2
1973-1979		2.5		2.4		2.0		1.8
1980-1990		2.8		2.9		2.5		3.5
1990-2000		2.8		3.0		2.9		3.2
1980-2000		2.8		2.9		2.7		3.4

COMPARISON OF EMPLOYMENT GROWTH
TVA vs SOUTHEAST vs NATION

Period	Manufacturing Employment Growth Rate - Percent			Total Employment Growth Rate - Percent		
	TVA Region	Southeast* Less TVA	Nation	TVA Region	Southeast* Less TVA	Nation
60-70	4.4	3.2	1.4	3.6	3.8	2.7
70-73	4.8	3.4	1.3	4.7	5.4	2.7
73-79	0.4	1.0	0.7	1.9	3.2	3.4
80-90	1.2		0.5	1.4		1.4
90-2000	0.3		0.1	1.2		1.1

*The Southeast includes the states of West Virginia, Virginia, Kentucky, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Tennessee.

1981 FORECAST
NET SYSTEM REQUIREMENTS

Alternate Load Forecasts	Billions of kWh		Growth Rates	
	1990	2000	1980-1990	1990-2000
High economic growth, medium substitution, medium change in electricity price, medium effect of conservation programs, expected DOE	169.5	213.0	3.26%	2.31%
Medium economic growth, medium substitution, medium change in electricity price, medium effect of conservation programs, expected DOE	156.7	182.6	2.45%	1.54%
Low economic growth, medium substitution, high change in electricity price, medium effect of conservation programs expected DOE	141.5	148.9	1.41%	0.51%

COMPARISON OF MEDIUM FORECAST
GROWTH WITH AND WITHOUT CONSERVATION

	Residential Growth Rate %	Commercial and Industrial Growth Rate %	Distributor Purchases Growth Rate %	Directly Served Industrials Growth Rate %	Federals and Interdivisional Growth Rate %	Net System Requirements Growth Rate %
1960-1970	8.6	9.2	8.8	6.9	-7.2	4.1
1970-1973	6.6	7.8	6.8	-0.2	8.8	5.3
1973-1979	1.9	3.3	2.6	2.1	-1.0	2.0
1979-1980	-1.1	-1.4	-0.8	-2.2	3.6	0.6
With Conservation						
1980-1985	0.2	1.5	0.9	1.0	5.0	1.3
1985-1990	2.1	3.9	3.1	1.3	6.9	3.4
1990-1995	1.7	4.2	3.0	0.7	-0.9	1.9
1995-2000	1.5	3.4	2.7	0.8	-4.4	1.2
1980-1990	1.1	2.7	2.0	1.1	6.0	2.4
1990-2000	1.6	3.8	2.8	0.8	-2.7	1.5
1980-2000	1.4	3.3	2.4	1.0	1.6	2.0
Without Conservation						
1980-1985	1.2	2.5	1.9	1.3	5.0	2.0
1985-1990	2.9	4.2	3.6	1.6	6.9	3.7
1990-1995	3.0	4.3	3.8	1.5	-0.9	2.5
1995-2000	2.6	3.8	3.3	1.5	-4.4	1.9
1980-1990	2.0	4.1	3.5	1.5	-2.7	2.2
1980-2000	2.4	3.7	3.1	1.5	1.6	2.5

SUBMITTED QUESTIONS

(The following questions were not asked at the hearing but were submitted to the Department for response subsequent to the hearing:)

DEMAND FORECASTING

Question. Last year the hearing I chaired for the Budget Committee centered around a GAO report titled "Electrical Energy Options Hold Great Promist for the Tennessee Valley Authority." During that hearing I raised a number of questions regarding TVA's demand forecasts. For the record, I would like to ask the TVA a number of follow-up questions.

For how many years in the future does TVA do a detailed demand forecast?

Answer. TVA projects loads in detail for 20 years. Also, forecasts are prepared for an additional 25 years based on aggregate classes of service, such as distributor purchases, directly served industrial sales, and sales to Federal agencies.

Question. Why was this time period chosen?

Answer. This covers the planning horizon of the power program in terms of the design and construction of additional capacity.

Question. Does TVA prepare a single forecast as was the case in 1977 or are several forecasts of future growth now being prepared as GAO recommended?

Answer. TVA now prepares several forecasts that cover a range of assumptions on the economy, price of competing fuels, price of electricity, and impacts of conservation. TVA commenced doing so before that recommendation was made by GAO.

Question. The GAO report recommended TVA prepare several 25-year demand projections emphasizing energy conservation and the use of renewable resources. Has TVA done this?

Answer. Yes. TVA prepares several forecasts reflecting the differing impacts of various programs to encourage energy conservation and the use of renewable resources. Forecast methodology allows individual programs to be varied to derive sensitivities of power costs on the system to different levels of program effort.

Question. This GAO report also recommended that TVA should prepare a long-range comprehensive plan (minimum of 25 years) with specific short-term goals to be presented to the President and the Congress. The plan should be updated and submitted annually. The report states that TVA should obtain comments from a wide spectrum of the regional population and the Department of Energy and that the GAO should evaluate the final plan, monitor its progress, and report to the President and the Congress periodically. In your response to the Senate Committee on Governmental Affairs dated January 31, 1979, you stated "this is a good idea which TVA was already in the process of implementing." I have not seen such a plan, could you explain what happened to this "good idea"?

Answer. With the sanction and hearty encouragement by the Board, TVA has begun implementing a comprehensive corporate planning system. One of the primary features of this system is the Strategic Plan, still evolving in format and specific content, but already requiring explicit documentation of TVA policies, goals, program implementation strategies, and an assessment of external trends and their impact on the Agency's ability to execute its policies

and programs. While the plan is designed to provide stability and guidance to the line organizations within TVA, it is also designed to be adaptable--capable of routine updating each December as well as revision as needed during the year.

The policies, goals, and programs laid out in the Strategic Plan will be developed through a system which will supply the Board with detailed analyses of policy alternatives, program effectiveness, TVA's public participation program, and social, economic, and demographic indicators. The Strategic Plan, accompanied by specific Board directives and by support material such as the semiannual Economic Forecast, will provide the assumptions on which the Agency's tactical planning (budgeting) process is to be predicated. The goals and policies of TVA therefore will permeate both the OMB and the President's budgets and will, in effect, be reviewed annually by the President and the Congress. The planning system also will contain a mechanism for taking issues under consideration directly to a broad cross-section of the region's citizens and actively solicit their review and comment.

Question. You indicated earlier that you prepare a series of projections. What is the range of these projections for energy usage and peak demand?

Answer. The projections for energy usage in the year 1990 range from 219.9 billion kilowatthours to 158.7 billion kilowatthours. The average annual growth rate from 1978 to 1990 would be 5.1 percent for the high projection and 2.2 percent for the low projection. In the year 2000, energy usage projections range from 328.8 billion kilowatthours to 169.2 billion kilowatthours. From 1990 to 2000 the average annual growth rate would be 4.1 percent for the high projection and 0.6 percent for the low projection. The projections for peak demand in the year 1990 range from 36,200 megawatts to 24,700 megawatts. The average annual growth rate from 1978 to 1990 would be 4.4 percent for the high projection and 1.2 percent for the low projection. In the year 2000 peak demand projections range from 56,000 megawatts to 26,700 megawatts. From 1990 to 2000 the average annual growth rate would be 4.5 percent for the high projection and 0.8 percent for the low projection.

Question. What growth rate is TVA designing its planning and budgeting around and how was this growth rate chosen from the above range? What were your assumptions?

Answer. For planning and budgeting TVA is using a range of load forecasts which indicate average annual growth rates which range from 2.2 to 5.1 percent between 1978 and 1990. The range of forecasts was based on alternative assumptions concerning economic growth, the real price of electricity, conservation, and the prices of alternative fuels. These rates, of course, come under review periodically.

Question. How does this growth rate projection compare with projections made during the past 10 years?

Answer. These load forecasts indicate lower growth rates than other forecasts prepared in the last 10 years. Load forecasts prepared over the last 10 years would indicate growth rates for the forecast period ranging from 4.5 to 6.5 percent.

Question. Is the reason for the declining projections a result of less than expected growth in the economy or the population, or some other factor, or is it the result of better, more realistic forecasts?

Answer. The growth rate projected has been declining due to changes in several assumptions. Ten years ago, the real price of electricity was projected to decline as it had historically; today the real price of electricity is projected to increase. Ten years ago, energy was cheap and consumers could not justify capital expenditures to conserve energy; today and in the future, energy

costs will increase and the consumers will be able to justify capital expenditures to conserve energy. In addition, the national economic growth projections are less optimistic than they were 10 years ago.

Question. What economic growth projections were used to prepare the forecast which was the basis of this budget?

Answer. The economic outlook used to prepare the forecast which was the basis of this budget shows total employment increasing from 2,708,000 employees in 1980 to 3,972,000 employees in 2000, which is an average annual growth rate of 1.9 percent. Employment in the manufacturing industries increases from 804,000 employees in 1980 to 1,005,000 employees in 2000, which is an average annual growth rate of 1.1 percent. Employment in the commercial industries increases from 1,904,000 employees in 1980 to 2,967,000 employees in 2000, which is an average annual growth rate of 2.2 percent. Real per capita income increases from $3,307 in 1980 to $5,618, in 2000, which is an average annual growth rate of 2.7 percent. This regional economic outlook is derived using a regional econometric model driven by the Wharton Econometric Forecasting Associates long-term forecast.

Question. Is this a higher economic growth rate than the country is expected to experience?

Answer. Yes, the TVA region has historically experienced higher economic growth than the country, and this trend is included in the long-term forecast.

Question. At the time of the GAO report cited earlier you acknowledged some problems with data used in your forecast. Tell me what you have done to improve your input data.

Answer. TVA has planned and begun implementation of surveys of the ultimate consumers of TVA power. A questionnaire to survey residential accounts was first mailed in September 1979. Followup mailings, phone, and field contacts have been completed, and preliminary survey results should be available in April 1980. A complementary survey of commercial and industrial accounts has been planned and is in the design stage. A continuing survey effort has been included in the budget of the power program.

Question. A report on TVA's demand forecasting by National Economic Research Associated in November 1978 pointed out that TVA's price projections are used as input to the demand forecast to help determine the level of demand. From this, the amount and type of generating facilities and the mix of fuels used by TVA are determined and those to some extent determine the future price of electricity. The report concludes that "closing this loop" to recognize this linkage is absolutely essential in the TVA forecasting methodology. What has TVA done to accomplish this so that customers can react to true price signals on future generations?

Answer. TVA is currently "closing the loop" with respect to the prices which are used in the load forecasts and the price projections which are derived from generation cost studies. If the price projection resulting from the analysis of generating facilities and the mix of fuels is different from that used in the load forecasts, revisions would be made to the load forecast.

Question. How does TVA's growth rate projection compare with the average growth rate for the Nation and the average in the Southeast region?

Answer. TVA is projecting sales to grow at an average annual rate between 2.2 and 5.1 percent a year. The National Electric Reliability Council in the "1979 Summary of Projected Peak Load, Generating Capability, and Fossil Fuel Requirements for the Regional Reliability Councils of NERC," reports an average growth rate for the Nation of 4.9 percent and a 5.6 percent average growth rate for the Southeastern Electric Reliability Council.

Question. I note that the distributor-served commercial and industrial sector is projected to increase its usage of electricity at the fastest rate of any sector. What's TVA doing to encourage conservation of electricity by these customers?

Answer. On January 4, 1979, the TVA Board of Directors approved a commercial and industrial energy conservation program. This program offers a free energy management survey for all commercial and industrial customers on the TVA system. The largest customers contribute a share of the labor in performing the surveys. Low-interest loans in the amount of $1,000 to $100,000 are available to aid the customer in implementing identified electrical energy conservation opportunities with a payback of greater than three years if the customer will implement with other funds those with a payback of less than three years. The program goals are to realize capacity savings of 1,000 megawatts by 1988 and 1,600 megawatts by 1998, with annual energy savings of 5.6 billion kilowatthours by 1988 and 9.1 billion kilowatthours by 1998.

While starting up the program during calendar year 1979, we surveyed 664 customer facilities. Potential capacity savings of 22 megawatts and energy savings of 55 billion kilowatthours were identified by these surveys.

Preparations are underway for a statistical survey to evaluate the actual implementation of survey recommendations. An evaluation is being conducted of the loan program to determine ways to make this program a more effective incentive for investment in energy conservation.

Question. Besides conservation of electricity, another way that new construction of facilities can be delayed is through better management of existing generating resources. Load Management seeks to maintain a demand that is as level as possible in order to limit the peaks. By using the existing facilities in the most efficient manner, rates can be kept at the lowest level as the TVA Act requires. Could you give me the status of load management projects which have been implemented?

Answer. We are now implementing a load management program to install controls on 50,000 central air conditioners by the end of 1983. The controls will allow the remote cycling of the air conditioners' operations, thereby reducing peak demand. Consumers who participate will be offered a $5 per month bill credit during the summer months. We plan to begin enrolling participants in this program in early April. The program should result in a summer peak reduction of about 68 MW in 1983.

In addition, we have expanded our efforts in a number of areas in order to gather data about the feasibility of various load management options. These demonstration efforts include a test conducted with about 450 participants which involves the use of radio signals to cycle the operations of conventional water heaters and space conditioning systems and the offpeak operation of large-capacity water heaters. We are also conducting a test of storage heating systems of three separate technologies (ceramic brick, pressurized water, and eutectic salt) in the homes of 75 residential consumers.

Question. What are the TVA's general plans for managing load growth in the future?

Answer. TVA's general plan for managing load growth is to initiate and demonstrate cost-effective programs that reduce the demand for electrical energy through direct conservation or substitution of less costly renewable energy alternatives. Reducing the demand postpones the requirement for new, more expensive capacity.

Question. Power sales decreased in FY 1979 and a further decrease is projected for FY 1981. If this trend continues, can TVA defer construction of additional generating capacity? How would this deferral affect planning and buying equipment for Hartsville B, Phipps Bend unit 2, and Yellow Creek unit 2?

Answer. The budget estimates do not support a decrease of sales in fiscal year 1981. The 1981 estimate shows sales increasing from 117.9 in 1980 to 120.4 billion kWh in 1981. However, we will be reviewing projections regularly and measuring the invested costs of our construction program against alternatives to determine what makes the most sense for our customers. It would be possible to further defer the construction of Hartsville B, Phipps Bend unit 2, and Yellow Creek unit 2. For obvious economies the designs and procurement for companion units were duplicated. Therefore, the procurement program for these units could not be separated and would have to continue. Although part of the materials could be deferred, large facilities would have to be constructed to store the delivered equipment.

Question. Will TVA be reevaluating its decision to build Hartsville B, Phipps Bend unit 2, and Yellow Creek unit 2 if demand continues to grow at a slower rate than anticipated? Considering the large capital and operating cost increases in nuclear plants, would coal or other options be less expensive?

Answer. We will be evaluating the pace at which TVA should be building these as well as other units.

While nuclear plants have experienced substantial capital and operating cost increases, coal-fired plants and the other available options have sustained similar cost escalations.

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GENERAL ACCOUNTING OFFICE

ENERGY AND MINERALS DIVISION

STATEMENT OF J. DEXTER PEACH, DIRECTOR, ENERGY AND MINERALS DIVISION, GENERAL ACCOUNTING OFFICE

ACCOMPANIED BY:

IRA B. SPEARS, ATLANTA REGIONAL OFFICE
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INTRODUCTION OF ASSOCIATES

Senator SASSER. Mr. Peach, I want to say to you we welcome you again before the subcommittee. We look forward to hearing your testimony, and I would ask you, sir, for the purpose of the record, to be kind enough to introduce your colleagues this morning.

Mr. PEACH. Yes, Senator, we are pleased to be here. My colleagues I would like to introduce are the people that should get the principal credit for the development of the material we will be presenting to you today. I have on my immediate left, Mr. Ira Spears from our Atlanta regional office, who is the team leader of this particular assignment, and to his left Mr. Paul Pansini, who has assisted in this effort.

To my immediate right, Mr. John Brown, who is the group director in charge of our work dealing with electrical energy problems in the General Accounting Office, and to his immediate right, Mr. John Clark, who is from our Atlanta regional office and assisted in the effort and review.

FORECASTS OF TVA FUTURE POWER DEMANDS

We did try to deal with the questions that you asked us to look into. My testimony is of necessity somewhat detailed because of the complexity of these questions and issues, and include a number of detailed exhibits which contain a great deal of information on these questions.

So in a number of places I will be at least referring back to the exhibits in the course of the testimony.

In February 1979, the Tennessee Valley Authority testified before the Senate Committee on the Budget. In that testimony, TVA presented its 1978 forecast of future demand for electricity in the valley. Since that time, TVA has prepared its 1979, 1980, and 1981 forecasts of future demand. In general, each successive forecast has predicted lower demand growth rates for the period 1980 to 2000.

As a result of the 1979 forecast, TVA announced in May 1979 that it planned to defer completion of four nuclear units—one at Phipps Bend,

one at Yellow Creek, and two at Hartsville. See exhibit 1. The purpose was to create a better fit between the completion of new nuclear units and the valley's estimated demand for additional power. Through this action, the construction program's completion date was deferred until 1980.

Subsequently, TVA prepared its 1980 forecast which was lower than the previous forecast, and consequently TVA decided in May 1980 to further defer completion of the four already delayed nuclear units. That deferral resulted in the current construction schedule which has a final completion date of 1996.

But, after the May 1980 deferral decision, TVA prepared another demand forecast that is referred to as the 1981 forecast. It was even lower than the previous forecast, and TVA is now in the midst of analyzing the economic effects of the various options for responding to this lower forecast. TVA plans to complete its analysis in December 1980 or January 1981.

In November 1978, GAO reported a number of demand forecasting weaknesses that were noted during our review of TVA's 1977 demand forecast.

CONCLUSIONS AND RECOMMENDATIONS

Our conclusions and recommendations included the following:

The end-use data on which TVA based its demand forecast was incomplete and inadequate. We recommended that TVA collect detailed data on the users and uses of electricity. For example, we said TVA should survey residential customers to determine patterns of ownership for household equipment, appliances and housing units.

TVA prepared only one demand forecast that was based primarily on a combination of trends and extrapolations of historic trends. We recommended that TVA prepare several electricity demand forecasts.

Since our report, TVA has made significant improvements in the methodology and approach used in demand forecasting. The major improvements since 1977 in TVA's forecasting system are as follows:

TVA uses a sophisticated set of models that permits the factors which TVA believes influence demand growth to be explicitly identified rather than relying on a trend forecast. These models include three econometric models and two end-use models.

TVA incorporates the results of a residential appliance survey of 9,400 customers completed in January 1980. The results include data on: Appliance saturation; type, age, and size of living quarters; implemented conservation measures; social and economic characteristics of households, such as, family size, age distribution, and income levels. TVA plans to update the residential survey periodically and is now preparing to do a commercial and industrial end-use survey.

TVA deals with uncertainty by producing a range of forecasts based on alternative levels of five explicitly identified factors which TVA believes drives its load growth. The more important factors are economic growth and the price of electricity. The other three factors are price of substitutes, conservation programs, and the Department of Energy's demand for electricity to enrich uranium.

For each of the five factors that drive load growth, TVA prepares a low, medium, and high forecast, with the exception of the DOE de-

mand which has two alternative levels. In total, this procedure will yield 162 alternative forecasts.

Because of analytical constraints and for practical reasons, only a limited number of forecasts are selected for analysis in great detail. Using various combinations of the five factors, TVA finally produces three basic planning demand forecasts that are referred to as the low, medium, and high demand forecasts.

In short, TVA has made significant improvements to its demand forecasting system along the lines that we recommended in our 1978 report. Nevertheless, I do have some observations to make about several assumptions related to the major factors which drive the forecasting system.

MAJOR FACTORS DRIVING FORECASTING SYSTEM

The demand forecast is driven directly by both national and regional forecasts of the level of economic activity. Before 1973, the TVA region grew significantly faster than the Nation. However, during 1973 to 1979, the TVA region's growth rate lagged the Nation's growth rate.

Until the 1981 forecast, TVA assumed that the pre-1973 relationship between regional and national growth rates would prevail in the long term.

However, based on TVA's own forecast of regional economic growth, TVA changed the assumptions in its 1981 forecast to reflect to some extent the lower regional growth rates experienced during 1973 to 1979.

For example, in the 1981 medium forecast, TVA assumed that the regional growth rate would be slightly less than the national rate during 1980 to 1990, but slightly higher during 1990 to 2000. For the total 20-year period 1980 to 2000, TVA assumed the region's annual growth rate would be 2.7 percent versus 2.8 percent for the Nation. In the high forecast, TVA assumed an annual growth rate of 3.5 percent, and in the low forecast, 2.2 percent.

TVA is now in the process of trying to determine why the TVA region grew slower than the Nation during 1973 to 1979. The results of this study may shed some light on what assumptions should be made for economic growth. Should the study reveal underlying structural changes that indicate the region may continue to grow slower than the Nation, then TVA's forecasts of demand for electricity would tend to be lower.

For example, according to a TVA sensitivity analysis, switching from the medium to the low economic growth rate assumption would reduce the medium demand forecast by 5.5 percent in 1990 and by 7.7 percent in the year 2000.

PRICE OF ELECTRICITY

One of the five major factors that drive the demand forecast is price of electricity. TVA's latest forecasts assumed average annual residential real price growth rates during 1980 to 1990 of 0.03, 1.9 and 3.5 percent in the low, medium, and high forecasts, respectively. The assumed commercial and industrial price growth rates were minus 0.03, 1.9, and 3.5 percent. See exhibit 4.

Interestingly, the bulk of the rate increases occur during 1981 and 1982 and taper off for several years and then picks up again toward the

end of the decade. In any event, TVA's assumptions about the price elasticity of demand for electricity will need continued scrutiny in the years ahead.

PRICE ELASTICITY OF ELECTRIC POWER

In general, as the price of electricity rises, consumers will tend to use less electricity. In economics, such consumer behavior demonstrates the concept of price elasticity of demand.

Senator SASSER. Mr. Peach, did I understand you to say the bulk of the rate increases occurred during 1981 and 1982?

Mr. PEACH. Yes; that is might, according to the way the forecasts are laid out, they occurred during 1981 and 1982 and tapered off, picking up at the end of the decade.

Specifically, the price elasticity of demand for electricity measures the percentage change in electricity consumption relative to a percentage change in electricity price. For example, an elasticity coefficient of 0.5 would indicate that a 1-percent increase in price would lead to a 0.5-percent decrease in consumption.

Estimates of elasticity for a given commodity are generally based on historical data. But whenever structural changes occur in the basic relationship between the price of the commodity and the prices of other commodities, problems may arise in estimating elasticity because historical data may not be representative of future consumption patterns.

Senator SASSER. Let me interrupt and ask you one question to be sure I understand.

You say using an elasticity coefficient of 0.5 would indicate a 1-percent increase in price which would lead to a 0.5 decrease in consumption; in other words, a 10-percent rate increase leads to a 5-percent decrease in consumption?

Mr. PEACH. That is right. We have those kinds of figures, using that kind of elasticity coefficient.

The TVA demand forecasting staff believes that since the time of the Arab oil embargo structural changes have taken place in the relationship between the price of electricity and the rest of the economy, and they surmise that the current estimates of price elasticity may be too low. However, sufficient historical data on new consumption patterns is not yet available to reestimate the long-term price elasticity of demand for electricity with a high degree of certainty. The staff believes that the next 3 or 4 years may provide sufficient data to reestimate price elasticity with a higher degree of certainty.

COMPARISON OF ELECTRICITY PRICES WITH OTHER ITEMS

Senator, going back to your previous question, one thing I probably should clarify, in dealing with those price increases you have to deal with the real price; the price of electricity increasing in a real sense in comparison with other things.

In TVA's view, DOE's demand for electricity to enrich uranium has two alternative levels. The first demand level is based on amounts of power under contract. The alternative level is the level that TVA expects DOE to demand. TVA used the expected demand in the three 1981 basic planning forecasts.

DOE's expected demand is determined from an analysis of expected requirements of enriched uranium for nuclear powerplants, national defense needs, and foreign exports.

Since nuclear powerplant completions and operations are uncertain, estimation of the expected DOE demand concentrates on an analysis of construction schedules, probable plant completions, and expected plant operating characteristics. As a result, the expected DOE demand is significantly lower than the load currently under contract.

Since the 1981 demand forecast was prepared, TVA has reestimated the expected DOE demand and preliminary results show that TVA now expects that DOE's average demand through 1992 may be even less than previously estimated. To the extent the new estimate is on target, surplus capacity under the current construction schedule would tend to increase.

SURPLUS CAPACITY

Let me turn to the topic of surplus capacity. Exhibits 6 through 8—and we have some blowups on charts—show TVA's forecasted winter and summer peak demand capacity requirements versus dependable capacity during the years 1981 through 2010.

We might quickly go through those. There are basically three forecasts you are dealing with. You are looking at the potential surplus capacity situation, first under the medium forecast, and that is the white area that appears between the dark part of the diagram, as it runs from the year 1981 to about the year 2000.

And, of course, you see evidence of any real surplus capacity disappearing under the construction schedule now in place around the year 2000. That is the medium forecast.

HIGH FORECAST

The next is based on a high forecast. As you see, working under the high forecast TVA is dealing with, you see a little surplus capacity basically in the early years, but as you run out beyond 1986 and 1987 and beyond, not much surplus capacity is existing under that current high forecast.

LOW FORECAST

And the next chart is with the low forecast. Again, you end up with a situtation of low forecast following the current construction schedule. You would end up with substantial amounts of excess capacity, particularly as you run out into the 1920's and on to the year 2000, with it not phasing out until a little bit beyond the year 2000.

Dependable capacity through about the year 2000 is based on the current nuclear construction program. Growth in dependable capacity after the year 2000 is based on expected additional capacity that would be necessary to meet demand growth beyond the year 2000. It should be noted that capacity requirements are not identical with the forecast of demand that the TVA power system must supply. Capacity requirements are made up of the forecasted peak demand plus the desired reserve margin.

DESIRED RESERVE MARGIN

The desired reserve margin is the additional capacity above expected peak demand that is necessary to provide for scheduled maintenance, emergency outages, and deviations from average weather conditions.

TVA's desired reserve margin is currently based on a standard designed to limit disconnection of firm loads to no more than 168 hours annually. This standard of 168 hours was selected in mid-1979 based on a cost-benefit study that indicated this was the least-cost option, taking into account TVA's variable and fixed costs and the cost of outages to TVA customers.

Any amount of available capacity over and above the desired reserves is surplus to TVA's needs. Exhibits 9 through 14 show TVA's desired reserves, available reserves, and surplus capacity—available reserves minus desired reserves)—under the three planning forecasts and the current construction schedule.

As shown in exhibits 9 and 10, the medium forecast and current construction schedule would result in surplus capacity during 1981 to 2000 ranging from about 4 to 12 percent in terms of summer peak demand and from about 8 to 22 percent for winter peaks. Exhibits 11 and 12 show that under the low forecast and the current construction schedule, surplus capacity during 1981 to 2000 would range from about 4 to 34 percent in the summer and from about 9 to 54 percent in the winter. In comparison, exhibits 13 and 14 show that under the high forecast summer and winter peaks, TVA would have relatively little or no surplus capacity.

One observation I would like to make is that, as mentioned before, TVA's desired reserve margin is based on a standard that was selected in mid-1979 as the least-cost option. But since that time, the estimated costs of constructing new capacity have risen sharply, and as new capacity costs rise, the optimum reserve margin may be lower. In other words, the least-cost option based on the higher expected costs of new capacity may dictate that TVA be willing to disconnect firm loads more than 168 hours each year. This would tend to lower capacity requirements.

SURPLUS CAPACITY

As pointed out above, TVA would have relatively little or no surplus capacity under the high forecast. However, based on the low forecast summer peaks, TVA would have surplus capacity equivalent to about six nuclear units by the early to mid-1990's. Therefore, to address the question of the effect that potential surplus capacity has had on rates to date, we obtained the estimated revenue requirements that have been generated by the construction of the last six units due to go into operation under the current construction schedule.

As shown in exhibit 15, the cumulative revenue requirements for these six units have been about $215.9 million in fiscal years 1974 through 1980. On a per kilowatt hour basis, the largest yearly increase in revenue requirements due to these units was only about 0.5 mills.

OVERCAPACITY SITUATION

Just what options is TVA considering to respond to the potential overcapacity situation? As I mentioned earlier, TVA will not complete its analysis until this month or January 1981. Thus, we have not had time to assess in any detail the options that TVA is now analyzing, but I can make several observations about the basic options and their potential effect on rates.

FOUR BASIC OPTIONS REGARDING RATES

Our observations are based on unaudited data provided to us by TVA. My remarks will be confined to four basic options that describe the general parameters within which TVA's decision will likely be made.

Option A—Continue the current construction schedule with four units deferred: Yellow Creek 2, Phipps Bend 2, Hartsville B–1, and Hartsville B–2. Resume construction of the deferred units in 1984.

Option B—Defer six units: Yellow Creek 1 and 2, Phipps Bend 1 and 2, and Hartsville B–1 and B–2. Resume construction of Yellow Creek 1 and 2 in 1984 and cancel the other four units in 1984.

Option C—Immediately cancel four units: Phipps Bend 1 and 2 and Hartsville B–1 and B–2. Defer Yellow Creek 1 and 2 and resume construction in 1984.

Option D—Complete all units at Yellow Creek, Phipps Bend, and Hartsville B. Transfer surplus power to oil-dependent utilities under long-term exchange agreements, which are defined by TVA as 10 years or more.

Exhibit 16 compares the deferral versus cancellation revenue requirements of options A, B, and C during the years 1981 through 1987, or what I would call the short term. The exhibit shows the additional revenue requirements of each option over and above the revenue requirement associated with borrowings for construction during prior years.

As shown, by 1987 the total additional annual revenue requirement associated solely with the continued deferral of 4 units—option A—is about $586 million; the total additional annual revenue requirement associated with deferring six units now and canceling four in 1984—option B—is about $359 million; and the total additional revenue requirement associated with deferring two units and immediately canceling four units—option C—is about $287 million. As shown in exhibit 16, the additional annual revenue requirements for options A, B, and C are relatively small in terms of their year-to-year impact on power rates.

Under option D, TVA would complete all nuclear units and transfer excess power under long-term exchange agreements to utilities that are dependent on oil-fired generating capacity. Under this option, TVA could either maintain the current construction schedule and transfer surplus power as it becomes available, or TVA could speed up the construction schedule in accordance with the earliest dates that the other utilities would want to take the power. The utilities that TVA has contacted about taking surplus power are located in Arkansas, Louisiana, Oklahoma, Florida, Virginia, New York, and New Jersey.

The attractiveness of this option is that it would have the potential to relieve TVA ratepayers of the financial burden of surplus capacity after the plants were built and the transfer of power begun. But until the plants were completed and the transfer of power begun, TVA ratepayers would continue to bear the financing costs associated with construction of the surplus capacity.

If the construction schedule were advanced to sell power earlier, rates could rise faster because financing costs would rise more rapidly.

ADVANCED CONSTRUCTION SCHEDULE MAY INCREASE RATES

Senator SASSER. Mr. Peach, you say if the construction schedule were advanced to sell power earlier, rates could rise faster because financing costs would rise more rapidly?

Mr. PEACH. It relates directly to the amount of borrowings that would have to be made to finance the construction. So your construction costs are going up and therefore your interest costs would be going up, causing an even quicker increase in rates.

Senator SASSER. If you accelerate construction?

Mr. PEACH. That is right.

Let me turn now to long-term effects. In addition to looking at the short-term effects of options A, B, and C, we believe it is also useful to look at the estimated long-term effects of these options.

Exhibits 17, 18, and 19 compare revenue requirements under options A, B, and C. As shown from 1980 to about 1997, option A is slightly more expensive than options B or C. Then in about 1997, the revenue requirements for options B and C overtake those of option A and become slightly larger. But it should be noted that no appreciable difference in revenue requirements occurs until after the year 2000.

The basic reason that there is little difference between the revenue requirements of options A, B, and C, is that under each scenario TVA must continue expanding its borrowings, which results in rising interest charges.

If option B or C, both of which would cancel some of the units in the current schedule, were chosen, TVA would still have to greatly expand its borrowings to complete the Sequoyah, Watts Bar, Bellefonte, and Hartsville–A nuclear plants and to meet the costs of other items such as additions and improvements to existing generating facilities, new transmission facilities, and general facilities.

PROGRAMS TO REPLACE COAL-FIRED PLANTS

Then, under either of the three options, TVA would begin a new construction program in the early 1990's to replace coal-fired plants which are assumed to be retired after 50 years of service and to meet expected demand growth beyond the year 2000.

Because of the necessity to finance the expanded capital requirements, interest charges are expected to increase greatly from 1980 to 2000. For example, under option A, interest charges would increase from about $848 million to about $6.6 billion—unadjusted for inflation.

INCREASE IN INTEREST COSTS

Senator SASSER. The interest costs for TVA for last year were a billion dollars, weren't they?

Mr. PEACH. Yes, that is correct, it was about $1 billion.

Senator SASSER. So you have almost a sevenfold increase in interest costs.

Mr. PEACH. Right. And I think there are three points to emphasize regarding costs: (1) there are other plants in operation, (2) there are transmission requirements, and (3) there are replacements for coal-fired plants. Increases in costs to do these kinds of things may require substantial increases in the financing costs for borrowing.

CONSERVATION PROGRAMS

TVA has implemented a range of conservation programs during the past several years. Original estimates of the programs' cost effectiveness indicated that conservation programs as a whole offered potentially lower rate increases to TVA ratepayers because the relatively low-cost programs would enable TVA to defer some expansion of more expensive generating capacity. However, as described earlier, TVA, with its current nuclear construction program, potentially faces substantial amounts of excess capacity under its medium- and low-demand forecasts. When a utility is in an overcapacity situation, the utility can produce energy without having to add new capacity. Therefore, the marginal costs of producing additional energy are relatively low because the only costs involved are the variable costs; no additional fixed costs are required.

In such a situation, if consumers conserve energy, the average cost per kilowatt hour consumed will actually rise because the fixed costs will have to be spread over fewer kilowatt hours. In addition, if the utility spends money to promote conservation, these additional expenditures will also increase average costs per kilowatt hour. Consequently, one must wonder how TVA's potential overcapacity situation would affect the cost effectiveness of spending power funds on conservation programs.

INCREASED COSTS RESULT FROM REDUCED CONSUMPTION

Senator SASSER: Mr. Peach, that sounds like a Catch-22 situation. In other words, TVA is expending power funds in their conservation program, which I have enthusiastically supported in the past, and this is actually going to increase the cost of electricity per kilowatt hour because not as much will be consumed?

Mr. PEACH. Certainly in the short term, if they are in an overcapacity situation. For example, if you look at the medium forecast situation happening, in the short term at least up to the 1990's you could see that kind of situation occurring. Now I think you have to look at this thing both from a standpoint of laying out the hard facts, as they would or could exist, and from the standpoint of what you are trying to achieve with Conservation 2. I happen to also be enthusiastic about conservation, and I think that you could certainly make the case that given the uncertainty now of not knowing whether or not you would have a

low, medium or high forecast kind of situation really occur, that you would argue for continuing investments in that area because under a high forecast situation it pays off much more quickly. I think that there is basically a need in the country in general and TVA is doing a lot to move forward in that area of establishing a conservation ethic in general. And if you look over the longer term, at some point in time under any of the forecasts you are still having to replace plants that would be going out of service, that are outdated, and the more you do in conservation the longer you can defer some of the capital expenditures because you are losing less energy. So I think what I am doing in my statement is laying out the practical facts you do have to deal with and some of the short-term implications.

At the same time, I would like to place it in another context of how you need to look at it.

I might see if I can't be a little brief, Senator, because in discussing that question, we really have covered some of the points we were trying to make. Some of the details are covered more in exhibit 23 and exhibit 24.

Picking up on the bottom of page 16, it should be noted that, under this scenario, the benefits from 1993 forward may be sufficiently large to justify investing power funds in conservation programs in earlier years even when they are not cost-effective on a year-to-year basis.

SPENDING OF POWER FUNDS

It should also be noted that TVA must spend some level of power funds on conservation programs in years when the programs are not cost-effective if the programs are to be in place and operational when they are needed in the future.

In its study, TVA also combined the marginal cost results of the 1980 medium and low forecasts on a weighted basis. The weighted results indicated that conservation programs would offer no cost benefit until about the year 1993 when total marginal costs begin to exceed average total costs.

As mentioned earlier, if expenditures of power funds on conservation programs are not cost-effective, ratepayers as a whole do not benefit from the programs. The only ratepayers who benefit from the programs are those whose electric bills are lower because of their participation in the programs. However, TVA has recently taken actions that offset this situation to some extent.

CHANGES IN CONSERVATION PROGRAMS

For example, effective November 1, 1980, TVA made the following changes to some of its conservation programs:

—To reflect the increasing cost of money to TVA, the interest rate was raised from 8.5 to 10.5 percent for the heat pump financing program and from 6.5 to 10.5 percent for the solar Nashville and solar middle Tennessee solar water heating programs. However, TVA will continue to provide energy surveys to residential consumers at no charge.

—In the commercial and industrial energy conservation program,

loans to implement energy conservation opportunities will continue to be made at TVA's cost of money plus 1 percent. TVA will begin charging for comprehensive energy surveys an amount that reflects TVA's cost for performing the survey. However, the comprehensive survey charges will be rebated to those customers who implement sufficient conservation measures to achieve 75 percent of the recommended energy savings.

SURVEYS OF ENERGY CONSERVATION OPPORTUNITIES

TVA will continue to offer free walk-through surveys to spot easily identifiable energy conservation opportunities and provide a cost estimate for a comprehensive survey at a later date.

In effect, Senator, these actions represent an understanding by TVA of the cost effectiveness of conservation at this point and an effort on their part to make their conservations more nearly recover the cost of the programs, and that is something they will need to remain attentive to in the future.

As to overall implications, based on the options we examined concerning the suspension or cancellation of four nuclear units, we noted that none of the options in themselves offers the hope of significantly lower annual rate increases during the next decade. While an individual option may offer dollar savings that seem large in an absolute sense, the potential annual savings are relatively small in relation to total revenues and to the new revenue requirements added each year to complete the other nuclear plants under construction and to meet the costs of other items such as additions and improvements to existing facilities and new transmission facilities.

FUTURE DEMAND FOR ELECTRICITY

As described in our discussion of demand forecasting, TVA now faces a great amount of uncertainty about future demand because of uncertainty about factors such as economic growth and price elasticity of demand for electricity. It appears that within the next 4 years TVA should have enough time to collect the information it needs to predict these factors with greater certainty. During this period, TVA needs to maintain sufficient flexibility to respond in a reasonable fashion to the high, medium, or low forecast, whichever of them appears to be the most probable forecast of demand after obtaining new data on economic growth and price elasticity.

In our minds, the preliminary data we have examined indicates that TVA should neither cancel any nuclear units immediately nor forge ahead with completion of any deferred units immediately. But, it should continue along a path of deferring four, or perhaps even six, nuclear units and hold expenditures on them to the bare minimum required to restart construction if necessary. Based on the options we have examined, this path would not add unreasonable amounts to rates on a yearly basis, and these relatively small amounts of revenues would buy the time and information TVA needs to decide with more certainty whether to cancel or complete deferred nuclear units.

The aspect of buying time at a reasonable cost is also important from

the standpoint of being in a position to take advantage of technological advances, if any, in the generation of electricity.

For example, TVA may find in 4 to 5 years that its demand forecasts require the deferred nuclear units to be restarted. But another possibility is that technological breakthroughs may have occurred that offer significantly reduced capital costs, operating costs and/or reduced construction lead times. By having deferred the units and spent a bare minimum on them, TVA could possibly cancel the nuclear units and replace them with lower cost, technologically advanced new capacity, if it exists.

BENEFITS FROM DELAYING DECISIONS ON NEW CONSTRUCTION

One further point. Conservation programs can also play a part in buying time. The longer TVA can delay decisions about starting new plants in the 1990's to replace retired coal-fired plants and to meet projected demand and growth beyond the year 2000, the greater the likelihood there will be new generating technologies that may offer lower costs to ratepayers. Therefore, even if expenditures on conservation programs during the next decade cannot be shown to be cost- effective based on today's data, expenditures on these programs possibly could prove to be cost-effective investments that buy time TVA needs to be in a position to take advantage of technological breakthroughs 5, 10, or 15 years from now.

That concludes my statement, Senator. I and my colleagues will be pleased to try to respond to any questions.

Senator SASSER. Mr. Peach, I thank you for your statement and thank you for the splendid work you and your colleagues have done on this very, very complex, but I might say very, very crucial and critical issue.

The statement that you have given us is thought provoking. It has an enormous volume of information in it. I must say it takes a while to read this and digest it and assimilate it all. But there are some questions which do come to mind immediately.

IMPROVEMENTS IN DEMAND FORECASTING SYSTEM

I was gratified to hear you say in your prepared statement that Tennessee Valley Authority has made significant improvements in its demand forecasting system. Now, is there anything in particular in your judgment and that of your colleagues here today that TVA should be concentrating on to further improve its demand forecasting system?

Mr. PEACH. Well, first, Senator, I would say that I think that TVA in this case needs to be complimented for efforts it has made to improve its demand forecasting system.

Senator SASSER. Let me just interrupt.

The improvement in demand forecasting has occurred between the GAO study in 1978 and the Senate hearings that I held in 1979 and today, is that correct?

Mr. PEACH. I think it has occurred over the course of the last 2 years, but they have made a number of very important strides. I think basically the system is a good system that they are using. As I stressed in the statement, the things we will need to pay close attention to, that

TVA will need to pay close attention to in the immediate years ahead are the two most important factors, and that is the rate of growth in the economy and the direction it will take in the Tennessee Valley area, and also the elasticity of demand for electricity and whether the situation we have seen in energy over the last few years has caused a basic change, a basic structural change, in terms of how the people consume the electricity and their willingness to conserve. And we need to understand these trends and what they mean for forecasting demand.

IMPACT ON NUCLEAR CONSTRUCTION PROGRAM FROM DEMAND FORECASTING

Senator SASSER. Now the improved demand forecasting that has been instituted over the past 2 or 2½ years, has this had any significant impact on the nuclear construction program, or were the nuclear plants all planned and pretty well contracted for before the improved demand forecasting system came into effect?

Mr. PEACH. I was just asking my colleague, Mr. Spears, but the forecasting change, as I would understand it, had some implications for the deferral system. Making the decision to go ahead and defer the units that are in that kind of status were the result of the continuing decline in demand seen in forecasts as they were developed during the 1979 and 1980 period.

ELECTRICAL RESERVE MARGINS

Senator SASSER. One of your exhibits attached to your testimony, I think exhibit 9, shows that TVA has desired reserve margins; that is, electrical reserve margins of about 30 to 40 percent during the 1980's. And exhibit 12 indicates that under the worst case, the reserve margins could reach 95 percent, or 54 percent surplus by the turn of the century, the year 2000. Now what reserve margins does the utility industry in general believe to be sufficient to provide adequate liability?

