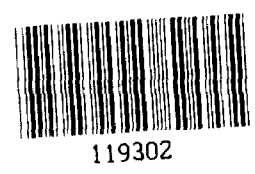


BY THE U.S. GENERAL ACCOUNTING OFFICE  
RELEASED

**Report To The Honorable John C. Stennis  
United States Senate**

**TVA Is Justified In Deferring The Yellow Creek  
Unit 1 Nuclear Powerplant**

The Tennessee Valley Authority's December 1981 demand forecast is reasonable and supports its projection of the timing and need for the Yellow Creek Unit 1 nuclear powerplant. Moreover, the methodology, assumptions, and data TVA used to compute the benefits and costs of continuing versus deferring construction appear reasonable and support the deferral decision.



GAO/EMD-82-114  
JULY 30, 1982

523032

**Request for copies of GAO reports should be sent to:**

**U.S. General Accounting Office  
Document Handling and Information  
Services Facility  
P.O. Box 6015  
Gaithersburg, Md. 20760**

**Telephone (202) 275-6241**

**The first five copies of individual reports are free of charge. Additional copies of bound audit reports are \$3.25 each. Additional copies of unbound report (i.e., letter reports) and most other publications are \$1.00 each. There will be a 25% discount on all orders for 100 or more copies mailed to a single address. Sales orders must be prepaid on a cash, check, or money order basis. Check should be made out to the "Superintendent of Documents".**



UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

ENERGY AND MINERALS  
DIVISION

B-208403

The Honorable John C. Stennis  
United States Senate

Dear Senator Stennis:

As requested in your March 8, 1982, letter, this report discusses the reasonableness of the Tennessee Valley Authority's basis for deferring construction of the Yellow Creek Unit 1 nuclear powerplant. The report specifically examines the December 1981 demand forecast used to determine the timing and need of the Yellow Creek plant, as well as, the benefit/cost analysis used to justify deferring construction of the plant.

As requested by your office, unless you announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request.

Sincerely yours,

A handwritten signature in black ink, appearing to read "J. Dexter Peach".

J. Dexter Peach  
Director



D I G E S T

At the request of Senator Stennis, GAO reviewed the demand forecast and benefit/cost analysis that the Tennessee Valley Authority (TVA) used as a basis for deferring construction on the Yellow Creek Unit 1 nuclear powerplant. Recognizing the difficulties of predicting 20 years into the future, GAO believes that the results of TVA's December 1981 demand forecast are reasonable and justify TVA's position concerning the timing and need for the Yellow Creek plant. In addition, the methodology, assumptions, and data TVA used in analyzing the benefits and costs of continuing construction of the plant appear reasonable and support TVA's decision to defer plant construction.

BACKGROUND ON TVA  
DEMAND GROWTH

TVA experienced rapid electricity demand growth prior to 1973 and, in expectation that such growth would continue, made commitments to build 17 nuclear reactors. However, unanticipated events slowed electricity demand growth drastically, and from 1979 to 1981 TVA deferred construction on five of the nuclear units.

In December 1981, TVA issued a new demand forecast indicating a further decline in projected demand. Based on this forecast and a January 1982 study, TVA concluded that the capacity from three nuclear units, including Yellow Creek Unit 1, would not be needed before the 1994-1996 timeframe. This led to TVA's decision to defer further construction on the plants since its analyses indicated deferral would be less costly for ratepayers.

TVA's deferral is predicated on two basic projections--a demand forecast, which determines when the nuclear unit will be needed; and a benefit/cost analysis, which shows the benefits of continuing construction versus the costs of deferral and restart, if necessary.

TVA'S DEMAND FORECAST IS BASED  
ON REASONABLE METHODOLOGY,  
ASSUMPTIONS, AND DATA

Although there are a great number of uncertainties and assumptions inherent in forecasting, GAO believes TVA did a credible job of preparing its December 1981 demand forecast. GAO found TVA's methodology, assumptions, and data for the forecast to be reasonable and agrees with TVA's conclusions concerning the timing and need for the Yellow Creek Unit 1 nuclear powerplant.

GAO did find instances, however, of TVA's projections that differ from projections made by other independent organizations. By themselves, some of these projections would tend to change the forecast results. When considered together, however, the differences appear not to alter the credibility of the forecast results because they tend to cancel each other out. For example, although TVA may have understated the population growth rate, the impact of this possible projection error is negated, to a large part, because TVA may have overstated the growth rate for energy-intensive industries.

In fairness to TVA, the majority of projection disparities GAO found came from studies that were prepared after TVA's forecast had been published. TVA is not only aware of these disparities, but is already revising its demand forecast to incorporate the results of these recent studies. TVA's Chief of Power Planning, Office of Power stated that this revised data is not expected to significantly change the results of the December 1981 demand forecast, nor TVA's analysis of the timing and need for the Yellow Creek plant. (See p. 4.)

TVA'S BENEFIT/COST ANALYSIS  
SUPPORTS A DEFERRAL DECISION

GAO believes that TVA used reasonable methodology and data in its benefit/cost analysis for the Yellow Creek Unit 1 nuclear powerplant and made an appropriate decision to defer construction of the plant. GAO's conclusion is based on a number of factors.

First, TVA prepared six benefit/cost ratios for the Yellow Creek plant alone. The ratios considered

benefits under all three forecasts--high, medium, and low--and for two periods of time--1982 to 2000 and 1982 to 2010. All six ratios showed a savings if the plant were deferred. (See p. 15.)

Second, the methodology that TVA used to prepare the benefit/cost ratios--comparing the present value of the total revenue required if the plants were completed on schedule to the present value of the total revenue required if the plants were deferred--appears to be sound. (See p. 17.)

Third, TVA's high and medium forecasts are somewhat sensitive to a number of variables, and, in particular, the present value discount rate and the price of coal. GAO's review of these variables showed that the values and methodologies used by TVA appear to be reasonable. (See p. 17.)

Although the benefit/cost ratios supported deferral, TVA also took another factor into consideration before deciding to defer the Yellow Creek plant--the timing and need for the deferred capacity. This is an important consideration because forecasts are predictions of future events which may or may not materialize. By deferring the Yellow Creek plant, TVA will have at least 5 additional years to further analyze and determine the need for this capacity. Consequently, TVA would benefit from the additional time because its final decision could be based on more accurate and factual information than is currently available. The additional time would also benefit ratepayers because it lessens the chances of them paying for electric capacity they may not need. As a result, their power needs would still be met, but because TVA would be in a better position 5 years from now to determine how best to meet these needs, the net result should be the most cost-effective power for the ratepayers.