Mr. PEACH. Well, we do have an opportunity to have some overview on a national basis from our other work in the electrical area. One publication you can refer to is Department of Energy data looking at electrical power supply and demand during the 1980 decade. A fairly recent report indicates that utilities generally have a planned reserve margin in the range of 15 to 25 percent that they are dealing with. So you do find a little bit of difference. They have generally been dealing in the 15 to 25 percent reserve margin range.

Senator SASSER. So we have the utility industry dealing with a 15 to 20 percent reserve margin, and you are indicating that TVA during the eighties could have about 30 or nearly 40 percent reserve, or using their low figure for electrical consumption, about 95 percent reserve, or a 54 percent surplus in capacity, if we take the worst case.

Mr. PEACH. Yes, Senator. The figures are somewhat detailed, but no, we would not see any difference in the figures. That is what they indicate.

TVA A CLOSED SYSTEM

Senator SASSER. TVA would be running a significantly higher reserve there taking the worst case than the utility industry does generally. Now

in assessing these reserves that are necessary, is it taken into consideration the possibility of purchasing power from other utilities in time of need, for example, when a generating facility goes down and is not producing?

Mr. PEACH. My understanding is that TVA tends to look at their system more in terms of a closed system in coming up with those kinds of projections. The question of how they may factor in the ability to obtain power from other sources if need be and how that would affect their reserve margin calculations, I really believe they at least include that in the calculation.

POWER POOLING BY RELIABILITY COUNCIL

Senator SASSER. Well, do other utilities look at it as a closed system, or do they look at it from the point of view of purchasing power from other areas when a generating facility goes down for some particular reason, a coal-fired plant malfunctions and puts them in a deficit period, at a time of peak demand?

Mr. PEACH. Many utilities around the country have entered into something called a reliability council, the power pooling kind of arrangement and in those kinds of situations they do take into consideration the possibility of being able to obtain power from other sources in the event of unusual outage kind of situations, and that does affect their calculations of reserve capacity.

RESERVE MARGINS

Senator SASSER. On page 9 of your statement, you indicate that TVA's estimated reserve margins are based on a standard that TVA adopted last year. Now, in view of the fact that conditions have changed in the past 12 to 15 months, I would suggest that perhaps the standard TVA has adopted is in error.

Now, you state if this is true, and I quote, "This would tend to lower capacity requirements." Another way of putting it is that the reserve margins could actually be higher than the surplus rate that you and TVA have estimated here today.

Now if the TVA standard is in error, and has been in error in the past 10 to 15 months, how much greater could the reserve margin be over what is presently expected, or could you answer that question today?

Mr. PEACH. Senator, I don't really have an answer for that one directly. I think it would be a good one to address to TVA. We were dealing principally with their situation, and as indicated, of course, we were trying to point out that as construction costs continue to expand, if you are looking at these things on a cost-effective basis, it will affect your calculation.

Now, just exactly how much would require sort of running those calculations, how much it is increased, and what that means for capacity: I will ask Mr. Spears if he can amplify on that.

Mr. SPEARS. Increasing the number of hours wouldn't drastically increase the surplus capacity, but I would point out there would be some margin of error if the cost/benefit study indicated that hours should be higher.

TVA DEBT CEILING

Senator SASSER. You mentioned in your statement that TVA will have to greatly expand its borrowing no matter which option it chooses, whether it chooses to go full tilt and construct all the nuclear generating facilities, whether it chooses to defer some, or whether it chooses just to abandon some of the facilities. Now, could you tell me approximately when the Tennessee Valley Authority will reach its $30 billion debt ceiling under the present construction schedule?

Mr. PEACH. I think our calculations indicate around 1990, under the present construction schedule. And, of course, the question of considering any kind of change in that ceiling would have to take place earlier if you were to have an orderly kind of situation with proceeding to obtain the funds and finance activities.

PRICING ARRANGEMENTS BY TVA

Senator SASSER. You said TVA has considered entering into long-term exchange agreements with other utilities to relieve TVA ratepayers of the burden of excess capacity as it comes on line.

Now, assuming that TVA enters into such exchange agreements with other utilities, what sort of pricing arrangements should TVA make to assure that TVA ratepayers are not subsidizing the customers of other private utilities around the country?

Mr. PEACH. As I indicate in my statement, one of the phenomena that would happen, of course, would be during the interim period, while construction was taking place, the ratepayers may still have to absorb the interest cost for the money required to finance the construction. In general, if you move to the long-term exchange agreements, we think they should try to get as complete a reimbursement as possible.

The price should cover such factors as the full cost of power, including all their fixed and variable costs, any risk of outage costs to TVA as a result of providing that power to others, and a return on the ratepayers' investment of TVA, and that would be the investment they made in the construction facilities during that interim period. Otherwise, you could end up with a situation where TVA ratepayers had to, in effect, subsidize the customers of other utilities.

SLOW TVA REGION GROWTH DURING 1970'S

Senator SASSER. In your statement, you also indicated that TVA is currently in the process of trying to determine why the TVA region grew slower than the rest of the Nation during the mid- and late 1970's. In fact, I think in 1973, the Tennessee Valley area began to grow at a rate less than that of the national average; up to 1973 it had grown faster than the national average for the decade preceding.

Now, based on the General Accounting Office's own knowledge, could you tell this hearing what factors that you see as leading to this slow growth? And I will ask you during this period, if the fact that TVA electrical rates have gone up rather dramatically, do you believe this would have an effect on the failure of the Tennessee Valley area to grow as fast as the national average, or significantly faster. The question is, do you have any explanation for the slow growth, and if so, are increasing electrical rates a significant factor in that slow growth?

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Mr. PEACH. Senator, I do not have any information, really, to provide on that kind of question. I think one of the issues that will have to be dealt with in trying to get better information to look at the future is whether or not that change was just for an interim period, and what the future growth rate is likely to be. But I don't have any good information. Factors that bear on it is while TVA's rates were going up, rates were increasing in other areas, and they still retain some relative advantage in terms of the rate structure compared to other locations.

Senator SASSER. Mr. Peach, I want to thank you this morning for your testimony, and express my appreciation to you and your colleagues for coming this morning.

Mr. PEACH. Thank you, Senator.

TENNESSEE VALLEY AUTHORITY

STATEMENT OF S. DAVID FREEMAN, CHAIRMAN, TENNESSEE VALLEY AUTHORITY

ACCOMPANIED BY:
RICHARD FREEMAN, DIRECTOR, TENNESSEE VALLEY BOARD
ROBERT CLEMENT, DIRECTOR, TENNESSEE VALLEY BOARD

INTRODUCTION OF TVA BOARD WITNESSES

Senator SASSER. Next I would like to call this morning the members of the Tennessee Valley Authority Board to the witness table.

Chairman Freeman, I want to welcome you this morning to this committee and say we look forward to your testimony. You and your distinguished colleagues, Director Richard Freeman and Director Robert Clement, are becoming regulars before this committee, and we are always glad to see you.

I want to say at the outset that it is well known I had disagreements with this TVA Board and with this TVA Chairman in the past over policy matters. We have also had areas of agreement, I want to emphasize that also. And I suspect that in the future in dealing with a matter as complex as economic growth, load forecasting, the increasing of electrical rates that might come about as a result of some of that, that we may have disagreements in the future.

But I want to say to you, Mr. Chairman, and to your fellow members of the Board, that I have a great deal of respect for each one of you and for the work that you are doing for the people in the Tennessee Valley area. Your dedication and hard work are appreciated by me and by others. That goes for every member of this committee, and I am sure I am speaking for every member of the subcommittee when I say that.

Now, it is my understanding, Mr. Chairman, that you will be presenting the testimony for the entire Board, and before getting into that, I would like to insert some material into the record.

I would like to insert a series of questions relating to the demand forecasting which I presented to the TVA at the regular hearing of this subcommittee just this past spring. Also included will be TVA's responses to my questions.

QUESTIONS SUBMITTED TO TVA

In preparation for this hearing we asked that TVA testify to the following questions: (1) what improvements have been made in TVA load forecasting; (2) what additional steps are being planned to assure continued improvement in TVA's load forecasting procedure; (3) what

will be the magnitude of TVA's surplus capacity by the middle of the 1980's; (4) will TVA ultimately need all of this electrical generating capacity in the future; and (5) what are the options being explored by the TVA to alleviate this excess capacity situation if indeed it does exist?

TVA RATE INCREASES

Mr. Freeman, before you get into your testimony I want to reiterate to you my continuing and growing concern about the magnitude of TVA's rate increases. GAO has already alluded to the fact that during the past several years, growth in the valley has lagged behind the rest of the Nation. The most recent econometric study developed by the University of Tennessee indicates that the unemployment rate in Tennessee will continue to be higher than the national average through the late 1980's. I can only hope that this econometric study is unduly pessimistic.

I understand that 700,000 families, or more than 30 percent of all the families in the Tennessee Valley Authority region are now paying 10 percent of their income for electrical energy. And I do not think any of us like what those statistics tell us here today. The traditional role of TVA of providing a rate yardstick and promoting accelerated economic growth seems to have been diminished severely. The people of the Tennessee Valley area unhappily just do not seem to have the same confidence in TVA that they have had in the past that TVA is doing all it can to hold down rates.

Now I know that this Board, each member of this Board is as concerned about this situation as I am. So I look forward this morning to your testimony, and you may proceed, Mr. Chairman.

Mr. FREEMAN. Thank you, Mr. Chairman. I very much appreciate the spirit in which this hearing is being held. I might say that when I say I am glad to be here on behalf of the Board, I really mean it. We believe that these hearings and the record that is being so painstakingly developed by the GAO testimony, will provide a more solid basis perhaps than TVA itself could provide in assuring the people of the valley that we are on the right track. Therefore, we believe that the hearings will serve and are serving a very constructive purpose.

PREPARED STATEMENT

I have a rather lengthy prepared statement with appendixes which I would like to submit for the record and proceed by summarizing it if I may, Mr. Chairman.

Senator SASSER. We would welcome that. I read your statement in detail.

Mr. FREEMAN. Thank you, sir.

[The statement follows:]

PREPARED STATEMENT OF S. DAVID FREEMAN, CHAIRMAN
TENNESSEE VALLEY AUTHORITY

MR. CHAIRMAN:

ON BEHALF OF THE TVA BOARD, I AM PLEASED TO HAVE THIS OPPORTUNITY TO TESTIFY BEFORE THE SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT.

THE QUESTIONS RAISED IN YOUR LETTER OF INVITATION--PRINCIPALLY WHETHER TVA IS BUILDING MORE ELECTRIC POWER GENERATING CAPACITY THAN IT NEEDS--CAN BEST BE EVALUATED IN THE CONTEXT OF TVA'S MISSION AND PURPOSE.

SINCE ITS CREATION IN 1933, TVA HAS BEEN CHARGED WITH PROMOTING THE ECONOMIC AND SOCIAL WELL-BEING OF THE PEOPLE OF THE TENNESSEE VALLEY AND OF SERVING AS A NATIONAL DEMONSTRATION OF RESOURCE DEVELOPMENT AND CONSERVATION. MEETING THIS CHALLENGE HAS NEVER BEEN EASY, NOR HAS IT BEEN WITHOUT CONTROVERSY. THE ONE CHARACTERISTIC THAT HAS DISTINGUISHED TVA FROM MANY OTHER GOVERNMENT AGENCIES HAS BEEN ITS ENTHUSIASM FOR TACKLING DIFFICULT PROBLEMS AND ITS TRACK RECORD OF COMING UP WITH ANSWERS THAT WORK. THIS SPIRIT IS STILL VERY MUCH ALIVE AT TVA.

TVA'S BASIC MISSION REMAINS THE SAME TODAY, BUT WE HAVE TO PURSUE OUR OLD MISSION IN A NEW WORLD. THIS PROCESS OF ADAPTING TO A CHANGING WORLD IS CONTINUOUS AND IT IS ONE IN WHICH TVA INVOLVES AND IS ACCOUNTABLE TO THE PEOPLE. THE BOTTOM LINE TODAY IS JOBS--HELPING THE REGIONAL ECONOMY GROW TO PROVIDE ENOUGH GOOD-PAYING JOBS FOR EVERY POTENTIAL WORKER. IT'S FAIR TO SAY THAT THIS BASIC CONCERN OFTEN GETS LOST IN THE DEBATE OVER MORE IMMEDIATE ISSUES, SUCH AS ELECTRIC RATES.

IN PURSUIT OF THIS GOAL, TVA'S EFFORTS ARE DIRECTED PRINCIPALLY AT HELPING THE REGION AND THE NATION THROUGH THREE ECONOMIC TRANSITIONS THAT WILL LIKELY DETERMINE THE QUALITY OF LIFE IN THE TENNESSEE VALLEY AND THE UNITED STATES FOR THE BALANCE OF THIS CENTURY AND BEYOND. THESE ARE:

--THE TRANSITION IN THE VALLEY FROM A LOW-COST ENERGY ECONOMY THAT RELIED ON LOW-COST HYDRO POWER, COAL, AND IMPORTED PETROLEUM TO AN ECONOMY OF MUCH HIGHER COST ENERGY DRAWN FROM A VARIETY OF RELIABLE DOMESTIC SOURCES, PRINCIPALLY COAL, URANIUM, RENEWABLE RESOURCES, AND CONSERVATION.

--THE TRANSITION FROM AN ECONOMY THAT ASSUMED AN UNLIMITED ABUNDANCE OF NATURAL RESOURCES, INCLUDING WATER, AIR, AND FARMLAND, TO ONE THAT RECOGNIZES THEIR LIMITS AND FACES THE COSTS AND BENEFITS OF GROWTH THAT WILL PRESERVE OUR BASIC LIFE-SUSTAINING RESOURCES.

--THE TRANSITION FROM A POST-WORLD WAR II REGIONAL ECONOMY BASED PREDOMINATELY ON AGRICULTURE AND LOW-SKILL, LOW-WAGE MANUFACTURING TO AN ECONOMY CAPABLE OF PROSPERING IN AN INTENSELY COMPETITIVE NATIONAL AND INTERNATIONAL ECONOMY.

THE IMPORTANCE AND DIFFICULTY OF THESE EFFORTS ARE JUST AS REAL AS TVA'S INITIAL TASK OF HARNESSING THE TENNESSEE RIVER AND PROVIDING THE BASIC ECONOMIC TOOLS FOR THE REGION TO LIFT ITSELF OUT OF THE POVERTY OF THE GREAT DEPRESSION. THE STAKES ARE JUST AS HIGH AS THEY WERE 47 YEARS AGO.

FOR TVA, THE JOB TODAY BOILS DOWN TO, FIRST, HELPING THE VALLEY MAINTAIN AND EXTEND ITS ENERGY ADVANTAGE IN A WORLD OF RISING ENERGY COSTS, ENERGY SHORTAGES, NEW ENERGY TECHNOLOGIES, ENVIRONMENTAL CONCERNS, AND REGULATORY UNCERTAINTY. THIS ENERGY ADVANTAGE WILL BE VITAL IN ACHIEVING TVA'S SECOND MAJOR OBJECTIVE OF HELPING KEEP OPEN THE DOOR TO ECONOMIC PROSPERITY FOR THE VALLEY IN A WORLD OF STIFF FOREIGN AND DOMESTIC COMPETITION.

TVA'S TWO MAJOR GOALS--ASSURING THE VALLEY'S ENERGY ADVANTAGE AND HELPING BUILD A COMPETITIVE REGIONAL ECONOMY--ARE INEXTRICABLY LINKED. NOTHING WOULD SLAM THE DOOR TO ECONOMIC PROSPERITY MORE COMPLETELY THAN LOSING THE VALLEY'S ENERGY ADVANTAGE.

WHAT IS TVA DOING TO MAINTAIN AND EXTEND THE VALLEY'S ENERGY ADVANTAGE?

THE FIRST STEP IN ANSWERING THIS QUESTION IS TO UNDERSTAND HOW TVA'S POWER SYSTEM HAS EVOLVED OVER THE PAST HALF-CENTURY. AS YOU KNOW, MR. CHAIRMAN, TVA'S RATES ARE STILL CONSIDERABLY LOWER THAN THE NATIONAL AVERAGE BUT THE PERCENTAGE MARGIN OF DIFFERENCE HAS FALLEN BY HALF SINCE 1970--FROM ABOUT 50 PERCENT LOWER THEN TO ABOUT 25 PERCENT LOWER TODAY. THIS CHANGE IS DUE TO SEVERAL FACTORS:

--INEXPENSIVE HYDROELECTRIC POWER IS PROGRESSIVELY BECOMING A SMALLER PART OF TVA'S TOTAL POWER SUPPLY. IT NOW PROVIDES ABOUT 15 PERCENT IN A YEAR OF AVERAGE RAINFALL INSTEAD OF 100 PERCENT AS FROM TVA'S EARLY YEARS TO THE EARLY 1950'S.

--TVA'S "APPROPRIATIONS ADVANTAGE" WHERE THE FEDERAL GOVERNMENT ADVANCED THE MONEY TO BUILD TVA'S POWER FACILITIES ENDED IN 1959 WHEN THE TVA POWER SYSTEM WAS MADE TOTALLY SELF-SUPPORTING. NOT ONLY THAT, TODAY'S RATEPAYERS MUST BEAR THE FINANCIAL BURDEN OF REPAYING, WITH INTEREST THAT REFLECTS CURRENT INTEREST RATES, THE GOVERNMENT FUNDS ADVANCED TO BUILD TVA'S DAMS AND EARLY COAL-FIRED STEAM PLANTS. (INCIDENTALLY, TVA PAID INTEREST OF 8.6 PERCENT IN 1980 FOR MONEY THAT THE GOVERNMENT BORROWED INITIALLY AT AN AVERAGE RATE OF 2.3 PERCENT.) THIS FEDERAL PAYMENT AMOUNTED TO $98 MILLION IN 1980.

--TVA'S "TECHNOLOGICAL ADVANTAGE" THAT GREW OUT OF BUILDING A LARGE INTEGRATED POWER SYSTEM AND PIONEERING THE INDUSTRY'S FIRST LARGE FOSSIL PLANTS--UP TO 1,000 MEGAWATTS--IS ALSO GONE. THE REST OF THE INDUSTRY HAS CAUGHT UP WITH TVA AND NOW ACHIEVES THE SAME KIND OF ECONOMIES OF SCALE AND EFFICIENCIES THAT TVA ALONE ENJOYED DURING THE 1950'S AND EARLY 1960'S.

THESE THREE FUNDAMENTAL CHANGES BEGAN TO AFFECT TVA POWER RATES IN THE 1960'S. AS A RESULT, TVA WAS SUBJECTED INCREASINGLY TO THE SAME INFLATIONARY PRESSURES AS EVERY OTHER ELECTRIC UTILITY.

A PROFILE OF THE BASIC FACTORS WHICH AFFECT TVA'S RATES TODAY IS MUCH LIKE THAT OF ANY LARGE UTILITY WITH A SIGNIFICANT CONSTRUCTION PROGRAM. THERE IS NO REASON TODAY, APART FROM TVA'S EFFICIENCIES AND FINANCIAL SOUNDNESS, WHY TVA'S RATES SHOULD BE LOWER THAN THE NATIONAL AVERAGE. HOWEVER, DUE TO THE EFFICIENCY AND SIZE OF TVA'S INTEGRATED SYSTEM, WE CAN LIKELY CONTINUE TO GENERATE POWER ABOUT 25 PERCENT CHEAPER, ON THE AVERAGE, BUT IT IS SIMPLY IMPOSSIBLE TO RECAPTURE THE 50-PERCENT ADVANTAGE WE USED TO ENJOY. MR. CHAIRMAN, I AM INCLUDING AS AN APPENDIX TO MY TESTIMONY A MORE DETAILED EXPLANATION OF THE CAUSES OF RECENT RATE INCREASES AND A SUMMARY OF TVA'S EFFORTS TO KEEP FUTURE INCREASES AS LOW AS POSSIBLE.

TVA'S FUTURE "ENERGY ADVANTAGE" WILL LIE IN HAVING AN AMPLE SUPPLY OF RELIABLE POWER AT COMPETITIVE PRICES WHEN OTHER REGIONS MAY WELL BE SHORT OF CAPACITY.

WE AGREE COMPLETELY WITH SENATOR SASSER WHEN HE STATED AT ANOTHER SENATE HEARING IN KNOXVILLE IN FEBRUARY 1979: ". . . WE MUST ASSURE THAT WE HAVE THE ENERGY TO EXPAND OUR ECONOMY AND PROVIDE NEW JOB OPPORTUNITIES FOR ALL OF OUR PEOPLE." TVA'S ACE-IN-THE-HOLE IN THIS REGARD IS ITS NUCLEAR CONSTRUCTION PROGRAM.

THE KEY QUESTION--AND THE FOCUS OF THIS HEARING--IS TO DECIDE HOW MUCH ELECTRICITY IS ENOUGH. WHAT MAKES THIS DECISION SO DIFFICULT IS THAT IT MUST BE MADE 10 TO 20 YEARS BEFORE THE POWER IS NEEDED. PRIOR BOARDS FRANKLY VIEWED THE POSSIBILITY OF HAVING TOO MUCH ENERGY AS ANALOGOUS TO THE POSSIBILITY OF HAVING TOO MUCH MONEY--THEY DIDN'T SPEND MUCH TIME WORRYING ABOUT IT. THEIR STRATEGY WAS TO PROVIDE THE POWER ON THE PREMISE THAT ITS AVAILABILITY WOULD STIMULATE ECONOMIC DEMAND WHICH, IN TURN, WOULD CREATE THE MARKET FOR THE POWER THAT THEY HAD PROVIDED. SUPPLY WOULD CREATE DEMAND THROUGH ECONOMIC GROWTH.

DURING THE 1950'S AND 1960'S, THIS STRATEGY WORKED WITH STRIKING SUCCESS. THE REGION'S ECONOMY GREW RAPIDLY--PER CAPITA INCOME ROSE AT BETTER THAN 7 PERCENT PER YEAR AND MANUFACTURING EMPLOYMENT INCREASED AT BETTER THAN 4 PERCENT ANNUALLY. AS A

RESULT, THE DEMAND FOR ELECTRIC POWER INCREASED ANNUALLY BY 7 PERCENT. THE ECONOMIES OF SCALE MADE POSSIBLE BY TVA'S PIONEERING LEADERSHIP IN BUILDING LARGE CENTRAL GENERATING PLANTS PUSHED THE UNIT PRICE OF ELECTRICITY LOWER AND LOWER.

TVA'S NUCLEAR CONSTRUCTION PROGRAM WAS CONCEIVED IN THE 1960'S LARGELY ON THE BASIS OF THIS BULLISH EXPERIENCE. THE BOARD'S PRINCIPAL CONCERN AT THAT TIME WAS HOW TO KEEP AHEAD OF LOAD THAT APPEARED LIKELY TO DOUBLE EVERY 10 YEARS. THIS LED TO APPROVAL BY 1974 OF THE NATION'S MOST AMBITIOUS NUCLEAR CONSTRUCTION PROGRAM OF 17 NUCLEAR UNITS.

CHART 1 DEPICTS THE LOAD FORECAST MADE IN 1974, WHEN THE LAST TWO PLANTS IN TVA'S NUCLEAR CONSTRUCTION PROGRAM WERE AUTHORIZED, AND COMPARES IT TO THE LOAD FORECAST MADE EARLIER THIS YEAR. THE STRIKING DIFFERENCE IN THESE TWO FORECASTS REFLECTS A NUMBER OF FACTORS, SUCH AS THE EFFECTS OF HIGHER ENERGY PRICES, LOWER ECONOMIC GROWTH, INCREASED CONSERVATION AND RENEWABLE RESOURCES, AND THE MORE SOPHISTICATED AND SENSITIVE FORECASTING TECHNIQUES DEVELOPED BY TVA OVER THE PAST SEVERAL YEARS.

IN RESPONSE TO THESE CHANGES, THE TVA BOARD CANCELLED PLANS FOR TWO ADDITIONAL UNITS AFTER BIDS HAD BEEN RECEIVED AND, IN 1979, DEFERRED FOUR NUCLEAR UNITS BY SHUTTING DOWN THE CONSTRUCTION WORK ON TWO UNITS AT HARTSVILLE B PLANT AND UNITS 2 AT BOTH PHIPPS BEND AND YELLOW CREEK--EXCEPT FOR COMMON ITEMS NEEDED FOR UNIT 1 OPERATIONS. FURTHER MODIFICATIONS TO THIS PROGRAM WILL BE MADE AS NECESSARY, BUT THEY COULD BE ON EITHER THE PLUS OR MINUS SIDE.

IN ITS EFFORTS TO MAINTAIN AND EXTEND THE VALLEY'S ENERGY ADVANTAGE, THE TVA BOARD HAS ALSO INITIATED THE NATION'S MOST EXTENSIVE EFFORT IN ENERGY CONSERVATION AND IN DEVELOPING RENEWABLE ENERGY RESOURCES. THIS EFFORT IS PARTICULARLY IMPORTANT IN EASING THE VALLEY'S TRANSITION FROM AN ECONOMY BASED ON ABUNDANT AND CHEAP ENERGY TO ONE THAT MUST FACE THE REALITY OF HIGHER ENERGY PRICES.

TVA'S LOAD FORECASTS TAKE INTO ACCOUNT THE REDUCED CONSUMPTION OF ELECTRICITY THAT WILL BE ACHIEVED THROUGH GREATER EFFICIENCY OF ITS USE AND BY SUBSTITUTING RENEWABLE RESOURCES, SUCH AS SOLAR ENERGY, FOR COAL AND URANIUM. ENERGY CONSERVATION SHOULD BE SEEN AS ANOTHER SUPPLY STRATEGY, ONE THAT IS CHEAPER AND QUICKER THAN BUILDING THE EQUIVALENT POWER PLANTS. BY THE END OF THE CENTURY, TVA HOPES TO ACHIEVE THE EQUIVALENT OF ABOUT 6,000 MEGAWATTS OF POWER, MORE THAN A FOUR-UNIT NUCLEAR PLANT, THROUGH GREATER ENERGY EFFICIENCY.

THE PAST DECADE HAS TAUGHT US THAT ANY FORECAST OF HOW MUCH ENERGY WILL BE NEEDED 10 OR 20 YEARS IN THE FUTURE IS HIGHLY UNCERTAIN. FORECASTING HAS NEVER BEEN AND NEVER WILL BECOME AN EXACT SCIENCE--AT BEST IT IS A FORM OF MAKING EDUCATED GUESSES. I AM ATTACHING AS AN APPENDIX TO THIS TESTIMONY A PAPER THAT DESCRIBES TVA'S INTENSIVE EFFORT TO UPGRADE ITS FORECASTING METHODOLOGY. THIS EFFORT HAS BEEN SUCCESSFUL. TODAY TVA'S LOAD FORECASTS ARE AS GOOD AS ANYONE IN THE BUSINESS AND BETTER THAN MOST. BUT LOAD FORECASTS, TAKEN ALONE, ARE NOT THE BASIS FOR A DECISION. THEY MUST BE SUPPLEMENTED BY ANALYSIS OF THE RELATIVE RISKS TO THE CONSUMER'S POWER BILL AND TO THE REGION'S ECONOMIC GROWTH OF "OVERBUILDING" AS COMPARED TO "UNDERBUILDING."

THE SUBSTANTIAL UNCERTAINTY THAT REMAINS ABOUT THE SIZE OF FUTURE LOADS CANNOT BE ELIMINATED BY MORE SOPHISTICATED FORECASTING TECHNIQUES. THE UNCERTAINTY ABOUT TVA'S FUTURE LOADS IS AN UNAVOIDABLE CONSEQUENCE OF A MORE UNCERTAIN WORLD.

ON THE LOW GROWTH SIDE THERE COULD BE SLUGGISH ECONOMIC ACTIVITY BECAUSE OF PROLONGED OR RECURRING NATIONAL RECESSIONS, HIGHER ELECTRICITY PRICES AND MORE CONSERVATION, AND GREATER SUBSTITUTION OF OTHER FUELS FOR ELECTRICITY. YET IT IS ALSO POSSIBLE THAT THE VALLEY COULD ENJOY HIGHER THAN NORMAL ECONOMIC GROWTH AS IT HAS IN THE PAST; THAT TRAINS, CARS, AND BUILDINGS WOULD SHIFT FROM OIL AND GAS TO ELECTRICITY AS PETROLEUM PRICES GO SKY-HIGH; AND THAT INDUSTRY WOULD MOVE TO THE POWER-SUFFICIENT TENNESSEE VALLEY FROM AREAS OF SHORTAGE. IN THE FIRST INSTANCE TVA MIGHT HAVE EXCESS

GENERATING CAPACITY IF IT CONTINUED ITS EXISTING CONSTRUCTION PROGRAM OF 10 NUCLEAR UNITS. IN THE LATTER CIRCUMSTANCES WE COULD FIND OURSELVES SHORT OF CAPACITY.

THOSE ARE THE UNCERTAINTIES OF THE REAL WORLD WHICH THIS BOARD MUST FACE WHEN DECIDING THE SCOPE AND PACE OF TVA'S NUCLEAR CONSTRUCTION PROGRAM. THE ANSWER IS NOT DICTATED BY ANY ONE SET OF NUMBERS THAT COME OUT OF EVEN THE MOST SOPHISTICATED COMPUTER MODEL.

TRADITIONALLY, TVA LOAD FORECASTS WERE PROVIDED IN TERMS OF A SINGLE FORECAST. IN ORDER TO IMPROVE OUR LOAD FORECASTING CAPABILITY, WE BEGAN TO DEVELOP A RANGE OF ESTIMATES BASED ON VARYING ASSUMPTIONS ABOUT SEVERAL FACTORS INFLUENCING LOAD GROWTH. THE GAO CONCURRED WITH THIS APPROACH. HOWEVER, SOME PERSONS EVALUATING THESE FORECASTS HAVE ATTRIBUTED FAR TOO MUCH PRECISION TO THE SPECIFIC MIDRANGE ESTIMATES. THE INTENT OF THE LOAD FORECAST IS TO ESTABLISH REASONABLE LIMITS TO THE RANGE OF UNCERTAINTY--NOT TO PICK A PRECISE NUMBER.

IN OUR CURRENT FORECAST, WITH THE INFORMATION AVAILABLE AND USING THE TECHNIQUES DESCRIBED IN THE APPENDIX, WE CONCLUDE THAT THERE IS SLIGHTLY LESS THAN A 10-PERCENT CHANCE THAT THE LOAD IN 1990 WILL BE GREATER THAN OUR HIGH ESTIMATE AND ONLY ABOUT A 7-PERCENT CHANCE THAT IT WILL BE LOWER THAN OUR LOW RANGE. WE ARE THUS FAIRLY CONFIDENT THE LOAD WILL FALL WITHIN THIS RANGE, BUT TO SELECT A MIDPOINT OF THIS RANGE AS THE PRIMARY BASIS FOR ANY DECISION WOULD BE FOOLISH AND, INDEED, WOULD BE A THROWBACK TO THE KIND OF SINGLE-VALUE FORECASTING TVA DID IN THE PAST. IT IS HIGHLY UNLIKELY THAT ANYONE IS WISE ENOUGH OR LUCKY ENOUGH TO HIT A TARGET RIGHT ON THE MONEY 10 OR 20 YEARS IN THE FUTURE.

HAVING ESTABLISHED A RANGE OF FUTURE DEMAND IN WHICH WE HAVE CONFIDENCE, THE BOARD IS FACED WITH THE KEY QUESTION OF WHETHER IT IS BETTER TO ERR ON THE HIGH SIDE OF THE RANGE--THAT IS, RUN THE RISK OF ENDING UP WITH EXCESS CAPACITY--OR ON THE LOW SIDE--THAT IS, RISK RUNNING SHORT OF GENERATING CAPACITY. WHAT ARE THE

RISKS--AND COSTS AND BENEFITS--OF HAVING TOO MUCH AND TOO LITTLE POWER? THAT IS THE KEY QUESTION BEFORE US.

THE BOARD IS UNITED IN THE CONCLUSION THAT THE RESPONSIBLE AND PRUDENT POLICY IS TO TARGET TVA'S NUCLEAR CONSTRUCTION SCHEDULE IN ORDER TO ACCOMMODATE THE LOAD THAT WOULD BE GENERATED BY ECONOMIC GROWTH AT THE HIGH END OF THE EXPECTED RANGE.

LET ME OUTLINE SIMPLY THE BOARD'S REASONING:

1. IF TVA WERE TO KEEP TO ITS CURRENT CONSTRUCTION SCHEDULE AND THE VALLEY WERE TO GROW AT THE LOW END OF THE RANGE, CAPACITY FROM NEWER, LOW-COST NUCLEAR PLANTS COULD BE SUBSTITUTED FOR OLDER, HIGH-COST COAL-FIRED PLANTS. MOREOVER, IF ANY EXCESS CAPACITY DEVELOPS, IT IS LIKELY THAT INTERIM EXCHANGES OF POWER WITH OIL AND GAS BURNING UTILITIES COULD BE ARRANGED THAT WOULD BENEFIT THE RATEPAYERS OF TVA, THE RECEIVING UTILITY, AS WELL AS NATIONAL ENERGY POLICY. THIS SHARPLY LIMITS THE COSTS OF ANY EXCESS CAPACITY.

2. ON THE OTHER HAND, IF TVA WERE TO REDUCE FURTHER ITS SCALED-DOWN CONSTRUCTION PROGRAM AND THE VALLEY ECONOMY WERE TO GROW AT THE HIGH END OF THE RANGE, TVA WOULD HAVE TO BUY POWER FROM OTHER UTILITIES IF AVAILABLE, AND, TO ENSURE RELIABILITY, ADD CAPACITY ON A CRASH BASIS. THIS WOULD SUBSTANTIALLY INCREASE COSTS AND RATES TO CONSUMERS.

3. IF TVA WERE TO REDUCE OR SLOW DOWN ITS CONSTRUCTION SCHEDULE, CAPITAL AND INTEREST COSTS WOULD BE LOWER. HOWEVER, THE SIZE OF THE REDUCTION IS MODEST--NEGLIGIBLE IN THE NEXT TWO OR THREE YEARS WHEN UPWARD PRESSURE ON RATES IS MOST SEVERE AND MODEST THEREAFTER. EVENTUALLY RATES WOULD HAVE TO BE HIGHER THAN IF TVA HAD KEPT TO THE CURRENT SCHEDULE BECAUSE OF HIGHER COST OF BUILDING THIS POSTPONED CAPACITY.

4. IF TVA WERE TO PLAN FOR SLOW ECONOMIC GROWTH BY REDUCING THE CURRENT SCHEDULE, WE WILL GET SLOW GROWTH--OUR PLAN WILL BE A SELF-FULFILLING PROPHECY WITH SUBSTANTIAL COSTS IN TERMS OF

JOBS, INCOME, AND OUTPUT. IN AN ERA OF POWER SHORTAGES THE ABILITY TO GIVE INDUSTRY BELIEVABLE COMMITMENTS TO SUPPLY POWER IN THE FUTURE IS A VALUABLE REGIONAL ASSET. IF TVA PLANS FOR SLOW GROWTH, IT WILL NOT BE ABLE TO MAKE SUCH A CREDIBLE COMMITMENT.

IN SHORT, MR. CHAIRMAN, ON THE BASIS OF THE INFORMATION WE HAVE AVAILABLE, THE BOARD BELIEVES THE RISKS TO THE RATEPAYER OF "OVERBUILDING" ARE NO GREATER AND LESS PERMANENT THAN THE RISKS OF "UNDERBUILDING," AND THE RISKS OF LOSING JOBS AND ECONOMIC GROWTH ARE SUBSTANTIALLY GREATER FROM "UNDERBUILDING" THAN "OVERBUILDING." AS A CONSEQUENCE, AT THIS JUNCTURE WE HAVE DECIDED TO MAKE NO FURTHER CUTBACKS BEYOND THE FOUR PRESENTLY DEFERRED UNITS. LET ME ELABORATE ON FACTORS CONSIDERED BY THE BOARD IN REACHING THE DECISION:

FIRST, ONE OF THE ADVANTAGES OF TVA'S NUCLEAR CONSTRUCTION PROGRAM IS THAT EVEN IF THERE IS EXCESS CAPACITY IN THE YEARS AHEAD, TVA CAN SAVE MONEY SUBSTITUTING LOW-COST NUCLEAR ENERGY FOR HIGHER COST ENERGY FROM COAL. FOR THE NUCLEAR PLANTS THAT WILL BE OPERATIONAL IN THIS DECADE, THE OPERATING COST PER KILOWATTHOUR IN 1990 WILL AVERAGE ONLY ABOUT ONE-THIRD THE COST OF OUR OLDER COAL-FIRED PLANTS.

ANOTHER WAY TO UNDERSTAND THE TVA SYSTEM'S ABILITY TO ADJUST TO EXCESS CAPACITY IS TO CONSIDER AN EXTREME--AND HIGHLY UNLIKELY--"WORST CASE." FOR INSTANCE, IF THERE WERE (1) LOW LOAD GROWTH THROUGHOUT THE NEXT DECADE, (2) ALL CONSTRUCTION NOW AUTHORIZED WERE COMPLETED ON SCHEDULE, AND (3) THERE WERE NO INTERIM EXCHANGES OF POWER WITH OTHER UTILITIES, RATES IN 1990 WOULD BE ABOUT 7 PERCENT HIGHER THAN IF WE WERE TO CUT BACK OUR CONSTRUCTION PROGRAM BY SIX UNITS (THE FOUR NOW DEFERRED PLUS TWO MORE NOW UNDER CONSTRUCTION). THIS IS AN UPPER LIMIT TO THE COST OF HAVING TOO MUCH CAPACITY.

In addition, TVA could also adjust by making interim exchanges of power. If TVA were to equalize capacity with demand by exchanging power on an interim basis with neighboring utilities that use oil to generate electricity, and if TVA and the receiving utility were to split the savings equally--where the savings would be equal to the difference between the cost of generating electricity with imported oil and the cost of generation at TVA's new nuclear plants--by 1985 each could realize savings of between $200 million and $400 million per year. By 1990 each could be realizing savings of between $500 million to over $1 billion. The "overbuilding" case thus presents the possibility of saving money for TVA consumers in the years ahead. I emphasize that we don't know whether TVA will want or be able to exchange this much power. If this region has power and other areas do not, any available power may be used up by new industry locating in the Valley simply to get the power they need to operate. However, the possibility of such power exchanges are an important form of insurance for both the Valley and the Nation--insurance that could save the Nation as much as 100,000 barrels of oil per day by 1990. As you know, Mr. Chairman, TVA is presently exploring the feasibility of such interim exchanges.

Second, if load growth were to outstrip TVA's capacity to bring new base-load plants on line, the most readily available option would be to purchase power from other utilities. It is doubtful that much power would be for sale since the events catching TVA short would also affect surrounding utilities and TVA has tended to be both more aggressive and more able financially to provide for the future than they have. However, if power were available, it would cost about three times as much as power from TVA's base-load plants. At the same time, TVA could not responsibly remain dependent on the availability of imported power to avoid brownouts or blackouts. We would have to add capacity on a crash basis. As a consequence, by the late 1990's rates would be about 10 percent higher than they would be if TVA kept to the current schedule.

Third, the cost reductions possible from cutting back the construction program depend on how much we cut back and what

HAPPENS TO LOAD. THE INVESTMENTS ALREADY MADE ARE SUNK COSTS AND WE WOULD HAVE TO CONTINUE TO PAY INTEREST ON THEM. IF TVA WERE TO CANCEL THE FOUR UNITS CURRENTLY DEFERRED PLUS TWO ADDITIONAL UNITS, FOR EXAMPLE, THE OVER $2 BILLION THAT HAS ALREADY BEEN INVESTED IN THESE UNITS PLUS ANOTHER $1 BILLION IN OUTSTANDING CONTRACTS WOULD BE LOST. WE WOULD NOT INCUR THE INTEREST COSTS ON THE FUNDS REQUIRED TO COMPLETE THEM. THE NEAR-TERM IMPACT ON RATES OF DOING THIS, HOWEVER, WOULD BE NEGLIGIBLE--AVERAGING LESS THAN 2 PERCENT FOR THE NEXT FOUR OR FIVE YEARS. AFTER THAT, THE IMPACT WOULD BE GREATER AND LAST LONGER THE MORE SLOWLY OUR LOAD GREW, BUT STILL WOULD PROBABLY AVERAGE LESS THAN 5 PERCENT. IF, ON THE OTHER HAND, WE HAD HIGH GROWTH, RATES BY THE YEAR 2000 WOULD BE 10 PERCENT HIGHER THAN IF WE MAINTAINED THE CURRENT SCHEDULE DUE TO THE FACT CONSTRUCTION COSTS WILL BE SO MUCH HIGHER IN THE FUTURE.

FINALLY, AND MOST FUNDAMENTALLY, IF WE PLAN ON THE BASIS OF LOW ECONOMIC GROWTH, OUR PLAN WILL BE A CEILING ON THE VALLEY'S GROWTH AND PROSPERITY. TVA'S EXPERIENCE WITH FIRMS EVALUATING THE VALLEY AS A PLACE TO DO BUSINESS CONVINCES US THAT OUR ABILITY TO GIVE A FIRM ASSURANCE OF AN ADEQUATE SUPPLY OF ELECTRICITY IS AN INCREASINGLY IMPORTANT ASSET FOR REGIONAL ECONOMIC DEVELOPMENT. IF WE DIMINISH THE CREDIBILITY OF THIS ASSURANCE, THE VALLEY'S POTENTIAL FOR ECONOMIC GROWTH SURELY WILL SUFFER. AND SO WILL THE VALLEY'S PEOPLE.

FOR MOST OF TVA'S EXISTENCE THE VALLEY HAS GROWN MORE RAPIDLY THAN THE REST OF THE NATION. FROM 1960 TO 1973 IT GREW ALMOST TWO TIMES AS FAST. HOWEVER, THIS PATTERN CHANGED IN 1974 WHEN THE RECESSION THAT WAS TRIGGERED BY THE OIL EMBARGO HIT THE ENERGY-INTENSIVE INDUSTRIAL STRUCTURE OF THE VALLEY CONSIDERABLY HARDER THAN THE REST OF THE NATION. FROM 1973 TO 1979 THE VALLEY GREW AT ABOUT THE SAME RATE AS THE NATION. OPINIONS DIFFER AS TO WHEN, IF EVER, THE VALLEY WILL REGAIN THE ADVANTAGE IT HELD PRIOR TO 1973. THE POSSIBILITY THAT IT WILL NOT IS WELL WITHIN THE LOWER END OF OUR LOAD FORECAST.

I THINK THAT MOST PEOPLE IN THE VALLEY BELIEVE THAT IT IS NOT ONLY POSSIBLE BUT IMPORTANT THAT THE VALLEY GROW MORE RAPIDLY THAN THE NATIONAL AVERAGE DURING THE REST OF THIS CENTURY--IN ORDER FOR THE REGION TO SHARE FULLY IN THE NATION'S PROSPERITY. MANY ECONOMIC FORECASTS, INCLUDING OUR OWN RECENT OUTLOOK AS WELL AS THOSE MADE BY THE BUREAU OF ECONOMIC ANALYSIS OF THE DEPARTMENT OF COMMERCE AND STATE GOVERNMENTS IN THE REGION, ARE CONSISTENT WITH THIS GOAL. THEREFORE, WE BELIEVE IT IS ONLY PRUDENT AND RESPONSIBLE TO PROVIDE THE CAPACITY--FROM NUCLEAR, COAL, CONSERVATION, AND RENEWABLE SOURCES--THAT WOULD BE REQUIRED BY A HEALTHY REGIONAL ECONOMY THAT GROWS AT A BETTER THAN AVERAGE RATE. AS CHART 2 REVEALS, OUR PRESENT CONSTRUCTION SCHEDULE BARELY PROVIDES THIS KIND OF MARGIN. ACTIVATING THE FOUR PRESENTLY DEFERRED UNITS WOULD BE NECESSARY IF LARGE ADDITIONAL LOADS DEVELOPED, SUCH AS EXCHANGES WITH OTHER UTILITIES. IN SHORT, WE VIEW THE PRESENT NUCLEAR SCHEDULE AS CONSERVATIVE WHEN VIEWED FROM THE BOARD'S PERSPECTIVE OF ENCOURAGING ECONOMIC GROWTH IN ORDER TO RAISE THE VALLEY'S STANDARD OF LIVING.

THE BOARD BELIEVES IT IS RESPONSIBLY DIRECTING TVA'S NUCLEAR PLANT CONSTRUCTION PROGRAM TO ACCOMMODATE THE RANGE OF DEMAND THAT IS LIKELY TO EXIST IN THE VALLEY THROUGH THE MID-1990'S. GIVEN THE HUNDREDS OF MILLIONS OF DOLLARS ALREADY INVESTED IN EACH OF OUR UNITS UNDER CONSTRUCTION, IT IS ONLY COMMON SENSE TO APPROACH ANY DECISION TO CANCEL OR DEFER ADDITIONAL NUCLEAR UNITS WITH GREAT CAUTION. CANCELLATION OF A NUCLEAR PLANT IS AN IRREVERSIBLE ACTION. AFTER CONTRACTS HAVE BEEN TERMINATED, THERE IS NO POSSIBILITY OF RESTORING THESE UNITS TO ACTIVE STATUS. SINCE OUR HIGH LOAD FORECAST INDICATES THE NEED FOR ADDITIONAL CAPACITY AS EARLY AS THE MID-1990'S, TVA WOULD HAVE TO BEGIN ALMOST IMMEDIATELY TO PLAN FOR NEW CAPACITY IF OUR FOUR PRESENTLY DEFERRED UNITS WERE CANCELLED. TVA NOT ONLY WOULD LOSE THE NEARLY $2 BILLION ALREADY INVESTED IN THESE PLANTS, IT WOULD HAVE TO REPLACE THIS DEFERRED CAPACITY WITH HIGHER COST CONSTRUCTION. ON THE OTHER HAND, THE DEFERRED UNITS CAN BE BROUGHT TO OPERATIONAL STATUS IN ABOUT EIGHT YEARS FROM THE DECISION TO PROCEED. THUS THEY PROVIDE AN IMPORTANT MEASURE OF FLEXIBILITY IN PLANNING TVA'S POWER SUPPLY FOR THE 1990'S.

A FURTHER FACT TO CONSIDER IS THAT NO ONE SERIOUSLY PROPOSES CANCELLING SEQUOYAH, WATTS BAR, OR BELLEFONTE NUCLEAR PLANTS; THEY ARE TOO CLOSE TO COMPLETION FOR THAT TO MAKE SENSE. THUS ANY CANCELLATION DECISION MUST NECESSARILY TARGET THE HARTSVILLE, PHIPPS BEND, AND YELLOW CREEK PLANTS. YET, BY THE TIME THESE CANCELLATION DECISIONS WOULD HAVE A VERY SIGNIFICANT EFFECT ON POWER RATES--THAT IS, IN THE POST-1985 PERIOD--THE PRESENT SHARP UPWARD PRESSURE ON RATES WILL HAVE ABATED. IN OTHER WORDS, GETTING SEQUOYAH, WATTS BAR, AND BELLEFONTE ON LINE AS RAPIDLY AS POSSIBLE--NOT CANCELLING OR DEFERRING ADDITIONAL UNITS AT HARTSVILLE, PHIPPS BEND, AND YELLOW CREEK--IS THE WAY TO SLOW DOWN RATE INCREASES.

AS I HAVE INDICATED, THE BOARD DOES NOT NOW PLAN ANY FURTHER DEFERRALS. HOWEVER, IF THE FACTS WE HAVE DISCUSSED CHANGE SUBSTANTIALLY, THIS DECISION WOULD BE RE-EXAMINED. DUE TO THE STAGE OF CONSTRUCTION AT OTHER TVA PLANTS, AS I HAVE NOTED, FURTHER DEFERRALS WOULD NECESSARILY BE RESTRICTED TO THE TWO UNITS OF THE HARTSVILLE A PLANT, YELLOW CREEK UNIT 1, AND PHIPPS BEND UNIT 1. IN FACT, WE ARE FURTHER LIMITED TO LOOKING ONLY AT HARTSVILLE AND PHIPPS BEND SINCE DEFERRAL OF YELLOW CREEK 1 WOULD RESULT IN LARGE TRANSMISSION LINE LOSSES DUE TO A CONTINUING LACK OF GENERATING CAPACITY ON THE WESTERN END OF THE TVA POWER SYSTEM. WE HAVE BEEN TRYING TO RECTIFY THIS SITUATION FOR MANY YEARS.

IN SUMMARY, THE BOARD HAS CONFIDENCE THAT FUTURE DEMAND FOR ELECTRIC POWER WILL FALL WITHIN THE RANGE OF OUR PRESENT FORECAST. WE HAVE NO CONFIDENCE IN SELECTING A SPECIFIC POINT WITHIN THIS RANGE--SUCH AS THE MIDRANGE ESTIMATE OF EARLIER FORECASTS. MOREOVER, THE BOARD IS CONVINCED THAT IT IS PRUDENT AT THIS TIME TO TARGET TVA'S NUCLEAR CONSTRUCTION PROGRAM SO IT CAN ACCOMMODATE LEVELS OF DEMAND ASSOCIATED WITH THE HIGHER END OF THIS RANGE. EXCESS CAPACITY, AT MOST, HAS ONLY A MODERATE IMPACT ON RATES. THE OPPORTUNITY TO EXCHANGE ANY EXCESS POWER WITH NEIGHBORING UTILITIES ALSO EXISTS AND IS A VALUABLE FORM OF INSURANCE. SHORTAGES OF CAPACITY WOULD BRING HIGHER RATES TO FUTURE CONSUMERS AND WOULD LIKELY CUT OFF ECONOMIC GROWTH. FOR VALLEY RESIDENTS

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THIS WOULD MEAN SUBSTANTIAL COSTS IN PER CAPITA INCOME, MANUFACTURING OUTPUT, JOBS, AND ECONOMIC OPPORTUNITY.

A NATIONAL ECONOMY OF HIGHER PRICED ENERGY MEANS THAT VALLEY CONSUMERS WILL WANT TO REDUCE THEIR ENERGY CONSUMPTION AND LOWER THEIR COSTS BY USING ENERGY MORE EFFICIENTLY. AS I STATED, OUR PROJECTIONS INCLUDE 6,000 MEGAWATTS OF POWER THAT WOULD OTHERWISE BE WASTED. TVA'S EFFORTS TO HELP RESIDENTS ACHIEVE THIS OBJECTIVE IS ANOTHER WAY OF MAINTAINING AND EXTENDING THE VALLEY'S ENERGY ADVANTAGE. THESE EFFORTS FALL INTO THREE CATEGORIES:

FIRST, TVA'S HOME INSULATION PROGRAM PROVIDES HOME ENERGY SURVEYS AND INTEREST-FREE LOANS TO FINANCE RECOMMENDED CONSERVATION MEASURES. BY 1986 THE PROGRAM WILL SAVE 2.75 BILLION KILOWATT HOURS ANNUALLY, BUT MORE IMPORTANTLY THAT WILL PRODUCE A DIRECT FINANCIAL BENEFIT OF $81 MILLION TO PARTICIPANTS.

SECOND, IN CONNECTION WITH ITS CURRENT PROCEEDINGS ON RATEMAKING STANDARDS, TVA IS ALSO CONSIDERING VARIOUS RATE STRUCTURES THAT WOULD ENABLE THE ENERGY CONSERVER TO SAVE MONEY. AMONG THE CONCEPTS CURRENTLY BEING REVIEWED ARE THE REPLACEMENT OF DECLINING BLOCK RATES WITH FLAT RATES; TIME-OF-DAY RATES; AND LOAD MANAGEMENT TECHNIQUES, SUCH AS THE REMOTE CYCLING OF CENTRAL AIR-CONDITIONERS TO SHAVE LOAD OFF PEAK POWER DEMAND.

THIRD, TVA'S PROGRAM ENCOURAGES VALLEY RESIDENTS TO SWITCH TO MORE EFFICIENT ENERGY SOURCES. THE HEAT PUMP, WOOD HEATER, AND SOLAR WATER HEATER FINANCING PROGRAMS PROVIDE LOANS FOR THE PURCHASE AND INSTALLATION OF UNITS WHICH CAN SAVE SUBSTANTIAL PORTIONS OF A RESIDENTIAL CUSTOMER'S PRESENT ENERGY BILL. TVA IS DESIGNING AND BUILDING APPROXIMATELY 40-45 MODEL PASSIVE SOLAR HOMES IN THE VALLEY TO DEMONSTRATE THE EFFICIENCY IN ENERGY USE OF PASSIVE SOLAR TECHNOLOGY AT A CONSTRUCTION COST NOT SIGNIFICANTLY DIFFERENT FROM NONSOLAR HOMES.

TVA IS ALSO SENSITIVE TO THE PLIGHT OF THE COMMERCIAL, INDUSTRIAL, AND MUNICIPAL CONSUMER. ABOUT TWO-THIRDS OF ALL TVA POWER IS USED BY THE COMMERCIAL AND INDUSTRIAL SECTOR. THE COMMERCIAL AND

INDUSTRIAL ENERGY CONSERVATION PROGRAM OFFERS ENERGY AUDITS AND FINANCING TO HELP THESE CUSTOMERS ELIMINATE ENERGY WASTE. THE PROGRAM IS EXPECTED TO REDUCE PEAK DEMAND BY 1,000 MEGAWATTS AND ANNUAL ENERGY USE BY 5.6 MILLION KILOWATT HOURS BY 1988. WITH RESPECT TO RATE STRUCTURES, TVA WOULD CONTEMPLATE THE CONTINUATION OF INTERRUPTIBLE RATES, WHICH ARE SUBSTANTIALLY LOWER THAN FIRM POWER COSTS, FOR THE COMMERCIAL AND INDUSTRIAL USER. TVA IS ALSO ENCOURAGING COGENERATION BY OFFERING TO PURCHASE EXCESS POWER FROM INDUSTRIAL PRODUCERS, PERMITTING MORE EFFICIENT USE OF ENERGY RESOURCES. CURRENTLY, SIX CUSTOMERS HAVE ONSITE COGENERATION WITH A TOTAL CAPACITY OF 173 MEGAWATTS.

IN THE AREA OF MAKING USE OF ALTERNATIVE ENERGY SOURCES, PUBLIC AND PRIVATE ENTITIES ARE ENCOURAGED BY TVA TO SOLVE SOLID WASTE AND ENERGY PROBLEMS THROUGH MUNICIPAL WASTE INCINERATION. SENATOR SASSER, WITH YOUR HELP AND THE HELP OF REPRESENTATIVE GORE, TVA WAS ABLE TO PROVIDE A $2-MILLION LOAN FROM APPROPRIATED FUNDS TO THE RESOURCE AUTHORITY OF SUMNER, TENNESSEE, TO PURCHASE A PORTION OF THE PLANT EQUIPMENT FOR A 150-TON WASTE INCINERATOR THAT WILL PRODUCE 600 KILOWATTS OF ELECTRICITY AND PROCESS STEAM AND DISPLACE 72,000 BARRELS OF OIL A YEAR. SIMILAR INITIATIVES ARE UNDER CONSIDERATION IN NASHVILLE, TENNESSEE; BRISTOL, VIRGINIA; AND OTHER LOCATIONS IN ALABAMA AND KENTUCKY. TVA ALSO PROVIDED $25,000 FROM APPROPRIATED FUNDS TO THE UNION COUNTY, GEORGIA, SCHOOL BOARD IN A DEMONSTRATION OF A WOOD CHIP FURNANCE APPLICATION TO THE UNION COUNTY HIGH SCHOOL, BLAIRSVILLE, GEORGIA.

TVA IS ALSO DEVELOPING NEW WAYS TO USE THE VALLEY'S INDIGENOUS RESOURCES, PRINCIPALLY COAL AND ITS FORESTS, THROUGH ITS RESEARCH AND DEVELOPMENT PROGRAM. SUCH IMPORTANT PROGRAMS AS THE ATMOSPHERIC FLUIDIZED-BED COMBUSTION PILOT PLANT, THE COAL GASIFICATION PROJECT, THE WATTS BAR WASTE HEAT PARK, AND TVA'S NEW INITIATIVE TO PRODUCE ETHANOL FROM VALLEY HARDWOODS ARE ADDITIONAL WAYS TO ENSURE THE VALLEY'S ENERGY ADVANTAGE. THESE R&D EFFORTS, TO THE EXTENT THEY DO NOT DIRECTLY BENEFIT RATEPAYERS, ARE FINANCED WITH FUNDS APPROPRIATED BY CONGRESS. BUT I DO NOT DOUBT FOR A MOMENT THAT SIGNIFICANT BENEFITS TO THE VALLEY WILL FLOW FROM THESE NATIONAL ENERGY DEMONSTRATIONS. MR. CHAIRMAN, I AM ALSO INCLUDING AS AN

APPENDIX MORE DETAILED INFORMATION ON TVA'S RESEARCH AND DEVELOPMENT PROGRAM.

CONCLUSION

TAKEN TOGETHER, THESE EFFORTS ARE UNMATCHED BY ANY REGION IN THE UNITED STATES. MY PERSONAL VIEW IS THAT THE TENNESSEE VALLEY WILL BE IN THE CATBIRD SEAT. OUR RATES WILL STILL BE AMONG THE LOWEST IN THE NATION. OUR CONSUMERS WILL USE ELECTRIC POWER EFFICIENTLY TO HOLD DOWN THEIR ENERGY COSTS. NEW ENERGY TECHNOLOGIES WILL PERMIT GREATER USE OF INDIGENOUS RESOURCES AND WE WILL BE BLESSED WITH AMPLE AND RELIABLE SUPPLIES OF ELECTRICAL ENERGY. THIS IS AN "ENERGY ADVANTAGE" NOT TO THROW AWAY LIGHTLY. THIS ADVANTAGE IS THE KEY TO ACHIEVING TVA'S SECOND MAJOR OBJECTIVE OF HELPING KEEP OPEN THE DOOR TO ECONOMIC PROSPERITY FOR THE VALLEY IN A WORLD OF STIFF FOREIGN AND DOMESTIC COMPETITION.

THERE IS NOT TIME TODAY TO EXAMINE IN DETAIL TVA'S NEW PROGRAM IN ECONOMIC DEVELOPMENT. A DESCRIPTION OF THIS PROGRAM IS ALSO INCLUDED AS AN APPENDIX TO MY TESTIMONY. I WOULD, HOWEVER, LIKE TO OUTLINE BRIEFLY THE MAGNITUDE OF THE CHALLENGE.

A PROSPEROUS VALLEY ECONOMY MEANS FULL EMPLOYMENT AND GOOD-PAYING JOBS AND THIS WILL REQUIRE GROWING FASTER THAN THE NATIONAL AVERAGE FOR THE BALANCE OF THIS CENTURY. LOOKING AT JUST THE NEXT DECADE, THIS MEANS ADDING ABOUT 350,000 NEW JOBS. MEETING THIS MARK WILL REQUIRE 100 NEW JOBS EACH DAY. SINCE THIS IS A NET FIGURE, ABOUT 750 NEW JOBS EACH DAY WILL ACTUALLY BE NEEDED TO OFFSET JOBS LOST THROUGH NORMAL BUSINESS FAILURES, RELOCATIONS, OR CONTRACTIONS.

IN SHORT, MR. CHAIRMAN, WE HAVE OUR WORK CUT OUT FOR US. TVA CAN ONLY CONTRIBUTE ITS SHARE TO THE BROADER EFFORT THAT WILL ENCOMPASS ALL SEGMENTS OF THE VALLEY ECONOMY. TVA'S SPECIAL CONTRIBUTION IS IN MAINTAINING AND EXTENDING THE VALLEY'S ENERGY ADVANTAGE IN THE MANY WAYS I HAVE DISCUSSED TODAY. LET THE WORD GO OUT THAT TVA HAS POWER TO SELL -- FIRST BY CONSERVING THE

ELECTRICITY WE ARE NOW WASTING AND THEN FROM THE NEW PLANTS WE ARE BUILDING. IN AN ENERGY-SHORT NATION, WE BELIEVE THAT IN CONCERT WITH STATE AND LOCAL ECONOMIC DEVELOPMENT OFFICIALS WE CAN GENERATE A MARKET FOR ALL THE POWER WE CAN SAVE AND ALL THE POWER WE PRODUCE.

THE CHOICE TODAY IS NOT BETWEEN MOVING AHEAD AND JUST HOLDING OUR OWN. IN TODAY'S WORLD THE VALLEY EITHER MOVES AHEAD ECONOMICALLY OR JUST AS SURELY IT WILL FALL BEHIND. TVA IS COMMITTED TO MOVING AHEAD. WE BELIEVE THE PROGRAMS AND DECISIONS I HAVE DISCUSSED TODAY WILL MAKE IT POSSIBLE FOR THE PEOPLE OF THE TENNESSEE VALLEY TO ACHIEVE A BETTER LIFE FOR THEMSELVES AND FOR THEIR CHILDREN.

THIS IS THE HEART OF WHAT I MEAN WHEN I SAY TVA IS COMMITTED TO CARRYING OUT ITS OLD MISSION IN A NEW WORLD.

I WOULD BE PLEASED TO ATTEMPT TO ANSWER ANY QUESTIONS YOU MIGHT HAVE.

Chart 1

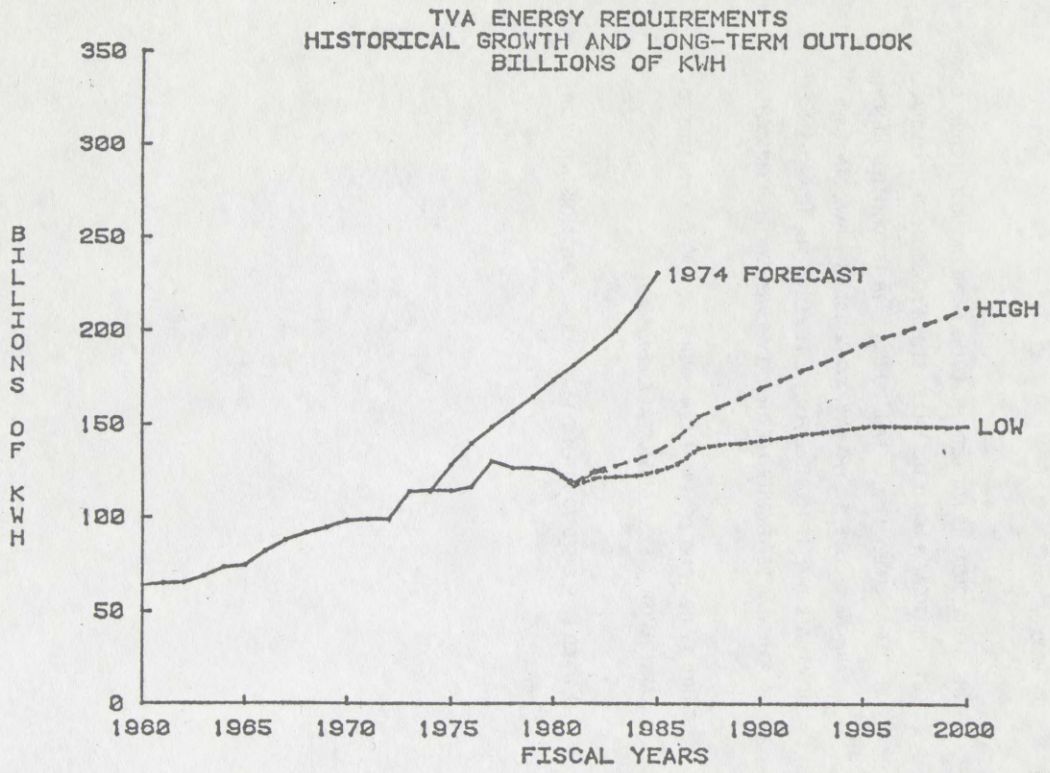
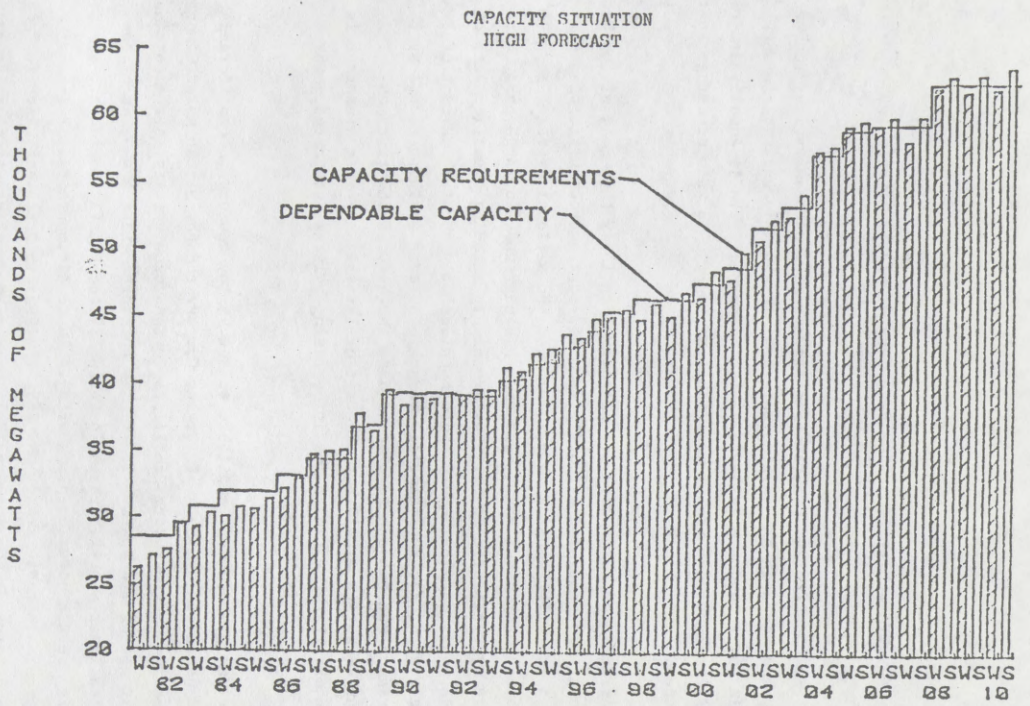

TVA ENERGY REQUIREMENTS
HISTORICAL GROWTH AND LONG-TERM OUTLOOK
BILLIONS OF KWH
BILLIONS OF KWH
350
300
250
200
150
100
50
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
FISCAL YEARS
1974 FORECAST
HIGH
LOW
1981 Forecast

Chart 2



GEB 9/11/80

APPENDIX I

Why TVA's Electric Rates Have Gone Up--TVA's Efforts to Hold Down Increases

TVA's nuclear construction program--and its efforts in conservation, renewable resources, and research and development--are not the only ways TVA is working to maintain and extend the Valley's energy advantage. TVA is equally determined that the Tennessee Valley will continue to enjoy a rate advantage in the years to come.

TVA's electric power rates have historically been lower than most of the Nation because power was generated primarily from low-cost hydroelectric plants. TVA's rates are still considerably lower than the national average, but TVA's rate advantage over other power producers has narrowed, in large part, because inexpensive hydroelectric power is progressively becoming a smaller part of TVA's total power supply. Today hydro supplies only about 15 percent of TVA's power in a year of average rainfall, roughly the same as the national average. For this reason and the others discussed in the body of the testimony, TVA has no inherent advantage over other electric utilities. Any rate advantage is the result of greater efficiencies in operating a large integrated power system.

Still, the energy advantage available to the Valley economy is considerable. The recent decisions by the A. E. Staley Company and the Nissan Motor Company to locate major manufacturing facilities in Tennessee testify to the continuing competitiveness of TVA power. It is also noteworthy that the areas of the country with lower electric rates, principally the Pacific Northwest, are now experiencing severe power supply shortages, a condition that will impede economic growth in those areas. S. 885, the Pacific Northwest Electric Power Planning and Conservation Act--recently passed by Congress--attempts to rectify the power shortage situation in the Pacific Northwest. The legislation will result in significant rate increases, particularly to the commercial and industrial user, to finance energy conservation and new construction. Thus, the Valley's situation is similar to those few areas presently enjoying lower rates. In the long run, the Valley's energy situation will likely be better because TVA is biting the bullet of adequate electric supplies now rather than later, when construction costs will be even higher.

Reasons for Increasing Power Rates

What then, specifically, have been the causes of the increases in TVA electric rates? Here are some of the reasons:

- Even though TVA buys coal for its system cheaper than other comparable eastern utilities, 39 percent of the total increase since 1966 is due to higher coal costs: the average price per ton of coal purchased by TVA increased from $4 in 1966 to more than $33 in 1980, a 700-percent increase.

- Twenty-three percent of the total increase since 1966 is due to increased interest rates, over half of which is due to the nuclear construction program, even though TVA builds nuclear plants as cheaply as any other utility.

- Under the TVA Act, the Agency is required to pay employees the prevailing rate of wages for work of similar nature in the vacinity. As a result, 17 percent of the rate increase since 1966 is due to higher wages and salaries negotiated through collective bargaining agreements as well as to the addition of workers at TVA's power plants and construction projects.

- Twenty percent is due to higher material and equipment costs, depreciation, and in-lieu-of-tax payments.

Over three-quarters of the total increase has been due to factors (principally inflation) over which TVA has no more control than any other business or agency.

The revenue requirements for the TVA power system in fiscal year 1981 were based on the following numbers:

TVA POWER PROGRAM OPERATING EXPENSES
(In millions of dollars)

	1980 Actual	1981 Estimate*
Fuel and imports:		
Fossil	1,237	1,328
Nuclear	57	79
Combustion turbine	8	-
Imports	65	-
Operation and maintenance	481	593
Depreciation	168	211
Demonstration of power use	14	54
Administrative and general	117	135
Payments in lieu of taxes	114	137
Social Security	17	22
Total operating expenses	2,278	2,559
Interest	882	1,068

*As of August 7, 1980

TVA POWER PROGRAM FINANCIAL RESULTS SUMMARY
(In millions of dollars)

	1980 Actual	1981 Estimate*
Total revenue	3,204	3,082
Total operating expense	2,278	2,559
Operating income	926	523
Total interest charges	882	1,068
Ratio:		
Operating income to interest charges	1.05	0.48
Additional revenue required for 1.05 coverage		598

*As of August 7, 1980

In summary, even if TVA had no new construction in progress, the inflationary rise in the power system's costs would have required an increase in rates. The inherent efficiency of the integrated TVA system--the Nation's largest--and the special effort being mounted by TVA to cut out all unnecessary expenses will keep rate increases as low as possible. But the reality of inflation means that electricity, like almost everything else, will cost more than it used to.

Efforts to Hold Down Increases

TVA is doing everything possible to cut costs in those areas under its control. Efficiency and productivity are being improved. A major feature of this effort is an improved maintenance program at TVA's coal-fired plants that will invest $140 million through 1982. The $80 million already invested in this activity produced savings this past year of $48 million because of increased reliability and $17 million due to increased plant efficiency. This investment will more than pay for itself by keeping these plants operating when they are needed and by improving their efficiency.

Personnel costs are continually being scrutinized for savings. Some $750,000 in 1980 was saved through personnel reductions made possible through use of automated word processing centers. Another $4.8 million was saved in just one quarter by reducing overtime at coal-fired power plants. A management appraisal system has been started which ties merit pay increases in salary to managerial performance. A comparison of the number of employees by category between TVA and similar private companies shows that the proportion of employees who are managers in TVA was lower than the composite industry average.

Other examples of cost reduction activities are illustrative of TVA's cost conscious attitude:

- In transportation, $200,000 was saved by replacing TVA's auto fleet with smaller, more efficient vehicles. Another $80,000 per year is saved by using buses between Knoxville and Chattanooga instead of cars.

- In computer applications, $20 million was saved through innovative use of computers in construction planning.

- In resource recovery, $28,000 was saved by recycling old oil drums formerly discarded and $15,000 was saved by reclaiming silver from photographic and electronic processing.

In addition to these specific cost-cutting measures, TVA is implementing a comprehensive system of cost management and responsibility reporting. This system will make possible monthly comparison of all spending activities by organizational units against annual operating plans. Managers will be able to

identify any deviations from plan and take remedial action. These data will also make possible responsible cost-control measures and avoid arbitrary cuts that often cost more in the long run than they save.

Further, TVA has instituted a four-point antitrust program to protect TVA and its ratepayers from high prices caused by anticompetitive activities in the energy and energy equipment markets. Point one of that program is appropriate antitrust litigation, including our pending lawsuit against 12 foreign and domestic uranium companies alleged to have been members of the international uranium cartel. The suit was filed in 1977 to recover damages and other relief from the cartel members' alleged price fixing, bid rigging, market allocations, and boycotts. Pretrial discovery already has consumed over three years, and trial is not expected to begin before next September. Also, to recover for overcharges cuased by bid rigging this past summer TVA brought an antitrust treble damage action against several suppliers of equipment for our Bellefonte Nuclear Plant.

Point two of TVA's antitrust program includes self-help measures such as TVA's Small Coal Operators' Assistance Program to help small producers compete, and TVA's approval of antimerger provisions in new fuel contracts.

Point three is public education. TVA believes that public pressure is an effective weapon against noncompetitive prices. This effort includes TVA's major study of competition in the energy markets, which was published in 1977, updated in 1979, and distributed to members of Congress and the public.

Point four of TVA's program is support for tougher antitrust legislation to increase competition in the Nation's energy markets. Testimony has been delivered before the Senate Judiciary Committee in 1979 and the House Interstate and Foreign Commerce Committee in 1980.

While TVA's antitrust program and its other cost-saving measures have been effective, future rate increases are inevitable. However, despite inflation, the picture on electric rates will improve as new nuclear units come on line. It is our expectation that the lower operating costs associated with nuclear plants will enable TVA to hold rate increases to the general inflation rate or below. This expectation, coupled with TVA's ample supplies of power, will comprise a significant energy advantage and a major boost to the region's economy.

How do TVA rates compare?

TVA rates are going up but power charges by utilities elsewhere in the Nation are still much higher. On average, TVA rates are 31 percent lower than they are nationwide. The rates listed below do not reflect the fact that many of the companies serving the communities listed have asked the State electric rate commissions for higher rates.

AVERAGE RESIDENTIAL PRICES FOR ELECTRICITY, SELECTED U.S. CITIES

City	Per 1,000 kWh July 1980	
Average	$ 56.70	
New York, NY	103.41	
Philadelphia, PA	81.67	
San Diego, CA	81.40	
Los Angeles, CA	73.29	
Boston, MA	72.75	
San Francisco-Oakland, CA	72.65	
Honolulu, HI	68.82	
Pittsburgh, PA	66.28	
Baltimore, MA	64.34	
Cleveland, OH	61.87	
Milwaukee, WI	58.32	
Miami, FL	57.61	
Dallas, TX	56.92	
Houston, TX	56.07	
Chicago, IL	55.67	
Washington, DC	55.51	
Detroit, MI	53.72	St.
Louis, MO	53.01	
Denver, CO	52.64	
Northeast PA	51.66	
Kansas City, MO	50.34	
Atlanta, GA	47.61	
Minneapolis-St. Paul, MN	47.24	
Buffalo, NY	44.97	
Cincinnati, OH	43.32	TVA
(effective October 2, 1980, RS-8)	38.79	
Anchorage, AK	35.93	
Portland, OR	32.41	
Seattle, WA	10.39	

Source: Utilities serving the cities listed.

TVA rates for typical commercial and industrial customers are not quite as low in comparison to other utilities as are its residential rates. But, they are lower than nearly every major city in the country and lower than all but a few utilities in the southeast. For the very largest industrial customers, TVA rates are near the middle of the range for southeast regional power companies. But, these rate comparisons are somewhat hypothetical because few other utilities have customers in this demand range. TVA serves approximately two-thirds of these very large customers in the region.

INDUSTRIAL RATE COMPARISON
July 1980

City	"Typical" 1,000 kW 400,000 kWh Electric Bill	50,000 kW 90% Load Factor 90% Power Factor Cost/kWh in Mills	100,000 kW 90% Load Factor 90% Power Factor Cost/kWh in Mills
New York, NY*	$35,779	NA	NA
Washington DC	$26,879	NA	NA
Tampa, FL*	$23,460	35.42	35.40
Richmond, VA*	$17,825	41.22	41.21
Atlanta, GA	$15,214	24.75	24.72
TVA	$14,792	27.16	27.06
Louisville, KY*	$14,516	23.68	23.68
Charlotte, NC	$10,837	23.99	23.93
Portland, OR	$10,098	NA	NA

*Rate increase pending

APPENDIX II

COMPARISON OF LOAD FORECASTING METHODOLOGIES
The 1977 LOAD FORECAST
AS COMPARED TO
THE 1981 LOAD FORECAST

Prepared by

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Raymond G. Tessmer
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Joseph P. Frueh

System Forecasting Group
Tennessee Valley Authority
Chattanooga, Tennessee
October 1980

SUMMARY

There have been significant improvements in the methodology, procedures, and processes which the Tennessee Valley Authority (TVA) utilizes in the preparation of the 1981 load forecasts compared to the load forecast which was prepared in 1977 and reviewed by the General Accounting Office. Significant differences exist between the two methodologies since several important improvements have been incorporated since 1977.

The 1977 load forecast was based primarily on a combination of trends and extrapolations in conjunction with judgemental techniques based on historical experience. The trend forecasts were complemented by the use of an econometric model of annual electricity sales. In 1977 only one load forecast was prepared with major emphasis on forecasts to the year 1990.

The 1981 load forecasts incorporate significant improvements in methods of forecasting in addition to producing a range of forecasts which explicitly identify the uncertainty in forecasting electricity consumption. These improvements are:

- The load forecast is based on a sophisticated set of models which are utilized in the forecasting process so that the factors which

influence load growth can be explicitly identified rather than relying on a trend forecast. These models are:

- Manufacturing Energy Model (econometric)
- Industrial Directly Served Model (econometric)
- ORNL Residential (End use)
- Regional Energy Model (End use eleven-sector total energy model)
- Annual Energy Model (Econometric electricity consumption for all classes of customers)

- Dealing with uncertainty by producing a range of forecasts based on alternative levels of the major factors which determine load growth. The alternative levels of the major factors are analyzed in extreme detail.

- Conservation program impacts are directly incorporated into the load forecast to include impacts on kWh sales, winter peak load, summer peak load, and the hourly load shape.

- Producing an alternative estimate of the Department of Energy uranium enrichment load which takes account of power plant completions and operations, national defense requirements, and net exports of enriched uranium.

- Residential appliance survey of 9,400 customers included data on: appliance saturation and penetration; type, age, and size of living quarters; implemented conservation measures; social and economic characteristics of households, such as, family size and age distribution and family income levels.

- Alternative rate structure impacts, including time-of-day rates which TVA is analyzing under the requirements of the Public Utilities Regulatory Policy Act of 1978. The alternative rate

structure impacts are included in forecasts of kWh sales, winter and summer peak loads and the hourly load forecast.

- Enhancements to the regional economic forecast model which include the following: an income sector which is endogenously linked to the employment and real earnings sectors; a real product sector which is directly linked to the employment and income sectors; explicit impacts of the price of electricity in the TVA region relative to the price of electricity in the rest of the Nation; high, midrange, and low forecast alternatives of regional economic growth.

- Internal planning reviews by the TVA Economics Committee and the Office of Power, Power Planning Committee, for the purpose of assuring consistency between the regional economic forecast, the load forecast, and various planning objectives and goals.

In addition to the above major improvements, other improvements have been implemented which have significantly advanced TVA's load forecasting capability. Specifically, improvements have been made in the methods of relating the kWh sales forecast to the distributor peak loads and system peak requirements. Also, the Regional Energy Model has provided the additional capability of direct feed-back impacts of changes in the level of energy consumption on the costs of energy production. The electric utility sector of the Regional Energy Model calculates direct changes in costs and the price of electricity resulting from changes in the level of electricity consumption.

A final important point should be made regarding the differences in the methodology of the 1977 load forecast as compared to the 1981 load forecast. Specifically, the improvements incorporated into the 1981 load forecast are very sophisticated and detailed in nature. The new models, methods of dealing with uncertainty, accounting for conservation program impacts, estimation of expected DOE loads, analysis of alternative rate

structure impacts, provision of appliance survey data, and enhancements to the regional economic forecast all represent the development and implementation of technically advanced methods. These methods are characterized by their capability to account for considerable detail over a wide range of varying conditions which impact electricity sales and load growth. A summary document of the nature of this paper does not do sufficient justice to either the individual capability of specific models and methods or, more importantly, to the combined generic capability of all models and methods when operated in unison.

INTRODUCTION

The purpose of this document is to describe the load forecasting methodology and procedures which were utilized by the Tennessee Valley Authority (TVA) in preparing the 1977 load forecast and also the methodology and procedures which were utilized in preparing the fiscal year 1981 load forecast used for power planning. It is not the purpose to make direct comparisons between the two vintages of methodologies. Differences should be readily apparent from the descriptions of the methodologies used in the two forecasts. The methodology utilized in the 1977 load forecast was reviewed by the General Accounting Office (GAO).[1] The descriptions and comparisons contained in this document are consistent with the GAO descriptions and criticisms of TVA's 1977 load forecasting methodology.

Section I provides a summary and evaluation of TVA's 1977 load forecasting methodology. Section II provides a summary description of TVA's new methodology and procedures, i.e., various forecasting capabilities which were used in preparing the fiscal year 1981 planning forecast. Both the 1977 and 1981 system load forecasts were prepared by first making separate forecasts for the individual classes of customers and then aggregating the individual forecasts to arrive at the system load forecast. The major customer classes include residential, commercial or

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[1] "Electric Energy Options Hold Great Promise for the Tennessee Valley Authority." Report to the Congress of the United States, The Comptroller General, General Accounting Office, November 1978.

nonmanufacturing, industrial or manufacturing, and the Department of Energy (DOE) uranium enrichment load. Some of the methodology improvements described in Section II will relate specifically to individual customer classes while other iomprovements are generic to all customers classes and the entire load forecast capability. The exact nature of each specific improvement is apparent from its description. Section II contains a brief conclusion.

I. 1977 LOAD FORECAST

The 1977 load forecast was based primarily on a combination of trends in conjunction with judgmental techniques based on historical experience and the use of an econometric model of annual electricity sales (Annual Energy Model). The combination of the various trend techniques and econometric capabilities varied according to each customer category. Separate methodology descriptions will be made for the residential class, the distributor-served commercial and industrial (C&I) class, the directly served industrial (DSI) class, and the DOE uranium enrichment load.

Residential: Three methods were employed in arriving at three alternative forecasts of residential kWh sales: The appliance method, the trend method, and the econometric model (AEM). The appliance method projected electricity consumption by household on the basis of appliance saturations and average annual usage per appliance. The product of saturation projections and average usage projections on a per household basis yielded a forecast of electricity consumption per household. The residential electricity sales forecast was then the simple product of the consumption per household projection and the forecast of the number of households. The strengths of the method were its simplicity and the capability to incorporate appliance efficiency improvements which were afforded by individual appliance usage detail. Also, demographic impacts were directly accounted for by the projection of households. There were several weaknesses associated with the procedure. The effects of electricity price changes, fuel substitution, and real income

changes could only be included judgmentally and on an ad hoc basis. Also, the saturation and equipment usage data on which the forecast was based was not current and was not based on credible survey results. Any efficiency changes which were incorporated into the results were also questionable since the impacts of price and income changes on efficiency improvement could not be consistently estimated.

The trend method was a straight linear extrapolation of historical consumption over varying historical periods. The only advantage of using the method was its simplicity. The method's lack of detail and structural consistency should not be grounds for entirely dismissing the use of simple trends as aggregate checks on the reasonableness of the results from more detailed and sophisticated methods.

The third method utilized was the Annual Energy Model (AEM) which provided a multiequation econometric analysis and forecast of total residential electricity sales and more detailed forecasts for end uses of space heating, water heating, cooking, and all other. The model had the following characteristics and capabilities:

- A dynamic adjustment which provided for lagged responses to changes in major causal factors and the calculation of both short-run and long-run responses.

- Direct impact of real electricity price changes.

- Substitution impacts resulting from changes in the real price of alternative fuels. The real price of natural gas was used as the proxy measure of alternative fuel prices.

- Direct impacts of real income changes as measured by real per capita income.

- Explicit analysis and forecast of the saturations and usage

levels of the major end uses of space heating, water heating, and cooking. These end uses are classified as competitive uses in the model since alternative fuels can be substituted.

- Direct impacts of demographic factors as measured by household formation, persons per household, and the mix of rural vs urban population.

- Historical data is weather normalized.

The residential forecast from the AEM had the following limitations:

- Lack of complete end-use detail. While the AEM has more end-use detail than other econometric models, not all end uses are modeled. This limitation is generic to econometric methods and is not peculiar to the AEM.

- The lagged adjustment on the three appliance saturations was assumed to be identical to the lagged adjustments on price and income responses.

- The three end-use saturations could not be checked for accuracy since current survey data for the TVA region was not available.

Distributor C&I: Four methods were utilized in forecasting kWh sales for the distributor-served commercial and industrial customers. These methods were trend judgement, crude linkage, aggregate econometric, and detailed econometric.

The trend judgement method involved a disaggregated extrapolation of historical experiences. Trend extrapolations of kWh sales were made for each of the three rate classes of 0-1000 kW demand, 1000-5000 kW demand, and greater than 5000 kW demand. Cross checks were made on these projections by further disaggregating by each major municipal distributor and all cooperative systems. An alternative trend extrapolation was

made by combining separate trend projections of kWh consumption per customer and the number of customers. Each of the trend judgement methods was fundamentally the same in that projections were extrapolations of historical experience modified by professional judgement.

In the crude linkage method, the relationship between gross (state) product and kWh sales was estimated from historical experience and extrapolated into the future with modifications based on professional judgement. For the 1977 load forecast, gross regional product estimates were not available. Consequently, gross product for the State of Tennessee was used as a proxy measure of gross product for the TVA region. The procedure involved aggregate estimates from historical data of the relationship between gross state product and gross national product and the relation between gross state product and distributor C&I kWh sales. Gross state product was then extrapolated into the future based on a forecast of gross national product. KWh sales were correspondingly projected into the future on the basis of the gross state product projection.

An aggregate econometric method was employed which projected kWh sales for each of the three major rate classes of 0-1000 kW, 1000-5000 kW, and greater than 5000 kW. The projections of kWh sales by rate class were a function of aggregate industrial output and average price for the specific rate class. It was not possible to disaggregate industrial output on a basis consistent with specific rate classes since industrial output is reported on the basis of SIC classifications, and appropriate forecasts of industrial output by SIC were not available.