#### TVA COMMENTS

GAO obtained formal, written comments from TVA on the matters discussed in this report, and, basically, TVA did not disagree with the information and conclusions GAO presents. In subsequent discussions, TVA suggested that GAO make a number of minor changes to improve the accuracy of the report. The body of the report has been revised to incorporate these changes, where appropriate. The full text of TVA's written comments is included in appendix II.





# C o n t e n t s

|          |   | <u>Page</u> |
|----------|---|-------------|
| DIGEST   |   | i           |
| CHAPTER  |   |             |
| 1        | INTRODUCTION  | 1           |
|          | Background on TVA demand growth   | 1           |
|          | Objectives, scope, and methodology  | 2           |
| 2        | TVA'S DEMAND FORECAST IS EASED ON REASONABLE<br>METHODOLOGY, ASSUMPTIONS, AND DATA    | 4           |
|          | TVA's methodology for the demand growth<br>projection                                 | 4           |
|          | Economic growth projections   | 5           |
|          | Prices of electricity and natural gas<br>projections                                  | 10          |
|          | DCE electricity requirement projections   | 12          |
|          | Energy conservation projections   | 12          |
|          | TVA in process of updating demand forecast  | 14          |
| 3        | TVA'S BENEFIT/COST ANALYSIS SUPPORTS A<br>DEFERRAL DECISION                           | 15          |
|          | All TVA benefit/cost ratios favor deferral  | 15          |
|          | Benefit/cost methodology appears to be<br>sound                                       | 17          |
|          | Values of sensitive factors appear reason-<br>able                                    | 17          |
|          | Present value discount rate   | 18          |
|          | Coal prices   | 20          |
| 4        | CONCLUSIONS AND TVA COMMENTS  | 22          |
|          | Conclusions   | 22          |
|          | TVA comments  | 22          |
| APPENDIX |   |             |
| I        | List of nuclear powerplants TVA made<br>commitments to build                          | 24          |
| II       | The Tennessee Valley Authority's July 23,<br>1982, comments on a draft of this report | 25          |

## ABBREVIATIONS

|     |                                       |
|-----|---------------------------------------|
| DRI | Data Resources Incorporated           |
| DOE | Department of Energy                  |
| GAO | General Accounting Office             |
| GNP | Gross National Product                |
| ICF | ICF, Incorporated                     |
| kWh | kilowatt hour                         |
| MIT | Massachusetts Institute of Technology |
| MW  | megawatts                             |
| SRI | Stanford Research Institute           |
| TVA | Tennessee Valley Authority            |



## CHAPTER 1

### INTRODUCTION

On March 4, 1982, the Board of Directors, Tennessee Valley Authority (TVA), deferred construction on three nuclear powerplants. On March 8, 1982, Senator John C. Stennis requested that we examine the economics of continuing construction at one of the deferred plants--Yellow Creek Unit 1. In a subsequent meeting with Senator Stennis' staff, it was agreed that, to satisfy the request, we would perform an analysis of TVA's December 1981 demand forecast and the supporting documentation.

On June 4, 1982, we briefed Senator Stennis' staff on the results of our analysis. At that time, Senator Stennis requested that we expand our review to include an examination of TVA's benefit/cost analysis for deferring construction of the Yellow Creek plant. The Senator also requested that we provide a written report on the results of both analyses. Accordingly, this report examines the reasonableness of TVA's December 1981 demand forecast and of the benefit-cost analysis TVA used as a basis for deferring the Yellow Creek Unit 1 nuclear powerplant.

### BACKGROUND ON TVA DEMAND GROWTH

Prior to 1973, the TVA region experienced a rapid growth rate in electricity demand. From 1960 to 1973, residential, commercial, and industrial electricity demand growth averaged 8 percent per year compared to about 7 percent for the Nation. Two factors contributed to the region's rapid electricity demand growth--a high economic growth rate along with low and stable electricity prices. During this period, the gross regional product was increasing about 5.0 percent per year. At the same time, however, electricity prices were stable and very low--about 0.9 cents per kilowatt hour (kWh) for residential customers and 0.6 cents per kWh for large industrial users.

Consequently, in the late 1960s and early 1970s, when TVA expected power requirements to double every decade, it made commitments to build 17 nuclear reactors to meet the anticipated demand. Appendix I provides a list of these plants and their status. At the time the last four of these units were ordered--the two at Yellow Creek and the two at Phipps Bend--TVA was forecasting a 7 percent per year increase in electricity demand for the next 10 years.

### Changes in demand growth from 1973 to 1981

From 1973 to 1981, the region's economy and electric industry were buffeted by changes unanticipated in the 1960s and early 1970s. The 1973-1974 oil embargo increased the price of petroleum and other fuels, which contributed to both higher inflation and slower economic growth in the region. For example, from 1973 to 1979, per capita income in the TVA region rose at a rate of 2.6

percent per year. At the same time, TVA electric rates rose at a rate of 19 percent per year. As a result, TVA customers started conserving electricity. During the period 1973-1981, electricity demand growth increased only 0.9 percent per year, and from 1977 to 1981, electricity demand actually declined 1.2 percent per year.

Because of the reduced demand for electricity, TVA, in 1979, deferred construction on four of its nuclear units and, in 1981, deferred construction on a fifth unit.<sup>1/</sup>

### Current situation

In December 1981, TVA issued a demand forecast which indicated that the projected electricity demand rate would not grow as fast as prior forecasts had predicted. Shortly thereafter, in January 1982, TVA issued a study entitled, "Review of the TVA Load Growth/Plant Construction Situation." The study showed that, based on the results of the December 1981 demand forecast, nuclear units A1 and A2 at Hartsville and nuclear unit 1 at Yellow Creek--scheduled to begin commercial operation in the 1990-1992 timeframe--would not be needed before 1994-1996 at the earliest. The study concluded that it would be less costly for ratepayers if TVA deferred and then restarted construction on these units, if needed, than to continue constructing them under the current schedule. Basically, this analysis concluded that the additional construction costs created by deferral would be more than offset by savings in interest costs incurred in operating and maintaining nuclear units that were not needed.

TVA's decision to defer the Yellow Creek plant is predicated on two basic projections--TVA's demand forecast, which determines when the nuclear unit will be needed; and TVA's benefit/cost analysis, which shows the benefits of continuing construction under the current schedule versus the costs of deferral and restart, if necessary.

### OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our review were to (1) evaluate TVA's December 1981 demand forecast to determine the reasonableness of assumptions made by TVA and (2) analyze TVA's benefit/cost analysis that was used as a basis for deferring the Yellow Creek Unit 1 nuclear powerplant.

We accomplished the first objective by reviewing TVA's December 1981 demand forecast and TVA documents showing the basis for this forecast. We interviewed TVA officials, primarily in TVA's Office of Power, to obtain their comments on specific meth-

---

<sup>1/</sup>Units deferred were Hartsville B1 and B2, Phipps Bend 1 and 2, and Yellow Creek 2.

odology, assumptions, and data used in the forecast. We also obtained documents and/or interviewed representatives from the Department of Energy (DOE), State of Mississippi, University of Tennessee Center for Business and Economic Research, ICF Incorporated (ICF), and the Federal Reserve Bank to obtain comments on TVA's assumptions and methodology and to make comparisons with TVA estimates. As additional determinations of the reasonableness of TVA's estimates, we reviewed economic and demographic projections made by Wharton Econometric Forecasting Associates, Charles Rivers Associates, Stanford Research Institute (SRI), Data Resources Incorporated (DRI), Massachusetts Institute of Technology (MIT)/Harvard University Joint Center for Urban Studies, Department of Commerce's Bureau of Economic Analysis, and Department of Labor's Bureau of Census.

In analyzing TVA's economic basis for deferring the Yellow Creek plant, we reviewed TVA's benefit/cost study and TVA documents supporting this study. We interviewed TVA officials, primarily in the Office of Power, as to the rationale for specific methodology, assumptions, and data. To determine the reasonableness of TVA's estimates, as compared to other independent sources, we interviewed representatives from and/or reviewed documents prepared by the University of Tennessee Center for Business and Economic Research, Department of the Treasury, DOE, Nuclear Regulatory Commission, ICF, Wharton Econometric Forecasting Associates, and DRI.

Our review was limited to an evaluation of the assumptions and methodology TVA used in its demand forecast and benefit-cost analyses. We determined the reasonableness of the analyses by comparing TVA's projections of certain factors with those made by other independent sources. Because of the limited time we had to complete our work, we were unable to thoroughly review all the factors involved in each analysis. As a result, we limited our evaluation to those factors that we considered to be the most significant and to have the greatest impact on the results of the analyses. For example, in examining the demand forecast, we looked at TVA's projections for economic growth, closely examining the projected employment, population, and industrial growth rates; electricity and natural gas prices; DOE electricity requirements for uranium enrichment activities; and energy conservation. In evaluating the benefit/cost analysis, we paid particular attention to a number of sensitive variables including the present value discount rate and the cost of coal.

Chapter 2 analyzes the reasonableness of the methodology, assumptions and data TVA used in its December 1981 demand forecast. Chapter 3 examines the significant factors of the benefit/cost analysis that TVA used as a basis for its deferral decision. Chapter 4 presents our conclusions and TVA's comments on the matters discussed in this report.

## CHAPTER 2

### TVA'S DEMAND FORECAST IS BASED ON REASONABLE METHODOLOGY, ASSUMPTIONS, AND DATA

Notwithstanding the uncertainties inherent in forecasts, we believe that TVA's December 1981 demand forecast represents a reasonable basis for planning future capacity requirements. Our review of the methodology, assumptions, and data used by TVA in preparing the forecast indicates that the forecast is reasonable and supports TVA's analysis concerning the timing and need for the Yellow Creek Unit 1 nuclear powerplant. In examining a number of other independent projections, we found, in some cases, projections that differed from those used by TVA. These differences, by themselves, tend to change the forecast results, but, when considered together, tend to cancel each other out and do not affect the credibility of the forecast results. For example, whereas TVA may have understated the population growth rate, it may have overstated the growth rate for energy-intensive industries. In fairness to TVA, the majority of differences in projections we found originated from studies that were published after TVA's forecast was issued. TVA is aware of these disparities and is currently preparing an update of its demand forecast which will incorporate the latest data. However, TVA officials anticipate the updated forecast results will be similar to the December 1981 forecast.

### TVA'S METHODOLOGY FOR THE DEMAND GROWTH PROJECTION

A demand growth projection is the basic tool a power system uses to determine the additional capacity needed to meet future consumption requirements. At best, however, forecasting demand or load growth beyond a few years into the future involves great uncertainty. Using a sophisticated set of models, TVA deals with uncertainty by producing a range of forecasts based on alternative levels of five explicit factors believed by TVA to influence demand growth. These factors include: economic growth, price of electricity, price of natural gas, DOE power requirements for uranium enrichment activities, and conservation.

In arriving at the December 1981 demand forecast, TVA's model considered high and low levels of economic growth and high, medium, and low levels of the other four factors. TVA then subjectively assigned probabilities to every level of each factor and derived a high, medium, and low demand forecast. The high and low forecasts are chosen so there is a 10-percent chance that the actual demand growth will be above the high forecast and a 10-percent chance that the actual demand growth will be below the low forecast. The medium forecast is taken from the median forecast level. To avoid future shortages of capacity, TVA uses the high forecast in planning for system capacity requirements.

The following table shows the results of TVA's demand forecast for the years 1990 and 2000 as well as the estimated growth in electrical demand from 1981 to 2000.

Demand Forecast For The TVA Area

| December 1981<br>Demand Forecast | Actual Demand                    | Demand Forecast   |             | Growth Rates       |                  |
|----------------------------------|----------------------------------|-------------------|-------------|--------------------|------------------|
|                                  | (billions of kWh)<br><u>1981</u> | (billions of kWh) |             | (Percent Per Year) |                  |
|                                  |                                  | <u>1990</u>       | <u>2000</u> | <u>1981-90</u>     | <u>1990-2000</u> |
| High Forecast                    | 119.1                            | 144.9             | 188.5       | 2.2                | 2.7              |
| Medium Forecast                  | 119.1                            | 134.3             | 161.7       | 1.3                | 1.9              |
| Low Forecast                     | 119.1                            | 123.6             | 126.7       | 0.4                | 0.2              |

As the table shows under the high forecast, by the year 1990, TVA projects peak demand to increase to 144.9 billion kWh, and by 2000, to 188.5 billion kWh. The low demand forecast shows only a slight increase in demand for those years.

The following sections discuss in detail the assumptions and data TVA used for the five significant factors of the forecast. Because of the similarities in and relationships of the analysis of the price of electricity and price of natural gas, we have discussed these factors in one section.