The AEM was used to produce the detailed econometric forecast of distributor C&I kWh sales. Separate forecasts were produced for each of sixteen manufacturing classes and six nonmanufacturing classes. Econometric estimates for each class were based on the relationship between kWh sales and the causal factors of employment, the real price of elec-

tricity, and the real price of natural gas. Employment served as a measure of economic activity, price conservation was captured by the real price of electricity, and real natural gas prices measure the substitution to alternative fuels. The econometric equations are dynamic in nature, allowing for a lagged adjustment in kWh sales resulting from changes in any of the causal factors.

Directly Served Industry: The two methods used to forecast directly served kWh sales were the trend survey and econometric. The trend survey method combined the level of contract loads for individual firms with actual experienced peak loads and expected operating levels based on individual firm surveys. This information was utilized to produce a "contract load" forecast. Historical experience was used to arrive at an allowance for growth factor which was added to the contract load forecast to produce the final trend survey load forecast for directly served industrial customers.

The econometric forecast was produced from the AEM. Specifically, usage in the four major categories of aluminum, chemical (excluding phosphorus), ferro alloys, and paper were econometrically estimated and forecast separately. These four industries accounted for approximately 80 percent of kWh sales in the directly served category. The forecast of all other directly served kWh sales was made using a trend or extrapolation of historical experience.

DOE Uranium Enrichment: TVA provides electricity to two DOE uranium enrichment facilities. The DOE load was approximately 20 percent of electricity sales in 1977. This load forecast was taken as being exactly equal to the demand levels which TVA and DOE had under formal contract.

Summary: The 1977 load forecast was based primarily on trend extrapolations of historical experience. While an "appliance method" was utilized for the residential forecast, it was unsophisticated and did

not incorporate the impacts of significant parameters. While the AEM provided a very adequate analytical and forecasting capability, it was the only formally structured model utilized. No end-use modeling capability was used in preparing the 1977 load forecast.

The impacts of conservation programs, including Federal programs employing tax credits, were relatively insignificant in the 1977 load forecast. The conservation impacts of efficiency improvements and new end-use technologies were not included in the forecast since there was no capability for reasonably quantifying such impacts.

Price conservation impacts and alternative fuel substitution impacts were included in the 1977 load forecast in only a limited fashion. Price conservation impacts could only be implicitly included or were entirely omitted in the forecasts produced from trend extrapolation. A full evaluation of substitution impacts was not possible since a total energy modeling capability did not exist.

II. 1981 FORECAST

The fiscal year 1981 planning forecast was developed using multiple methodologies which have primarily been developed beginning with the 1978 planning forecast. These methodologies represent an effort to develop a comprehensive forecasting capability. The generic nature of this forecasting capability can be described by two characteristics. First, multiple methodologies greatly assist in the evaluation process by allowing for comparison of the several results. No single technique or model can be all encompassing and the comparison of results helps to isolate strengths and weaknesses. Second, a range of load forecasts are produced which are based on alternative levels of the major factors which determine load growth. Future levels of the major determinants of load growth are very uncertain and producing a range of forecasts provides a basis for quantifying the impacts of uncertainty.

II.A. New Models: In addition to the AEM which was used in preparing the 1977

load forecast, four additional models are being utilized: two of the models are econometric, the Manufacturing Energy Model (MEM) and the Industrial Directly Served Model (IDSM); the other two models are end use, the Oak Ridge National Laboratory residential model (ORNL) and the Regional Energy Model (REM). In addition, several enhancements have been made to the AEM.

MEM: The MEM is an econometric model using a set of demand equations which are based on several econometric studies.[1] The model forecasts annual electricity consumption by industry classified by two-digit SIC code for the manufacturing sector which consists of both distributor-served and directly served customers. The forecasts of electricity consumption are provided for the following industries: textiles (SIC 22); paper (SIC 26); chemicals (SIC 28); primary metals (SIC 33); and other (SIC 20, 21, 23, 24, 25, 27, 29, 30, 31, 32, 34, 35, 36, 37, 38). The data used in the model is annual from 1959 to 1979.

The structural form of each demand equation is double logarithmic partial adjustment. This form gives the equation dynamic capabilities which allow both short-run and long-run characteristics to be quantified. Elasticities estimated using U.S. data are employed. The MEM uses assumptions about gross regional product, the average industrial price of electricity in the TVA region, and the regional average price of oil to forecast electricity consumption.

IDSM: The IDSM is an econometric model which analyzes and forecasts electricity sales to TVA's directly served industrial customers which have contract loads of greater than 5000 kW. Unlike the MEM and AEM, the IDSM deals only with the directly served industrial electricity sales. The AEM deals with residential and all commercial and industrial electricity sales including distributor-served commercial and industrial and directly served industrial. The MEM deals with

1. "Electricity Demand by Manufacturing Industries in the United States, Wen S. Chern, Oak Ridge National Laboratory, November 1975.

"An Econometric-Based Forecast of Sales and Peak-Load Growth for Virginia Electric and Power Company," Louis A. Guth, National Economic Research Associates, Inc., March 1975.

distributor-served industrial electricity sales and directly served industrial electricity sales. Thus, the IDSM provides the third modeling capability to analyze and forecast the directly served industrial customers.

The model is structured on the premise that electricity is a factor of production and therefore the demand for electricity is a derived demand based on relative factor prices and the level of output. The model has simultaneous equations for the five major groups of aluminum, ferroalloy, chemical, paper, and miscellaneous. Each demand equation has a dynamic partial adjustment capability and specifies electricity consumption as a function of lagged electricity consumption, the appropriate production index, and the real marginal price of electricity.

Substitution impacts are not modeled since the estimated coefficient for the price of alternative fuels was insignificant. Each supply equation specifies electricity production as a function of the real marginal price of electricity and the average per kWh of electricity production. The data used in the model is annual from 1959 to 1979.

ORNL: The ORNL residential model is a total energy model which simulates energy consumption in the residential sector from 1970 through 2000. The model provides detail on annual energy use by fuel, end use, and housing type. Four fuel types, eight end uses, and three housing types are included in the model. The model estimates annual equipment installations and ownership, equipment energy requirements, structural thermal performance, fuel expenditures, equipment costs, and the costs of improving thermal performance of new and existing housing units. These details are useful for evaluating alternative energy conservation policies and alternative technologies for their energy and economic effects during the next twenty years. The results of the model were directly compared to the 1980 residential appliance survey results for tracking purposes.

REM: The REM is a long range planning model that is used to assist TVA in its total energy planning and analysis. The model represents, in considerable detail, energy supply, distribution, and consumption activities in two regions - the TVA Power Region (170 counties) and the Rest of the United States. It is a multiperiod, nonlinear, optimization model which employs a dynamic, capital-stock adjustment process. The model selects the types and levels of energy activities that meet levels of final energy service demands over the model horizon at minimum discounted cost.

Annual energy accounting is conveniently represented by a network showing all feasible connections between activities. The networks for each region are subdivided into ten supply, conversion, distribution, and end-use sectors. The greatest level of detail is modeled in the electricity production sector and in the four end-use sectors: residential, commercial and government, industrial, and transportation.

The TVA residential sector explicitly accounts for all major end uses of energy and provides for efficiency improvements and the market penetration of new end-use technologies. In certain cases, a new and old end-use device is specified, such as with gas space heaters. This permits the specification of different conversion efficiencies and costs for capital stock in existence in the initial model year, 1975, and for new capital stock subsequently installed. All significant end-use equipment currently in use in the region is modelled, including wood heaters and heat pumps. New types of equipment on the horizon are also modelled; i.e., solar space and water heaters, electric automobiles, and heat pump water heaters. Modelling of the commercial and government sector is similar, and the activities represented include solar space and water heaters and heat pump water heaters. The results of the model were directly compared to the 1980 residential appliance survey results for tracking purposes.

The industrial sector includes specific representation of nine energy-intensive industries such as aluminum, phosphates, newsprint, and cement. Industrial generation of electricity from fuel cells with utilization of the waste heat for other process needs is also represented.

Energy conversion activities in the model include upgrading of shale oil to synthetic oil products, production of synthetic liquid products from coal, and production of low, medium, and high Btu gas from coal. Upgrading of medium Btu gas to high Btu gas and conversion of medium Btu gas to synthetic gasoline is also represented.

Thus, the model presents an extremely useful tool for evaluating technological change in energy production and consumption over time within the context of overall economic growth and future changes in the relative prices and availabilities of conventional fuel resources.

AEM: Even though the AEM was used in preparation of the 1977 forecast, the model is an integral part of the load forecasting effort and, therefore, warrants some discussion. Also, there have been some recent enhancements to the AEM which should be explained.

The AEM is a multisector, multiequation, econometric model with dynamic capabilities which allows for quantifying both short-run and long-run effects. The model provides a detailed forecast of annual peaks and energy for the TVA system and annual energy for the three major customer classes of residential, distributor-served commercial and industrial and directly served industrial customers. The commercial and industrial detail is by two-digit SIC. Forecasts are also provided for Federal Agencies (DOE uranium enrichment), interdivisional, and nonclassified customers. The model is based on annual data beginning in 1960. All historical electricity sales data are weather normalized. Alternative scenario forecasts are driven off the AEM. The model has

the capability to quantify the impacts on electricity consumption due to changes in the following causal factors: economic activity, real price of substitute fuels, and real price of electricity.

Enhancements have been made to both the residential and C&I sectors of the model. In the residential sector a lagged response was included in the appliance saturation equations which was equal to the average life of the appliance. Also, appliance saturation results of the model were compared with actual results from the 1980 appliance survey.[1] In the C&I sector, estimating equations were structurally revised to allow for a separate instantaneous response to employment changes while retaining the lagged response to real price changes. This change represents a more realistic description of the alternative impacts of economic activity and real price changes. Also, the directly served industrial equations now directly incorporate measures of gross regional product and the U.S. industrial production index.

II.B. Uncertainty and Multiple Forecasts: In the recent past, load forecasting could be approached within the context that load growth was a function of market forces which operated to determine the demand for electricity. These market forces were fairly explicit and were primarily such factors as economic activity, the price of electricity, and the price of substitute fuels. Load forecasting in today's environment has increased in complexity and uncertainty. It is no longer the case that external factors which impact load growth will remain few in number and stable over time. Instability and a corresponding degree of uncertainty have been increasingly apparent in the level of sustained economic growth and energy prices. New end-use technologies, conservation, load management, and new alternative rate structures are expected to have a significant impact on future electricity sales and load growth. The important consideration regarding forecasts of future electricity sales and load growth is that limited historical experience exists regarding the impacts of such factors as alternative rate structures, conservation programs, and new technologies as well as other factors.

TVA's method of dealing with forecast uncertainty is to produce a range of forecasts based on alternative levels of the relevant factors which significantly impact load growth. Such factors are the level of economic activity, price of electricity, price of alternative fuels, conservation programs, and uranium enrichment load. Each of these factors is analyzed in considerable detail to determine alternative levels of possible future outcomes of each of the factors and their corresponding impact on load growth. Alternative levels of the five factors are combined to produce a range of alternative forecasts which, with a certain probability, will bound the range of uncertainty associated with load growth.

For each of the five major factors determining load growth, a low, medium, and high forecast is prepared with the exception of the DOE uranium enrichment load which has two alternative levels. In total, this procedure will yield 162 alternative forecasts. Because of analytical constraints and for practical reasons, only a limited number of forecasts are selected for analysis in great detail. The forecasts selected must sufficiently bound the range of uncertainty and must also be reasonable regarding the combination of alternative levels of the five factors which determine load growth. To achieve this objective, probabilities are assigned to each of the alternative levels of the five major factors which are combined to produce any single load forecast. In this manner, probabilities are calculated which relate to the possibility of actual load growth being equal to or less than the load growth corresponding to any single forecast. These probabilities associated with the possible forecast outcomes are used as a guideline in selecting those forecasts which will be evaluated explicitly in the decision process.

II.C. Conservation Program Impacts: The impacts of both TVA and national conservation programs are included in the load forecast. Three alternative levels of the TVA programs are estimated for inclusion in alternative load forecasts. The program impacts include impacts on

kWh sales, seasonal peak load impacts, and, ultimately, load shape impacts. These impacts are estimated on the basis of the specific end uses which are associated with each individual conservation program. In the residential sector nine specific program impacts are included in the load forecast, such as, solar heating, heat pump space heating, heat pump water heating, home insulation, etc. In the C&I sector, four specific program impacts are incorporated in the load forecast to include solar, cogeneration, energy audits, and electric vehicles. While electric vehicles will increase kWh sales, their impact is functionally treated as a negative conservation impact.

II.D. DOE Alternatives: Two alternative levels of the DOE uranium enrichment load are projected for use in the load forecast. The first level is the contract load which was determined for the 1981 load forecast in the same manner as for the 1977 load forecast. The alternative DOE forecast is determined from an analysis of expected requirements of enriched uranium for nuclear power plants, national defense needs, and foreign exports. Since nuclear power plant completions and operations are a significant source of uncertainty, estimation of the expected DOE load concentrates on an analysis of construction schedules, probable plant completions, and expected plant operating characteristics. The expected DOE load is estimated to be significantly lower than the DOE load currently under contract.

II.E. Surveys: A major system-wide residential appliance survey was completed in January of 1980. The survey included 9,400 residential customers and there was an overall 91 percent effective response rate. The results of the survey were sufficiently analyzed for inclusion in the 1981 load forecast. The survey provided valuable information on appliance saturations and penetrations by fuel type. Information was also collected on type of living quarters, such as, single family, multiple family, and mobile home. Also included were the approximate sizes and ages of living quarters. A significant amount of information was collected on conservation measures which had been undertaken in the

past five years. Data was also collected on the social and economic characteristics of households, such as family size and age distribution and family income levels.

This survey data provides the basis for estimating correlations between such factors as household size and income, appliance saturation, energy consumption, and various conservation measures. For example, one important specific finding of the survey was a 13 percent saturation of wood stoves which was significantly higher than expected. This finding resulted in explicitly including wood stoves as an end-use activity in the residential sector of the REM and correspondingly changed the mix of residential energy consumption by fuel type.

II.F. Alternative Rate Structure Impacts: In compliance with the standards of the Public Utilities Regulatory Policy Act of 1978, TVA has analyzed the impacts of alternative rate structures on the fiscal year 1981 load forecast. The alternative rate structures analyzed include time-of-day rates and flat rates with separate capacity and energy charges. The impacts of these rates are not explicitly incorporated into the official planning forecasts since the form of the final set of rates is incumbent on a Board decision. For this reason a range of alternative rate scenario impacts were estimated and included in the load forecast as sensitivities. The alternative rate scenarios included varying degrees of phased implementation of time-of-day rates in conjunction with the impacts of flat rates. The impacts of these rate structures were evaluated on the basis of energy consumption, winter and summer peak loads, and, ultimately, the hourly load forecast.

II.G. Regional Economic Forecast: The load forecast is driven directly by both national and regional forecasts of the level of economic activity. The national forecast, which is provided by Wharton Econometric Forecasting Associates, is also directly linked to the regional forecast. While the national forecast of economic activity provides direct input to the load forecast, primarily for the industrial sector, the

regional economic forecast provides the primary driving input to the load forecast. In this manner, the load forecast is consistent with both national and regional forecasts of the level of economic activity. The regional economic forecast is derived from the Regional Economic Simulation Model (RESM). The model is a multisector econometric model with explicit dynamic capabilities which account for both short-run and long-run impacts of changes in population, the level of employment, and real output. The model provides detailed forecasts of income, earnings, employment, population, and gross regional product.

Several significant improvements in the regional economic forecast provided by RESM were included in the 1981 load forecast which were not incorporated in the 1977 load forecast. An income sector was explicitly incorporated in the model which was endogenously linked to the employment and real earnings sectors of the model. A real product sector was developed which provides an analysis and forecast of real gross regional product. The real product forecast is directly linked to the employment and income sectors of the model. Finally, the cost of electricity in the TVA region relative to the cost of electricity in the rest of the Nation was explicitly included in the model to account for the impacts of relative power costs on levels of employment, gross regional product, and, ultimately, real income in the TVA region. An additional improvement is in the form of the range of alternative regional economic forecasts which are produced. The high, midrange, and low economic forecasts provide direct input into the multiple load forecasts which are produced.

II.H. Internal Planning Reviews: In the process of producing the load forecast, three internal planning reviews are conducted for the purpose of assuring consistency between the regional economic forecast, the load forecast, and the overall planning goals and objectives of the Office of Power and other offices within TVA. The Regional Economic Committee, which is composed of representatives from each office, reviews and approves the regional economic forecast and its explicit

relationship to the national economic forecast. A second internal review is undertaken by the Office of Power, Power Planning Committee. The purpose of this review is to establish and approve the entire set of factors which will be the basic conditions and assumptions underlying the load forecast. Such factors include the real price of electricity, price of natural gas, levels of conservation program impacts, regional economic conditions in the form of employment, income, and real product, the saturations of end-use appliances, and conditions regarding the DOE uranium enrichment load. The final internal review is also performed by the Office of Power, Power Planning Committee. The purpose of this review is to evaluate the range of load forecasts which were produced from the previously established conditions and assumptions. This final review assures consistency between program objectives within the Office of Power before the load forecast is sent to the Board for final review and approval. The range of load forecasts becomes the official planning forecasts upon the direction of the Board.

II.I. External Reviews: Over the period of 1978 to 1980 two extensive reviews of TVA's load forecasting capability were performed by consultants knowledgeable in the area of analyzing and modeling electricity consumption and the area of load forecasting. The two reviews were conducted by National Economic Research Associates (NERA) in November 1978 and by Booze-Allen in January 1980. The dates given are publication dates. The actual surveys and reviews of methodologies and procedures occurred significantly in advance of these publication dates. This fact is of importance since significant new methodologies were developed and implemented in the brief period since the reviews were completed. Even so, the reviews were generally favorable and, in some cases, highly complimentary. What follows are direct quotations from the summarized results of each of the reviews.

- NERA

The main body of our report, therefore, will deal with our

own specific comments on the current methodology being used by TVA to forecast future energy and peak load requirements --of the TVA system. The orientation of this sort of review must always appear critical. That is, in order to provide some useful inputs to TVA, the bulk of the material below deals with some general problem areas or finer points in the TVA methodology which could be improved. For all these critical comments, however, sight should not be lost of the fact that the general approach to forecasting used by TVA and the specific implimentation of its methodology are certainly well to the forefront of the electric utility industry.

- Booze Allen

We also found that (the Office of) Power has significant strengths in a number of areas. For example, in providing an adequate and reliable supply of electricity, Power has:

o Established a state-of-the-art load forecasting and analysis capability.

While both of these reports contained certain specific criticisms and recommendations for improvement, each report demonstrated that TVA has a significant load forecasting capability. As a final point, the Booze-Allen report was based on a review which took place before the development and implementation of methodology for analyzing and forecasting the impacts of time-of-day rates and other rate structures on the system hourly load forecast. The NERA report was prepared prior to the development and implementation of several significant methodologies.

III. CONCLUSION:

The 1981 load forecast is based on significant improvements in methodology and procedures over the 1977 load forecast. The improvements incorporated into the 1981 load forecast are very sophisticated and detailed in nature. The new models, methods of dealing with uncertainty, accounting for conservation program impacts, estimation of expected DOE loads, analysis of alternative rate structure impacts,

utilization of appliance survey data, and enhancements to the regional economic forecast were designed to enhance TVA's forecasting capability over a wide range of varying conditions which impact electricity sales capability to account for extreme detail over a wide range of varying and load growth.

APPENDIX III

The Role of TVA's Research and Development

While the present concerns of the Valley consumers are vital to the Agency, TVA also must plan for the future in order to ensure the Valley maintains its energy advantage. This responsibility has been recognized by its Board of Directors since TVA was established. TVA first led in the development of a comprehensive system of dams for harnessing the Tennessee River to control floods, allow safe navigation, and produce electric power. When electric power demand outstripped hydropower capacity, TVA demonstrated the economies of scale in building progressively larger coal-fired steam electric generating units--units that many warned were too large, but have now become the standard for the utility industry. With the promise of cheaper power through nuclear plants, TVA led with the Nation's largest nuclear power plant construction program. It is following through on this commitment as it finishes this construction program and commits itself to the safe and efficient operation of these plants.

The future challenge to TVA is already here. Only 40 percent of the energy used in the Valley is electric power; the remaining 60 percent is heavily dependent on oil and natural gas. Spurred by the national goal of reducing dependence on foreign oil and a mandate to provide a national proving ground for new energy supply and conservation technologies, TVA has begun a major effort to help solve the nonelectrical part of the energy problem. This effort involves renewable resources such as solar and biomass, and our old friend coal, but seen in a new light.

The scarcity of supply and decontrol of natural gas prices means that in the 1990's both oil and natural gas are going to be increasingly expensive. Coal will be the principal replacement fuel. However, the environmental disadvantages of coal use must be recognized and dealt with. TVA's program of demonstrating atmospheric fluidized-bed combustion (AFBC) technology is one answer. This technology reduces sulfur dioxide emissions by 90 percent with less nitrogen oxide emissions than other methods. A major asset of the AFBC process is that it permits the use of lower-cost, high-sulfur coal which is abundant in the Valley and the Northeast U.S. In addition, capital and operating costs of the

process are estimated to be less than conventional coal-fired electric production methods.

Coal gasification and fuel cells are related projects which hold the promise of lessening our dependence on foreign oil and providing environmentally acceptable power generation from coal. In 1979, TVA took the first step to provide the Nation's first commercial-scale coal gasification plant and is now moving rapidly toward breaking ground for this facility next spring. The first module of the plant will be in operation by the mid-1980's. By 1989 the completed facility will convert 20,000 tons of coal each day into the equivalent of 50,000 barrels of oil.

Another major use of the coal gasification process is the production of ammonia for nitrogen fertilizers. TVA's pilot Ammonia from Coal plant at Muscle Shoals began operation this fall and will demonstrate a method that can insure U.S. fertilizers remaining competitive in international trade. In late 1979, TVA authorized a seven-year program to develop fuel cells for the generation of electricity in the late 1980's and beyond. The Ammonia from Coal plant will be used to test cogenerating fuel cells.

The Tennessee Valley's indigenous forest resources are an important potential energy source also being investigated by TVA. Besides the direct combustion of wood for heat encouraged by the wood heater financing program, TVA is investigating the conversion of wood to liquid fuels as a supplement or replacement for petroleum-based motor vehicle fuels. Such conversion is not now economical but TVA intends to develop and demonstrate technologies that will provide an alternative to imported petroleum. This technology can also be the basis for a major new Valley industry using excess supplies of indigenous hardwoods as fuel to replace imported oil.

TVA is testing electric vehicle technology and studying railroad electrification with private companies as another way to substitute coal- and nuclear-fueled electrical power for imported petroleum--as well as an excellent strategy for enhancing power revenues. A 21-passenger electric bus purchased for testing had a maximum range at half payload of 84.3 miles at a constant speed of 35 miles per hour during an acceptance test. These initiatives complement TVA's employee ridesharing program which is estimated to be saving gallons of gasoline per year. TVA is also building a waste heat park in conjunction with its Watts Bar Nuclear Plant. This facility will tap the thermal energy contained in the power plant's discharge water for various commercial uses, such as agriculture and aquaculture.

These research and development programs--national energy demonstrations--to the extent they do not directly benefit power system ratepayers are financed with congressional appropriation and by other sources, such as the Electric Power Research Institute.

Each of these energy initiatives makes a unique contribution to maintaining and extending an energy advantage for the Tennessee Valley. Some have immediate payoff, such as energy conservation and the new nuclear capacity as it comes on line. Others, such as electric vehicles and liquid fuels from forest resources, are in the future. All reflect TVA's commitment to pursue its old mission in a new world. All contribute to TVA's second fundamental goal, that of helping keep the door to economic prosperity in a new era of stiff foreign and domestic competition.

APPENDIX IV

TVA's Economic Development Role

What does it mean to keep open the door to economic prosperity in the Tennessee Valley? Fundamentally, it means a prosperous Valley economy with full employment, good-paying jobs, and opportunities for economic improvement on par with other regions. To eventually achieve it, the Valley economy must grow at a rate greater than the national average. This is a substantial challenge. To provide jobs for those entering the labor force over the next decade, there will have to be 350,000 new jobs added to the Valley's economy.

For most of TVA's existence the Valley's economy has in fact grown faster than the Nation's. As a consequence, average per capita income in the region has increased from 45 percent of the national average to nearly 80 percent. But progress toward economic parity with the Nation stopped in 1973 with the oil embargo and subsequent quadrupling of oil prices. The energy-intensive industrial base of the Tennessee Valley was hit considerably harder than the rest of the Nation. Economic activity in the Valley grew at about the same rate as in the Nation during the rest of the 1970's.

The potential for a prosperous Valley economy clearly exists. The Valley is assured of an adequate supply of energy for decades to come. Its forests are increasing in productivity. It continues to enjoy an abundant supply of clean water for both domestic and industrial uses. Environmental amenities of climate, recreation resources, and general life style are assets which make it an increasingly attractive place to live. Sustained improvement in the Valley's economy can occur if a competitive economic base is developed with attentiveness to the wise use and conservation of the region's natural and social resources.

To do this successfully, a partnership of governmental institutions and the private sector will be essential. TVA's role will be supportive in most areas and it will take the lead in only a few. A viable strategy for achieving a prosperous Valley economy must be built on the Valley's resources and strengths and recognize the new economic facts of life of the current era.

The world is entering a new era of international economic competition brought on by rising aspirations and worldwide competition for markets, raw materials, and energy. The Tennessee Valley is merged into an American economy and society characterized by increasing interdependence among regions, economic sectors, industries, and people. Increasingly even the stability of a relatively self-contained continental market--North America--is vanishing. Products and services that U.S. manufacturers traditionally provided to domestic markets are being displaced by overseas imports. Prospering in the decades to come will require the regional economy to recognize these realities and to pursue a strategy that will ensure that its goods and services are competitive in other regions of the U.S. and in foreign markets.

Fifty years ago, the economy of the Valley region was highly dependent on farming, which accounted for over half of the region's employment. Today that proportion is closer to 5 percent, only slightly higher than the Nation. As farm employment declined, many people migrated out of the region. New job opportunities within the Valley were made available primarily in the manufacturing sector. However, the type of manufacturing that located and expanded in the region was preponderantly low skill and, therefore low wage. In 1977, 41 percent of the region's manufacturing employment was in low-wage industries compared to 21 percent for the Nation as a whole. Due in part to the low income resulting from these manufacturing jobs, the trades and service sectors in the region have grown more slowly than they have nationally.

More jobs must be created for the better trained and better educated residents of the region and more rapid growth must occur in the trades and service sectors. State and local governments must continue to attract branch plants of larger firms. Recent studies show that the sources of economic growth and new jobs in areas of the country growing most rapidly are the expansion of existing firms and formation of new firms--especially small firms involved with emerging technologies. More of this type of activity in the Valley is needed.

In light of these considerations, what is TVA's role? Obviously, maintaining the Valley's energy advantage is inextricably linked to the economic prosperity of the Valley. This is TVA's major role today as it has been in the past.

Availability of power is the key consideration to most commercial and industrial customers. No other section of the country will have a more reliable supply of electricity than the Valley. TVA is also helping Valley customers lower their energy costs by keeping its electric rates competitive, conserving energy, providing improved rate structures, and making available alternate, renewable energy sources.

TVA is augmenting its existing efforts to support industrial recruitment efforts in the Valley, which historically has been principally the respon-

sibility of State and local organizations. These organizations must continue to take the lead. TVA believes it can best assist these groups through provision of regional data and technical assistance in power availability, energy planning and conservation, siting, and environmental compliance.

TVA will also support a new effort to identify and support opportunities for commercialization of new technologies and establishment of service industries in the Valley. Those technologies that focus on energy and the region's natural resource strengths, particularly coal, agriculture, and forests, are prime candidates for commercialization. New enterprise development will be a routine consideration in TVA's demonstration and R&D activities.

The coal gasification project in northern Alabama and the waste heat park demonstration at TVA's Watts Bar Nuclear Plant are examples of existing programs with high commercialization potential. The ammonia-from-coal pilot plant, the electric vehicle testing program, and TVA's new effort to develop liquid fuels from Valley hardwoods are other examples. The National Fertilizer Development Center at Muscle Shoals is probably the Nation's most successful public institution in developing new technologies and transferring them into the marketplace. The knowledge and skill here will be invaluable in expanding TVA's commercialization activities.

Finally, TVA will continue to demonstrate through its own programs and by working collaboratively with local communities that economic growth need not bring undesirable social and environmental consequences. Just as TVA demonstrated in its early years that control of soil erosion and reforestation were vital in building the region's economic base, TVA can demonstrate that environmental quality is compatible, indeed essential, to economic prosperity. First of all, the Agency must keep its own environmental house in order. TVA is making steady progress in bringing its coal-fired power plants into compliance with State and Federal air quality standards. Nuclear wastes from TVA power plants will be kept on site until the Federal Government approves and implements a safe method of permanent disposal. The Agency is well along in developing a land management plan for Pickwick Reservoir through a process based on active citizen participation.

TVA will also continue to develop specific technological initiatives which enhance the environment while promoting economic prosperity, such as the AFBC technology. TVA has found a simple, inexpensive solution to the low dissolved oxygen problem in discharges from many of its dams. This innovation will open up new opportunities for industrial development along the region's waterways. Other technological initiatives will take advantage of the Valley's indigenous forest and coal resources, such as liquid-fuels-from-biomass and coal gasification projects, and will recover useful products from the region's wastes, such as waste heat and energy from waste initiatives.

TVA MISSION AND PURPOSE

Mr. FREEMAN. The questions raised in your letter of invitation, I believe, can be best evaluated in the context of TVA's mission and purpose. Since its creation in 1933, TVA has been charged with promoting the economic and social well-being of the people of the Tennessee Valley, and serving as a national demonstration of resource development and conservation.

TVA'S BASIC MISSION

In our judgment TVA's basic mission remains the same today, but we have to pursue our old mission in a new world, in a new world which is harsh and painful in some of its economic aspects. This process of adapting to a changing world is continuous and it is one in which TVA involves and is accountable to the people. The bottom line today, as it was in the 1930's, is jobs; helping the regional economy grow to provide enough good paying jobs for every potential worker. And I think it is fair to say that this basic concern which is the heart and soul of TVA often gets lost in the debate over the more immediate issues such as electric rates.

TVA COMMITMENT TO POWER AND EMPLOYMENT

For TVA the job today boils down to, first, helping the valley maintain and extend its energy advantage in a world of rising energy costs, in a world of energy shortages, because there is a growing shortage of electrical energy and all forms of energy, and in a world of new energy technologies, of environmental concerns and of regulatory uncertainty. This energy advantage will be vital to achieving TVA's second major objective, and the primary objective of the people of the valley, and that is keeping open the door to economic prosperity in a world of stiff domestic and foreign competition.

EVOLUTION OF TVA'S POWER SYSTEM

Our two major goals of assuring the valley's energy advantage and of helping build a competitive economy are linked together. Nothing would slam the door to economic prosperity more completely than losing the valley's energy advantage. And that raises a question of what is TVA doing to maintain and extend the valley's energy advantage? The first step in answering that question is to understand how our power system has evolved for the past half century. As you know, Mr. Chairman, TVA's rates in absolute terms are considerably lower than the national average. The percentage margin of difference has fallen by half since 1970. Our rates have grown at a higher percentage than the rest of the country because they were so much lower than the rest of the country, but in absolute terms our rates have not increased any more, and perhaps somewhat less, than the utility industry as a whole in the last decade.

The reason for this change, the reason that our percentage increase is higher than the rest of the country, is that the inexpensive hydropower is progressively becoming a smaller part of our total power supply. TVA used to be a system of 100 percent low-cost hydro. Today we

have about 15 percent hydro, which is not basically different from the Nation as a whole.

CONSTRUCTION OF FIRST COAL-FIRED PLANTS

Senator SASSER. When did you start building the first coal-fired plants, back in the early 1950's?

Mr. FREEMAN. TVA began construction of the Watts Bar steam plant in August 1940. Congress provided appropriations for TVA's first peacetime construction of a coal-fired steam plant, the new Johnsonville plant, in 1949. I was in the design organization at that time. The money was requested in 1948, it was defeated. The Congress then passed the first appropriations in 1949. It was a very, very hard battle and our whole power program in those days was like a neon sign, it would come and go with the appropriation process. But we did have another advantage in those days, our second advantage was our appropriations advantage. The Federal Goverment used to advance money to build TVA's power facilities and we did not have to go to the financial markets and pay the kind of interest rates we are paying now.

We also, over the decades had a major technological advantage, because TVA pioneered the large integrated power system and the large fossil fuel units going up to a thousand megawatts. The rest of the industry has caught up with us in the economies of scale and now they are able to achieve much the same kind of economies as TVA, although we still believe we operate one of the most efficient power systems in the Nation.

EFFECT OF CHANGES ON POWER RATES

These fundamental changes have affected our power rates in a dramatic way, beginning in the late 1960's. As a result we have been forced to subject our customers increasingly to the same inflationary pressures as every other electric utility. If we still had an all-hydro system, Mr. Chairman, we would not have to hold these hearings, because our rates would still be way down there and they would be constant. It is the fact that we moved into an economic growth pattern that required us to go to coal and then nuclear and made us subject to these inflationary pressures. But we certainly would not want to turn the clock back to where the valley's economy stood at the end of World War II.

There is an appendix to my testimony that goes into the story of rising power rates and also the number of specific measures that we have taken to cut costs, which we have so much difficulty dramatizing, but which represents the day-to-day work of this agency. Our efforts to keep the rates as low as feasible are a harder job today than they were when the rates were low, and we are working at it harder. We are increasingly tightening our belt and coming up with economies which 6 months ago we did not believe could be obtained. That fact is the story of the TVA organization over the years, to try harder and to succeed. I think that the story that we have documented in my testimony is a compelling one.

TVA'S ENERGY ADVANTAGE IS AMPLE POWER SUPPLY

Mr. Chairman, if we talk about Tennessee Valley's energy advantage for the future, I believe that it will lie in an ample supply of reliable energy at competitive prices. The price issue is important, but increasingly in a world of energy shortages, the energy advantage that we will have is the availability of reliable supply as the rest of the Nation becomes increasingly short.

NUCLEAR CONSTRUCTION PROGRAM

We believe that you stated the point quite well yourself at the last hearings we had in Knoxville in February of 1979. If I may quote you, Mr. Chairman, "We must assure that we have the energy to expand our economy and provide new job opportunities for all of our people." And, Mr. Chairman, TVA's ace in the hole in this regard is our nuclear construction program. The key question, and I think the focus of this hearing, is to try to place on the record the basis for deciding how much electricity is enough. What makes this decision so terribly difficult, so terribly difficult, is that it has to be made 10 to 20 years before the power is needed.

Chart 1 depicts the load forecast that TVA made in 1974, when the last two plants in TVA's nuclear construction program were authorized. It is important to get that date in mind. Our present construction program was completely put in place in 1974, and that forecast is compared with the load forecasts that we made earlier this year. There is a striking difference in the two forecasts, and it reflects a number of factors: the higher energy prices; the lower economic growth that we have experienced; the fact that we have a strong conservation program that is now factored into our projections; the use of renewable resources and the more sophisticated and sensitive forecasting techniques developed by TVA over the past several years.

REVISED LOAD FORECASTING

And as Mr. Peach testified, that revised load forecasting has not been an academic exercise. This Board has acted on the basis of it. We have deferred four nuclear power units that were already under construction, and we canceled the plans for two units where the bids were in hand. Further modifications in this program will be made as necessary, but we cannot say at this time whether the future facts will dictate an increase or a decrease in the construction program.

ENERGY CONSERVATION AS SUPPLY STRATEGY

In its efforts to maintain and extend the valley's energy advantage, the Board has also initiated the most extensive effort in energy conservation and in developing renewable resources, I believe, of any organization of our kind in the country. This effort is particularly important in easing the valley's transition from the economy based on abundant cheap energy to one that must face the reality of higher energy prices. Our load forecasts take into account the reduced consumption of electricity which will be achieved through the greater efficiency of its use, and by substituting solar energy for electric power.

Energy conservation, Mr. Chairman, can be seen as another source of energy supply. And a very important source because the conservation operation is cheaper and quicker than building equivalent power plants. Our load forecast projects that by the end of the century we hope to achieve the equivalent of 6,000 megawatts of power through greater energy efficiency, which is roughly the equivalent of more than four of these nuclear powerplants.

And I say to you that the conservation program comes first. If there are revisions in the load forecast that suggest that we need to cut back, it will be the nuclear power plants that will be deferred and not our conservation program, because the conservation program looks better to our system and to our customers in terms of costs and benefits.

UNCERTAINTY OF FUTURE LOAD FORECASTS

For the past decade we have learned that any forecast of how much energy will be needed 10 to 20 years from now is very, very uncertain. Forecasting never will be an exact science. It is at best an educated guess. I am attaching as an appendix to this testimony a paper that describes our efforts to improve our methods of forecasting.

But there remains substantial uncertainty about the size of our future loads that no degree of sophistication can eliminate. We live in an uncertain world and the heart of our forecast is how the economy is going to grow. On the low side, if there is a sluggish economy because of prolonged recession, higher electric rates, people conserve more, and there is greater use of other fuels we could get to the lower end of our forecast. But it is also possible, Mr. Chairman, that the valley's economy will grow faster than the Nation; that we will begin to substitute electric power, as I think we should, for petroleum in the transportation sector; that as the 1990's unfold we will be electrifying our railroads; that we will be using electric cars, substituting electric power for petroleum in heating buildings, and thus there will be a much higher than expected growth in the efficient use of electric power.

These uncertainties, Mr. Chairman, lead us to believe that we cannot pay much attention to a single forecast. And I think perhaps in the past, as you yourself pointed out, that reliance was in error. In our current forecasts, with the information available to us, we conclude that there is less than a 10 percent chance that the load in 1990 will be greater than the high end of our range, and only a 7-percent chance that it will be lower than the low range. We are fairly confident that the load will fall within the range. But to select a midpoint, or any other point within that range as a primary basis for any decision in our judgment would be foolish. Indeed it would be a throwback on the kind of single value forecasting that TVA was criticized for using in the past.

It is highly unlikely that anyone in this world is wise enough or lucky enough to hit a target right on the money 10 or 20 years in advance. We have, I believe, with the aid of our improved forecasting techniques, established a range in which we have confidence. We, therefore, are faced with a key question of whether it is better to err on the high side of the range, that is, to run the risk of ending up with excess capacity, or to err on the low side, that is, run the risk of running short.

COSTS AND BENEFITS OF TOO MUCH POWER VERSUS TOO LITTLE

The key question, I believe, is: What are the costs and benefits of having too much on the one hand, or too little power on the other hand? The Board has struggled with this question very thoroughly. We are united in the conclusion that responsible and prudent policy is to target TVA's nuclear construction program in order to accommodate the load that would be generated by economic growth at the high end of the expected range.

NUCLEAR CONSTRUCTION TO ACCOMMODATE ECONOMIC GROWTH

If I may, let me put the Board's reasoning before you. If we were to keep to our current construction schedule and the valley were to grow at the low end of the range, lower cost nuclear power would be substituted for older, higher cost, coal-fired power. Moreover, if any excess capacity develops it is likely that interim exchanges of power with oil- and gas-burning utilities could be arranged that would profit, to use your word, profit the ratepayers of the valley, as well as the serving utility and as well as the Nation. And this sharply limits the potential costs of any potential excess capacity.

On the other hand, if TVA were to scale down its construction program further and the valley economy were to attempt to grow, or grow at the high end of the range, we would have to buy power from other utilities, if it were available, and to insure reliability add capacity on a crash basis. This would substantially increase costs and rates to the consumers. If TVA were to reduce or slow down its construction schedule, obviously capital and interest costs would be somewhat lower in the intervening years. However, the size of the reduction is modest, negligible in the next 2 or 3 years, when upward pressure on rates is most severe, and more modest thereafter. Eventually rates would have to be higher than if TVA kept to the current schedule because of the higher costs of building this postponed capacity with inflated dollars later on.

If TVA were to plan for slow economic growth by reducing the current schedule we will get slow economic growth, Mr. Chairman, of that we can be sure. The plan will be a self-fulfilling prophesy, with substantial costs in terms of jobs, income, and economic output. In an era of power shortages, the ability to give industry reliable commitments to supply power in the future is a valuable regional asset. It is today and will be in the future a major energy advantage. If TVA plans for slow growth, it will not be able to make a credible commitment for energy supply.

RISKS IN OVERBUILDING AND UNDERBUILDING

In short, Mr. Chairman, on the basis of the information we have available, we believe the risks of overbuilding, narrowly stated, just to the ratepayer, are no greater and much less permanent than the risk of underbuilding. But over and above that, the risks of losing jobs and economic growth are substantially greater from underbuilding than from overbuilding. As a consequence, at this juncture we have decided to make no further cutbacks beyond the four presently deferred units.

Let me elaborate on the factors considered by the Board in reaching that decision.

SUBSTITUTION OF NUCLEAR PLANTS FOR COAL PLANTS

First, one of the advantages of our nuclear construction program is even if there is excess capacity in the years ahead, we can save money by substituting the energy from lower cost uranium fuel for higher cost energy from coal. For the nuclear plants that will be operational in this decade, the operating costs per kilowatt hour in 1990 will average only about one-third of the cost of our older coal-fired plants.

Senator SASSER. Are you not assuming there, Mr. Chairman, though that the price of uranium is not going to rise, at least not rise as fast as the price of coal?

Mr. FREEMAN. No, sir, we are relying on the fact that the TVA Board has largely protected the consumers of the valley against increases in uranium costs by already having much of the uranium supply under contract and by prudently acquiring uranium resources. Also, in a weird sort of way, the Three Mile Island accident has resulted in slower growth for the nuclear industry generally and the price of uranium in real terms has fallen in recent years. In fact, we could acquire more uranium today at relatively stable prices if we needed it. On the other hand, all of the experts agree that as we move out of the current recession and as demands of the synthetic fuels program increase, we are going to experience higher coal costs.

And indeed today the operating costs of a coal-fired plant are substantially higher than the operating costs of a nuclear plant.

I would like to add one other thought. When you look at these charts showing a large future generating capacity, Mr. Chairman, you should realize that our energy capability is much lower than our capacity. We have 2,500 megawatts of capacity in combustion turbines that we can't afford to use because the oil and gas burned in them are horribly expensive. In addition, most of our hydroelectric facilities, which have capacity, can operate only part of the time.

We have at Raccoon Mountain a pump storage project which gives us capacity but no net energy. So the potential energy supply, which needs to be looked at just as much as capacity, is considerably less than the capacity numbers suggest.

Another way to understand the TVA system's ability to adjust to any excess capacity is to consider an extreme, a highly unlikely worst case.