ECCNOMIC GRCWTH PROJECTIONS

Economic growth is an important factor in projecting the demand for electricity. In deriving its regional economic growth projection, TVA considers numerous national economic and demographic indicators. The regional projections are computed using a TVA Regional Economic Simulation Model. This Model incorporates national indicators obtained from Wharton's Econometric Forecast and projects high and low estimates of growth for each economic factor. The table on the next page shows a list of the key economic indicators and their growth rates used by TVA in its December 1981 demand forecast.

Based on our analysis of TVA's economic growth projections, we believe that, on the whole, TVA did a reasonable job of considering the relevant factors and making appropriate projections. Our analysis however, did disclose a number of issues that warrant discussion. These include the possibility that

TVA Planning Forecast  
Growth Rates For Various Indicators Of  
Economic Activity (note a)  
Average Annual Percentage Change)

|                            | <u>1980-1990</u><br>(percent) | <u>1990-2000</u><br>(percent) | <u>1980-2000</u><br>(percent) |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|
| Real Gross Product         |                               |                               |                               |
| Nation                     | 2.9                           | 2.8                           | 2.8                           |
| TVA Region                 | 3.6                           | 3.4                           | 3.5                           |
| Real Manufacturing Product |                               |                               |                               |
| Nation                     | 3.4                           | 2.7                           | 3.0                           |
| TVA Region                 | 5.1                           | 3.7                           | 4.4                           |
| Real Commercial Product    |                               |                               |                               |
| Nation                     | 3.3                           | 3.3                           | 3.3                           |
| TVA Region                 | 3.1                           | 3.5                           | 3.3                           |
| Total Employment           |                               |                               |                               |
| Nation                     | 1.2                           | 1.1                           | 1.2                           |
| TVA Region                 | 1.4                           | 1.5                           | 1.5                           |
| Manufacturing Employment   |                               |                               |                               |
| Nation                     | 0.5                           | -0.1                          | 0.2                           |
| TVA Region                 | 1.4                           | 0.9                           | 1.1                           |
| Real Per Capita Income     |                               |                               |                               |
| Nation                     | 1.6                           | 2.5                           | 2.1                           |
| TVA Region                 | 1.3                           | 2.0                           | 1.6                           |
| Population                 |                               |                               |                               |
| Nation                     | 0.9                           | 0.7                           | 0.8                           |
| TVA Region                 | 0.8                           | 0.8                           | 0.8                           |
| Households                 |                               |                               |                               |
| Nation                     | 1.8                           | 1.4                           | 1.6                           |
| TVA Region                 | 1.8                           | 1.7                           | 1.7                           |

a/The "real" rates reflect actual growth rates for certain indicators, adjusted to eliminate inflation.



- the population growth rate projection may have been understated,
- the growth rate for energy-intensive industries may have been overstated, and
- the economic growth rate may have been overstated.

Population growth rate projection  
may have been understated

During the period 1980 to 2000, TVA's economic analysis projected an annual population growth rate of 0.82 percent under the high forecast and 0.78 percent under the low forecast. The following table shows the population assumptions used by TVA in deriving these growth rates for the region.

Population Assumptions Used In The TVA Regional  
Economic Forecast For The Period 1980-2000

| <u>Year</u>  | <u>Population<br/>(Thousands)</u> |            |
|--|-----------------------------------|------------|
|  | <u>High</u>                       | <u>Low</u> |
| 1980   | 6,570.2                           | 6,570.2    |
| 1985   | 6,842.9                           | 6,830.8    |
| 1990   | 7,145.3                           | 7,117.9    |
| 1995   | 7,449.2                           | 7,407.7    |
| 2000   | 7,723.3                           | 7,676.0    |
| <u>Average Annual Percentage<br/>Rate of Population Growth</u> |                                   |            |
| 1980-1990  | 0.84                              | 0.80       |
| 1990-2000  | 0.78                              | 0.76       |
| 1980-2000  | 0.82                              | 0.78       |
| <u>Total Percentage Change</u>                                 |                                   |            |
| 1980-1990  | 8.75                              | 8.34       |
| 1990-2000  | 8.22                              | 7.84       |
| 1980-2000  | 17.69                             | 16.83      |

As the table shows, TVA's high and low forecasts were based on a 1980 population estimate of 6.57 million people. For the year 2000, the high forecast projected population to be 7.723 million, and the low forecast to be 7.676 million. Although these projections were generally in line with projections developed by the Bureau of the Census, the projections were made before results of the 1980 census were available.

The latest census showed that, since 1970, Tennessee and the East South Central region (including the TVA area) grew faster than expected, 16.9 percent and 14.5 percent respectively, versus 11.4 percent for the Nation. Further, projections from other groups also indicate that TVA may have understated population growth. For example, the MIT/ Harvard University Joint Center for the Urban Studies projected a TVA regional population growth rate of nearly three times that used in the TVA forecast. The State of Tennessee, which lies entirely in the TVA service area, projects a population growth rate somewhat higher than TVA's for the period 1981 to 1990. Finally, the State of Mississippi, 10 percent of which is served by TVA, also projects a higher population growth rate than TVA for the period 1981 to 1986. Should TVA's population growth rate projections be too low, the demand forecast would tend to be understated.

Growth rate for energy-intensive industries may have been overstated

Economic data shows that the TVA region is more manufacturing and energy intensive than the national average. For example, 28 percent of the region's work force is engaged in manufacturing compared to 22 percent for the Nation. Additionally, 14 percent of the regional work force is employed in industries classified as energy-intensive (i.e. primary metals, textiles, chemicals, and paper) compared to 8 percent for the Nation. In this regard, TVA commissioned two studies--one by Charles Rivers Associates on the aluminum industry and one by SRI on the chemical industry--to determine the outlook for these energy-intensive industries in the TVA region.

The Charles River Associates study, dated October 1981, concluded that, because of a lack of competitiveness of TVA's industrial rates and competition from overseas aluminum producers, little growth is expected for the region's aluminum industry. The study forecasts that the equivalent of one additional aluminum plant, at most, would be constructed in the region. However, TVA projected two such plants in its high forecast, which would tend to overstate projected demand.

The SRI study, dated March 1, 1982, predicted minimal growth or decline for the chlor-alkali, phosphorus, and plastics industries and 3 percent annual growth in the synthetic organic fibers industry. Because its study results were not available at the time TVA prepared its forecast, TVA could not include the study results in its December 1981 forecast. The Chief of TVA's System's Forecast Group, Office of Power said, however, that the study results would have tended to lower TVA demand projections.