For example, if we had low load growth through the whole next decade but continued all the construction now underway, and there were no interim changes with any outside utility, rates in 1990 would be about 7 percent higher than if we were to cut back our construction program by the four units we have deferred plus two more units. That 7 percent is an upper limit to the cost of having too much capacity. Subtracted from that would, of course, be the opportunity to make interim exchanges of power. If TVA were to equalize capacity with demand by exchanging on an interim basis with the utilities that used oil, and if TVA and the receiving utilities were to split the savings, which is a normal and accepted criteria for making those kinds of exchanges, then by 1985 both TVA and the receiving utility could realize savings of between $200 and $400 million per year.

By 1990, each could be realizing savings of between $500 million to over $1 billion a year.

To be clear, I am not predicting that we are going to have excess capacity, and I am not predicting that we are going to make those kinds of exchanges. But in evaluating that option, the basic economics provide that kind of possibility. Thus, the overbuilding case presents the possibility of saving money for TVA customers in the years ahead.

POSSIBILITY OF EXCHANGING POWER

And, as you know, Mr. Chairman, we announced that TVA is presently exploring the feasibility of such interim exchanges, and also announced that at the request of the companies involved we are not revealing any of the details of those discussions while they are taking place because understandably they don't want their public service commissions and other regulatory bodies hearing about the details of this informally.

The second point I would like to make is that if the load growth were to outstrip TVA's capacity to bring these base load plants on line, the most readily available option would be to try to purchase the power from other utilities.

Now, it is doubtful that if we are running short that there would be the power available from the surrounding utilities. However, if the power were available, our best judgment is that it would cost about three times as much as power from TVA as base load plants. We certainly could not remain dependent on imported power and we would have to go back adding capacity on a crash basis.

We believe as a consequence that by the late 1990's our rates under this scenario would be about 10 percent higher. There would be no opportunity for offsetting relief through interchanges, and, of course, the costs to the economy would be over and above that.

I have mentioned that we would gain some interim relief, and I think Mr. Peach's numbers kind of confirm the small relative value of that, of cutting back.

LOSSES FROM CANCELLATION OF INVESTMENTS

But we have to also consider the investments that we have already made in the existing plants, these commitments having been made in the late 1960's and early 1970's. If TVA were to cancel the four units that we have deferred and two additional units, over $2 billion that has already been invested in these plants would be lost. Another $1 billion in outstanding contractual commitments also would be lost.

And we would continue to have to pay the interest on that $3 billion and get nothing for it.

The near-term impact on rates would average less than 2 percent over the next 4 or 5 years.

EFFECT OF GROWTH CEILING ON POTENTIAL INDUSTRY IN VALLEY

Finally, and most fundamentally, the reason that guides us is that if we plan on the basis of low growth, we will put a ceiling on the valley's economy. Our most recent experience with firms evaluating the valley as a place to do business convinces us that our ability to give firm

assurance of an adequate supply of electricity is an increasingly important asset for regional economic development. If we diminish the credibility of this assurance, the valley's potential for economic growth surely will suffer, and so will the valley's people.

I think most people in the valley believe that it is not only possible, but important that the valley grow more rapidly than the national average during the rest of the century, if we are going to get our fair share of the Nation's prosperity. Our economic forecast, as well as the economic forecasts of others, is consistent with this goal.

Therefore, we believe that it is only prudent and responsible to provide the capacity, from conservation and from new powerplants, that would be required by a healthy regional economy that grows at a better than average rate. Quite frankly, activating the four presently deferred units may well be necessary if our goals, ambitions, programs for economic growth are successful, and if we were to enter into any exchanges with other electric systems.

In short, we view the present nuclear construction schedule as conservative when viewed from the Board's perspective of encouraging economic growth in order to raise the valley's standard of living. Given the hundreds of millions of dollars invested in each of our units under construction, I think it is only a matter of common sense to approach any decision to cancel or defer additional units with great caution.

We do not have plans for any further deferments, but I want to say if the facts we have discussed change substantially, this decision would be reexamined. But it will be the nuclear plants that will go first and not our conservation program, because our conservation program is more cost-effective than nuclear plants.

SUMMARY REMARKS

In summary, the Board has confidence the future demand for electric power will fall within the range of our forecast. We have no confidence in selecting a specific point such as the mid-range. Moreover, the Board is convinced that it is prudent at this time to target our program of construction so that it can accommodate the demands associated with the higher end of the range. Excess capacity at most has only a moderate impact on rates and the opportunity to exchange power is a valuable form of insurance against that contingency. Shortages would bring higher rates and would likely cut off the economic growth.

IMPORTANCE OF ENERGY EFFICIENCY

The national economy of higher priced energy means valley customers will want to reduce their energy consumption and lower their costs by being energy efficient. And as I stated, we built 6,000 megawatts of conservation into the program, and as you know, we are carrying that out with our home insulation program.

We are viewing conservation as an objective in our rate reform, and we are certainly encouraging all of our customers to switch to more energy-efficient sources such as the heat pump and solar energy.

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We are also sensitive to the plight of the commercial and industrial customers, since two-thirds of our power is used in the commercial and industrial sector, and we have an energy conservation program designed to help those customers. We have also worked through your leadership to help communities like the communities of Gallatin, Tenn., take their wastes and make energy, and we believe that that is an enormously valuable experience and demonstration of getting this valley off of imported petroleum; whether it is imported from Saudi Arabia or imported from Texas, it is draining money from the valley's economy and is a major source, I think, of the sluggish economic growth.

WASTE DISPOSAL

Senator SASSER. It also gets rid of waste. We are running out of places to put it.

Mr. FREEMAN. That is entirely correct. It is in the best tradition of multipurpose activities that TVA has pioneered over the years, and we are grateful to you and your leadership in getting that first demonstration plant underway at Gallatin. As you know, we have broken ground and that is under construction, which is more than you can say about most of the energy projects we talk about nowadays, our synfuel programs and the like.

And we, of course, are very, very attentive to the fact that our valley's forests are a source of energy in the future and hopefully can be converted into liquids that will help us in our transportation sector.

EFFORTS OF TVA IN ELECTRIC POWER FIELD

Let me say in conclusion if I may, Mr. Chairman, that taken together we believe these efforts of the Tennessee Valley Authority are unmatched by any region in the United States. My own view is that the Tennessee Valley will be in the catbird seat in the years ahead, and that our energy advantage will grow, not diminish. Our rates will still be among the lowest in the Nation, our consumers will be using electricity efficiently to hold down their energy costs, and I hope more and more as a substitute for petroleum. New energy technologies will permit greater use of our indigenous resources. This is an energy advantage not to be thrown away lightly. This advantage is a key to our future economic growth. There is not time today to tell you in detail about the efforts that the Tennessee Valley Authority is launching to help spur economic growth in the valley, but we are working very closely with the chambers of commerce, with the State officials, and with our distributor organizations that are encouraging economic growth to help attract to the valley the industry which can economically be located there.

A prosperous valley economy means full employment and good-paying jobs, but this is going to take a lot of effort.

Looking at just the next decade this means adding 350,000 new jobs. This will mean acquiring about 100 new jobs each day. Since this is a net figure, about 750 new jobs a day will actually be required to offset relocations and other factors.

In short, we have our work cut out for us, and TVA can play a small but, I think, decisive role. Our special contribution is in maintaining and extending the valley's energy advantage in the many ways I have discussed. So I say to you this morning, Mr. Chairman, let the word go out throughout the Nation that the Tennessee Valley Authority has got power to sell. First, by conserving electricity we are wasting, we will have that energy to sell, and then beyond that from the new plants we are building. And in an energy-short Nation, we believe that in concert with the State, local economic development officials, and with leadership of the valley delegation here we can generate a market for all the power we can save and all the power we can produce. The choice today is not between moving ahead and just holding our own. In today's world the valley either moves ahead economically or it just as surely will fall behind. And TVA is committed to moving ahead. We believe the programs and decisions that we discussed today will make it possible for the people of the Tennessee Valley to achieve a better life for themselves and for their children. This is the heart of what I mean when I say that TVA is committed to carrying out its old mission in a new world.

I would be very pleased to try to answer your questions and we thank you for your attention.

FAILURE OF NEW INDUSTRY TO PURCHASE TVA POWER

Senator SASSER. We thank you, Mr. Chairman, for your statement. Now, let me just say this: What if the word goes out that TVA has got power to sell but nobody wants to buy it? You tell us that we are looking in the future at an electrical energy shortage but other experts tell me that other utilities are in the same posture that TVA is to some extent that they, too, have been overbuilding. Perhaps their load forecasting has not been as accurate as it could have been, or because of an economic recession, or increasing electrical rates. Therefore, there is some indication we are not going to get into a shortage situation nationally but we are going to get into a surplus situation. I would cite as evidence of that, partial evidence of it, the fact that the Potomac Electric Power Co. right in this area has canceled construction of a nuclear generating plant with a statement they did not need the capacity.

So how confident are you, Mr. Chairman, that indeed people will want to purchase TVA's power.

Mr. FREEMAN. Well, no one can be absolutely confident of anything in the future, but what I learn from the industrial prospects that we speak to on a weekly basis and from the executives of other utilities with whom I am in communication, is that the future posture of electric power supply is such that while there will be plenty of electric power today and perhaps a few years ahead, that in many sections of the country the private utilities have been unable to continue a construction program that will give them capacity in the 1990's. And indeed it is on the strength of our ability to say we have power that in recent weeks we have helped to secure the location of two large industries.

We are fairly confident that another large company in the aluminum industry will be making a decision to locate in the Tennessee Valley within the next 10 days. The discussions that I have had with everyone in the industrial recruitment business is that our energy advantage is growing.

Indeed, the analysis that has been presented to me indicates that a major reason why our economic growth deteriorated in the 1974 to 1979 period may have been that word went out that TVA did not have power to sell. The TVA Board, because of the very tight supply situation was forced to place a restriction for a year on new loads in excess of 50 megawatts. As a consequence, the search firms and the industry people around the country looking for new locations may have ruled out the Tennessee Valley during those years.

Now, one can't be absolutely certain that is the reason but that certainly makes as much sense and has as much causal relationship to what happened as any other reason that has been advanced. It certainly coincides with our experience in the last few months of being able to sell new prospects on the notion that this is a part of the country that has power. I do know that in California, in the Pacific Northwest, for example, they say openly that they don't have any power to sell for industry beyond the 1980's. There are other regions of the country that are similarly situated. Many of the cancellations of units by the utilities are not because they don't want to build them to meet future loads but because their financial situation has not permitted them to.

One of TVA's energy advantages, if I might say so, is the steadfastness of the TVA Board in continuing a progran which all the facts suggest and the GAO analysis suggests represents a prudent approach to try to put us in a flexible position to take advantage of all the economic growth that will be available.

NUCLEAR POWER PROGRAMS CREATED OVERCAPACITY

Senator SASSER. Mr. Chairman, when we really distill it all down and boil it down to the bottom line, isn't the situation this, that a decision was made in the 1960's and early 1970's to go forward with these nuclear power programs, that we are now getting in a position where we think we are going to have overcapacity? You see the economic situation in the Tennessee Valley area not having grown as rapidly as we had thought it would in the past 7 years, but we reached the point of no return on the nuclear program. We are not going to save much money by stopping it now in relative terms. We are not going to save a lot of money by deferring it now in relative terms. So we have to go forward with it and hope for the best, hope that the Tennessee Valley area is going to grow fast enough to use some of the capacity, and to hope that we can sell the capacity outside of the Tennessee Valley area?

Mr. FREEMAN. No, sir, that is not the situation we face. We have adjusted the construction program to the lower rate of growth—well below 7 percent that was used at the time the units were ordered. I personally am confident that what I said in my testimony is true; that we can find a market for all the power that we can save first, and then all the power we can produce from this 10-unit construction program. If I felt we were building toward overcapacity, I would vote to defer more units, as I voted to defer four units sometime ago.

I happen to believe that we have a major energy advantage by being in a position to go ahead with this program. In the airport last night a fellow from Kentucky came up to me and said, "You know, we are trying to build a synfuels plant in Kentucky, but we can't get any commitment for electric power out of any of the utilities because it takes 300 or 400 megawatts."

I said, "Don't talk to me about getting power, just bring the plant down here and we will serve it." I just think the energy advantage we have is enormous. The synfuel plant was planned without adequate thought of its electricity requirements. Each of these plants requires hundreds of megawatts of electricity. I think we are going to attract all sorts of high-paying jobs in the valley from this energy advantage if we just hang in there. I know it is painful. I am not the least bit oblivious to the cost, but when you look at the cost of electricity almost anywhere else in the country, you will find that the rates that we have are still reasonable. But the important thing is that we are going to have the power for economic growth, and I have no belief that we are painted in a corner, stuck with a construction program that results in our overbuilding. We took care of that situation when we deferred the four units.

But I will say to you that if the economy goes to hell in a handbasket in the next few years and just doesn't grow at all, we will continue to adjust. We are not going ahead with stars in our eyes.

RATE OF SAVINGS FROM CUTBACKS

Senator SASSER. But the question is if you adjust, can you adjust at this point and realize in relative terms any significant savings? Now, as I understand your testimony this morning, and as I understand the General Accounting Office's testimony, if we cut back on nuclear generating plants or defer nuclear generating plants there is not going to be, in relative terms, that significant a saving——

Mr. FREEMAN. That is correct.

Senator SASSER. Now you told us earlier, I think in your testimony, correct me if I am wrong, that if we cut back on the construction or deferred it, it was going to have a favorable impact of what, 2 percent on the rates in 1990?

Mr. FREEMAN. Yes, sir. You are correct, the shape of our rate increase curve is a function of the fact that nuclear power and coal power is just an awful lot more expensive than anyone thought it was going to be years ago, and certainly much more expensive than our hydro and other forms of energy. And no one, I think, is suggesting that we defer or cut back on the Sequoyah plants, which are nearly finished, nor the Watts Bar or Bellefonte units, which are nearly finished.

So we have a major construction program ahead of us that is going to cost us money and help drive the rates up somewhat. That is beyond controversy. There is a question over some of the later plants whether they should be deferred, but you are right. The impact on rates will be relatively small, but it is not a question of being stuck with a construction program. It is facing up to the fact that the era of low-cost energy is over and if we are going to grow economically and have the power supply, it is going to have to be at higher rates than what we had in the past.

But we are still determined that on a relative basis, that our rates will be competitive. Certainly compared to the energy alternatives such as petroleum they are going to be competitive.

POSSIBLE INCREASE IN NATURAL GAS RATES

I will say to you, Mr. Chairman, that 5 years from now you will have a bunch of angry natural gas consumers appearing before you at a hearing because the price of natural gas is going to grow in a way that will make these electric rate increases seem modest over the next decade, and the relative price advantage of electricity will be enhanced. And I will predict that within a decade people who are using natural gas or oil to heat their homes will be switching to heat pumps and just using that furnace on the very coldest days. Thus, there will be a major additional demand for electric power just to supply the basic heat for homes in the 1990s. We have to get off of petroleum. That is the heart of the energy crisis. At least nuclear powerplants that we are building offer an economic opportunity to do so.

Senator SASSER. Let me say to you that I have already had the angry natural gas users appear before me. We had some hearings in Memphis about a year ago when they first started getting the price increases as a result of the natural gas deregulation bill which was passed which I opposed, but we are hearing from them already.

ECONOMIC GROWTH PREDICTIONS FOR TENNESSEE VALLEY

The troubling thing to me is that we are talking about increased economic growth in the Tennessee Valley area, yet all of the evidence seems to indicate the contrary. Now I indicated earlier that the University of Tennessee's econometric study indicated that the growth rate for my State of Tennessee, and that is the State I am most concerned with, is estimated to be lower than the growth for the Nation as a whole. Now you keep saying, Mr. Chairman, and you may be right, but you keep saying it is only prudent and responsible to provide capacity that would be required by a healthy regional economy that grows at a better than average rate. Yet we have seen the Tennessee Valley area over a period of 7 years grow at a rate below the national average, and we have a study by the University of Tennessee which gives us unhappily the gloomy news that Tennessee is expected to grow at a rate lower than the national average. I would assume that the availability or a lack of energy is factored into these econometric models.

Where do we come up with the idea this increased capacity is going to enhance our ability to grow? Have we got any concrete evidence other than our hopes and rhetoric?

OUTSIDE INVESTMENT IN TENNESSEE VALLEY

Mr. FREEMAN. Well, the concrete evidence, Mr. Chairman, are the more recent decisions by major private companies to invest hundreds of millions of dollars in the valley's economy. Other concrete evidence is the fact that this slower growth took place in a period when the Tennessee Valley Authority was saying we did not have power to sell. And, Mr. Chairman, if I may quote from page 30 of the report that you re-

ferred to, the University of Tennessee report, Metropolitan Area Economic Report: "An important determinant of Tennessee's economic growth will be its ability to remain competitive with alternative business locations." The availability of energy looms as perhaps the most significant location consideration for being firm. So for TVA's economy to expand more rapidly than the Nation's, availability of energy will be a key factor. The Tennessee Valley Authority appears to be adopting the philosophy that power availability is essential, even if the average cost of electricity rises. This may be appropriate from the State's perspective as business firms may consider the consistency of supply more important than cost. Nonetheless, it should be noted that the TVA region has been identified as one of four power suppliers that could experience difficulties in meeting unusual demands during the early 1980's. This may result because the nuclear supply may be slow in coming on line. If business firms perceive that energy will be unusually tight in the TVA region, slower growth may result in Tennessee.

I submit the people who are looking at the economy of Tennessee understand the value of the fact that I mentioned, and that one of the reasons they were projecting slower economic growth is because there has been this uncertainty about the availability of power supply. As we eliminate the uncertainty, we are going to enhance our opportunities for getting new industry. But there is no proof any better than accomplishment.

I would submit that if you look at the record of the past few months when this Board and this agency stressed the availability of power and worked closely with the State and local agencies in landing industrial prospects, we are moving from success to success and we intend to continue.

RELIABILITY OF POWER SUPPLY

Senator SASSER. Well, I hope you are right, Mr. Chairman. I was in on some of the discussions with the facility coming to Tennessee and there was no discussion of energy, although perhaps that is implicit in a proposal. They seemed to be concerned, the ones I talked to, about labor and transportation.

Mr. FREEMAN. I will say to you, sir, at the invitation of the State of Tennessee that was conducting the negotiations, I sat in on a detailed discussion with Mr. Runyan and the issue of energy was the subject of a long meeting. And he told me that reliability was the most important factor to him, that it would cost him $1 million a day if they were without power supply. The rates at the time were lower in Georgia than the TVA rate but he said that the long-term outlook that I presented to him, and more importantly the fact he knew we would have the power was a crucial factor to him. We were on the telephone a lot of times discussing it. He even is paying for duplicate power lines coming into his plant to insure the reliability. The reliability today and in the future of a TVA power supply system was a factor in their decision. I would not want to say that it swung it, but it certainly was a factor important enough for the manager of the plant to sit down and discuss with me at some length and go back and forth on the phone with me several times.

OFFER TO SUPPLY POWER BY GEORGIA POWER CO.

Senator SASSER. At the time of those negotiations, was the Georgia Power Co. offering to supply power cheaper than TVA could supply it?

Mr. FREEMAN. They were between rate increases and although as I pointed out to him he does not know what the rate is going to be when his plant goes on the line 3 years from now, today's rate was slightly lower than TVA's rate. But it was the reliability of power that was more important and he knew that the TVA assurance was stronger. The man is from Georgia and I reminded him that the Georgia Power Co. almost went broke 2 or 3 years ago and had to cancel some units because they were not able to raise the capital. That point I think had an impact on him.

RATES BETWEEN TVA AND GEORGIA POWER

Senator SASSER. Would you be kind enough to supply for the record the rates, or the difference between the rates of the Georgia Power Co. and TVA at the time of these negotiations? I think that would be an interesting comparison and something we had been interested in looking into.

Mr. FREEMAN. I certainly shall.

[The letter follows:]

LETTER FROM S. DAVID FREEMAN, CHAIRMAN, TVA

DECEMBER 19, 1980.

Hon JAMES SASSER
U.S. Senate, Washington, D.C.

DEAR SENATOR SASSER: During my testimony on December 11 before the Subcommittee on Energy and Water Development, Committee on Appropriations, you asked how much higher the planned Nissan facility's electric power rates would presently be in the Tennessee Valley Authority's service area than in the Georgia Power Co.'s service area. We are assuming that the facility's ultimate peak demand will be over 5,000 kilowatts at a load factor of approximately 60 percent. Under these assumptions, the present energy rate charged by Georgia Power Co. is 3.149 cents per kilowatt-hour compared to TVA's energy rate of 3.477 cents.

Sincerely,

S. DAVID FREEMAN,
Chairman,

GROWTH RATE OF TVA DURING 1970'S

Senator SASSER. In the testimony of the General Accounting Office they referred to a study being done by TVA to determine why the TVA region's economic rate of growth had lagged behind the Nation's growth rate during the period of 1973 to 1979. How near completion is TVA's study in this matter? Is it being done by in-house personnel or outsiders?

Mr. FREEMAN. TVA's chief economist, Allan Pulsipher, has been reviewing our assumptions and our analysis there, and indeed it was his office that made a preliminarily suggestion to me that one of the reasons for that slow growth may very well have been TVA's own policy of saying we don't have large blocks of power to sell. We do not accept the assumption that the valley's economy can't grow faster than the national average, and we believe to a certain extent, Mr. Chairman, that assumption too can be a self-fulfilling prophesy. As I said to you, we have determined that the Tennessee Valley Authority's entire program,

including its power program and its nonpower programs, are to be focused on supporting, not leading but supporting, the local chambers and economic development people in attaining this goal of full employment for the valley.

So rather than a paper study, I think our analysis has led us into program changes, and we would be glad to provide you a paper on that subject if you would like. We are working more closely with our distributors in funding the economic development entities that they have been funding, and will be working with the State and local people. As I said, I think that the efforts we have launched in the last few months are already beginning to bear fruit.

Senator SASSER. Do I understand from that that the study is completed or will be shortly completed?

Mr. FREEMAN. The study continues as part of TVA's power planning process. We are going to continually be looking at the valley's economy. If you would like a paper that gives you an up-to-date picture of what our forecast is, we have a recent forecast of the economy that our economists have supplied us. I do not know that we are conducting a formal study that we say will be the end—all of what the valley's economy is going to be. Every economic forecast made in this country has been wrong, as we both know. I do not necessarily want to become a player in that parade of errors. But I do think we are trying to find out what it is that is driving the valley's economy and what it is that is holding it back so we can work on it. We have identified, interestingly enough, power supply more than rates as having been a bottleneck in recent years and we have moved actively to overcome that. We are going to be working very hard to get that message out to people all over the country.

OUTSIDE CONSULTANTS IN TVA STUDY

Senator SASSER. To return to my original question, GAO had indicated that a study was being done by TVA. I think that is being done by your in-house people? Do you have outside consultants?

Mr. FREEMAN. No, sir, it is not outside consultants. I believe GAO was referring to the fact that Mr. Pulsipher, who has been with us a matter of months, our chief economist, was taking a fresh look at our analysis of the growth of the economy. He has supplied an internal paper to the Board which we would be glad to make available to you.

Senator SASSER. I would like to see that and we appreciate you making it available for the committee files.

Mr. FREEMAN. It is labeled "draft" but we will be very glad to give you the draft.

Mr. RICHARD Freeman. It also will be updated in February.

CONCLUSIONS REACHED IN RATE OF GROWTH STUDY

Senator SASSER. Have you reached any preliminary conclusions yet in your economic rate of growth study, and if so, what implications does this have for demand forecasting?

Mr. FREEMAN. The conclusion reached is that it may be premature to assume that our growth will be no greater than the national average growth. The analysis suggests that there are a number of factors that

indicate that it is not pie-in-the-sky or starry-eyed to suggest that the valley's economy can and very well may grow faster than the national economy over the next decade. Of course, to the extent that we work at it, that will help make it so.

I would not want to try to summarize the paper any more than that but that is the essence of it; namely, that we may have moved too quickly to suggest that we could not grow faster than the rest of the Nation. There are a lot of favorable factors. This was maybe a temporary period. We now have power and there are a number of other factors here that give us a basis for optimism.

ECONOMIC FORECAST

Senator SASSER. I take it that your economic forecast supports your building program?

Mr. RICHARD FREEMAN. The economic forecast is higher than the forecast used in competing assumptions.

Senator SASSER. I did not understand you.

Mr. RICHARD FREEMAN. Economic forecasts that we now have are higher than the forecast used in the assumption for the intermediate case.

Mr. FREEMAN. Basically the economic forecast that we now have in draft form is higher than the one upon which our latest load forecasts were made. Mr. Pulsipher is continuing to scrutinize that situation. We will supply you the October draft for your use and for the record.

[The information follows:]

DRAFT

ECONOMIC OUTLOOK

TENNESSEE VALLEY AUTHORITY

Office of Planning and Budget

I. Introduction

A. Purpose

The Economic Outlook is a part of TVA's corporate planning system. Its purpose is to provide consistent economic information and analysis to managers and planners in the Tennessee Valley Authority. This is the first Outlook that has been prepared and suggestions and comments are welcome. Future Outlooks will be prepared and distributed according to the following schedules:

February Economic Outlook--Published at the end of February, it will incorporate the President's budget assumptions and Wharton's December long-term forecast. The February Outlook is intended for use during preparation of ZBB budget packages.

May Economic Outlook--Published in early June, it will be the principal annual economic forecast, prepared for the July load forecast and August rate review. A special run of the Wharton National Models probably will be necessary to prepare this forecast.

August Economic Outlook--Published by mid-August, it will be an update prepared to assist offices in preparation of their situation assessments. It will incorporate Wharton's July long-term forecast.

November Economic Outlook--Published by November 1, it will be an update tailored to the agenda of the annual policy conference held in mid-November.

B. Summary

The principal conclusions of this Outlook are:

- Both the national and regional recessions appear to have "bottomed out" after the precipitous economic decline experienced during the second quarter of the year.

- A Composite Coincident Index of Economic Activity has been constructed for the TVA region. It indicates that the current recession bottomed out in the region in May--well before it did in the rest of the Nation, and that this recession will affect the region less than the Nation as a whole, in contrast to the recession of 1974-1975, which was more severe in the region.

- For the remainder of 1980 and most of 1981 the most likely path for the economy is sluggish growth. The growth rates projected for both gross regional and gross national product are less than 1 percent for 1981.

- The core inflation rate has not been diminished significantly by the recession. It is expected to increase to over 9 percent in 1981. The actual inflation rate will be higher, probably in the 11- to 12-percent range for most of the year.

- A sustained, vigorous economic expansion is not consistent with a core inflation rate this high. Such an expansion would drive interest rates close to the extremely high levels experienced earlier this year. If the Board of Governors of the Federal Reserve System were to permit a rise in interest rates to choke off an expansion, they would risk plunging the economy into a renewal of the recession. Thus their goal is likely to be slow or sluggish growth during the coming year.

- Over the longer term more robust economic growth and more tolerable rates of inflation will require a significant improvement in productivity. The rate at which productivity has grown has diminished significantly since 1973. Some of the factors responsible for this change will become less important as the region moves into the 1980's, but extreme uncertainty remains about longer term productivity trends.

- In the early years of the 1980's the rate of economic growth will be moderate by historical standards. How moderate will depend on how successful economic policymakers are in resolving the dilemma of very high rates of inflation that have been built into economic decisionmaking and the decline in productivity. During the latter years of the period, more rapid growth is possible but whether it will, in fact, take place is very uncertain.

- Although any economic forecast ten years in the future is a form of making educated guesses, according to the principal forecasts used to prepare this Outlook, from 1982 to 1989 the Nation is expected to grow at a little less than 3 percent annually and the

region is expected to grow at about 3.75 percent annually. These forecasts reflect regional and national economic performance since the mid-1960's. If the post-embargo period of 1973 to 1979 were to be used as the exclusive basis for forecasting the future, the national growth rate would be lower and the region would mirror the rest of the Nation more closely.

II. Current Outlook

A. The Year to Date:

For economic forecasters, 1979 was a year of waiting for a recession that would not come. They had begun to warn of recession as early as the summer of 1978, and by 1979 they agreed that recession was imminent. Throughout the year, however, output remained stubbornly stable. Late in the year a strong surge of consumer spending occurred which carried over into the first part of 1980 and which, in retrospect, appears to have been caused by the first wave of true expectations of runaway inflation of the post-World War II American economy. "Buy now because it will cost more tomorrow" became the slogan that motivated many--and they were willing to borrow if necessary to do it.

The urge to buy was reinforced by the impact on the inflation indices of the second major round of escalation in world energy prices. Since the quadrupling in prices that followed the 1973 embargo, the price of oil on world markets had increased more slowly than world inflation and thus in real terms had actually declined. However, from the first quarter of 1979 to the second quarter of 1980, the cost of imported crude oil more than doubled as a result of the turmoil that followed the revolution in Iran.

Driven by surging energy prices measured inflation reached record levels in the first quarter of 1980 when the Consumer Price Index rose at an annual rate of 16.9 percent. In turn this encouraged those who feared even larger price increases tomorrow to buy today, and created an illusion of being on the brink of a true runaway inflation. The monetary authorities, perhaps somewhat puzzled themselves by the failure of the recession of 1979 to materialize, were not immune to the illusion. In the face of an inflation-inspired, seemingly insatiable appetite for credit, even a normal degree of restraint would have driven interest rates above customary levels. By the end of the first quarter the well-publicized prime interest rate had hit a record high 20 percent. Home mortgage rates exceeded 17 percent in some parts of the country.

In an emergency atmosphere in March consumer credit controls were instituted and patriotic appeals were made to stop buying. Unfortunately, acquiescence to the appeals apparently coincided with the delayed effect of a major tightening of credit which the Federal Reserve Board had initiated earlier in the year, and the recession came with apparent vengence. Real GNP declined at an annual rate of 9 percent in the second quarter of the year. Interest rates fell just as rapidly with the key Federal funds rate, for example, dropping from a record high of 20 percent in late March to less than 9 percent by early May.

In retrospect the first two quarters were dominated by "overreactions" in opposing directions that fell outside the expected range of economic fluctuations. Repercussions and adjustments to these "overreactions" are still major influences on economic performance and easily can be confused with changes in the more fundamental determinants of economic activity. In the third quarter the decline has stopped, but there is no consensus about whether this is merely a pause in a decline that will continue or a position from which a sustainable recovery can start. The view adopted in this Outlook is that the decline phase of the recession has ended but that the recovery phase will be sluggish with real growth probably averaging less than 1 percent for the next year.

B. National Economic Forecast: 1980-1981

Most forecasts begin with caveats and lamentations about the inherent uncertainty of the exercise. This year such protestations are appropriate. Starting with rollercoaster first and second quarters still not well understood, the Nation is now in the midst of a presidential campaign which features pledges on all sides to cut taxes, increase real defense spending, and revitalize the American economy. More importantly, the eventuality ritualistically used as a cause of extreme uncertainty--war in the Persian Gulf--is now a reality. A glut in world oil markets has obscured its immediate impact, but the probability of a rupture in the world's energy pipeline has increased by an order of magnitude.

The speed of the decline in the second quarter caused many analysts to be concerned that the economy might be retracing the path of the 1974-1975 recession--the most severe economic contraction since the end of the Great Depression in the 1930's. Both began with some disconcerting similarities: a sudden escalation of world energy prices and a general rate of inflation that was considered dangerously excessive. But there are important differences between the current situation and 1974-1975 as well. As explained later in the Outlook,

the available economic evidence indicates this recession will be less severe than 1974-1975--nationally and even more so in the region.

The 9-percent decline of the annualized growth rate of real GNP experienced in the second quarter has slowed to around 1.5 percent in the third quarter and is expected to approach zero in the fourth quarter, but there are numerous opinions about where the economy will go from here. Proponents of the "V-shaped" recession believe the speed of the descent will be mirrored by the speed of the recovery, and point for support to a three-month rise in the index of leading economic indicators. The more pessimistic analysts ascribe to the "U" or "W" theory, arguing either that the trough in which we are now resting will last through the rest of this year and next or that, if a recovery begins, it will soon be aborted by restrictive monetary policy and succeeded by a second and possibly more severe period of economic contraction.

The scenario adopted in this Outlook is not easily described in terms of the alphabet--as close as one could come is an "L" that leans slightly backward. This corresponds to the view that the economy is now at the bottom of recession and a recovery is beginning. But it is likely that the "recovery" will be abnormally sluggish. Thus the forecast growth rate presented later in the Outlook, in Table 1, shows a very modest growth rate of only 0.7 percent for 1981. More vigorous expansion is possible and some of the major national forecasters believe it will occur. The latest "control" forecast by Wharton Econometrics, for example, shows a considerably higher rate of 2.2 percent for 1981.[1]

The view that the recovery will be fairly robust assumes that sufficient stimulus can be provided by a tax cut. Both major candidates have promised to cut taxes in 1981, with the emphasis on easing business taxation in order to encourage investment and production. But it is now certain that this will not be done before the election. If the recession abates and inflation rises, congressional enthusiasm for tax cutting could well moderate--especially under the budgetary pressure of the promised increase in real defense spending and continued growth of nondescretionary "entitlement" programs such as social security and medicare.

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1. The forecast summarized in Table 1 and in more detail in the tables in the Appendix are based on the Wharton Econometric Model. The national projections are the results of a forecast performed by Wharton Econometrics for TVA in September (referred to as the TVA Alternative) with assumptions that differ slightly from those used to make the "control" forecast Wharton issued in June for its regular customers. The regional projections were made by TVA's Regional Economic Analysis group using Wharton's TVA Alternative national forecast.

The prediction that the recovery will be sluggish is based on the judgment that the constraints of monetary policy make a very rapid recovery unlikely--regardless of fiscal policy decisions made in 1981. The culprit in this scenario is the "core inflation rate," which measures the amount of inflation that is "built-in" to economic decisionmaking by past experience and future expectations. The core inflation rate provides a floor below which wage settlements and interest rates are not likely to fall. This rate is now estimated to be above 8 percent and is expected to increase to over 9 percent next year.

To determine, conceptually, actual or market interest rates, a "real interest rate" (the return above the expected inflation) must be added to the core inflation rate. Real interest rates have historically been above 2 percent but less than 6 percent, specifically where depends, roughly, on the demand for and supply of loanable funds. (If there were no expectation of inflation the actual and the real rate of interest would be equal.)

Given the current high core inflation rate, this means that if the credit demand generated in a normal, strong recovery were to push the real rate toward the upper bound of its historical range, market interest rates would soon return to the levels that they reach in credit crunches, such as the one experienced earlier in the year. Most analysts do not believe a strong recovery, particularly in the depressed housing and automobile industries, would be consistent with interest rates at these levels.

People simply will not buy enough cars and houses at 15- to 20-percent interest rates to keep an expansion going. Thus in the immediate future, the optimistic scenario seems to be sluggish growth. Better performance in the longer term is possible but will require sufficient improvement in productivity to allow wage increases consistent with a lower rate of core inflation. This is discussed in a later section of the Outlook.

C. Regional Economic Forecast: 1980-1981

Economic activity in the TVA region was less sensitive to national business cycles in the 1950's and 1960's. Recessions in the region were milder and recoveries were stronger. Hence it was a surprise when the recession of 1974-1975 hit the region considerably harder than the rest of the Nation. This change in the relationship of the region and Nation is illustrated in Figures 1 and 2.

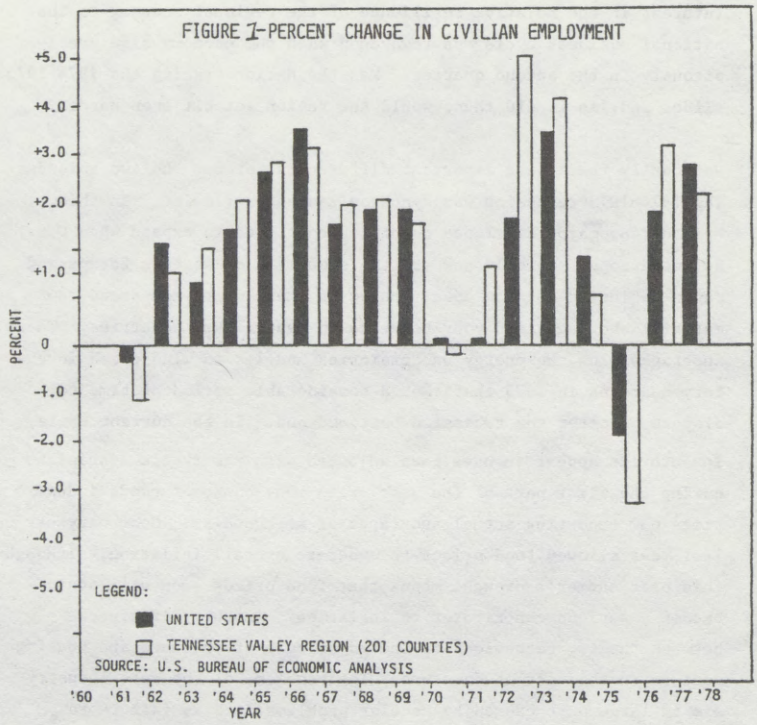
FIGURE 1-PERCENT CHANGE IN CIVILIAN EMPLOYMENT
+5.0
+4.0
+3.0
+2.0
+1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
PERCENT
LEGEND:
UNITED STATES
TENNESSEE VALLEY REGION (201 COUNTIES)
SOURCE: U.S. BUREAU OF ECONOMIC ANALYSIS
'60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78
YEAR

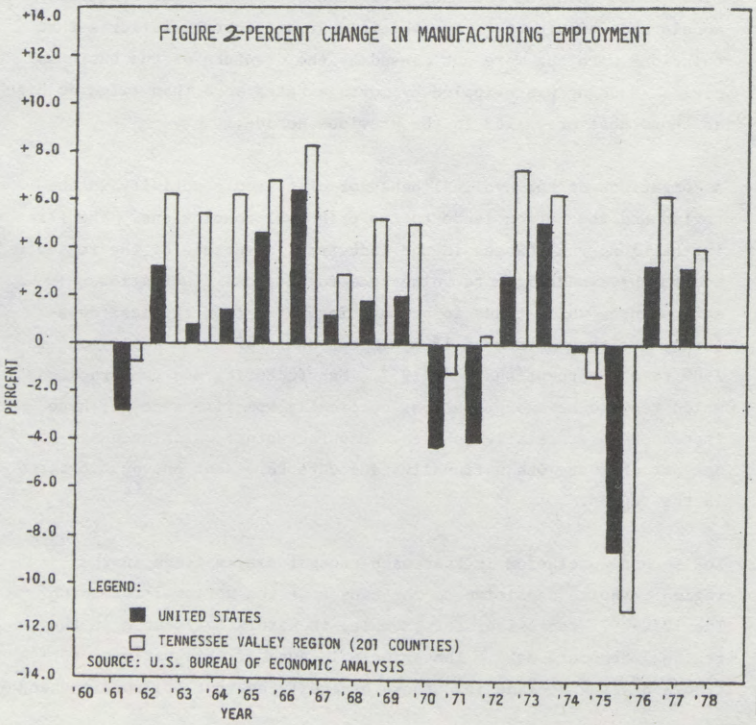
FIGURE 2-PERCENT CHANGE IN MANUFACTURING EMPLOYMENT
+14.0
+12.0
+10.0
+ 8.0
+ 6.0
+ 4.0
+ 2.0
0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
PERCENT
LEGEND:
UNITED STATES
TENNESSEE VALLEY REGION (201 COUNTIES)
SOURCE: U.S. BUREAU OF ECONOMIC ANALYSIS
'60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78
YEAR

71-531 O - 81 - 9

Interest in the relative resilience of the regional economy to the national business cycle was rewakened when the economy slid precipitously in the second quarter. Was the Nation tracing the 1974-1975 slide, and, as it did then, would the region get hit even harder?

Nationally there were important differences between the two episodes. The 1974-1975 recession was synchronized and worldwide. In this episode the major developed countries continued to expand when U.S. output dropped and only now are the economies of western Europe and Japan beginning to slow down. Moreover there were widespread raw material shortages and poor harvests in several key countries. These shortages plus the energy uncertainties had led to widespread inventory hoarding in 1973 that took a considerable period of time to dispose of after the recession bottomed out. In the current cycle, inventories appear to have been adjusted with remarkable discipline during the first part of the year, with many consumer goods industries now reporting actual shortages of merchandise. Good harvests last year allowed food prices to moderate overall inflation, although this past summer's drought means that food prices soon will again become a serious contributor to inflation. Another difference between the two recessions is the major role of the auto and housing sectors in the current downturn. The problems of the auto industry are in large part caused by secular problems such as failure to accommodate changing consumer preferences for more fuel-efficient models and failure to meet competition from imports--failures that coincided with but were not caused by the downturn of the business cycle. Housing was crippled by mortage rates more than twice as high as those that prevailed in the previous decade.

A comparison of the cyclical behavior of economic activity in the region and the Nation leads to two principal conclusions. The first is that long-run changes in the industrial structure of the region's economy have made it more vulnerable to national fluctuations. Agriculture, which tends to be more insulated from cyclical downturns, has shrunk from an 18.6-percent share of total employment in 1960 to a 7-percent share in 1977. Manufacturing and construction, which tend to be among the most cyclically volatile sectors, have increased their relative shares. Manufacturing, which accounts for one out of four jobs nationally, accounts for about one out of three in the region.

The second conclusion is that each recessionary episode in the region is quite sensitive to the causes of the national recession. The 1970-1971 recession, for example, is hardly noticeable in the regional economic data. The principal cause of this national contraction was a decline in defense expenditures that followed the end

of the Nation's involvement in Vietnam, and defense expenditures were relatively unimportant in the region. Conversely, consumer expenditures remained strong during this recession and consumer-oriented industries such as textiles, apparel, and furniture are important regionly. In contrast, the 1974-1975 recession was caused by the rapid runup of energy prices which hit the energy intensive regional economy harder than the rest of the Nation. Moreover, unlike 1970-1971, consumer expenditures in 1974 declined in real terms and this hurt the consumer-oriented regional economy.

In order to better understand the cyclical behavior of economic activity in the region and Nation, a composite index has been compiled from data available for the region on a monthly basis that is comparable to the Index of Coincident Indicators compiled for the Nation. The regional index is based on information on electricity sales, nonagricultural and manufacturing employment, residential units authorized by building permits and public contracts, sales tax collected, and an index of agricultural activity encompassing all crops and livestock.[2] Figure 3 portrays the TVA index along with the comparable index for the Nation. Each series reflects changes in economic activity relative to the base year of 1972. As such, the series does not reflect the position of the TVA regional economy relative to the national economy in 1972 but does show behavior subsequent to that time. (The greater regional severity of the 1974-1975 recession is clearly observable in the figure).

The index is also suggestive of the likely shape of the current recession. It supports the "backward leaning L" view, at least to the extent that the national index shows a clear leveling off in the summer months. Not only is this pattern reflected in the regional index, but somewhat surprisingly, the regional index started to increase well ahead of the national index--in May. The regional index is more volatile than the national index and three or four months do not establish a trend. Nevertheless, the behavior of the index suggests this recession may be considerably milder for the region than the Nation at large.

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2. Specifications for the index and the data used to construct it are available upon request from the Chief Economist in the Office of Planning and Budget.