In addition, the University of Tennessee Center for Business and Economic Research is also predicting lower real growth in manufacturing gross State product (3.1 percent) for the State of Tennessee than does TVA's high forecast for the TVA region (5.1 percent). This is significant because the State of Tennessee

accounts for about two-thirds of the economic activity in the TVA region. An official for the Center believes there is a shift from manufacturing to commercial industries and points out that any shift from manufacturing reduces demand.

Economic growth rate  
may have been overstated

Wharton's most recent forecast predicts lower economic growth rates than those used by TVA in its December 1981 forecast. If this study's projections prove accurate, TVA's demand forecast would tend to be overstated.

In April 1982, Wharton published revised economic projections, which generally were lower than the previous Wharton projections that were used by TVA. The following table shows the significant changes made in the Wharton economic forecast since the TVA load forecast was developed.

Changes Made In Wharton National Economic  
Forecasts Since TVA Forecast Was Made  
(Projections For 1990)

|  | <u>Wharton<br/>Forecast<br/>Used by TVA</u> | <u>April '82<br/>Wharton</u> | <u>Percent<br/>Change</u> |
|--|---|------------------------------|---------------------------|
| U.S. population (millions)               | 243.9                                       | 251.4                        | +3.07                     |
| U.S. employment (millions)               | 111.4                                       | 114.93                       | +3.16                     |
| Percent of population employed           | 45.67                                       | 45.71                        | -                         |
| Number of people employed (millions):    |   |                              |                           |
| Manufacturing                            | 21.794                                      | 20.394                       | -6.42                     |
| Primary metals                           | 1.438                                       | 1.008                        | -29.90                    |
| Textiles                                 | 0.848                                       | 0.818                        | -3.54                     |
| Paper                                    | 0.709                                       | 0.652                        | -8.04                     |
| Chemicals                                | 0.931                                       | 1.076                        | +15.57                    |
| Gross National Product:                  |   |                              |                           |
| GNP (billions in 1972 \$)                | 1,971.6                                     | 1,913.9                      | -2.92                     |
| GNP - Manufacturing                      | 489.4                                       | 454.7                        | -7.09                     |
| GNP - Primary metals                     | 28.3  | 22.9                         | -19.08                    |
| GNP - Textiles                           | 14.1  | 12.6                         | -10.64                    |
| GNP - Paper                              | 18.0  | 16.3                         | -9.44                     |
| GNP - Chemicals                          | 38.6  | 38.6                         | -                         |
| Per capita disposable income<br>('72 \$) | 5,383                                       | 5,170                        | -3.95                     |

As the table indicates, overall population and employment estimates for 1990 were up about 3 percent. However, employment and gross national product projections for those types of industries found in the TVA region were revised downward.

In addition, economic forecasts by the States of Tennessee and Mississippi tend to confirm TVA's premise that its high economic forecast is optimistic. The following table compares these States' projections to those used by TVA in its demand forecast.

Projected Average Annual Growth Rates Of  
Economic Variables For TVA Region, Tennessee  
And Mississippi (note a)

|                                | TVA<br>(1980-90)<br>(percent) | Tennessee<br>(1981-90)<br>(percent) | Mississippi<br>(1981-86)<br>(percent)<br>(note c) |
|--------------------------------|-------------------------------|-------------------------------------|---|
| Gross product (note b)         | 3.60                          | 2.72                                | 2.16  |
| Manufacturing product (note b) | 5.13                          | 3.12                                | 2.97  |
| Personal income (note b)       | 2.10                          | 3.03                                | 1.05  |
| Total employment               | 1.44                          | 1.26                                | 0.76  |
| Manufacturing employment       | 1.35                          | 1.06                                | 0.70  |
| Population growth              | 0.84                          | 1.10                                | 1.03  |

a/All figures shown are derived from TVA and State "control" forecasts.

b/Figures in "real" terms, 1972 dollars, the last time prices were adjusted.

c/These projections are for the State of Mississippi, but TVA only serves about 10 percent of the region.

As the table shows, the States' forecasts, except for both population growth rates and Tennessee's personal income projection, are generally much lower than the regional projections made by TVA in its high forecast.

PRICES OF ELECTRICITY AND  
NATURAL GAS PROJECTIONS

The price of electricity is a significant factor, in that, demand increases when prices are lowered and decreases when prices are raised. Furthermore, the price of electricity in relation to the price of natural gas influences the amount of substitution that occurs between electricity and natural gas.

TVA projects in its demand forecast that natural gas prices will rise much faster than electricity prices and that substantial substitution will occur. To determine the reasonableness of TVA's projections, we compared the increases in electricity and gas prices projected by TVA with price projections made by other

organizations, such as Wharton, DRI, and DCE. The following table shows the results of this comparison.

Projected Gas And Electric Price Real  
Rates Of Increase Per Year

|  | <u>1980-1990</u><br>(percent) | <u>1990-2000</u><br>(percent) | <u>1980-2000</u><br>(percent) |
|--|-------------------------------|-------------------------------|-------------------------------|
| <u>Residential Gas Prices</u>                            |                               |                               |                               |
| TVA Region, High Case                                    | 9.7                           | 4.3                           | 7.0                           |
| TVA Region, Mid Case                                     | 7.9                           | 2.3                           | 5.1                           |
| DRI, Autumn 1981   | 8.1                           | 2.1                           | 5.1                           |
| DCE, Nationwide Prices,<br>Mid-Price Case                | 8.5                           | -                             | -                             |
| <u>Industrial Gas Prices</u>                             |                               |                               |                               |
| TVA Region, High Case (Commercial<br>and Industrial Gas) | 9.9                           | 4.8                           | 7.3                           |
| TVA Region, Mid Case (Commercial<br>and Industrial Gas)  | 8.1                           | 2.8                           | 5.4                           |
| DRI, ESC I, Autumn 1981                                  | 8.2                           | 2.8                           | 5.5                           |
| DOE, Nationwide Prices, Mid Case                         | 11.5                          | -                             | -                             |
| <u>Residential Electricity</u>                           |                               |                               |                               |
| TVA (High)   | 4.6                           | 2.6                           | 3.6                           |
| TVA (Medium)   | 3.2                           | 0.4                           | 1.8                           |
| TVA (Low)  | 1.4                           | -0.5                          | 0.4                           |
| DRI, National Prices                                     | 1.5                           | 1.2                           | 1.3                           |
| DCE (Mid Price), National                                | 2.4                           | -                             | -                             |
| Wharton, National  | 2.0                           | 1.5                           | 1.8                           |
| <u>Commercial and Industrial<br/>Electricity</u>         |                               |                               |                               |
| TVA (High)   | 3.3                           | 2.6                           | 2.9                           |
| TVA (Medium)   | 1.9                           | 0.5                           | 1.2                           |
| TVA (Low)  | 0.2                           | -0.5                          | -0.2                          |
| DRI (Commerce), National                                 | 1.2                           | 1.1                           | 1.1                           |
| DRI (Industrial), National                               | 3.8                           | 1.9                           | 2.9                           |
| DRI - C&I, National                                      | 2.8                           | 1.6                           | 2.2                           |
| DCE, National  | 3.3                           | 0.0                           | 1.6                           |