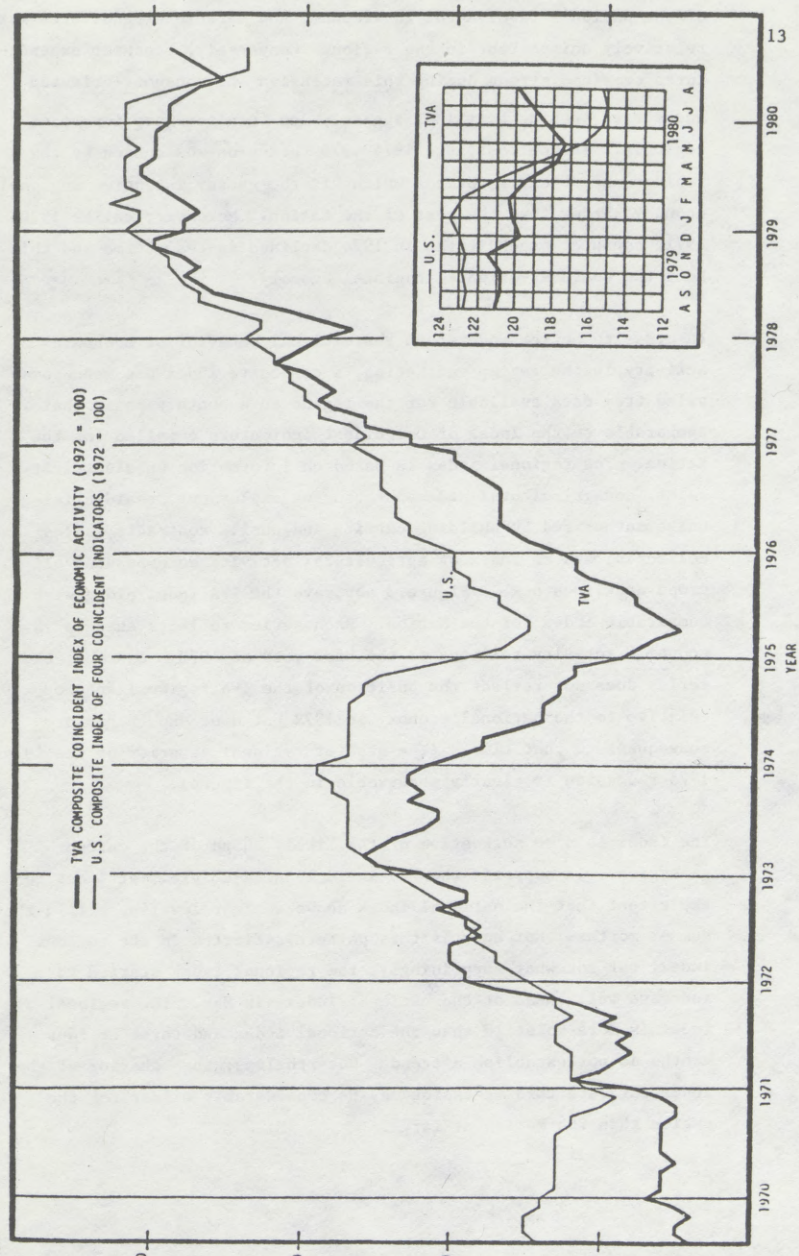
TVA COMPOSITE COINCIDENT INDEX OF ECONOMIC ACTIVITY (1972 = 100)
U.S. COMPOSITE INDEX OF FOUR COINCIDENT INDICATORS (1972 = 100)
INDEX
YEAR
U.S.
TVA
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
10
20
30
10
U.S.
TVA
124
122
120
118
116
114
112
1979
1980
A S O N D J F M A M J J A

FIGURE 3

The upward movement in the regional index started with an increase in the housing and agricultural activity measures in May. These measures have continued to increase in June and July and was followed in August by an increase in commercial and small industrial electricity sales. The indices for sales tax revenue and larger electricity sales remained essentially constant in August, and electricity sales to the very large customers TVA serves directly increased slightly in September. The diffusion index for the composite index measures the weighted proportion of the components of the index which have increased in value over the previous month. It was increased over the summer from 11.1 in May to 38.9 in June, and to 55.6 in July. The preliminary value for August is also 55.6. The economic explanation for the region suffering less than the Nation during the current downturn is probably to be found in the relatively stronger performance of the consumer-oriented sectors of the economy compared to the heavy industrial sectors during the summer months.

If the downturn in the region has, in fact, bottomed out, it does not follow that a return to a healthy, growing, fully employed economy is imminent. The scenario for sluggish growth in the near term applies to the region as well as the Nation.

III. Future Prospects

A. The Economic Fundamentals of the Post-World War II Economy

The short-term dilemma facing economic policymakers is that apparently the "best" course to follow is one of sluggish growth with the level of both inflation and unemployment excessive by historical standards. Using traditional macroeconomic policies such as tax cuts, expenditure increases, or changes in the money supply to provide more economic stimulus is likely to lead to another credit crunch and consequent economic contraction. In the past policymakers have not been limited to such unpleasant choices. If the Nation wants more robust growth in the future, it is important to understand why this was so.

From the end of the World War II until the escalation of the Vietnam conflict in the mid-1960's, the U.S. economy performed well. From 1947 to 1965 the consumer price index increased by less than 2 percent per year, and total compensation in the private sector (wages plus fringe benefits) increased at more than 5 percent; thus, the majority enjoyed a steadily improving standard of living. This occurred because the simple, fundamental relationship among compensation, prices, productivity, and costs was kept in rough balance. Because the 5-percent increase in compensation for private sector workers was accompanied by a better than 3-percent improvement in productivity,

unit labor costs rose only at about 2 percent. With labor costs increasing at this rate it was necessary for prices to rise by less than 2 percent for profit margins and returns to other factors of production to remain at stable, sustainable levels.

There are several reasons why productivity did so well. First, net investment averaged a healthy 10 percent of GNP each year, and because the civilian labor force grew at a relatively slow rate of only slightly more than 1 percent per year, the amount of capital each worker had to work with rose at a rate of about 3 percent annually. With newer, better tools and equipment, worker productivity increased. The second reason was the availability of cheap energy. Domestic crude oil supplies were so plentiful that an elaborate system of production limitations was instituted and import quotas were imposed to limit penetration by the even cheaper imported oil. The price of coal purchased by utilities to generate electricity actually declined by 9 percent between 1950 and 1965. The third important factor was the strength of the American economy in international trade--or more accurately--the weakness of the western European and Japanese economies in the wake of World War II. The dollar was strong because American exports--particularly the output of heavy industry--were needed to rebuild these economies.

America's improving productivity, cheap energy, and weak economies in the rest of the world led to an unusual period of economic improvement. Between 1947 and 1965 real GNP grew at 3.9 percent annually; personal income, after taxes and correcting for inflation, grew at 3.7 percent per year; and by 1965 median family income in real terms was more than 60 percent higher than it was in 1947.

The period from 1965 to 1973 was a period of transition for the American economy. Compensation increased but productivity improvement slowed, and thus costs and inflation rose. Energy prices also increased as the price of imported crude oil rose from $2.14 per barrel in 1965 to $3.37 per barrel in 1973, although the important change in the energy sector was a growing dependence on imported petroleum. However, real output and living standards continued to improve but at much more modest rates.

In the fall of 1973 the OAPEC oil embargo ushered in a different economic era. It resulted in a quadrupling of oil prices that severely shocked a world grown dependent on imported oil. This shock was a principal cause of the 1974-1975 recession--the most severe of the post-war period.

As in all recessions, output fell more rapidly than employment in 1974-1975, and thus productivity declined sharply. Similarly, in the recovery phase a reversal of the output/employment relationship led to increases in productivity. But these cyclical movements are less important than longer-term trends. It is the long-term trend in productivity that is the cause of concern. If one calculates this trend by comparing the peak of the business cycle reached in 1973 to the position the economy reached before beginning its current slide, the annual rate of improvement in productivity is less than one-half of 1 percent (compared to the 3-percent annual rate of improvement recorded in the 1947 to 1965 interval). If this trend continues, the immediate economic future is bleak. From recently negotiated wage bargains and other labor market information, one can estimate that compensation per worker will rise at close to 10 percent annually for at least the next year or so. With an improvement in productivity of one-half of 1 percent, it follows that unit labor costs will increase annually at about 9.5 percent. This implies a continuation of a high rate of inflation.

To control inflation and encourage economic growth, productivity must improve. How likely is a significant improvement in productivity? One way to answer this question is to analyze the reasons advanced to explain the decline in productivity growth.

As Table 1 shows the size of the labor force from 1970 to 1980 increased by over 20 percent. As the proportion of new, young, and inexperienced workers increases, average productivity would be expected to decline. However, as illustrated in the table, this phenomenon ended around 1979. As the products of the baby boom work their way through the labor market, and as the baby-boom bulge enters the prime work force bracket--30 to 45--the productivity effect should become positive rather than negative. Moreover, in some sections of the country, such as the Tennessee Valley, the younger workers are better educated than the older workers they replace; thus, as the quality of the labor force increases, productivity should improve.

TABLE 1
U.S. LABOR FORCE, 1967 TO 1989
GROWTH RATES FOR

	1967	1970	1973	1976	1979	1982	1985	1989
Total labor force (millions).....	77.3	82.7	88.7	94.8	102.9	108.2	112.0	117.6
New entrants--age 20-19 (millions).	27.3	30.9	33.9	37.4	39.2	40.8	41.1	39.3
(Percent change)[1].....	4.1	4.2	3.1	3.3	1.6	1.3	0.2	-1.5
Prime working ages--30-45 (millions).....	35.1	34.7	35.8	37.2	41.7	45.9	50.7	54.9
(Percent change)[1].....	-0.7	-0.4	1.0	1.3	3.9	3.3	3.4	2.7

1. Average annual percent changes for the three years ending in the year shown.

Another explanation of declining productivity is increasing governmental regulation, especially concerning environmental protection and occupational health and safety. Such regulations have required investment of capital that otherwise could be used to increase productive capacity. This effect is, in part, illusory, since cleaner air and a healthier work place improve individual well-being even though they do not show up in the customary measures of economic output. Moreover, most expect that the relative magnitude of such regulation-induced investments will decline in the future.

The explosion in energy costs has also had an effect. Buildings and capital equipment designed on the assumption of an assured supply of cheap energy have had to be modified and, in rare cases, abandoned. In the Tennessee Valley and other regions of the country with relatively energy-intensive industries and products, the need to adjust the existing capital stock to the reality of higher energy costs might have been particularly difficult. After these adjustments are made, however, the depressing effects of higher energy costs on output should diminish.

The factor that most economic analysts have focused on is the slowdown in the capital labor ratio which measures how much capital (tools, machines, and equipment) each worker has to work with. Investment simply did not keep up with the growth in the labor force. In net terms, the ratio actually declined slightly between 1976 and 1979. This is a very short period of time upon which to base any prediction. Moreover, the conviction is widely shared that policies must be implemented to reverse it by providing incentives for a faster rate of investment. Nonetheless, if investment were merely to keep up with the growing labor force, the prospects are not good for

breaking the cycle in which high compensation and low productivity lead to higher costs, slower growth, and continued inflation, and inflation reinforces demands for higher compensation, to catch up or keep up ... and the low-productivity/high-inflation cycle goes on.

B. National and Regional Economic Forecast: 1980 to 1990

Tables 2 and 3 present summary data from the principal national and regional economic forecasts that were used as the basis for this Outlook.[3] Detailed tables with both historical data and forecast data are included in the Appendix. By historical standards the forecast does not present a particularly optimistic picture. As explained in section II-C of the Outlook, the high-inflation/low-productivity dilemma will require understanding, patience, and luck to solve. This is reflected in the national forecast. Real GNP grows at a modest rate over the forecast period. In 1981 both the Nation and region are expected to grow only slightly at a rate of 0.7 percent. From 1982 to 1989 the forecasts show the Nation growing at a rate of a little less than 3 percent and the region at a rate of about 3.75 percent.

The magnitude of these estimates is consistent with historical experience, but no great precision should be imputed to the yearly numbers.[4] In "normal" times economic forecasts a year or two into the future are uncertain and subject to a wide margin of error. In uncertain times in which major changes in economic fundamentals have taken place, such as the 1973 to 1979 period as well as the period in which we are now living, a forecast 10 years into the future tends to take on more the character of, at best, an educated guess. The

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3. The national projections are derived from the Wharton Econometric Forecasting Associates Annual Model of the American Economy. This model was used to make a forecast in late September with assumptions specified by TVA in order to produce a 10-year forecast consistent with the experience of the first two quarters of this year. The regional projections were made by TVA's Regional Economic Analysis Staff using their Regional Economic Simulation Model. This model translates national estimates from the Wharton model into estimates of regional growth by simulating the effects of the projected national pattern on the structure of the regional economy.

4. The Regional Economic Simulation Model forecasts a deeper recession for the region than the Nation as indicated in the 1981 values in Table 4. The analysis presented in this Outlook, as well as the Composite Index for the TVA Region, does not support this view. Nevertheless, the 1981 data are presented as they were calculated from the model. A principal value of the model is to insure that the relationships among its components (i.e., sectors, industries, years, etc.) are consistent. If values for some components are changed after the forecast has been made, this consistency is lost. Thus the 1981 data are included in the tables even though, in the judgment of those preparing this Outlook, they are likely to be considerably too low. This does not imply that the entire forecast is biased. For the period as a whole the forecast represents the best, consistent estimate that is available.

TABLE 2
PROJECTIONS OF SELECTED ECONOMIC INDICATORS FOR THE UNITED STATES ECONOMY, 1979 TO 1989

	1979	1984	1989
Gross national product (billions of current dollars)[1]	2,369	3,853	6,400
(Percent change)[1]	10.9	8.6	10.7
Gross national product (billions of 1972 dollars)[1]	1,432	1,666	1,783
(Percent change)[1]	3.0	1.8	2.6
Per capita income (1972 dollars)[1]	5,348	5,593	6,031
(Percent change)[1]	2.9	0.9	1.5
Total employment (millions)[1]	97	103	110
(Percent change)[1]	2.5	1.1	1.4
Gross national product deflator (1972 = 100)[1]	165	246	359
(Percent change)[1]	7.4	8.3	7.8
Consumer price index - all items (1972 = 100)[1]	218	349	521
(Percent change)[1]	8.1	9.9	8.4

TABLE 3
PROJECTIONS OF SELECTED ECONOMIC INDICATORS OF THE
TVA POWER SERVICE AREA, 1979 TO 1989

	1979	1984	1989
Gross regional product (billions of current dollars)	52.9	88.2	153.4
(Percent change)[1]	10.5	10.8	11.7
Gross regional product (billions of 1972 dollars)	31.9	35.8	42.7
(Percent change)[1]	2.8	2.3	3.6
Per capita income (1972 dollars)	4,351	4,683	5,196
(Percent change)[1]	3.5	1.5	2.1
Total employment (000's)	2,823	2,944	3,172
(Percent change)[1]	1.6	0.8	1.5

1. These are average annual percent changes for the five years ending in the year shown.

Source: Wharton Annual and Industry Forecasting Model, TVA Alternative, September 1980, and Regional Economic Simulation Model, Regional Analysis Staff, Office of Community Development, Tennessee Valley Authority, September 1980

Table 4

COMPARISONS OF GROWTH RATES FOR EMPLOYMENT, PRODUCT, AND INCOME FOR THE TVA POWER SERVICE AREA AND THE U.S. FOR SELECTED PERIODS

Period	Total Employment		Manufacturing Employment		Real Gross Product		Real Per Capita Income	
	TVA	U.S.	TVA	U.S.	TVA	U.S.	TVA	U.S.
1960-1970	3.6	2.7	4.4	1.4	N/A	3.9	4.5	3.1
1970-1973	4.7	2.7	4.8	1.3	7.1	4.7	5.6	3.8
1973-1979	1.9	3.4	0.4	0.7	2.0	2.5	1.3	1.1

forecasts give a rough indication of behavior consistent with historical experience; the trend values of some key economic measures such as prices, productivity, and investment; and an assumed scenario for the economic policy of the Government. A casual acquaintance with history, however, reveals how rapidly both the trend values and Government policy can change.

A related issue that complicates the longer-term regional forecast is the interpretation of the experience in the 1973 to 1979 period. From 1960 to 1970 manufacturing employment in the TVA region grew three times as fast as the Nation and total employment in the region grew at 3.6 percent per year as contrasted to 2.7 percent per year for the Nation. During the 1970 to 1973 period the regional advantage increased. However, as shown in Table 4, following the 1973 embargo this pattern changed and, in terms of employment, the region fell behind the Nation. Comparable data for product is not available for the region for the 1960's but for the 1970 to 1973 and post-1973 period the pattern is comparable--the region grew at about the same rate as the Nation at large. If the 1973 to 1979 experience is treated as the beginning of a new regional trend and it is assumed that thereafter the region's growth will mirror that of the Nation, then regional growth would be expected to be considerably lower than if this period is viewed as a period of adjustment to a particularly severe regional recession--after which it is expected that the region's pre-1973 advantage would be regained. The forecast summarized in Table 3 implicitly reflects the latter view.

Table 5 compares a number of forecasts that have been made for the TVA Power Service area and for three of the TVA States. The variation between the forecasts is a measure of the uncertainty associated with regional economic forecasting.

With the exception of the low series prepared for the 1981 load forecast, each of the regional forecasts show faster regional than national growth rate. Projections of employment do not, however, show this same pattern, and the question of what the 1973-1979 period portends for future growth clearly is one that needs more research.

The high-inflation/low-productivity dilemma is the fundamental reason that early in the forecast period the national and regional growth rates fall below levels experienced in the past. In the middle and later years of the forecast period, however, this explanation is progressively less relevant. Naturally the less successful economic policymakers are improving in productivity, avoiding another inflationary surge or plunging the economy into a deeper recession--then the more probable the persistence of lower growth rates throughout

the decade become. If tax reform, "reindustrialization," or "revitalization" policies prove to be effective in increasing investment and improving productivity, there is less reason to expect that, as the Nation moves forward to the end of the decade, growth rates will be lower than they have in the past. Although there is widespread and continuing concern about the decline in productivity growth in the past decade, as reviewed above, some of the principal factors advanced to explain declining productivity should diminish in the next few years.

TABLE 5
COMPARISON OF REGIONAL PROJECTIONS FOR THE 1980'S
(PERCENT CHANGE IN REAL GROSS REGIONAL PRODUCT)

Year	For TVA Power Service Area				For Individual States		
	Based on TVA Alternative (Sept. 1980)	Based on Wharton Control (Oct. 1980)	1981 Load Forecast (Summer 1980) High	1981 Load Forecast (Summer 1980) Low	Tennessee[1]	Alabama[2]	Mississippi[3]
1979	0.9	0.9	0.6	0.6	1.4	2.5	2.1
1980	-2.8	-1.4	-0.1	-0.1	-1.2	1.1	2.3
1981	0.8	4.1	1.6	0.3	0.7	2.8	3.2
1982	5.7	6.7	4.0	2.1	4.1	4.3	3.6
1983	3.9	3.1	4.0	1.9	3.1	4.6	3.5
1984	4.3	3.1	2.9	1.5	2.9	4.5	4.5
1985	3.5	2.6	3.3	1.2	2.2	3.5	4.4
1986	3.7	3.8	3.5	1.5	2.5	-	4.7
1987	4.1	3.7	3.5	1.7	2.3	-	4.3
1988	3.8	3.4	3.9	2.7	2.4	-	4.7
1989	2.8	3.5	4.0	1.6	-	-	-

1. Percent change in gross State product for State of Tennessee taken from Tennessee econometric model as reported on page 18 of Metropolitan Area Economic Report, Center for Business and Economic Research, The University of Tennessee, August 1980.
2. Percent change in real gross State product, "Alabama Economic and Demographic Information System," unpublished report from the Center for Business and Economic Research, University of Alabama, September 1980.
3. Percent change in gross State product, taken from Mississippi econometric forecast dated January 1980, Mississippi Research and Development Center.

LIST OF TABLES

Table	Title
1:00	Selected Indicators of the U.S.: Selected Years, 1940 to 1978
1:01	Projections of Selected Indicators for the U.S.: 1979-1989
1:20	Selected Indicators for the TVA Power Service Area: Selected Years, 1940 to 1978
1:21	Projections of Selected Indicators of the TVA Power Service Area: 1979-1989
2:00	Population and Households: Selected Years, 1940-1978
2:01	Projections of Population and Households: 1979-1989
2:10	Population and Household Growth Rates: Selected Historical Years
2:11	Projected Population and Household Growth Rates: 1979-1989
3:20	Projections of U.S. Manufacturing Employment by Two-Digit SIC Category: 1979-1989
3:22	Projections of TVA Power Service Area Manufacturing Employment by Two-Digit SIC Category: 1979-1989
4:00	Output: Real Gross National Product and Real Gross Regional Product by Major Industry Division: 1979-1989
4:10	Output: Real Gross National Product and Real Gross Regional Product, Projected Growth Rates: 1979-1989
5:1A	Basic Socioeconomic Statistics for the TVA Administrative District, Alabama Administrative District
5:1B	Basic Socioeconomic Statistics for the TVA Administrative Districts, Appalachian Administrative District
5:1C	Basic Socioeconomic Statistics for the TVA Administrative Districts, Central Administrative District
5:1D	Basic Socioeconomic Statistics for the TVA Administrative Districts, Kentucky Administrative District
5:1E	Basic Socioeconomic Statistics of the TVA Administrative Districts, Mississippi Administrative District
5:1F	Basic Socioeconomic Statistics for the TVA Administrative Districts, Southeastern Administrative District
5:1G	Basic Socioeconomic Statistics for the Administrative Districts, Western Administrative District
5:1H	Miscellaneous Statistics for the TVA Administrative Districts

TABLE 1:00
SELECTED INDICATORS FOR THE U.S.: SELECTED YEARS, 1940 TO 1978

	1940	1950	1960	1970	1971	1972	1973	1974	1975	1976	1977	1978
Population (millions).....	132.1	152.3	180.7	204.9	207.1	208.8	210.4	211.9	213.6	215.2	216.9	218.7
(Percent change).....	-	-	-	1.1	1.1	0.9	0.7	0.7	0.8	0.7	0.8	0.8
Households (millions).....			52.8	63.4	64.8	66.7	68.3	69.9	71.1	72.9	74.1	76.0
(Percent change).....	-	-	-	1.9	2.2	2.9	2.4	2.4	1.8	2.5	1.7	2.5
Total employment (millions).....	NA	58.9	65.8	78.6	79.1	81.7	84.4	85.9	84.8	87.5	90.6	94.4
(Percent change).....	-	-	-	0.9	0.6	3.3	3.3	1.8	-1.3	3.2	3.5	4.2
Manufacturing employment (millions).....	10.0	15.2	16.8	19.4	18.6	19.2	20.2	20.1	18.3	19.0	19.7	20.3
(Percent change).....	-	-	-	-4.0	-3.8	2.8	5.2	-0.4	-8.7	3.7	3.4	3.5
Percent of total population employed.....	NA	38.7	36.4	38.4	38.2	39.1	40.1	40.6	39.7	40.7	41.7	43.2
Percent of total employment in manufacturing....	NA	25.9	25.5	24.6	23.5	23.4	23.9	23.4	21.6	21.7	21.7	21.5
Unemployment rate.....	NA	5.3	5.5	4.9	5.9	5.6	4.9	5.6	8.5	7.7	7.0	6.0
Per capita income (current dollars).....	595	1,496	2,222	3,893	4,132	4,493	4,980	5,428	5,851	6,396	7,024	7,836
(Percent change).....	-	-	-	6.2	6.1	8.7	10.8	9.0	7.8	9.3	9.8	11.6
Per capita income - (1972 dollars).....	NA	NA	3,099	4,209	4,277	4,493	4,720	4,643	4,629	4,816	5,003	5,224
(Percent change).....	-	-	-	1.6	1.6	5.1	5.1	-1.0	-0.3	4.0	3.9	4.4
Gross national product (billions of current dollars).....	100.0	286.2	506.0	982.4	1,063.4	1,171.1	1,306.6	1,412.9	1,528.8	1,702.2	1,899.5	2,127.6
(Percent change).....	-	-	-	5.0	8.2	10.1	11.6	8.1	8.2	11.3	11.6	12.0
Gross national product (billions of 1972 dollars).....	343.3	533.5	736.8	1,075.3	1,107.5	1,171.1	1,235.0	1,217.8	1,202.3	1,273.0	1,340.5	1,399.2
(Percent change).....	-	-	-	-0.3	3.0	5.7	5.5	-1.4	-1.3	5.9	5.3	4.4
Gross national product deflator (1972 = 100)....	29.1	53.6	68.7	91.4	96.0	100.0	105.8	116.0	127.1	133.7	141.7	152.0
(Percent change).....	-	-	-	5.4	5.1	4.1	5.8	9.7	9.6	5.2	6.0	7.3
Wholsesale price index - all commodoties (1972 = 100).....	NA	NA	94.9	110.4	114.0	119.1	134.7	160.1	174.9	183.(	194.2	209.3
(Percent change).....	-	-	-	3.7	3.3	4.5	13.1	18.9	9.2	4.6	6.1	7.8
Consumer price index - all items (1967 = 100).....	42.1	72.1	88.7	116.3	121.3	125.3	133.1	147.7	161.2	170.5	181.5	195.3
(Percent change).....	-	-	-	5.9	4.3	3.3	6.2	11.0	9.1	5.8	6.5	7.6
All bond rate (percent)...	NA	NA	4.7	8.5	7.9	7.6	7.8	9.0	9.6	9.0	8.4	9.1
Prime commercial rate, 4-6 month (percent).....	NA	NA	3.9	7.7	5.1	4.7	8.2	9.9	6.3	5.4	5.6	8.0

NA Not available

Sources: Economic Report of the President, January 1980
Wharton EFA Annual and Industry Forecasting Model, Historical Tables, September 1979

TABLE 1:01
PROJECTIONS OF SELECTED INDICATORS FOR THE U.S.: 1979-1989

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Population (millions)..	220.3	222.3	224.3	226.5	228.6	230.8	233.0	235.2	237.4	239.5	241.6
(Percent change).....	0.8	0.9	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
Households (millions)..	78.0	79.7	81.4	83.2	84.8	86.3	87.8	89.3	90.7	92.1	93.5
(Percent change).....	2.2	2.2	2.2	2.2	1.9	1.8	1.7	1.7	1.6	1.5	1.5
Total employment (millions).....	97.0	97.0	97.3	99.2	100.9	102.6	104.1	105.7	107.3	108.8	110.1
(Percent change).....	2.7	0.1	0.3	1.9	1.7	1.7	1.5	1.5	1.6	1.4	1.1
Manufacturing employment (millions).....	21.0	20.5	20.2	20.5	20.8	21.1	21.2	21.3	21.3	21.4	21.4
(Percent change).....	3.2	-2.5	-1.4	1.7	1.4	1.3	0.6	0.2	0.2	0.4	-0.2
Percent of total population employed...	44.0	43.6	43.4	43.8	44.1	44.5	44.7	44.9	45.2	45.4	45.6
Percent of total employment in manufacturing.....	21.7	21.1	20.7	20.7	20.6	20.5	20.4	20.1	19.8	19.6	19.4
Unemployment rate.....	5.8	7.5	8.3	7.7	7.3	6.8	6.6	6.4	6.2	5.9	5.9
Per capita income (current dollars).....	8,733	9,493	10,300	11,371	12,456	13,586	14,788	16,185	17,819	19,532	21,246
(Percent change).....	11.4	8.7	8.5	10.4	9.5	9.1	8.8	9.4	10.1	9.6	8.8
Per capita income (1972 dollars).....	5,348	5,259	5,244	5,379	5,482	5,593	5,651	5,733	5,816	5,935	6,031
(Percent change).....	2.4	-1.7	-0.3	2.6	1.9	2.0	1.0	1.5	1.4	2.0	1.6
Gross national product (billions of current dollars).....	2,368.7	2,548.0	2,801.0	3,138.3	3,481.0	3,852.7	4,257.7	4,720.0	5,274.4	5,839.2	6,400.0
(Percent change).....	11.3	7.6	9.9	12.0	10.9	10.7	10.5	10.9	11.7	10.7	9.6
Gross national product (billions of 1972 dollars).....	1,431.6	1,413.4	1,423.7	1,475.7	1,516.7	1,565.5	1,604.2	1,645.9	1,693.7	1,744.1	1,782.7
(Percent change).....	2.3	-1.3	0.7	3.7	2.8	3.2	2.5	2.6	2.9	3.0	2.2
Gross national product deflator (1972 = 100).	165.5	180.3	196.7	212.7	229.5	246.1	265.4	286.8	311.4	334.8	359.0
(Percent change).....	8.8	9.0	9.1	8.1	7.9	7.2	7.8	8.0	8.6	7.5	7.2
Wholesale price index all commodoties (1967 = 100).....	236.1	271.5	301.7	329.1	355.7	382.3	410.2	439.7	470.4	503.1	537.8
(Percent change).....	12.8	15.0	11.1	9.1	8.1	7.5	7.3	7.2	7.0	7.0	6.9
Consumer price index all items (1967 = 100)	217.8	248.2	273.8	299.5	324.0	348.6	377.7	410.0	447.4	483.6	520.8
(Percent change).....	11.5	13.9	10.3	9.4	8.2	7.6	8.4	8.5	9.1	8.1	7.7
All bond rate (percent)	10.0	12.2	11.5	10.5	10.3	10.0	10.2	10.3	10.4	10.0	9.8
Prime commercial rate, 4-6 month (percent)...	10.9	11.3	10.4	8.9	8.7	8.0	8.8	8.8	8.8	8.6	8.5

Source: Wharton Annual and Industry Forecasting Model, TVA Alternative - September 1980

TABLE 1:20
SELECTED INDICATORS FOR THE TVA POWER SERVICE AREA: SELECTED YEARS, 1940 TO 1978

	1940	1950	1960	1970	1971	1972	1973	1974	1975	1976	1977	1978
Population (000's).....	4,726	5,083	5,362	5,899	5,995	6,094	6,155	6,226	6,258	6,339	6,430	6,438[2]
(Percent change).....	-	-	-	-	1.6	1.7	1.0	1.2	0.5	1.3	1.4	0.1
Households (000's).....	NA	NA	1,486.7	1,802.3	NA	NA	NA	NA	NA	NA	NA	NA
(Percent change).....	-	-	-	-	-	-	-	-	-	-	-	-
Total employment (000's)...	1,367.4[1]	1,501.9[1]	1,861.9	2,302.9	2,348.5	2,489.6	2,604.8	2,640.8	2,561.6	2,632.2	2,725.8	2,774.8[2]
(Percent change).....	-	-	-	-	2.0	6.0	4.6	1.4	-3.0	2.8	3.6	1.8
Manufacturing employment (000's).....	219.8	332.7	435.3	670.7	674.3	724.7	771.3	762.4	684.1	726.9	756.7	780.3[2]
(Percent change).....	-	-	-	-	0.5	7.5	6.4	-1.2	-10.3	6.3	4.1	3.1
Percent of total population employed.....	28.9[1]	29.5[1]	34.7	39.0	39.2	40.9	42.3	42.4	40.9	41.5	42.4	43.1[1]
Percent of total employment in manufacturing.....	16.1[1]	22.2[1]	23.4	29.1	28.7	29.1	29.6	28.9	26.7	27.6	27.8	28.1
Per capita income (current dollars).....	284	884	1,491	2,977	3,219	3,537	4,004	4,289	4,604	5,123	5,668	NA
(Percent change).....	-	-	-	5.9	8.1	9.9	13.2	7.1	7.3	11.3	10.6	-
Per capita income (1972 dollars).....	NA	NA	2,079	3,219	3,265	3,537	3,795	3,669	3,642	3,858	4,037	NA
(Percent change).....	-	-	-	1.3	1.4	8.3	7.3	-3.3	-0.7	5.9	4.6	-
Gross regional product (millions of current dollars).....	NA	NA	NA	21,142	23,233	26,305	30,038	32,141	34,685	39,156	43,801	48,120.2
(Percent change).....	-	-	-	6.2	9.9	13.2	14.2	7.0	7.9	12.9	11.9	9.9
Gross regional product (millions of 1972 dollars)	NA	NA	NA	23,085	24,216	26,305	28,323	27,760	27,344	29,401	31,125	31,658.0
(Percent change).....	-	-	-	0.8	4.9	8.6	7.7	-2.0	-1.5	7.5	5.9	1.7

1. Excludes private household workers in the service sector and nonfarm proprietors.
2. Data are taken from estimates of the Regional Economic Simulation Model, Regional Analysis Staff, Office of Community Development, and exclude private household workers in the service sector.

NA Not available.

Source: Estimates prepared by the Regional Analysis Staff, Office of Community Development, Tennessee Valley Authority

TABLE 1:21
PROJECTIONS OF SELECTED INDICATORS OF THE TVA POWER SERVICE AREA: 1979-1989

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Population (000's)	6,497	6,548	6,602	6,661	6,721	6,783	6,845	6,906	6,967	7,027	7,086
(Percent change)	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
Households (000's)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(Percent change)	-	-	-	-	-	-	-	-	-	-	-
Total employment (000's)	2,823	2,790	2,795	2,843	2,891	2,944	2,989	3,035	3,082	3,132	3,172
(Percent change)	1.7	-1.2	0.2	1.7	1.7	1.8	1.5	1.5	1.6	1.6	1.3
Manufacturing employment (000's)	793	780	775	792	811	832	851	866	880	894	903
(Percent change)	1.6	-1.6	-0.5	2.1	2.5	2.6	2.2	1.8	1.6	1.6	1.1
Percent of population employed	43.4	42.6	42.3	42.7	43.0	43.4	43.7	43.9	44.2	44.6	44.8
Percent of total employment in manufacturing	28.1	28.0	27.8	27.8	28.1	28.3	28.5	28.5	28.5	28.5	28.5
Per capita income (current dollars)	7,105	7,678	8,402	9,386	10,349	11,375	12,480	13,731	15,222	16,768	18,306
(Percent change)	-	8.1	9.4	11.7	10.3	9.9	9.7	10.0	10.9	10.2	9.2
Per capita income (1972 dollars)	4,351	4,254	4,278	4,440	4,555	4,683	4,769	4,864	4,968	5,095	5,196
(Percent change)	-	-2.2	0.6	3.8	2.6	2.8	1.8	2.0	2.1	2.6	2.0
Gross regional product (millions of current dollars)	52,859.2	55,956.1	61,533.7	70,329.3	78,812.6	88,182.6	98,466.1	110,297.5	124,616.1	139,102.7	153,368.4
(Percent change)	9.8	5.9	10.0	14.3	12.1	11.9	11.7	12.0	13.0	11.6	10.3
Gross regional product (millions of 1972 dollars)	31.939.1	31,035.0	31,283.0	33,065.0	34,341.0	35,832.0	37,101.0	38,458.0	40,018.0	41,548.0	42,721.0
(Percent change)	0.9	-2.8	0.8	5.7	3.9	4.3	3.5	3.7	4.1	3.8	2.8

NA Not available

Source: Regional Economic Simulation Model, Regional Analysis Staff, Office of Community Development

TABLE 2:00
POPULATION AND HOUSEHOLDS: SELECTED YEARS, 1940-1989

United States (millions)	1940	1950	1960	1970	1971	1972	1973	1974	1975	1976	1977	1978
Total population.....	132.1	152.3	180.67	204.88	207.05	208.85	210.41	211.90	213.56	215.15	216.86	218.55
Ages: 0-19.....	42.3	51.7	69.51	77.19	77.25	76.87	76.22	75.42	74.62	73.73	72.78	71.88
20-29.....	51.6	57.4	22.07	30.90	32.06	33.13	33.91	34.97	36.16	37.44	37.82	38.48
30-44.....	51.6	57.4	36.20	34.72	34.83	35.16	35.83	36.35	36.81	37.32	38.96	40.28
45-64.....	26.2	30.8	36.19	41.98	42.41	42.79	43.07	43.32	43.55	43.70	43.80	43.85
65+.....	9.0	12.4	16.68	20.08	20.49	20.89	21.35	21.83	22.42	22.95	23.51	24.05
Households.....	NA	NA	52.80	63.40	64.78	66.68	68.25	69.86	71.12	72.87	74.14	76.03
Persons per household.	NA	NA	3.42	3.23	3.20	3.13	3.08	3.03	3.00	2.95	2.93	2.80
TVA (201-County) Region (000's)												
Total population.....	5,523	5,928	6,194	6,750	6,865	6,973	7,046	7,128	7,172	7,265	7,373	7,459
Power Service Area												
Total population.....	4,726	5,083	5,362	5,899	5,995	6,094	6,155	6,226	6,258	6,339	6,430	6,438

Source: Wharton EFA annual and Industry Forecasting Model, Historical Tables, September 1979
Regional Economic Simulation Model, Regional Analysis Staff, Office of Community Development, Tennessee Valley Authority

TABLE 2:01
PROJECTIONS OF POPULATION AND HOUSEHOLDS: 1979-1989

United States (millions)	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total population...	220.34	222.27	224.33	226.47	228.64	230.83	233.02	235.21	237.38	239.52	241.62
Ages: 0-19.....	71.13	70.57	70.08	69.79	69.61	69.54	69.69	70.07	70.55	71.11	71.64
20-29.....	39.15	39.81	40.40	40.82	41.08	41.19	41.05	40.65	40.02	39.31	38.64
30-44.....	41.65	42.97	44.41	45.93	47.45	49.04	50.66	52.20	53.72	54.87	56.18
45-64.....	43.86	43.89	43.94	44.03	44.13	44.19	44.18	44.33	44.58	45.22	45.66
65+.....	24.55	25.05	25.48	25.91	26.35	26.85	27.44	27.96	28.52	29.01	29.50
Households.....	77.96	79.67	81.41	83.18	84.75	86.30	87.80	89.25	90.67	92.07	93.48
Persons per household.....	2.83	2.79	2.76	2.72	2.70	2.67	2.65	2.64	2.62	2.60	2.58
Power Service Area (000's)											
Total population...	6,497	6,548	6,602	6,661	6,721	6,783	6,845	6,906	6,966	7,027	7,086
Age: 65+.....	782	799	817	835	853	868	886	903	921	938	955

Sources: Wharton Annual and Industry Forecasting Model, TVA Alternative, September 1980, and Regional Economic Simulation Model, Regional Analysis Staff, Office of Community Development

TABLE 2:11
PROJECTED POPULATION AND HOUSEHOLD GROWTH RATES: 1979-1989

United States (Percent)	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total population.....	0.8	0.9	0.9	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
Ages: 0-19.....	-1.1	-0.8	-0.7	-0.4	-0.3	-0.1	0.2	0.5	0.7	0.8	0.7
20-29.....	1.7	1.7	1.5	1.0	0.6	0.3	-0.3	-1.0	-1.5	-1.8	-1.7
30-44.....	3.4	3.2	3.4	3.4	3.3	3.4	3.3	3.0	2.9	2.1	2.4
45-64.....	0.0	0.1	0.1	0.2	0.2	0.1	0.0	0.3	0.6	1.4	1.0
65+.....	2.2	2.0	1.7	1.7	1.7	1.9	2.2	1.9	2.0	1.7	1.7
Households.....	2.2	2.2	2.2	2.2	1.9	1.8	1.7	1.7	1.6	1.5	1.5
Persons per household.....	-1.4	-1.4	-1.1	-1.4	-0.7	-1.1	-0.7	-0.4	-0.8	-0.8	-0.8
Power Service Area (Percent)											
Total population.....	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
Ages: 65+.....	2.4	2.2	2.2	2.2	2.1	1.8	2.0	2.0	1.9	1.9	1.9

Source: Calculated from data in Table 2:01

TABLE 3:20
PROJECTIONS OF U.S. MANUFACTURING EMPLOYMENT BY TWO-DIGIT SIC CATEGORY: 1979-1989

Industry	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total manufacturing (000's)	20,987	20,457	20,172	20,519	20,804	21,069	21,197	21,249	21,301	21,378	21,345
Food and beverages	1,726	1,679	1,665	1,691	1,704	1,709	1,713	1,715	1,716	1,713	1,707
Tobacco	71	69	69	69	69	68	67	65	64	63	62
Textiles	924	913	925	952	967	978	982	981	979	974	967
Apparel	1,319	1,300	1,302	1,323	1,336	1,347	1,354	1,360	1,365	1,369	1,372
Lumber	774	738	720	743	732	736	744	753	767	783	789
Furniture	506	491	477	481	487	497	503	506	512	520	521
Paper	729	724	732	753	770	783	792	797	799	800	797
Printing and publishing	1,202	1,187	1,191	1,219	1,249	1,281	1,311	1,341	1,371	1,400	1,427
Chemicals	1,080	1,066	1,055	1,066	1,074	1,080	1,082	1,082	1,079	1,075	1,067
Petroleum	218	218	218	220	221	220	217	214	210	206	201
Rubber	764	766	777	802	826	849	867	882	897	910	920
Leather	253	253	254	252	250	250	249	249	248	247	245
Stone, clay, and glass	736	717	691	703	712	727	733	742	755	770	776
Primary metals	1,234	1,180	1,145	1,162	1,198	1,234	1,254	1,265	1,274	1,287	1,292
Fabricated metal products	1,709	1,659	1,621	1,625	1,631	1,642	1,640	1,633	1,632	1,635	1,623
Nonelectrical machinery	2,474	2,416	2,366	2,392	2,413	2,423	2,409	2,379	2,349	2,323	2,285
Electrical machinery	2,072	1,998	1,943	1,983	2,015	2,045	2,056	2,053	2,048	2,043	2,026
Transportation equipment	2,047	1,967	1,937	1,987	2,041	2,083	2,102	2,112	2,121	2,144	2,154
Instruments	685	664	647	661	670	677	682	686	689	694	697
Miscellaneous manufacturing	467	450	437	436	440	441	438	432	427	423	415

Source: Wharton Annual and Industry Forecasting Model, TVA Alternative - September 1980

71-531 O - 81 - 10

TABLE 3:22

PROJECTIONS OF TVA POWER SERVICE AREA MANUFACTURING EMPLOYMENT BY TWO-DIGIT SIC CATEGORY: 1979-1989

Industry	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total manufacturing (000's).....	792.6	779.8	775.6	791.5	811.2	832.2	850.8	865.8	879.7	893.6	903.0
Food and beverages	61.7	61.4	61.2	62.4	64.2	66.1	68.1	70.1	72.1	73.9	75.4
Tobacco.....	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Textiles.....	64.0	59.1	58.1	60.2	63.1	65.8	68.0	69.1	69.6	69.4	68.5
Apparel.....	119.6	120.4	121.8	123.8	126.1	127.8	129.5	131.0	132.4	133.8	135.2
Lumber.....	36.4	35.0	34.0	34.5	33.9	33.8	33.8	33.8	34.1	34.4	34.3
Furniture.....	44.7	43.4	42.2	42.7	43.7	45.2	46.6	47.6	48.9	50.6	51.6
Paper.....	21.8	22.7	23.4	24.3	25.4	26.5	27.6	28.7	29.7	30.6	31.5
Printing and publishing.....	30.1	30.7	31.1	31.8	32.7	33.7	34.7	35.8	36.8	37.9	39.0
Chemicals.....	66.2	61.4	60.1	61.3	63.0	64.7	66.2	67.3	68.0	68.5	68.5
Petroleum.....	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Rubber.....	37.0	38.4	39.8	41.7	43.8	45.8	47.7	49.6	51.5	53.4	55.1
Leather.....	26.2	26.3	26.5	26.6	26.7	26.7	26.8	27.0	27.1	27.3	27.4
Stone, clay, and glass.....	24.9	24.4	23.5	23.9	24.6	25.5	26.2	26.9	27.8	28.9	29.6
Primary metals....	32.0	30.2	30.0	30.7	31.2	31.9	32.2	32.5	32.7	33.2	33.6
Fabricated metal products.....	53.2	52.2	51.4	51.8	52.3	53.0	53.4	53.6	53.9	54.4	54.5
Nonelectrical machinery.....	46.9	44.8	43.9	44.9	46.5	48.2	49.6	50.7	51.7	52.8	53.6
Electrical machinery.....	61.3	60.6	59.4	60.4	62.1	64.1	65.6	66.6	67.2	67.7	67.7
Transportation equipment.....	36.4	38.5	38.8	39.5	40.4	41.3	41.8	42.0	42.2	42.4	42.6
Instruments.....	13.6	13.7	13.6	14.0	14.6	15.1	15.5	15.9	16.2	16.6	16.9
Miscellaneous manufacturing....	13.8	13.7	13.7	13.8	14.0	14.2	14.4	14.6	14.7	14.9	15.0

Source: Regional Economic Simulation Model, Regional Analysis Staff, OCD, September 1980

TABLE 4:00

OUTPUT: REAL GROSS NATIONAL PRODUCT AND REAL GROSS REGIONAL PRODUCT BY MAJOR INDUSTRY DIVISION

United States (billions of 1972 dollars)	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total[1]	1,431.6	1,413.4	1,423.7	1,475.7	1,516.7	1,565.5	1,604.2	1,645.9	1,693.7	1,744.1	1,782.7
Agriculture, forestry, and fisheries	39.6	44.0	46.8	49.1	50.0	50.9	51.7	52.7	53.9	55.1	56.1
Mining	21.5	21.5	22.0	22.5	22.5	22.5	22.4	22.3	22.2	22.2	22.0
Contract construction	59.3	55.3	50.2	53.3	53.2	55.6	56.2	57.2	59.7	62.2	62.3
Manufacturing	352.1	340.0	344.1	359.5	372.8	386.5	395.6	404.9	416.0	428.1	435.5
Transportation, communications, and utilities	139.9	141.9	145.2	152.6	158.5	164.6	170.1	176.0	182.9	190.1	196.9
Wholesale and retail trade	243.3	236.6	237.6	248.5	255.4	265.2	273.0	281.5	290.6	300.1	307.4
Finance, real estate, and insurance	222.6	223.5	223.9	227.3	235.3	244.0	252.0	260.2	269.1	278.2	286.6
Services	174.0	174.9	178.8	186.4	191.1	196.9	202.1	207.9	214.1	220.7	226.6
Government	169.3	170.3	171.4	173.0	174.1	175.4	177.2	179.2	181.3	183.6	185.8
TVA Power Service Area (millions of 1972 dollars)											
Total[1]	31,939.1	31,035.0	31,283.0	33,065.0	34,341.0	35,832.0	37,101.0	38,458.0	40,018.0	41,548.0	42,721.0
Agriculture, forestry, and fisheries	877.0	726.3	755.0	796.6	798.4	799.0	798.5	798.1	805.5	810.4	815.5
Mining	67.8	71.7	67.1	65.4	59.9	57.4	54.6	52.3	51.0	51.5	52.1
Contract construction	1,343.5	1,280.4	1,325.9	1,378.1	1,409.8	1,462.8	1,517.8	1,575.1	1,637.8	1,694.3	1,732.7
Manufacturing	10,353.5	10,031.0	10,185.0	10,794.0	11,318.0	11,929.0	12,441.0	12,968.0	13,544.0	14,159.0	14,609.0
Transportation, communication and utilities	2,443.9	2,471.4	2,550.9	2,702.8	2,820.1	2,945.6	3,045.8	3,142.5	3,251.8	3,360.8	3,449.2
Wholesale and retail trade	5,358.2	5,086.1	5,004.4	5,215.1	5,404.2	5,653.7	5,797.0	5,967.7	6,155.3	6,329.6	6,457.5
Finance, real estate, and insurance	4,034.9	4,021.7	3,955.1	4,223.6	4,393.0	4,561.4	4,786.7	5,037.2	5,338.3	5,600.8	5,843.1
Services	3,227.7	3,117.3	3,083.2	3,268.8	3,395.2	3,531.7	3,644.2	3,784.1	3,955.5	4,126.6	4,264.6
Government	4,182.6	4,229.4	4,357.5	4,621.5	4,742.1	4,891.7	5,015.2	5,141.5	5,279.2	5,414.5	5,497.8

1. Includes category labeled rest of world and statistical discrepency, so the major industry divisions do not sum to the total.

Sources: Wharton Annual and Industry Forecasting Model, TVA Alternative, September 1980. Estimates by Regional Analysis Staff for 1979. Economic Simulation Model (for 1980-1989), Regional Analysis Staff, Office of Community Development

TABLE 4:10
OUTPUT: REAL GROSS NATIONAL PRODUCT AND REAL GROSS REGIONAL PRODUCT
GROWTH PROJECTED RATES: 1979-1989

United States (Percent)	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Total	2.3	-1.3	0.7	3.7	2.8	3.2	2.5	2.6	2.9	3.0	2.2
Agricultural, forestry, and fisheries	2.4	11.1	6.4	4.9	1.7	1.8	1.7	1.9	2.3	2.2	1.8
Mining	3.1	0.0	2.4	2.6	-0.1	0.1	-0.6	-0.6	-0.3	-0.1	-0.7
Contract construction	0.2	-6.8	-9.2	6.1	-0.1	4.5	1.2	1.6	4.4	4.3	0.1
Manufacturing	3.1	-3.4	1.2	4.4	3.7	3.7	2.4	2.4	2.7	2.9	1.7
Transportation, communications, and utilities	7.8	1.4	2.3	5.1	3.9	3.8	3.3	3.5	3.9	3.9	3.6
Wholesale and retail trade	1.8	-2.8	0.4	4.6	2.8	3.8	3.0	3.1	3.2	3.2	2.4
Finance, real estate, and insurance	3.0	0.4	0.2	1.5	3.5	3.7	3.3	3.3	3.4	3.4	3.0
Services	2.9	0.5	2.2	4.3	2.6	3.0	2.7	2.8	3.0	3.1	2.7
Government	0.4	0.6	0.6	0.9	0.7	0.8	1.0	1.1	1.2	1.2	1.2
TVA Power Service Area (Percent)											
Total	0.9	-2.8	0.8	5.7	3.9	4.3	3.5	3.7	4.1	3.8	2.8
Agricultural, forestry, and fisheries	-5.5	-17.2	4.0	5.5	0.2	0.1	-0.1	-0.1	0.9	0.6	0.6
Mining	3.7	5.8	-6.4	-2.5	-8.4	-4.2	-4.9	-4.2	-2.5	1.0	1.2
Contract construction	0.6	-4.7	3.6	4.0	2.3	3.8	3.8	3.8	4.0	3.4	2.3
Manufacturing	1.5	-3.1	1.5	6.0	4.9	5.4	4.3	4.2	4.4	4.5	3.2
Transportation, communications, and utilities	1.5	1.1	3.2	6.0	4.3	4.5	3.4	3.2	3.5	3.4	2.6
Wholesale and retail trade	-0.7	-5.1	-1.6	4.2	3.6	4.6	2.5	2.9	3.1	2.8	2.0
Finance, real estate, and insurance	2.7	-0.3	-1.7	6.8	4.0	3.8	4.9	5.2	6.0	4.9	4.3
Services	1.2	-3.4	-1.1	6.0	3.9	4.0	3.2	3.8	4.5	4.3	3.3
Government	0.6	1.1	3.0	6.1	2.6	3.2	2.5	2.5	2.7	2.6	1.5

Sources: Wharton Annual and Industry Forecasting Model, TVA Alternative - September 1980. Estimates by Regional Analysis Staff for 1979. Economic Simulation Model (for 1980-1989), Regional Analysis Staff, Office of Community Development

TABLE 5:1A
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
ALABAMA ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	864,589	909,340	5.2
White population	776,962	816,497	5.1
Nonwhite population	87,627	92,843	6.0
Personal income by place of residence ($000's)	2,908,444	4,960,714	70.5
Per capita income ($)	3,364	5,455	62.2
Labor and proprietor's income by place of work - total ($000's)	2,368,412	3,891,894	64.3
Farm	122,268	142,742	16.7
Agricultural services, forestry, fisheries, etc	7,438	8,225	10.5
Mining	8,454	32,185	280.7
Construction	101,367	191,547	88.9
Manufacturing	731,767	1,369,539	87.1
Transportation and public utilities	93,358	173,550	85.8
Wholesale and retail trade	286,803	496,271	73.0
Finance, real estate, and insurance	64,176	109,184	70.1
Services	347,049	450,684	29.8
Government	605,732	917,967	51.5

Data compiled by TVA Office of Community Development

TABLE 5:1B
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
APPALACHIAN ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	1,625,215	1,747,495	7.5
White population	1,558,698	1,677,299	7.6
Nonwhite population	66,517	70,196	5.5
Personal income by place of residence ($000's)	5,466,195	9,341,419	70.8
Per capita income ($)	3,363	5,345	59.0
Labor and proprietor's income by place of work - total ($000's)	4,341,423	7,067,153	62.8
Farm	143,979	146,717	1.9
Agricultural services, forestry, fisheries, etc	7,378	12,243	65.9
Mining	146,604	274,554	87.2
Construction	266,419	451,007	69.2
Manufacturing	1,536,559	2,427,052	57.9
Transportation and public utilities	245,414	399,149	62.6
Wholesale and retail trade	658,587	1,077,482	63.6
Finance, real estate, and insurance	130,672	210,690	61.2
Services	553,448	983,419	77.6
Government	167,578	294,930	75.9

Data compiled by TVA Office of Community Development

TABLE 5:1C
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
CENTRAL ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	1,290,059	1,392,397	7.9
White population	1,129,657	1,219,745	8.0
Nonwhite population	160,402	172,652	7.6
Personal income by place of residence ($000's)	4,792,249	8,164,513	70.3
Per capita income ($)	3,715	5,864	57.8
Labor and proprietor's income by place of work - total ($000's)	3,832,516	6,361,044	66.0
Farm	141,458	155,453	9.8
Agricultural services, forestry, fisheries, etc	10,064	15,024	49.2
Mining	8,665	35,498	309.6
Construction	248,217	397,185	60.0
Manufacturing	1,119,499	1,804,694	61.2
Transportation and public utilities	235,388	423,102	79.7
Wholesale and retail trade	631,495	1,094,388	73.3
Finance, real estate, and insurance	219,481	367,688	67.5
Services	635,259	1,086,566	71.0
Government	582,990	981,466	68.3

Data compiled by TVA Office of Community Development

TABLE 5:1D
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
KENTUCKY ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	419,584	441,483	5.2
White population	380,403	399,517	5.0
Nonwhite population	39,145	41,966	7.2
Personal income by place of residence ($000's)	1,359,189	2,431,036	78.8
Per capita income ($)	3,239	5,507	70.0
Labor and proprietor's income by place of work - total ($000's)	1,132,465	1,954,094	72.6
Farm	105,230	122,041	15.9
Agricultural services, forestry, fisheries, etc.	2,610	4,712	80.5
Mining	8,195	17,180	109.6
Construction	68,476	114,454	67.1
Manufacturing	293,875	505,521	72.0
Transportation and public utilities	61,119	121,416	98.6
Wholesale and retail trade	164,141	290,650	77.1
Finance, real estate, and insurance	32,688	59,283	81.3
Services	117,280	212,842	81.4
Government	278,851	505,995	81.4

Data compiled by TVA Office of Community Development

TABLE 5:1E
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
MISSISSIPPI ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	632,699	655,138	3.5
White population	428,279	445,378	4.0
Nonwhite population	204,412	209,760	2.6
Personal income by place of residence ($000's)	1,818,070	3,056,253	68.1
Per capita income ($)	2,874	4,665	62.3
Labor and proprietor's income by place of work - total ($000's)	1,508,293	2,261,796	50.0
Farm	182,367	220,578	20.9
Agricultural services, forestry, fisheries, etc	4,596	9,642	109.7
Mining	3,520	7,639	117.0
Construction	65,304	110,424	69.0
Manufacturing	501,048	834,493	66.5
Transportation and public utilities	62,818	107,054	70.4
Wholesale and retail trade	179,085	301,825	68.5
Finance, real estate, and insurance	34,246	64,482	88.2
Services	142,209	229,694	61.5
Government	243,100	375,965	54.6

Data compiled by TVA Office of Community Development

TABLE 5:1F
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
SOUTHEASTERN ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	869,968	928,263	6.7
White population	796,654	850,689	6.8
Nonwhite population	73,314	77,574	5.8
Personal income by place of residence ($000's)	3,107,149	5,120,249	64.7
Per capita income ($)	3,572	5,516	54.2
Labor and proprietor's income by place of work - total ($000's)	2,535,098	3,973,792	56.8
Farm	45,342	51,389	13.3
Agricultural services, forestry, fisheries, etc	8,056	10,442	29.6
Mining	22,446	35,848	59.7
Construction	143,223	210,639	47.0
Manufacturing	1,072,625	1,568,492	46.2
Transportation and public utilities	114,525	191,512	67.2
Wholesale and retail trade	364,093	570,681	56.7
Finance, real estate, and insurance	108,685	185,070	70.2
Services	291,892	461,827	58.2
Government	364,211	687,892	88.8

Data compiled by TVA Office of Community Development

TABLE 5:1G
BASIC SOCIOECONOMIC STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS
WESTERN ADMINISTRATIVE DISTRICT

	1972	1977	Percent Change 1972-1977
Total population	1,215,909	1,257,526	3.4
White population	833,559	853,005	2.3
Nonwhite population	382,350	404,521	5.8
Personal income by place of residence ($000's)	4,701,962	7,560,584	60.7
Per capita income ($)	3,867	6,012	55.5
Labor and proprietor's income by place of work - total ($000's)	3,955,208	6,202,303	56.8
Farm	108,452	80,610	-25.6
Agricultural services, forestry, fisheries, etc	9,251	12,634	36.5
Mining	6,090	13,373	119.5
Construction	250,913	327,752	30.6
Manufacturing	1,002,940	1,631,072	62.6
Transportation and public utilities	293,856	504,051	71.5
Wholesale and retail trade	800,918	1,299,736	62.3
Finance, real estate, and insurance	200,733	313,128	55.9
Services	573,305	931,027	62.3
Government	708,750	1,088,920	53.6

Data compiled by TVA Office of Community Development

TABLE 1:4
MISCELLANEOUS STATISTICS FOR THE TVA ADMINISTRATIVE DISTRICTS

	TVA Administrative Districts						
	Alabama	Appalachian	Central	Kentucky	Mississippi	Southeastern	Western
Percent of population in urban areas - 1970.....	48.8	36.6	56.5	39.8	32.1	42.4	70.0
Percent of population with less than eighth grade education - 1970.....	36.6	43.2	41.0	46.9	41.6	43.9	37.3
Percent of population who graduated from high school - 1970.....	41.9	38.2	41.0	37.6	36.1	36.6	42.6
Percent of district classed as prime farmland.....	28.9	4.4	15.4	3.5	30.8	6.1	51.8
Average size of farms in district - 1978.....	143.0	100.1	146.3	170.0	224.8	128.4	228.0

PRICE AND COST FORECASTS AND ECONOMIC EVALUATION RATES
October 1980

In developing plans and performing economic evaluations, it is important that consistent data be used. In order to encourage consistency in estimating future costs and benefits, the attached set of estimated changes in prices of specific items and economic evaluation rates have been prepared. These indicies and rates will be updated in future "Outlooks."

Since most prices are established in national markets and only limited information is available to derive them on a local and regional level, the attached indicies and rates are primarily based on national forecasts and are intended for general guidance. Therefore, if local or regional information is available (e.g., contracts, etc.), or the analyst has more specific information, this information may be used; but it should be fully documented.

It is not possible to publish all price and cost indices that might be useful, and others may be added to the attached list and published in future "Outlooks." However, if you believe there is a need for other items to be added, contact your office representative on the Economics Committee or the Office of Planning and Budget.

PRICE AND COST FORECASTS AND ECONOMIC EVALUATION RATES

I. Aggregate Price Deflators and Indices

See Table 1:01 "Projections of Selected Indicators of the U.S. Economy: 1979-1989."

II. Price and Cost Forecast of Specific Items (Annual Percent Change from Previous Year)

Item	Year				
	1980	1981	1982	1983-1987	1988+
Energy					
Petroleum products	60.0	30.0	20.0	12.0	11.0
Natural gas	13.0	15.0	15.0	20.0	12.0
Electric utilities	11.0	11.0	10.0	9.0	8.5
TVA electricity	10.8	21.2	16.0	10.0	8.5
Labor					
Petroleum	9.0	12.0	10.0	10.0	9.0
Mining	9.0	12.0	10.0	9.0	8.5
Manufacturing					
Nonelectric machinery	10.0	11.0	10.0	9.0	8.5
Electric machinery	11.0	12.0	11.0	9.5	8.5
Fabricated metal	10.0	11.0	10.0	9.5	8.5
Primary metal	9.0	11.0	10.0	10.0	8.5
Chemicals	9.0	10.0	9.5	9.5	8.5
Contract construction	10.0	11.0	12.0	9.0	9.5
TVA T&L hourly	7.4	9.5	10.0	9.0	8.5
TVA T&L annual	9.5	9.0	10.0	10.0	9.0
TVA annual salary	9.5	9.0	10.0	10.0	9.0
Materials and equipment					
Construction machinery and equipment	12.0	11.0	10.0	9.0	8.5
Stone and clay	13.0	9.0	9.5	9.0	9.0
Concrete	13.0	9.0	9.5	9.0	9.0
Iron and steel	8.0	11.0	13.0	9.0	8.0
Explosives	13.0	15.0	14.0	10.0	9.0
Chemicals and allied products	17.0	13.0	9.0	8.0	8.0
Nonelectric machinery	11.0	10.0	9.0	8.0	7.0
Electric machinery	11.0	9.0	8.0	7.0	6.5
Tires	15.0	8.0	9.0	8.5	7.5
Transportation					
Truck	20.0	18.0	16.0	12.0	10.0
Rail	19.0	15.0	14.0	10.0	9.0
Barge	12.0	11.0	10.0	8.0	7.0
Land	10.0	12.0	11.0	8.0	7.0
Cost of TVA debt	11.0	10.5	10.0	10.0	9.5

Derived From: Wharton Annual and Industry Forecasting Model, TVA Alternative, September 1980; Data Resources, Incorporated, Cost Forecasting Review, 3rd Quarter, 1980; TVA Office of Power and TVA Division of Personnel

71-531 O - 81 - 11

III. Economic Evaluation Rates

According to law, analysts at TVA must use several different economic evaluation rates. In addition, there are evaluation rates that have been adopted for administrative purposes. The current forecast of evaluation rates for different legal and administrative purposes is shown below. A discussion of each of the rates follows the table.

FORECAST OF AVERAGE ANNUAL ECONOMIC EVALUATION RATES IN PERCENT
October 1980

Rate	Year 1980	1981	1982	1983-87	1988+
TVA Office of Power economic evaluation rate	15.0	12.0	12.0	12.0	12.0
TVA Office of Power capital rationing rate - nonessential, deferrable investments	15.0	15.0	15.0	15.0	15.0
Water resource projects covered by Principles and Standards	7.125	7.375	7.625	-	-
Repayment of construction costs allocated to water supply purposes under Title III of Public Law 85-500, The Water Supply Act of 1958 (Section 301(b))	7.25	8.625	9.00	-	-
Appropriated funds (capital rationing and project decisionmaking)	10.0	10.0	10.0	-	-

The first rate is used in the evaluation of all Office of Power funded economic decisions. The estimated cost of capital is used in determining the economic evaluation rate. The capital rationing rate is used to eliminate those investments which are justified at the economic evaluation rate but which can be deferred until a later date. The higher capital rationing rate is based on a judgment of the rate required to limit investment to desired levels. The average opportunity cost of capital is considered in arriving at this judgment. These rates are reviewed and revised periodically as required by changing conditions and forecasts. Both of these rates include the effect of general inflation; thus, actual expected (nominal) cash flows that include estimates of price inflation are to be used with these discount rates.

The next set of rates apply to projects covered by Principles and Standards. Specifically, they apply "to the planning and evaluation of the effects of . . . water and land programs, projects, and activities carried out directly by the Federal Government and by State or other entities with Federal financial or technical assistance." TVA is explicitly covered by this application. This rate is revised annually by the U.S. Water Resources Council. This is a "real" rate which means that cash flows analyzed using this rate should be estimated in terms of present price levels (real prices). Only when a change in relative prices can be documented, should anything but present price levels be

used. The discount rate to be used in a specific case does not change over the period of analysis. The rate that should be chosen is the rate that is expected to prevail when the plan is presented for authorization or initial appropriation.

The fourth set of discount rates have application limited to the repayment of those construction costs for water supply purposes described in the table. They are also "real" rates. See above.

The final set of discount rates are prescribed by the Office of Management and Budget (OMB) for use in allocating all appropriated funds other than those covered by the two water project rates described above. The rate prescribed by OMB has remained constant for several years although OMB is presently in the process of reviewing both the rate and the discounting procedure used with it. OPB will issue a memorandum specifying any changes that may occur. This is also a "real" discount rate. See the discussion under the discount rates for water projects covered by Principles and Standards.

PROPOSED ELECTRIFICATION OF TRAINS BETWEEN ATLANTA AND CINCINNATI

Senator SASSER. I would like very much to get that. I note in the October 17, 1980, edition of "Energy Data," that you are quoted, Mr. Chairman, as saying TVA has been conferring with the Southern Railway and the L. & N. Railroad about electrifying their line between Atlanta and Cincinnati; that is, have some electric trains. Tell us how this could be achieved and what is the status of the negotiations? That sounds good.

Mr. FREEMAN. Yes, sir. The technology is available and in our judgment the economics are favorable also. From a business point of view this would be a sale of power of 100 to 200 megawatts which would help improve the financial situation of our power system. That is our first interest. Our second interest would be a major first step in getting this Nation off of oil and on to domestic energy sources. The situation is at the point where the question is: Can the railroads raise the capital to pay for their care of the project? TVA would finance the electric side of it on a basis no different than the way we serve any other industrial customer. There would be facilities that we would charge a facility rental. We do not have agreement because the railroads have not made a decision to go ahead, although they have informed us that the economics look good.

If I might speculate, I think the possibility of getting a subsidy from the Federal Government may be one of the reasons they are holding back. While it is still economical if they cannot get a subsidy from the Federal Government they may very well prefer to wait a little while longer to see if they can get one. This is just speculation on my part. But we have had some good discussions with them and I am hopeful that one way or the other within the next year that we can reach agreement and go forward. Interestingly enough there are no serious

technical problems, and the economics look good. In other words, today it would be economical to run the trains from Atlanta to Cincinnati on electric power supplied by TVA in our area and the other utilities in their area, rather than petroleum. But it is not happening because the capital is just not being allocated for that purpose.

EXCHANGE AGREEMENTS BETWEEN TVA AND UTILITIES

Senator SASSER. The General Accounting Office indicated, and you have also indicated in your testimony, Mr. Chairman, that TVA is considering some long-term exchange agreements with utilities in several States to dispose of power that TVA may not and will not use. Without asking you which utilities you contacted, I will ask you how many utilities TVA has actually contacted and how close are you to signing any agreements with these utilities?

Mr. FREEMAN. Mr. Chairman, I appreciate the intense interest in this subject on behalf of all the people in the valley because we are pursuing it for their benefit and for that reason only. We have been requested by the utilities that we are discussing this matter to keep these businesslike discussions private until they reach a stage where there is something to talk about. With your permission, in the interest of our customers, since, as I have indicated in my testimony, the potential here is for significant revenues to minimize the amount of future rate increases, that I feel it would not be in the interest of our customers to get into any of the details of those discussions at this time except to say that they are underway. If they reached an unsatisfactory conclusion, I would feel compelled to report that to you.

Senator SASSER. You mean you cannot even tell us this morning whether or not you are close to signing an agreement with any of them, or give us a ball park figure of how many you are talking to?

Mr. FREEMAN. Mr. Chairman, you have I am sure conducted negotiations yourself and one way to be sure that you are not close to an agreement is to say that you think you are. I just think that it would be irresponsible on my part to get into characterizing these discussions in any way because they do offer so much potential for minimizing the rates to our customers and I would not want to jeopardize them.

Believe me, as soon as this Board has anything to talk about on that subject, we will make it public because we think if you have something to talk about that is positive, that it will indeed be very good news for our ratepayers and we certainly do not want to withhold good news; we do not have very much of it.

CUSTOMER RATE INCREASES IN 1981 AND 1982

Senator SASSER. Speaking of bad news, the General Accounting Office in their testimony indicated, as I interpreted their testimony, that there would be further rate increases, in fact significant rate increases would occur in 1981 and 1982. Is it your view that we are going to be looking at significant rate increases in 1981 and 1982?

Mr. FREEMAN. I assume that our customers would define almost any kind of a rate increase as being significant. I would hate to characterize any rate increase as being insignificant. With the inflationary pressure

that we have I would have to say to you that our rates will of necessity have to be increased each year for the foreseeable future.

Our point is that as we finish the Sequoyah plant and the Watts Bar plant and get some stability from the lower cost generation into our system, that the rate of increase will go down. But as long as the economy is being driven by high inflation and the price of the coal that we have to buy for our plants keeps going up, the cost of everything that we buy and our labor goes up, TVA will be increasing the rates each year.

Senator SASSER. Let me ask you this question, and five bells have rung and I will have to go to the floor and this would be a good stopping place. I understood the General Accounting Office's testimony there would be a bulge of rate increases in 1981 and 1982 which would come about as a result of the power construction program.

Mr. FREEMAN. Yes, sir. We expect the rate increases to taper off in the 1984, 1985 period. So they are correct. The rate increases in 1981 and 1982 are going to be more severe than they will be in the later years. Most of our construction program will still be uncompleted. As we finish the units and get production out of them, the rate of increase is going to taper off.

INCREASES RESULTING FROM NUCLEAR CONSTRUCTION PROGRAM

Senator SASSER. What we are saying is we are going to be looking apparently at some more increases in 1981 and 1982 that will be attributed primarily to the nuclear construction program.

Mr. FREEMAN. And the increased price of coal and all the other inflationary pressures; yes, sir.

Senator SASSER. But after 1981 and 1982, the increases in price of fuel and other inflationary pressures will still be there but you think the rate increases will taper off.

Mr. FREEMAN. Yes, sir.

Senator SASSER. Well, Mr. Chairman, I want to thank you and the members of your Board for appearing here today.

I thank you for coming and we will be in touch with you again shortly. Thank you very much.

Let me say to the remainder of the witnesses that I am going to go to the floor, I will be gone I guess about 20 minutes and I will come back, we will resume and attempt to finish as rapidly as we can, but still cover the material in an adequate fashion.

[A short recess was taken at 12:30 for a vote.]

NONDEPARTMENTAL WITNESSES

TENNESSEE VALLEY INDUSTRIAL COMMITTEE

STATEMENT OF RON FOGEL, CHAIRMAN, TENNESSEE VALLEY INDUSTRIAL COMMITTEE

PREPARED STATEMENT

Senator SASSER. The committee will come to order and our next witness will be Mr. Ron Fogel, the chairman of the Tennessee Valley Committee.

Is Mr. Fogel present in the room?

Mr. FOGEL. Yes, sir.

Senator SASSER. Mr. Fogel, I might say that I have read your statement and I believe it raises some important issues which we need to review. So if you would proceed, we would be delighted to hear from you.

Mr. FOGEL. Thank you, Mr. Chairman.

[The statement follows:]

PREPARED STATEMENT OF RON FOGEL, CHAIRMAN

TENNESSEE VALLEY INDUSTRIAL COMMITTEE

THANK YOU, MR. CHAIRMAN. MY NAME IS RON FOGEL, AND I AM WITH THE MONSANTO COMPANY IN COLUMBIA, TENNESSEE. I AM HERE TODAY AS CHAIRMAN OF THE TENNESSEE VALLEY INDUSTRIAL COMMITTEE, AN ORGANIZATION OF VERY LARGE ENERGY-INTENSIVE INDUSTRIES WHICH PURCHASE THEIR ELECTRICITY DIRECTLY FROM THE TENNESSEE VALLEY AUTHORITY. WITH ME IS TOM MCCARTHY, SENIOR ATTORNEY WITH THE DUPONT COMPANY WHO ALSO IS CHAIRMAN OF TVIC'S LEGAL SUBCOMMITTEE.

WE ARE GRATEFUL FOR THE OPPORTUNITY TO APPEAR, AND WE ARE PARTICULARLY APPRECIATIVE OF YOUR EFFORTS TO ASSIST YOUR TENNESSEE VALLEY CONSTITUENCY THROUGH THESE HEARINGS. WE BELIEVE YOUR PRINCIPAL CONCERN--THE EXPANSION OF THE TVA POWER SYSTEM, AND ITS ATTENDANT COSTS AND BENEFITS TO THE RATEPAYERS--IS HIGHLY APPROPRIATE FOR A THOROUGH INVESTIGATION AT THIS TIME. FURTHER, WE WOULD OFFER WHATEVER SUPPORT AND ASSISTANCE TO YOU THAT WE CAN AS YOU GO ABOUT LOOKING INTO THESE VERY COMPLEX PROBLEMS FOR WHICH THERE ARE PRECIOUS FEW EASY SOLUTIONS.

THE TENNESSEE VALLEY INDUSTRIAL COMMITTEE IS VITALLY INTERESTED IN ANY PROCEEDINGS WHICH HAVE A BEARING ON EITHER TVA RATE LEVELS, OR THE MANNER IN WHICH THOSE RATES ARE APPLIED TO THE VARIOUS CUSTOMERS, BECAUSE OF THE TREMENDOUS IMPACT OF TVA RATES ON OUR MEMBER COMPANIES.

THE ELECTRIC POWER PURCHASES OF TVIC COMPANIES FROM TVA ACCOUNT FOR A SIGNIFICANT PORTION OF TVA'S TOTAL POWER OUTPUT--TYPICALLY AROUND 20 PERCENT, AND THIS YEAR AT CURRENT RATE LEVELS, AT A COST OF ABOUT $730 MILLION. THAT AMOUNT, TO BE PAID BY 31 CUSTOMERS, IS MORE THAN ALL OF TVA'S CUSTOMERS PAID FOR ALL OF THEIR ELECTRICITY AS RECENTLY AS FISCAL YEAR 1973. IN MANY CASES, THE COST OF ELECTRICITY FOR TVIC MEMBER COMPANIES IS ONE-THIRD OR MORE OF THEIR TOTAL PRODUCT COST.

WE, LIKE YOU, ARE CONCERNED WITH THE FUTURE DIRECTION OF THE ECONOMY OF THE TENNESSEE VALLEY. TVIC MEMBER COMPANIES ARE SIGNIFICANT CONTRIBUTORS TO THE REGIONAL ECONOMY. WE WOULD LIKE TO CONTINUE TO PLAY THAT VITAL ROLE IN THE 1980S AND BEYOND, AND POSSIBLY EVEN EXPAND ON IT. WE ARE IN THE VALLEY IN A VERY BIG WAY...THIS IS HOME TO US... MYSELF, A TRANSPLANTED PENNSYLVANIAN, AS WELL AS SOME 45,000 TVIC MEMBER COMPANY EMPLOYEES WHOSE LIVES AND LIVELIHOODS ARE DEEPLY ROOTED IN THE TENNESSEE VALLEY. WE CERTAINLY HOPE THAT THE ELECTRIC RATES CHARGED BY

TVA TODAY AND IN THE FUTURE WILL ALLOW OUR COMPANIES AND THE JOBS THEY REPRESENT TO REMAIN.

THOSE RATES, AS WE ALL KNOW, HAVE BEEN INCREASING DRAMATICALLY. TO LARGE INDUSTRIES THEY HAVE MORE THAN QUADRUPLED SINCE 1973. THE RESULT HAS BEEN TO PLACE MANY INDUSTRIES IN THE VALLEY AT A COMPETITIVE DISADVANTAGE WITH OTHER PARTS OF THE COUNTRY.

THE COMPANIES REPRESENTED BY OUR ORGANIZATION HAVE INVESTED BILLIONS OF DOLLARS IN THE VALLEY. EVEN IN AN ADVERSE RATE ENVIRONMENT, THAT MUCH MONEY IS HARD TO WALK AWAY FROM. BUT IN AN ADVERSE RATE SITUATION, OURS WILL NOT BE THE PLANTS WHICH GET THE CORPORATE ORDERS FOR EXPANSION. AS HIGHER COST PLANTS, IT IS OUR PRODUCTION THAT WILL BE THROTTLED BACK WHEN BUSINESS IS NOT GOOD AND, WE WILL NOT BE RUNNING AT THE CAPACITY FOR WHICH OUR PLANTS WERE DESIGNED AS LONG AS LOWER COST PRODUCTION ELSEWHERE IS ADEQUATE. SO IT'S NOT SO MUCH A CASE OF ABANDONMENT IN THE FACE OF VERY HIGH ELECTRIC RATES, ALTHOUGH THERE COULD BE SOME PLANT CLOSINGS. IT'S MORE OF A CASE OF THE PRODUCTION, BECAUSE OF HIGH COSTS, BEING DONE ELSEWHERE. AND THAT COULD MEAN LOST JOBS. IT'S ALSO A CASE OF THE EXPANSION TAKING PLACE ELSEWHERE. THAT MEANS NEW JOBS CREATED ELSEWHERE, RATHER THAN IN THE TENNESSEE VALLEY.

SO I HOPE THAT YOU WILL REALIZE THAT OUR CONCERNS ARE GENUINE. AND THAT THEY HAVE ECONOMIC CONSEQUENCES WHICH COULD AFFECT ALL OF US IN THE TENNESSEE VALLEY FOR YEARS TO COME.

THE ISSUES WHICH YOU HAVE RAISED, SENATOR SASSER, ARE DIFFICULT ONES INDEED, RELATING TO WHETHER TVA HAS COMMITTED TO TOO MUCH NEW GENERATING CAPACITY FOR THE FUTURE. SOME HISTORICAL PERSPECTIVE ON THE PROBLEM MIGHT BE HELPFUL. WHEN MOST OF TVA'S CURRENT COMMITMENT TO ITS PRESENT CONSTRUCTION PROGRAM OF GENERATING PLANTS WAS MADE--IN THE LATE 1960S AND EARLY 1970S--IT WAS, BASED ON THE EVIDENCE AT HAND, A REASONABLE DECISION. BACK THEN, THE IDEA WAS TO BUILD NEW NUCLEAR CAPACITY, WITH CONSIDERABLY LESS EXPENSIVE OPERATING COSTS, AND GRADUALLY, IF APPROPRIATE, PHASE OUT SOME OF THE OLDER, LESS EFFICIENT COAL-BURNING PLANTS. BUT IN THE INTERIM, THE WORLD CHANGED, AND I DOUBT IF ANYONE IN TVA OR ELSEWHERE COULD HAVE ANTICIPATED THOSE CHANGES. WE ARE ALL TOO FAMILIAR WITH THEIR SEQUENCE. THEY RANGE FROM THE ARAB OIL EMBARGO TO THE INCIDENT AT THREE MILE ISLAND.

SO THE DECISIONS MADE IN EARLIER YEARS, WITH THE BENEFIT OF 20-20 HINDSIGHT, TURN OUT NOT TO HAVE BEEN SO GOOD. OTHER UTILITIES, MEANWHILE, HAD THE SAME VIEW OF THE WORLD AS TVA. BUT MANY OF THE MASSIVE COMMITMENTS ON THE PART OF THE PRIVATE UTILITIES, MADE INITIALLY, WERE LATER CUT BACK. MUCH OF THIS CUTBACK WAS CAUSED BY REGULATORY INDECISION AND DELAY. PERHAPS IT IS IRONIC TO NOTE THAT THE REGULATORY

DECISIONS MADE IN THOSE DAYS FOR THE PRIVATE UTILITIES MAY HAVE BEEN MADE ON AN INCORRECT BASIS....BUT THEY MAY ULTIMATELY TURN OUT TO BE GOOD DECISIONS, BASED ON THE WORLD WE FACE TODAY. PRICE AND THE CONSERVATION ETHIC HAVE REDUCED THE ELECTRIC DEMAND CURVE ACROSS THE NATION.

THE WORLD WE AND OTHER RATEPAYERS OF TVA FACE TODAY IS ONE OF AN ENORMOUS INTEREST BURDEN BECAUSE OF THE MASSIVE AMOUNT OF PLANT WHICH IS UNDER CONSTRUCTION. THAT, REGARDLESS OF ONE'S VIEW OF THE APPROPRIATENESS OF TVA'S NEW CAPACITY UNDER CONSTRUCTION, IS AN INDISPUTABLE FACT.

DESPITE THIS INTEREST BURDEN, WE ARE UNSURE WHETHER TVA WAS CORRECT IN ITS DECISION TO POSTPONE THE CONSTRUCTION OF FOUR OF ITS REACTORS. THE SIMPLE FACT OF THE MATTER IS THAT WE HAVE NOT BEEN GIVEN ACCESS TO THE COST-BENEFIT INFORMATION ON WHICH THE TVA BOARD ACTED IN MAKING ITS DECISIONS.

THE TVIC POSITION, THEREFORE, HAS BEEN TO TAKE THE SITUATION AS IT EXISTS, AND RATHER THAN TO SAY WHETHER IT IS RIGHT OR WRONG, MAKE CONSTRUCTIVE SUGGESTIONS AS TO HOW WE, AND ALL OTHER RATEPAYERS, MIGHT GET SOME RELIEF.

WE HAVE FOCUSED IN ON THREE BASIC ISSUES, AND HAVE BEEN IN COMMUNICATION WITH TVA ON THEM OVER THE PAST SEVERAL MONTHS. IN SOME AREAS, WE BELIEVE, PROGRESS HAS BEEN MADE. IN OTHERS, THERE HAS BEEN NONE. LET ME QUICKLY SUMMARIZE THE KEY POSITIONS WE HAVE ADVOCATED.

FIRST, THERE IS THE HASTE WITH WHICH TVA CAN MAKE POWER RATE DECISIONS. IT IS, AS FAR AS WE HAVE BEEN ABLE TO DETERMINE, UNPRECEDENTED IN THE UTILITY FIELD TODAY. FROM THE TIME AT WHICH THE TVA STAFF PRESENTS THE FINANCIAL INFORMATION ON WHICH A RATE DECISION IS TO BE MADE...UNTIL THAT DECISION <u>IS</u> MADE...THERE NORMALLY IS ONLY A TIME LAPSE OF A COUPLE OF WEEKS. WE BELIEVE THAT THIS IS NOT SUFFICIENT TIME FOR OUR ORGANIZATION OR OTHERS TO WEIGH THE IMPACT OF THOSE DECISIONS ON PLANT OPERATIONS OR FAMILY BUDGETS, MUCH LESS QUESTION THEM. AS AN ALTERNATIVE TO THIS RAPID PROCESS, WE HAVE SUGGESTED THAT THERE BE A MINIMUM OF 60 DAYS BETWEEN THE TIME OF THE TVA STAFF'S PRESENTATION OF THE FINANCIAL SITUATION, UNTIL THE TIME THE TVA BOARD MAKES A DECISION BASED ON THAT SITUATION. WE PROPOSED THIS IN A LETTER TO TVA DATED AUGUST 22, AND IN A PRESENTATION TO THE BOARD AT ITS MEETING SEPTEMBER 2, BUT WE DO NOT YET HAVE A RESPONSE TO EITHER.

SECOND, WE HAVE RAISED QUESTIONS CONCERNING THE AMOUNT BY WHICH TVA'S EARNINGS SHOULD EXCEED ITS INTEREST CHARGES, AND WE ALSO HAVE ARGUED THAT THE AGENCY SHOULD RETURN TO CONSUMERS THOSE APPROPRIATE AMOUNTS WHICH ARE LEFT OVER FROM EARNINGS AFTER COVERING COSTS DURING

A PARTICULAR YEAR. IN THESE AREAS, THERE HAS BEEN SOME PROGRESS. THE TVA BOARD, IN EACH OF THE PAST TWO FISCAL YEARS, HAS IMPLEMENTED A POWER CREDIT MECHANISM WHICH HAS OR WILL GIVE BACK TO CONSUMERS CREDIT FOR MONIES COLLECTED IN EXCESS OF NEEDS AS DETERMINED BY THE BOARD. IN THE FISCAL YEAR JUST ENDED, THE AMOUNT THE BOARD DECIDED COULD BE CREDITED IS APPROXIMATELY $57 MILLION. AND THAT $57 MILLION BENEFIT PRESUMABLY WILL FLOW THROUGH TO RATEPAYERS EITHER IN THE FORM OF A REBATE, OR IN THE FORM OF A LOWERED, LATER RATE INCREASE.

OUR FINAL POINT RELATES TO TVA'S TREATMENT OF INTEREST ON ITS CONSTRUCTION DEBT, AND ON THIS ISSUE, WE HAVE MADE NO PROGRESS. BASICALLY, OUR BELIEF IS THAT IT IS INAPPROPRIATE FOR TODAY'S RATEPAYERS TO PAY THE COSTS OF TOMORROW'S GENERATING PLANTS AND ELECTRICITY, UNTIL SUCH TIME AS THOSE RATEPAYERS RECEIVE THE BENEFITS OF THAT GENERATING CAPACITY AND ELECTRICITY. THIS RELATES, OF COURSE, TO THE QUESTION OF CAPITALIZATION OF INTEREST ON THE CONSTRUCTION PROGRAM. HOW MUCH IS IT APPROPRIATE TO EXPENSE--OR PAY FOR THIS YEAR--AND HOW MUCH IS IT APPROPRIATE TO CAPITALIZE--OR, PAY FOR AFTER THE PLANT IS IN SERVICE?

WE HAVE STATED, AND CONTINUE TO BELIEVE, THAT TVA IS COLLECTING AN INORDINATE AMOUNT OF MONEY FROM TODAY'S RATEPAYERS, WHO IN FACT ARE PAYING FOR TOMORROW'S ELECTRICITY. TVA MAINTAINS THAT ALL OF THIS IS CAUGHT UP WITHIN THE TVA ACT AND THE COVENANTS TVA HAS WITH ITS BOND-HOLDERS. WE DO NOT BELIEVE THE ANSWER IS SO SIMPLE, AND THE LEGAL PEOPLE WE HAVE CONSULTED AMONG OUR 31 COMPANIES BELIEVE THAT TVA'S PRESENT POSITION WITH RESPECT TO CAPITALIZED INTEREST IS NOT MANDATED BY EITHER THE LAW OR THE BOND RESOLUTION. IT IS ALSO APPROPRIATE TO POINT OUT THAT THE DOLLAR AMOUNTS BEING CONSIDERED ARE MORE THAN THOSE INVOLVED IN THE LAST INCREASE FROM TVA. PUT ANOTHER WAY, IF TVA COULD HAVE ADOPTED THE POSITION SET FORTH BY TVIC, IT WOULD NO LONGER HAVE THE NEED FOR A RATE INCREASE THE SIZE OF THAT IMPOSED IN OCTOBER, OR CONTEMPLATED FOR APRIL.