As the table indicates, TVA is predicting that gas prices will increase approximately twice as much as electricity prices. Under its high forecast, TVA projects that residential gas prices will increase an average of 7.0 percent per year through the year 2000, compared to 3.6 percent per year for electricity prices. For the most part, when compared to the projections made by Wharton, DRI, and DCE, it appears that the TVA projections are reasonable.

DOE ELECTRICITY  
REQUIREMENT PROJECTIONS

TVA projections of DOE electricity requirements for uranium enrichment activities appear to be reasonable. In 1981, DOE purchased 1,590 megawatts (MW) of electricity from TVA for uranium enrichment at Paducah, Kentucky, and Oak Ridge, Tennessee. TVA projections for DOE usage for 1985 to 2000 are shown below.

| <u>YEAR</u> | <u>TVA ESTIMATE (MW)</u> |               |            |
|-------------|--------------------------|---------------|------------|
|             | <u>HIGH</u>              | <u>MEDIUM</u> | <u>LOW</u> |
| 1985        | 2400                     | 1800          | 1300       |
| 1990        | 2400                     | 1800          | 1300       |
| 1995        | 3200                     | 2000          | 500        |
| 2000        | 3300                     | 1900          | 400        |

TVA's demand forecast model uses, as input, the medium DOE usage projection.

Although DOE has contracted for about 4300 MW of power for the 1985-1990 timeframe, TVA projects actual usage will be substantially less because of falling demand for uranium enrichment and the possibility that DOE may establish more energy-efficient gaseous centrifuge technology at Oak Ridge. A DOE representative concurred that DOE will not need the full contract load for the reasons specified by TVA and said the TVA projections appear realistic.

A Power Planning Advisor in TVA's Office of Power pointed out that DOE purchases power for its Portsmouth, Ohio, and Paducah, Kentucky, enrichment facilities from two other utility organizations at prices 16 to 32 percent below TVA's. Consequently, TVA has factored into its projection that as demand for enrichment energy declines, the shortfall will come directly from TVA's allocation.

ENERGY CONSERVATION  
PROJECTIONS

In October 1981, TVA was implementing, or planning to implement, 21 programs broadly aimed at encouraging energy conservation. These conservation programs include such activities as insulation and heat pump financing, and various applications of solar energy including water heating. TVA projects these conservation programs may save at least 13.4 to 23.6 million kwh of power as shown by the following table.

TVA Conservation Program Impacts Over 1981 Levels

|                            | <u>Year</u> | <u>Energy Savings--Millions of kWh</u> |               |             |
|----------------------------|-------------|--|---------------|-------------|
|                            |             | <u>Low</u>                             | <u>Medium</u> | <u>High</u> |
| Residential Programs       | 1990        | 3,093                                  | 3,786         | 4,373       |
| Energy Savings             | 2000        | 5,649                                  | 7,342         | 8,601       |
| Commercial and Industrial  | 1990        | 1,864                                  | 2,660         | 4,588       |
| Energy Savings             | 2000        | 7,792                                  | 11,554        | 14,966      |
| Total Conservation Program | 1990        | 4,957                                  | 6,446         | 8,961       |
| Energy Savings             | 2000        | 13,441                                 | 18,896        | 23,567      |

In reviewing TVA's demand forecast, ICF commented that TVA's estimates of energy savings through conservation measures may be too high. Both ICF and the University of Tennessee, which also reviewed TVA's demand forecast noted, however, that TVA does have the option of increasing its conservation program efforts if conservation starts to slow, thereby making the conservation estimates self-fulfilling.

We also noted other factors which point to substantial conservation potential for the TVA region. In 1973, TVA residential customers used an average of 15,400 kWh of electricity per year. By 1981, this usage had declined to 14,097 kWh. However, TVA residential customer usage still remains 57 percent above the national average of about 9,000 kWh.

TVA is projecting that, by the year 2000, its residential customer usage will still be above the national average, but that the percentage difference will decline. The following table shows projections for electricity usage per household for the TVA region and the Nation for the period 1980 through 2000.

Electricity Consumed Per Household  
TVA And United States For The  
Period 1980-2000

|                           | <u>1980</u><br>(kWh/household) | <u>1990</u><br>(kWh/household) | <u>2000</u><br>(kWh/household) |
|---------------------------|--------------------------------|--------------------------------|--------------------------------|
| TVA demand forecast       |                                |                                |                                |
| High forecast             | 15,800                         | 14,400                         | 14,000                         |
| Low forecast              | 15,800                         | 12,000                         | 10,200                         |
| National forecasts        |                                |                                |                                |
| General Accounting Office | 9,391                          | 10,475                         | 10,947                         |
| Data Resources, Inc.      | 8,979                          | 10,121                         | 11,334                         |

As the table indicates, at the TVA high demand forecast, TVA residential customers would use about 14,000 kWh per year by the year 2000 as compared to national forecasts of about 11,000 kWh per year. Consequently, TVA is still expecting its customers to use more electricity per household than the national average, but it is expecting the percentage difference to decline.

Recent usage data also indicates that conservation measures are affecting electricity usage in the region. During 1981, the number of residential customers increased about 2 percent but total residential usage declined about 2 percent. Total system usage in 1981 was 119.1 billion kWh, but TVA projects 1982 usage will be down to about 113 billion kWh.

TVA IN PROCESS OF  
UPDATING DEMAND FORECAST

TVA is currently updating its demand forecast. The updated forecast will incorporate, among other things, the 1980 census data as well as Wharton's latest economic projections. TVA expects the revised forecast to be available by late August 1982. In addition, TVA's Chief of Power Planning, Office of Power said that preliminary results show the updated forecast will not be substantially changed from the current forecast.



### CHAPTER 3

#### TVA'S BENEFIT/COST ANALYSIS

#### SUPPORTS A DEFERRAL DECISION

After reviewing the methodology and data TVA used in its benefit/cost analysis for the Yellow Creek Unit 1 nuclear powerplant, we concur with TVA's decision to defer construction on the plant. Our conclusion is predicated on the following factors. First, TVA's benefit/cost ratios show a savings under deferral for all three forecasts and for both time periods tested. Second, the methodology TVA used to analyze the benefits of continuing versus deferring construction appears to be sound. Third, although the benefit/cost ratios are sensitive to several variables, the variables we reviewed, which we believe to be the most significant, appear to be reasonable when compared with similar variables obtained from independent sources. The variables we reviewed included the present value discount rate and the price of coal.

More importantly, although the benefit/cost ratios supported deferral, TVA did not use these ratios solely as the basis for making the deferral decision since forecasting involves many uncertainties. Another important factor which TVA considered was the timing of the need for the deferred capacity. Such timing merits consideration because forecasts are predictions of future events which may or may not materialize. Thus, the shorter the time period between the forecast date and the date of the forecasted events, the more likely the events will materialize as forecasted. By deferring the construction of this plant, TVA has at least until 1987 to gain additional insight and knowledge about the need for this capacity. By that time, TVA will be in a better position to more accurately determine the timing and need for the Yellow Creek plant.

#### ALL TVA BENEFIT/COST RATIOS FAVOR DEFERRAL

To determine whether construction of the Yellow Creek plant should be continued or deferred, TVA prepared six benefit/cost ratios. The results of all six analyses supported deferral. Also, since the decision to defer Yellow Creek was being considered at the time that TVA was also considering deferring two other nuclear plants, Hartsville Units A1 and A2, TVA prepared 12 other benefit/cost ratios. Six of these 12 ratios related to continuing versus deferring construction for the Hartsville plants alone, and six related to the Yellow Creek and Hartsville plants combined. All 12 of the ratios supported the deferral decision. The following table shows the six ratios that relate to the Yellow Creek Unit 1 plant alone.

Present Value of the Benefits  
and Costs for Continued Construction  
of Yellow Creek Unit 1 (note a)

(Millions of dollars)

|                                   | 1982-2000                |                              |                         | 1982-2010                |                              |                         |
|-----------------------------------|--------------------------|------------------------------|-------------------------|--------------------------|------------------------------|-------------------------|
|                                   | High<br>Load<br>Forecast | Midrange<br>Load<br>Forecast | Low<br>Load<br>Forecast | High<br>Load<br>Forecast | Midrange<br>Load<br>Forecast | Low<br>Load<br>Forecast |
| Benefits (note b)                 | 660                      | 670                          | 560                     | 1010                     | 1010                         | 880                     |
| Costs (note b)                    | 880                      | 1020                         | 1160                    | 1040                     | 1100                         | 1490                    |
| Benefit/<br>Cost Ratio            | .75                      | .66                          | .48                     | .97                      | .92                          | .59                     |
| Dollar<br>savings for<br>deferral | 220                      | 350                          | 600                     | 30                       | 90                           | 610                     |

a/Incorporated in this table is the restart of the Yellow Creek Unit 1 plant in 1987 with a commercial operating date of about 1996 for the high forecast.

b/Benefits represent the present value revenue requirements associated with deferral and costs represent the present value revenue requirements associated with continued construction.

As the table indicates, TVA projects that ratepayers will save at least \$30 million and as much as \$610 million during the period from 1982 through 2010 as a result of the plant deferral. This savings would occur because ratepayers will not be required to absorb the cost of 1,375 megawatts of capacity (i.e., the capacity of Yellow Creek Unit 1) during the period this capacity is not needed. Specifically, based on the high load forecast, demand for electricity will increase by 4,089 megawatts during the period from 1981 through 1990. TVA's four non-deferred nuclear units scheduled to start commercial operation in the mid-1980s will provide 5,184 megawatts which will apparently satisfy this increase in demand through the early 1990s. If the Yellow Creek Plant were built according to the pre-deferred schedule, it would be providing capacity for which ratepayers would be paying but not using. Under the deferred schedule, this plant will not come on line until 1996 which is more in line with when its capacity will be needed.

Moreover, TVA is considering another option to supply this capacity that, it believes, could be less costly than the Yellow Creek plant. This option involves building a 900 megawatt coal-fired plant in lieu of the Yellow Creek plant. According to a Supervisor in TVA's Planning and Analysis Group, Office of Power, a benefit/cost analysis was performed which slightly favored the

coal fired plant option. However, TVA will not have to make a decision on this option until 1987.

BENEFIT/COST METHODOLOGY  
APPEARS TO BE SOUND

The methodology that TVA used to prepare the benefit/cost ratios appears to be sound. These ratios basically compare the present value of the total revenue required if the plants were completed as scheduled (called costs) to the present value of the total revenue required if the plants were deferred (called benefits).

Although TVA could have used some factor other than revenue requirements, such as annual expenses, to measure benefits and costs, in our view, TVA's use of revenue was the most reasonable approach. The approach was reasonable because TVA apparently believes, and we agree, that the ultimate costs to ratepayers should be the basis for favoring one option over another. Since TVA's rates are based on annual revenue requirements, we believe TVA's approach is reasonable.

Without question, TVA is on sound ground in using the present value of the annual revenue to make the benefit/cost comparison. GAO policy provides for using present value analysis in any cost comparison where cost will extend for 3 or more years. Furthermore, the use of present value analysis is a generally accepted practice when investment alternatives involve incurring different costs at different points in time. For two or more alternatives to be compared on an equal economic basis, it is necessary to consider the costs of each alternative at the same moment or at their present values.

VALUES OF SENSITIVE FACTORS  
APPEAR REASONABLE

The benefit/cost ratios contain several important variables for which the values TVA used appear to be reasonable. However, we found that TVA's benefit/cost ratios for its high and medium forecasts are somewhat sensitive to two variables in particular--the present value discount rate and the cost of coal. We reviewed these values as well as the methodologies TVA used to compute them and found that, generally, the values and methodologies appeared to be reasonable.