IN FISCAL YEAR 1980, THE AMOUNT COLLECTED FROM RATEPAYERS WHICH WE BELIEVE WAS IN EXCESS OF TVA'S NEEDS WAS $436 MILLION. IN FISCAL YEAR 1981, WE BELIEVE AN ADDITIONAL $381 MILLION COULD BE CAPITALIZED AND THEREFORE NOT HAVE TO BE COLLECTED NOW. SO EVEN IN A TWO-YEAR SPAN, THE POTENTIAL AMOUNTS INVOLVED ARE STAGGERING. WE BELIEVE EVERY POSSIBLE ALTERNATIVE TO COLLECTING THEM FROM PRESENT RATEPAYERS SHOULD BE EXPLORED.

FURTHER, THE DISCUSSION OF TVA'S OVERCAPACITY RIGHTFULLY INCLUDES ALTERNATE CONSIDERATIONS SUCH AS SELLING POWER FROM THOSE PLANTS DEEMED IN EXCESS--OR SELLING SOME PORTION OF THE PLANTS THEMSELVES. THE INTEREST ISSUE BECOMES PARTICULARLY IMPORTANT IF ONE OF THESE ALTERNA-

TIVES IS CHOSEN. BECAUSE IF THAT WERE THE CASE, WE BELIEVE PRESENT TVA POLICY IS HAVING TODAY'S RATEPAYERS FOOT THE BILL FOR TOMORROW'S ELECTRICITY WHICH MAY BE SOLD ELSEWHERE.

MR. CHAIRMAN, THAT CONCLUDES MY STATEMENT, AND I WOULD LIKE TO THANK YOU FOR YOUR TIME AND ATTENTION. NOW IF THERE ARE ANY QUESTIONS, I WOULD BE HAPPY TO TRY TO ANSWER THEM.

TVA OBLIGATION TO BONDHOLDERS

Senator SASSER. Thank you, Mr. Fogel, and I appreciate your testimony here this morning.

Now, there appears to be a question regarding just what the TVA Act says and what TVA's obligations are to the bondholders. I presume that your organization has done some research on this, isn't that correct?

Mr. FOGEL. Yes, sir.

Senator SASSER. Would you supply this legal research for our record?

Mr. FOGEL. Yes, sir. I have with me Mr. Tom McCarthy, our legal chairman.

Senator SASSER. It would be very helpful for us to have that.

Let me say that this issue was first raised by your organization last spring and I carefully reviewed the issue.

[The information follows:]

IS THE TENNESSEE VALLEY AUTHORITY LEGALLY PROHIBITED FROM PAYING FROM BORROWINGS INTEREST ON CONSTRUCTION BORROWINGS?

The Issue

The TVA's annual interest bill has passed $1 billion. Half of the amount is interest paid on borrowings to finance TVA's current construction program. Electric utilities throughout the nation traditionally pay such construction interest from additional borrowings. These interest borrowings -- like the other borrowings to finance the other costs of the construction program -- are paid from rate revenues when construction is completed and the plant begins producing electricity. Thus, only the ratepayers who enjoy this electricity are asked to pay for it. TVA has stated that the TVA Act and the Resolution governing the Bonds TVA has sold prohibit TVA from paying construction (or any other) interest from borrowings. Their statements in this connection (e.g., the September 2, 1980 meeting of the TVA Board) suggest that they would pay such interest from borrowings if they thought they legally could. It should be kept in mind that the TVA's most recent rate increase (13% to produce an additional $401 million) would have been virtually eliminated if the $381 million of construction interest scheduled to be paid in 1981 from rate revenues would be paid from borrowings. More importantly, the TVA expects a further rate increase of approximately 13% to be necessary April 1981. This future increase, also, would not be needed if construction interest were paid from borrowings. This issue, in brief, is one of substantial importance to all Valley ratepayers.

The TVA Act

TVA has not set forth its position in a comprehensive legal opinion. However, based on TVA correspondence and discussions with the Tennessee Valley Industrial Committee, it seems that TVA bases its position that the TVA Act prohibits borrowing to pay interest on an interpretation of TVA Act section 15d(f). That section provides in pertinent part:

> (f) The Corporation shall charge rates for power which will produce gross revenues sufficient to provide funds for [inter alia]...debt service on outstanding bonds, including provision and maintenance of reserve funds and other funds established in connection therewith....

TVA maintains simply that the above language speaks for itself -- rate revenues must cover debt service, including interest. For completeness sake, another section of the Act should be mentioned here, although the TVA thus far has not relied on it -- section 15d(a), which provides in pertinent part:

> 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 831y of this title 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. [Emphasis added.]

In answer to TVA's argument, note that neither of the above-quoted provisions, nor any other provision of the TVA Act, tells TVA when it must include in its rates sufficient revenues to pay interest. TVA, therefore, is not precluded from postponing the collection of rate revenues to pay such interest by means of an interim borrowing. That is, TVA can borrow to pay the interest as it comes due with the intention of paying off that borrowing in the future from rate revenues. Indeed, such action would seem clearly to be within the purview of the last sentence of the portion of 15d(a) quoted above, which empowers TVA to "...pledge...its net power proceeds for the payment of the ... interest on said bonds...." (Emphasis added.) The language granting the TVA the power to issue bonds also seems sufficiently broad in scope to include such action:

> 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 $5,000,000,000 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 chapter, use the proceeds of such bonds for the construction, acquisition, enlargement, improvement, or replacement at 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. [Emphasis added.]

Finally, section 15d(f), the very section TVA relies upon, also reminds us that "primary objectives" of the Act include "...the objective that power be sold at rates as low as are feasible."

The Bond Resolution

With respect to the Bond Resolution, TVA focuses on the Resolution's section 3.2, which states in pertinent part:

> The Corporation shall fix, maintain, and collect rates for power sufficient to meet in each fiscal year the requirements of that portion of the present subsection (f) of section 15d of the Act which reads as follows:
>
> > (f) The Corporation shall charge rates for power which will produce gross revenues sufficient to provide funds for [inter alia]... debt service on outstanding bonds, including provision and maintenance of reserve funds and other funds established in connection therewith....
>
> For purposes of this Resolution "debt service on outstanding bonds," as used in the above provision of the Act, shall mean for any fiscal year the sum of all amounts required to be (a) paid during such fiscal year as interest on Evidences of Indebtedness, (b) accumulated in such fiscal year in any sinking or other analogous fund provided for in connection with any Evidences of Indebtedness, and (c) paid in such fiscal year on account of the principal of any Evidences of Indebtedness for the payment of which funds will not be available from sinking or other analogous funds, from the proceeds of refunding issues, or from other sources; .... [Emphasis added.]

First, TVA points to the underlined phrase "in each fiscal year" in the introductory sentence of the provision. TVA contends that phrase is the controlling element of the provision, and that it mandates rate revenue coverage of interest in the year in which the interest becomes due. A better, more logical view is that the controlling phrase is "the requirements of...subsection (f) of section 15d of the Act". That is, what specifically must be done in "each fiscal year" depends upon what are section 15d(f)'s

requirements. And as discussed earlier in this memorandum, the requirements of section 15d(f) do not include a directive telling the TVA when -- i.e., in which year -- it must cover interest from rate revenues.

TVA then, however, points to the above-quoted definition of "debt service" in section 3.2, specifically the portion stating that debt service includes "for any fiscal year...all amounts required to be (a) paid during such fiscal year as interest...." Those words, they contend, speak for themselves and mean that interest must be paid currently. (TVA also refers to the Resolution's section 2.2 for support; but this section simply repeats portions of TVA Act section 15d(a) pertaining to net power proceeds, which is quoted on page one of this memorandum.) TVA further argues that the following phrase, from the definition of "debt service" quoted above, only applies to part (c) of that definition:

> ...for the payment of which funds will not be available from sinking or other analogous funds, from the proceeds of refunding issues, or from other sources;....

This, they maintain, indicates that interest is not to be paid from borrowings, otherwise the phrase would have modified (a) as well as (c). This interpretation is not unreasonable, but neither is it the only interpretation. The phrase last quoted above from 3.2 can be read as referring back to the term "all amounts required" in the same sentence and applying, therefore, to (a) and (b) as well as (c) of the definition. More importantly, the Resolution contains another, more explicit provision on this subject, section 3.1, which states:

> Payment of Bonds. The Corporation shall duly and punctually pay or cause to be paid from Net Power Proceeds (or at the option of the Corporation from the proceeds of refunding obligations or other funds legally available for that purpose) the principal and any applicable redemption premium of every Bond, and the interest thereon, in accordance with the provisions of the Bonds and any appurtenant coupons. [Emphasis added.]

Very clear, unequivocal language -- the TVA can pay at its option, from the proceeds of refunding obligations -- which are, of course, additional borrowings -- the interest on any Bond. TVA really has no argument against the plain language of 3.1. They note that 3.1 does not purport to alter 3.2; but neither does 3.2 purport to modify 3.1. They also characterize 3.1 as a general covenant, but why that would be significant is neither explained nor apparent.

Modifying the Bond Resolution

TVA Chairman S. D. Freeman, at the September 2, 1980 TVA Board Meeting, indicated that amendment of the TVA Act by the U.S. Congress would be futile with respect to this interest issue because the TVA "...can't crawfish on a commitment to existing bondholders...." This statement ignores Article VII of the Resolution, which provides several procedures for modifying the Resolution, if such modification is necessary. The most direct is section 7.3, which provides for amendment by securing the consent "...of the holders of at least 66-2/3 percent in principal amount of the outstanding Bonds to which the modification or amendment applies...." The Federal Financing Bank, another U.S. Government entity, owns well over 2/3 of the Bonds, so the FFB could give this consent itself. If this would be deemed unfair to the public holders of Bonds, their bonds could be excluded from the application of the amendment, and the interest thereon paid from revenues.

Conclusion

The pertinent provisions of the TVA Act do not prohibit TVA from postponing rate revenue coverage of construction interest by means of interim borrowing. To the contrary, such action would be comfortably within the purview of the provisions; indeed, they appear to contemplate it. The Bond Resolution contains a provision explicitly authorizing borrowings to pay interest; and to the extent that other provisions may create ambiguity or even conflict, this can be remedied by an appropriate modification.

CAPITALIZATION OF NUCLEAR POWERPLANT CONSTRUCTION

Senator SASSER. Now, to get down to the bottom line, Mr. Fogel, I would like to ask you some specific questions relating to the interpretation of the TVA Act and the bond resolution. Now, as I understand it, your organization is proposing that TVA capitalize the construction of the nuclear powerplants, the ones under construction, and that they not start paying on the interest until such time as the plants come on line and start producing revenue, is that correct?

Mr. FOGEL. Yes, sir, that is correct. And I might add, sir, that that is what is done routinely around the Nation in the utilities. In fact, it is good business.

ADVANCE PAYMENT OF INTEREST COSTS

Senator SASSER. Is there any other utility other than the TVA that pays interest costs prior to the generating facility coming on line and producing electricity, to your knowledge?

Mr. FOGEL. Yes, sir. If a particular utility is in a very serious cash flow situation, then the public service commissions, and with industry's support, by the way, have gone ahead and said, "We need to put some of the interest into the rate base so that they can have a sufficient cash flow to keep operating."

Senator SASSER. I see.

Mr. FOGEL. But only in areas of critical need.

BORROWING OR DEFERRING OF INTEREST PAYMENTS

Senator SASSER. Now, as I understand, the question in dispute here between your organization and TVA is the belief of TVA officials that section 15(D)(f) of the TVA Act prevents borrowing or deferring interest payments. TVA believes that rate revenues must cover all costs, all current costs, including interest costs. Now, do you agree that this provision of the TVA Act precludes the agency from postponing the collection of revenues to pay for interest through interim borrowing?

Mr. MCCARTHY. Senator, we disagree with their position. We don't think they are included in borrowing.

ANNUAL INTEREST PAYMENTS

Senator SASSER. TVA feels that section 3.2 of the basic bond resolution mandates rate revenue coverage of interest each year; do you disagree with that.

Mr. McCarthy. Yes, sir, we disagree.

Senator Sasser. Well, section 3.1 of the bond resolution provides that TVA can pay at its discretion the interest on bonds from the proceeds of the funding obligations, which indicate additional borrowing. Now, what is your interpretation of this section?

Mr. McCarthy. We consider that to be a very clear, unequivocal statement indicating that the TVA can borrow with interest. That is what funding obligations are.

INTEREST PAYMENT DEFERRALS PRECLUDING NUCLEAR PLANT ACTIVITY

Senator Sasser. Could we defer these interest payments until the nuclear plants came on line without endangering the financial stability of TVA, that is the power program?

Mr. Fogel. Yes, sir. We would not recommend anything that we thought would endanger their financial ability. It is our opinion that it is good business. There are a number of factors that indicate that TVA believes the same. For example, their nuclear fuel lease, that they entered into, was an attempt to try to avoid having today's customers pay interest on nuclear fuel.

Another example, the new office building in Chattanooga, TVA is going to lease that so as to allow their interest to be charged as they utilize the facility.

It is in our mind good business and it would not damage their financial viability.

AVAILABILITY OF FEDERAL FINANCING BANK

Senator Sasser. Now, TVA says that even—as I understand their argument—that even if they could do this, if they could defer interest payments under the TVA Act, that in so doing they run the risk that if they were put out of the Federal financing bank that allows them to get money at the lowest possible interest rate, that is the rate that the Federal Government pays, if they should lose their access to the Federal financing bank, that by deferring these interest rate payments, this would endanger their ability to get a trip A bond rating or whatever the rating that is necessary to get the lowest interest cost in the future, should they be excluded from the Federal financing bank. What do you say about that?

Mr. Fogel. Well, sir, we don't believe that that will happen in the way TVA envisions it. Now, admittedly the Federal financing bank may in the future not be available to TVA.

FUTURE TVA ACCESS TO FEDERAL FUNDING BANK

Senator Sasser. What if we got a commitment, and I have been thinking about this, what if we got a commitment out of this new incoming administration that they would continue to allow the Tennessee Valley Authority to have access to the Federal financing bank over the next 4 years. What position would that put us in?

Mr. Fogel. I think that would be proper, and I would like to see that happen, as far as TVA is concerned. I think that if you consider the fact that TVA borrows money from the Federal financing bank at an

71-531 O - 81 - 12

interest level that is less than the inflation rate, and I have asked TVA that question and been given that answer, "Yes, that is true, we borrow money less than at the inflation rate." It is inconceivable they wouldn't go ahead and try to borrow the money for the plants in construction, even the interest.

Senator SASSER. Well, I am contemplating addressing this issue to the new President-elect and ask for a commitment from him that TVA be included in the Federal financing bank during the term of his administration. We haven't firmly made up our minds on that but we are looking at that question very carefully, trying to find some way to get these interest payments to construct these nuclear plants off the back of the ratepayers in the Tennessee Valley area.

Now, one final question, Mr. Fogel. Chairman Freeman today indicated that the real question was not so much the cost of the power but availability of the power, that was what would be the attraction for industry in the Tennessee Valley in coming years, and that has been the attraction at least in the last year or year and a half.

REASONS FOR INDUSTRY ATTRACTION IN TENNESSEE VALLEY

What is your reaction to that? Is the availability of power the attraction or is it the cost of the power that is attractive?

Mr. FOGEL. Of course industry, when looking at a place to locate or expand, looks at both short- and long-term price and availability. But I will say that the world again has changed, and although 2 years ago most of us in the energy field felt there were going to be serious shortages in electrical supplies in the early 1980's and now because of price and conservation that situation has completely changed, and the point you made earlier with Mr. Freeman, was I am not sure there's going to be a need to sell all that power in the short range. If you look far enough down the road, it does appear that unless there is some new technology that comes on stream pretty soon, some of the power companies in this country will be in a very, very tight spot.

As far as what our company or other companies think, I can say it is the environment of the administration, of the utilities and the public service commission, if that happens to be the case, that is looked at just as strongly as availability or cost.

Senator SASSER. Mr. Fogel, thank you very much for coming here this morning and giving us the benefit of your views and those of your organization.

Mr. FOGEL. Thank you.

TENNESSEE VALLEY ENERGY COALITION

STATEMENT OF BILL TROY, EAST TENNESSEE ENERGY COALITION

Senator SASSER. Our next witness this morning is Bill Troy, representing the East Tennessee Energy Coalition.

Mr. Troy, if you would come forward.

Mr. Troy, we are delighted to have you here—I can't say this morning, it has become this afternoon.

I do recall your testimony before the Budget Committee hearings which I held in 1979 and it was very, very helpful.

I might say this: We have had other requests to testify at the hearings today and I want to hear from everyone who would like to testify. We have a problem that because of the lateness of the hour, in fact, the majority leader has called a meeting of all Democratic Senators at 2 p.m., that I would ask you please to telescope your testimony just as much as you possibly could without losing some of the thrust of your thoughts.

So you may go ahead, Mr. Troy.

CONSTRUCTION WORK IN PROGRESS

Mr. TROY. Thank you, Senator.

First, before I get to the testimony that you have before you, I didn't know that the subject that Mr. Fogel just raised was going to come up. The construction work in progress issue has also been a concern of ours. We figure that for the last year that I looked at those figures, that if the interest were not treated the way it is now, that we would be talking about something like a 13-percent savings in the rates to ratepayers, if the interest were treated as it is in some 35 other jurisdictions in the United States.

RESIDENTIAL RATE USERS

As far as residential rate users are concerned, I had been happy to give to you, I don't have it with me, but there are studies that have been done in other States having to do with time value of money in consumers' pockets that show clearly, and that has been accepted by public service commissions in other places, that even if the interest costs are capitalized and plants that come on line later in the day are more expensive because of that procedure in themselves, ratepayers save because the money is more valuable to them in their pockets right now than it is at that later time. And I had been happy to send that material to you because I think it is germane to that question, and I am happy to know that you are concerned about that because it is a concern of ours and something that in these times is in our thoughts.

Senator SASSER. We would very much like to have that material. If you will send it forward, we will make it a part of the record.

Mr. TROY. First, I would like to thank you on behalf of the Tennessee Valley Energy Coalition, and just correct that if I may, these initials get difficult over the years. The name of our organization is the Tennessee Valley Energy Coalition. We are a coalition of independent groups throughout the middle-east Tennessee area whose members face the toughest time of anyone trying to pay for the rising cost of energy. In our number we count the elderly, organized labor, minority organizations, church groups, as well as low-income community organizations from both the inner city and the countryside. These people and thousands like them are the backbone of our region, we believe. It is their labor that has helped lay the foundation for the prosperity we enjoy today. And yet at this moment the vise grip of economic conditions is gradually but surely constricting these people's very ability to provide for themselves and their families. It is within this context that a

tremendous increase in energy cost becomes so critical, and nowhere is that increase steeper or more sharply felt than the monthly utility bill.

CRISIS IN RESIDENTIAL ELECTRIC RATES

It is no exaggeration, we believe, to say that we are sailing squarely into the teeth of a serious crisis in this matter of residential electric rates. We are moving swiftly past the point where a recital of recent rate increases alerts us to more problems in the future. The future for many of our people is already here.

Four or five years ago, when I first became involved in these matters, occasionally you might find an elderly person whose winter electric bill was in excess of their monthly check. Today that is not at all uncommon. Past studies of low-income people in the Northeast have revealed that people will do without food in order to pay utility bills. That is now happening in our area.

I know of at least two people who have recently changed residences because of the cost of electricity. Last winter the halls of our community action centers were so jammed with people applying for emergency fuel assistance that all their other functions came virtually to a standstill, and yet we stand only at the beginning of a decade when according to the TVA, electric rates could rise as much as 15 percent a year. You get lots of answers to the question, what we look forward to, and just listening to today's testimony, I thought I heard we can expect to bulge in 1981 and 1982 and then the interest costs will go down, then they will go up. I suppose this is like an estimate like the one Mr. Freeman has given in the past.

It is the purpose of our organization to do everything within the power of our citizens to ease this burden on ourselves and on others, and we believe before other remedies are sought, every opportunity ought to be taken to reduce costs within the power system itself. That is why we are concerned about the question of possible overbuilding.

Two years ago the average ratepayer was only barely aware of the connection between TVA's new powerplant construction and his electric bill, but the recent sharp escalation in the rates has changed this. The ratepayer has discovered interest costs and now understands that debt service on borrowing, for over 25 percent of the electric bill, that this is the fastest rising cost in the whole system, and that building no more plants than absolutely necessary will reduce the increase in his bill.

OVERBUILDING BY TVA

Is TVA overbuilding? First, and I will try to telescope this, you need the facts in order to make a judgment about that. It is not clear to us why citizens and ratepayers should have to file a freedom of information request to get the documents on which decisions like the one in July were made. That is exactly what happened to us. We were told that data would be open to misinterpretation, and we feel we have the right to make even misinterpretations on that, particularly when it regards so crucial a subject.

Second, based on what we do know, and accepting the fact that load forecasting is an inexact science, and admitting we have no more special wisdom than anyone else, we do see numerous signs that overbuilding may be taking place. The first signs are the two GAO reports themselves. While TVA disputed the findings of the first 1978 report, they soon came to similar conclusions.

Senator SASSER. What is that, Mr. Troy? I didn't hear that.

Mr. TROY. After the 1978 GAO report, my memory of that meeting was we heard very much the same story from TVA that we heard today.

BOND CEILING INCREASE REQUEST

Senator SASSER. What we heard in February 1979 is if we didn't go ahead and raise the bond ceiling to $30 billion and let it go ahead full tilt with the nuclear power construction, I was told by the Board that at those hearings that "The lights would go out in the valley," that they were not overbuilding, that their load forecasts were correct, and then 3 months later they deferred four nuclear-generating plants.

Mr. TROY. That is exactly what I am referring to.

Today's report seems to us at least poses the same problem. I refer specifically to the fact that the meeting of lower forecasts could result in up to 50 percent oversupply. Now, we have heard eloquent testimony earlier to the fact that probably won't be the case, but it is a very uncertain environment and it may well be. Perhaps the most serious evidence in our possession surrounds the decision made in July. In 1979, after the original GAO report was published, TVA's own forecasts went down from 7 percent to 4.5, and as a result, 4 reactors were delayed. Yet this year, when demand projections went down even farther, to 2 percent, that may be a low figure between now and the year 2000, no similar decision to delay or cancel was forthcoming even though two other reactors at Phipps Bend and Yellow Creek could feasibly be delayed or canceled, and TVA's own medium rough forecast, subsequently unearthed, indicated that 4 plants could be canceled and 2 delayed and still give TVA adequate reserve power through the rest of the century.

SAVINGS TO RATEPAYER

The possible savings to the ratepayer was dramatically underscored for us in October when TVA released its new cost estimates for the whole construction program. Out of the new maximum figure of $31.6 billion, some $14 billion would be saved on the four plants now deferred, another $6 billion or more would be saved if it became feasible to scratch the other two plants at Yellow Creek and Phipps Bend. Now in light of today's testimony by GAO, which was not available to us when we put the testimony together, the thrust of that testimony, as I gather it, is the savings gained from canceling wouldn't be that important. To which I would like to make two remarks: One is any savings to the residential ratepayer at this point in time is significant. Mr. Freeman said the rates might go down by 7 percent by 1990, as though that was not consequential. That is consequential to people who cannot pay their bill today. When we testified at the PURPA hearings,

we plugged very hard for a change in the residential preference provision, which wouldn't save very much more for people, but anything you save is important for people today. That is why this question is so important.

The second thing that is not accounted for there is unknown costs that may occur in the future; the doubling of the cost estimates for the program, as I understand it, in October, since January, the doubling from January to October in the cost estimates had a great deal to do with provisions for what happened in the wake of Three Mile Island and other nuclear accidents. There is no assurance that similar things won't happen in the future, is all I am saying.

These signs——

CONTINUED ESCALATION OF CONSTRUCTION COSTS

Senator SASSER. The fact is you have learned from the past, there would be reasonable assurance these things would happen in the future. The whole history of the nuclear construction program has been plagued with horrendous cost overruns, not just with TVA, but with other projects. Then we have sums imposed on the additional regulations and time delays and stretch-outs as a result of Three Mile Island.

So if we look at history, I think we can expect the cost of construction to continue to escalate much faster than the rate of inflation.

Mr. TROY. Well, that would seem to be the trend. We feel like that should at least be taken into account when numbers are given about how negligible the effects of canceling or delaying would be on the rate increases in the future.

These signs, taken together with Representative Gore's recent observation that the Valley would have to attract 146 percent of all the new manufacturing jobs in the Nation before the year 2000 to justify current projections, are at least enough to give you pause. They don't prove the case because as TVA reminds us, this is the case where absolute certainty is not to be had. But taken together they begin to form a body of serious reservations that must be taken seriously when so much ratepayer money is involved.

EXPORTING OF TVA POWER

The prospect of TVA's exporting power is also a concern of ours. At the current level, people simply don't understand why they should pay ever-increasing rates to produce power for someone else. At the very least, it seems to us that if it is consistent with the TVA Act for firm power sales to be made outside of normal interchange agreements, then that power must be sold not at system cost but at the costs of the latest plant on line, the plant that is producing the excess power. Otherwise, the valley ratepayers will in fact be subsidizing the cost of power for people outside the region.

Since that cost would be the highest in the system, it would seem to make the power more difficult to sell. Moreover, unknown costs should be included in export prices as they occur. That, too, will make the price less competitive. If demand should remain flat or fall due to eco-

nomic conditions in conservation and other markets, this very concern that you raised earlier today, is there not the chance that down the road we cand find ourselves with excess capacity and no buyers?

Even supposing that it is possible to guard against all these conditions in negotiations with other utilities, we believe that it is still important to warn against viewing export as a safety valve for possible overbuilding, even if that overbuilding is done with the best of intentions. The climate is too uncertain for that. The way things look now, it isn't certain there will be a market for power that will definitely come on line during the next few years, not maybe.

CREATION OF EXCESS CAPACITY

The problem must not be complicated by creating excess capacity. If ratepayers are restless now, it is a sure bet that large amounts of excess capacity sitting idle in the future while interest costs continue to mount will drive them crazy.

In taking these views, Senator, we don't want to be misunderstood as people who are opposed to economic growth and job creation in the Tennessee Valley. Since most of our members are part of the industrial work force or have been in the past and may have children who are today, it would be contradictory for us to take such a position. On the contrary, we want very much to know there will be an adequate power supply for economic growth. It simply seems to us there is evidence that more than enough capacity is being built to meet those needs, and since new plant construction is the most expensive and inflationary part of the system, we don't want to pay for more than we need if possible.

The time has come when some balance must be achieved between the availability of power and people's ability to pay for it. We are fortunate that presently such a balance still leaves room for substantial economic progress. TVA is right in saying their rights for industrial development will remain competitive with the rest of the country. The location of two large plants in Tennessee supports this view.

TECHNOLOGY DEVELOPMENTS AND RENEWABLE RESOURCES

TVA has some useful concepts about the kind of economic growth we might see in the region. We are especially impressed with the calling for technology developments and renewable resources.

There are several advantages to that economic growth scenario. It taps our indigenous resources and is thus fitted to our region. Conservation and solar activities have been shown to have a much higher job creation potential than conventional power production. Industry based on these activities should reinforce that effect. Perhaps most important, economic growth of this sort creates jobs that are truly productive, adding to the national wealth in permanent savings rather than wasting our resources in inflationary, capital-intensive activities.

We believe the time is soon coming when this scenario will cease to appear as desired. Despite the fact that it sails against the present time, sheer economic circumstance will dictate its acceptance eventually just as hard-pressed consumers are now open as never before to solar power and other energy ideas that can help them save money.

SUMMARY REMARKS

In summary, let me repeat our major concerns. Residential users of TVA electricity are about to enter a period of unprecedented hardship unless ways are found to ease the costs that have already forced many to do without other necessities in order to meet utility payments. If TVA is overbuilding and there is serious indications pointing in that direction, then because construction costs are the primary controllable cause of today's rising utility costs, eliminating overbuilding is the best potential source of savings within the power system itself.

Consequently, we urge the TVA and the appropriate Congressional oversight committees to review once again TVA's construction program with a view to abandoning at the earliest possible date any construction that a fresh analysis would indicate is unnecessary to provide for the economic growth and well-being of the region.

Let me say in conclusion that we are glad to have leadership at TVA who have proven in the past their openness to moving in these directions.

It is a far cry from the old days when this Board's predecessors put all this business into place and all you heard was 7 percent annual rate of growth in electricity demand forever and nuclear power cost equivalent of $3 per ton of coal. Not only has this Board adapted to new circumstances when that was appropriate, they have also headed the agency in new and constructive directions in many areas.

We trust they will continue to operate in this manner especially in regard to their promise to keep the load forecast under constant review.

Our criticism should in no way be taken as a challenge to the TVA idea either. We believe in public power. If anything, we believe it should be more public than it is. TVA is not in trouble today because it isn't businesslike enough. It is in trouble because in the past two decades it has acted too much like any other investor-owned utility in America.

In our view, the bill is now coming due for that mistake, and what we need are people willing to make the changes necessary to steer us through the serious dilemma we find ourselves in today.

Thank you very much.

Senator SASSER. Thank you, Mr. Troy, we thank you for coming up and giving us your views today. They have been very, very helpful.

STATEMENT OF MARTIN SIR, LAWYER, FAYETTEVILLE, TENN.

Senator SASSER. Our next witness is Mr. Martin Sir, a distinguished lawyer from Fayetteville, Tenn.

Mr. Sir, if you would come forward.

Welcome, Martin, glad to have you.

Mr. SIR. Thank you, Senator. Everyone in the valley I know, at least in my hometown is certainly appreciative of you having these hearings. As Mr. Troy pointed out, they are facing some critical times with TVA's direction.

My response is primarily as a layman. I have been enlightened this morning but I still think my remarks are accurate.

Senator SASSER. Thank you very much, Mr. Sir. We appreciate you coming here this morning and this afternoon I might say, and giving us the benefit of your views. They are very interesting and very provocative and thought-provoking and I am sure we will be discussing these issues with you in the future. Thank you.

Mr. SIR. Thank you.

[The statement follows:]

PREPARED STATEMENT OF MARTIN SIR

Gentlemen:

I want to congratulate you for having these hearings today. They show your concern for critical problems the people in the Tennessee Valley face as a result of Tennessee Valley Authority overbuilding in electric capacity and in putting the load of paying for this capacity on the people.

The ability of these hearings to have any beneficial effect rests on one basic question that is national in scope.

That question is whether TVA and other utilities must continue to build more and more plants and sell more and more power in order to stay in business; thereby possibly stalling wide-scale conservation until past the year 2000.

This question points out a contradiction for anyone attempting to formulate energy policy. A good example of the contradiction is in recent statements by TVA Chairman Freeman and by TVA action contrary to his statements.

For Chairman Freeman said that conservation and decentralized energy sources should be the new TVA yardstick and should be given equal billing with centralized generating facilities.

And, he stated, these alternatives would be more cost-effective in supplying short and long-term energy needs. In fact, he said energy gained from conservation is ten times cheaper than building a new generating facility.

Then, he made the dire prediction that without equal spending on these alternatives, TVA and other utilities would be on a "suicide path"; unable to control costs.

Yet, TVA has held back the development of decentralized sources by waiting four years to implement the requirements of the 1976 Public Utilities Regulatory Policies Act (PURPA) which permits distributors to sell decentralized power to TVA.

And this year, TVA will put only 2% of its power money into conservation and decentralized alternatives.

With anticipation high for these alternatives in the Valley, as well as in the Nation, this Congress and the public ought to know why TVA is holding back. Likewise, we ought to know to what extent, if any, as a result of investments already made, is TVA now locked into a construction program for large surpluses of electricity to the extent that conservation and decentralized energy sources will not pay?

The importance of answering these questions cannot be stressed enough because if TVA and our nation are locked into more construction without equal billing for conservation, we can anticipate all our industry ending up in the same internationally competitive position as the Detroit automobile industry.

For while our industry would be continuing its extravagant use of energy, Japan and Western Europe will be continuing to develop conservation and cogeneration techniques which have already enabled them to save nearly one-half the amount of energy consumed by our industry in the production process.

If this wasteful trend continues, our productivity will suffer, causing even more joblessness in the Valley and our Nation.

Also, conservation and decentralized alternatives offer TVA an opportunity to confront its powerlessness to control the price of electricity. TVA's control of prices and custody of the yardstick has passed in the last 15 years to those from whom TVA is forced to buy ever more costly raw materials and to those whom TVA is forced to pay ever more higher interest rates. As Chairman Freeman has indicated, conservation and decentralized energy sources can help TVA recapture the yardstick by lessening these people's control.

Similarly, these alternatives would help deal with the growing sense of powerlessness within the people of the Tennessee Valley since it would enable communities to have more local control over their power sources.

This desire of communities is apparent from the increased clamoring of mayors, like that of my own mayor in Fayetteville, Tennessee, who actively is seeking a waste-to-energy conversion plant in our area similar to the one in Gallatin, Tennessee.

Gentlemen, a proper evaluation of these problems cannot tolerate the type of presentation TVA made to the Tennessee Valley Congressional Caucus in September. For in TVA TODAY: AN UPDATE, at the section entitled "Is TVA Building The Lowest-Cost System", they muddled their own question by selecting from a range of comparative costs on coal and nuclear plants, those figures most favorable to their policy. And, the question was further muddled by their failure to compare the costs of either coal or nuclear with conservation or decentralized sources.

This report was not like the TVA I have known for I have a deep appreciation for the many good things TVA has done and continues to do.

Therefore, I propose to you today that you seek a detailed scientific analysis of these questions:

1. Has TVA reached the point in its construction program that conservation of electricity is more costly than building new facilities?

2. What is the potential for wide-scale conservation and decentralized alternatives to reduce construction needs?

3. In light of cogeneration planned at Watts Bar nuclear plant, what is the potential for cogeneration at TVA's other thermal generating plants to reduce construction needs?

Since TVA's present course has deep social implication, these additional questions should be answered also:

1. What is the potential for conservation and cogeneration to increase the productivity of Tennessee Valley industry and thereby improve its competitive position in the world market?

2. What is the potential of decentralized facilities to improve local economies through wider dispersal of TVA capital investments?

3. If TVA must continue on its present course, what is the potential for other financing methods or for conservation to relieve the overtaxed middle-income citizen, the poor, and the elderly from bearing most of the cost of the present construction?

Gentlemen, I do not adovcate a halt to TVA's present construction; rather, if it is not too late, I advocate a slowdown and a balance with more conservation and decentralized alternatives.

And, there should be frequent re-examinations of the questions I have posed, since the comparative values of conservation and decentralized alternatives will change with the steady rise in energy costs.

It is incumbent upon this Committee and the Congress to seek this information; hopefully, to alleviate the powerlessness of TVA and of the people in the Tennessee Valley to deal with this basic aspect of our lives.

Thank you very much.

KNOXVILLE UTILITY BOARD

STATEMENT OF C. H. DEAN, GENERAL MANAGER, KNOXVILLE UTILITY BOARD

CONSTRUCTION OF NUCLEAR POWERPLANTS

Senator SASSER. We have one other witness, Mr. C. H. Dean, the general manager of the Knoxville Utility Board.

Mr. Dean, would you come forward please and summarize your testimony as best you can.

Mr. DEAN. Unfortunately, Senator, I didn't expect to have more than 3 or 4 minutes anyway, so I will get you to your meeting on time.

I am C. H. Dean, Jr., general manager of the Knoxville Utility Board, one of TVA's largest power distributors. I am a licensed professional engineer and have served on the board of the American Public Power Association, and as president of the Tennessee Valley Public Power Association.

My statement is in support of the construction of all of TVA's nuclear powerplants.

President Carter has stated that achieving energy independence is the moral equivalent of war, but there are apparently people in high places who do not share his enthusiasm for this battle. These people seem to be preoccupied with the fact that TVA may have planned for more power than the valley will need. On the other hand, many of us who have to face an uneasy public every day feel that all of the TVA nuclear powerplants which have been sited and started, including units which are currently being delayed, should be built as quickly as possible.

We feel that this can be done without penalizing the citizens of the valley, which Senator Sasser is properly worried about, and to the great ultimate benefit of the country as a whole. In short, we do not fear a surplus of electricity in the Tennessee Valley. If TVA has made an error in projections, the error is on the right side of the ledger.

Any nuclear plants which apparently will supply power in excess of the needs of the TVA should be completed by TVA forces with Federal funds. When these plants are completed—and this always takes longer than anyone suspects—the plants would constitute a national electric reserve. The energy generated by these plants would be sold at a price based on their final cost and the price of fuel at that time. Top priority for this energy would go to Federal installations related to defense, such as Oak Ridge, Paducah, and Huntsville.

ALTERNATE FUELS

Next in line would come utilities still burning oil and natural gas wherever they are located, since wheeling blocks of power is now quite feasible. Any excess power could probably be easily sold because, except for hydro, nuclear energy is still the least expensive electricity currently available. As an example of this, I am told that it costs the ratepayers a half a million dollars extra a day for replacement power every day that any one unit at Browns Ferry nuclear plant is out of service.

A nation which can put a man on the Moon ought to be able to work out the details of this arrangement. To ease the minds of persons living in other parts of the country, it should be made clear from the beginning that any profits reached from the sale of Federal nuclear power would be returned to the Treasury to repay contractor costs and interest on the capital investment. In this way, the plants would neither hurt nor help TVA consumers relative to other U.S. citizens.

I have talked to Mr. Jerry Campbell, executive director of the Tennessee Valley Public Power Association, and Mr. Tommy Walker, executive director of the Tennessee Municipal Electric Power Association, about some of these proposals and we can foresee no objection from any of my fellow managers in the valley. To reinforce this position I would quote from three letters which are attached in full to my statement.

EXCERPT FROM HANSEN LETTER

In a letter to TVA Chairman Freeman, dated July 22, 1980, Mr. David Hansen, president of Memphis Light, Gas, & Water Division, stated:

I am aware that the investor-owned utilities are canceling generation projects at an alarming rate. In the next decade, it is probable that the planned TVA generation capacity will be sorely needed both inside and outside the Valley. If possible, we would encourage TVA to take such steps as would be necessary to shelter us from the burdens of sizable excess capacity that could probably occur over the short run.

Senator SASSER. I have discussed this with Mr. Hansen.

Mr. DEAN. Dave wants to see them built. It does not put much heat on our ratepayers. For instance, I quote one line:

Charlie Dean's suggestion would certainly be an acceptable solution as far as MLGW is concerned. Another approach that might work would be a commitment by the Federal Government to protect the valley from temporary overcapacity in return for the benefits to the U.S. economy as a whole for having such plants completed on schedule.

EXCERPT FROM HEMBREE LETTER

In another letter from Mr. Paul Hembree, general manager of the Nashville Electric Service, to Mr. Freeman, dated July 25, 1980, Mr. Hembree states:

I certainly agree with your efforts in trying to figure out ways to presell blocks of energy to the Southwest or any other section for the purpose of replacing imported oil. We need to take every step possible to divest ourselves of the burden imposed by payments to foreign countries for imported petroleum products.

If there is any way I can help in this respect, please do not hesitate to call on me. Any energy we can generate in this country will help us to achieve the goal of energy independence for America.

EXCERPT FROM TOWERS LETTER

Another letter written this summer by Mr. Bill Towers who is general manager of the Holston Electric Cooperative, and also currently president of the Tennessee Valley Public Power Association, to Chairman Freeman, said in part:

I know that you and the TVA Board are faced with a very difficult decision concerning the construction program that is presently underway in the TVA system. When I heard the figure of $200 million a year to write off nuclear plants that are under construction at this time, I was frankly flabbergasted. To think that TVA would

be in such a position at the present time when the energy situation facing America today is such a grave one, is a paradox. I believe that it would be unpatriotic for TVA to stop construction of the nuclear powerplants. It seems to me that everyone in the valley should get behind TVA in this matter. I believe without a doubt all the power distributors in the valley would support your efforts to sell this power out of the valley at the present time and for as long as needed to meet this problem. I further believe that even the Congress should look at this situation and appropriate tax moneys to finish the plants that are under construction. The cost of constructing these plants in the future when the power is needed in the valley would be far greater than the cost of completing them today.

OVERESTIMATION OF ENERGY NEEDS ADVANTAGE TO NATION

Senator, I firmly believe as do these wise men that I have quoted, that the apparent overestimation of the valley's energy needs can be part of the Nation's salvation in difficult times ahead. As long as there is any power being generated anywhere in the country with gas- or oil-fired boilers, and as long as our railroads continue to burn oil instead of electricity which the railroads use in Europe, and as long as there are unemployed U.S. craftsmen looking for really important work to do—as long as these conditions exist, we need to continue the construction of all of these nuclear units, and I would suggest that we proceed to meet these energy problems head-on, and we hope that history will record that your position on these matters, Senator, was part of the solution, and not part of the problem.

Senator SASSER. Thank you, Mr. Dean. I appreciate your views on this. As I understand one section of your statement, you indicated that you are advocating completion of the nuclear plants with Federal funds.

Mr. DEAN. Yes, sir. It is just like they build Grand Coulee or any other units. Anything TVA does not think of they can use, like before they got delayed, finish them up, put them in an energy bank. I realize you are talking about spending money but the power is going to be sold, it is just a question of when. We are going to have to get off foreign oil, it is just a question of when. You know that as well as I.

CONSTRUCTION PROGRAMS AFFECTED BY RATE INCREASES

Senator SASSER. I think, as you know one of my real problems with the nuclear construction program and the problem that Dave Hansen has down in Memphis, and he has been very vocal about down there, is the problem of rate increases.

Mr. DEAN. It is not pleasant being a utility manager these days.

Senator SASSER. You are familiar with the rate increases and you know what it is like, but we have a situation here where it appears to many of us that the ratepayers in the Tennessee Valley area are being asked to finance the building of nuclear power plants that in the final analysis are going to be plugged into some sort of national power grid and the power used out of the Tennessee Valley area. There is a good chance that that would happen.

Mr. DEAN. I suggest a different approach to the problem.

FEDERAL SUBSIDIZATION OF NUCLEAR PLANT PROGRAMS

Senator SASSER. If that is the direction we are going, I think your idea of perhaps the Federal Government subsidizing the cost of these, I think that has some merit, because if TVA is going to be plugged into a national energy plan, if TVA is going to take the responsibility for energy to utilities in Florida, Texas, and other areas off of oil, if TVA is going to supply electricity to move the country off of oil, that is part of a national energy program and not a plan that regional ratepayers should have to pay.

So I think you and I have more areas of agreement than you might have anticipated when you came up here, Mr. Dean.

In any case, we do appreciate you coming up here and giving us the benefit of your views. They have been very helpful and I think you speak not only for yourself as the head of the Knoxville Utility Board, but I think you are also speaking for other heads of utility boards around Tennessee. So we thank you for coming.

Mr. DEAN. You are welcome.

CONCLUSION OF HEARING

Senator SASSER. The committee will now stand in recess subject to the call of the Chair.

[Whereupon at 2 p.m., Thursday, December 11, the hearing was concluded and the subcommittee was recessed to reconvene at the call of the Chair.]

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