In order to determine the sensitivity of the benefit/cost ratios to certain variables, such as the present value discount rate and the cost of coal, TVA computed the ratios using alternative assumptions for these variables. In computing these alternative benefit/cost ratios, TVA considered the total benefits and costs associated with continuing construction of all three deferred plants--Yellow Creek Unit 1 and Hartsville A Units 1 and 2--but did not compute the alternative ratios considering only the Yellow Creek plant. Because of time constraints, we also were un-

able to compute these alternative ratios for only the Yellow Creek plant. However, the following table demonstrates, the sensitivity of the combined benefit/cost ratios for the Yellow Creek and Hartsville plants to changes in these two variables. A discussion of the variables we reviewed follows the table.

Alternative Benefit Cost Ratios  
for Continued Construction of Yellow Creek Unit 1  
and Hartsville A Units 1 and 2  
for the period  
1982-2010

|   | <u>Load Forecast</u> |               |            |
|---|----------------------|---------------|------------|
|   | <u>High</u>          | <u>Medium</u> | <u>Low</u> |
| Base case   | .98                  | .94           | .67        |
| <u>Alternative Assumption Which Decreases Benefit/Cost Ratios</u>   |                      |               |            |
| Decrease in coal fuel costs - coal costs increase 7.4 percent per year compared with 9.4 percent per year in base case  | .71                  | .68           | .50        |
| Increase discount rate from 15 percent to 18 percent  | .91                  | .92           | .81        |
| <u>Alternative Assumption Which Increases Benefit/Cost Ratios</u>   |                      |               |            |
| Increase in coal fuel costs - coal costs increase 11.4 percent per year compared with 9.4 percent per year in base case | 1.34                 | 1.31          | .90        |
| Decrease discount rate from 15 percent to 13 percent  | 1.07                 | 1.01          | .54        |

Present value discount rate

Generally, we believe that the methodology TVA used to compute the 15 percent present value discount rate is reasonable. Although TVA's methodology differs from that recommended by GAO, we believe the uniqueness of TVA tends to justify this variance. We also believe that the rate resulting from the TVA approach is generally reasonable based on comments from an independent source and comparison with a rate we independently computed, adjusted to allow for TVA's uniqueness.

Discounting, the reverse of compound interest, is the technique used to determine the present value of a stream of expected future costs. The particular discount rate used has a direct effect on an analysis' conclusions because the rate adjusts or

modifies all, or nearly all, costs contained in the analysis. Therefore, the rate selected is very important.

Selecting an accurate or reasonable discount rate is generally a difficult task because it is based on a number of uncertain factors. Moreover, determining the proper discount rate for TVA's Yellow Creek plant presents even greater difficulties because of the agency's uniqueness (i.e., quasi-governmental) and the nature of nuclear projects in general. These and other problems make it difficult to conclusively say whether the 15 percent figure used is accurate. However, based on available information, we believe the rate used is reasonable. Our rationale for this conclusion follows.

First, we believe that the basis of TVA's discount rate--required rate of return--is appropriate, although it varies somewhat from the GAO recommended basis--U.S. Treasury Bond yield. In our view, this variance is generally justified because the GAO basis relates to governmental agencies that rely on the U.S. Treasury for financing. However, TVA is a quasi-governmental agency which currently relies on the Federal Financing Bank and revenue collections for financing. Also, in the past, and possibly in the future, TVA financed debt by issuing its own bonds. According to a TVA official, the 15 percent rate represents the weighted average of the required return on investment for the funds that would be used to finance TVA operations. TVA finances its operations using both borrowed and internal funds. Therefore, its discount rate is based on the cost of new debt increased by a required margin and a required rate of return on internal funds. TVA's criteria for required margin is intended to produce operating income equal to 1.10 times the total interest charges. The required rate of return on investment for internal funds is based on a TVA policy designed to protect the agency's bond rating. Consequently, TVA's discount rate should reflect the foregone return that would have resulted if the funds had been invested. In other words, the discount rate should bear some relationship to the expected interest rates and the required rate of return on internal funds used to finance operations. We found that the TVA discount rate complies with this criteria.

Secondly, TVA's discount rate is comparable to the GAO rate, when adjusted to account for TVA's uniqueness. The GAO Project Manual, "A Guide to Selecting, Designing, and Managing GAO Projects" provides guidance for selecting present value discount rates used to evaluate long-term investment options. Essentially, the manual recommends that the discount rate for long-term investments be equal to the average yield on outstanding Treasury Bonds. TVA established its 15 percent discount rate in July 1981. To determine how reasonable this rate is, we computed the discount rate with GAO's adjusted methodology for the month ending June 30, 1981. We found that the average yield on outstanding Treasury Bonds through May 2011 was 13.28 percent. When this rate is increased by 0.125 percent, because TVA's debt costs are greater than the U.S. Treasury's by this amount, and by the required

margin of 1.10 times the total interest charges, the adjusted rate equals 14.75 percent. Based on this analysis TVA's discount rate is appropriate.

Finally, we attempted to confirm the reasonableness of TVA's discount rate with a number of other organizations including the University of Tennessee, the Congressional Budget Office, and the Federal Financing Bank. Officials from the University of Tennessee which has been thoroughly involved in analyzing TVA's load forecasts and its benefit/cost analysis stated that the 15 percent rate was reasonable. Officials from the other two organizations declined official comment, but provided no evidence which would indicate the rate was unreasonable.

Based on the above factors, we found no basis or evidence which would lead us to believe that TVA's rate of 15 percent is unreasonable or inappropriate.

### Coal prices

The methodology TVA used to compute the cost of coal is reasonable. In addition, the coal costs used by TVA in its benefit/cost analysis are reasonable when compared with generally similar rates published by an independent source.

As previously mentioned, TVA's benefit/cost ratios are sensitive to coal prices, primarily because the price of coal is a significant part of electricity prices at TVA coal-fired plants currently operating. Therefore, if the Yellow Creek plant were completed on the pre-deferred schedule, it would most likely replace some of TVA's existing coal-fired capacity. Consequently, increases in coal prices would tend to make constructing the nuclear plant more favorable and decreases would tend to have the opposite affect.

The coal costs TVA used in its benefit/cost analysis were based on contract prices, termed old coal, and forecasted cost increases provided by an independent source, termed new coal. To compute the coal prices included in the ratios, TVA determined coal requirements for each plant on a per year basis. Since much of TVA's coal requirements for the period prior to 1990 are under contract <sup>1/</sup> and since each TVA coal contract relates to a specific plant, TVA developed coal prices for this period by simply reviewing contracts, with appropriate considerations for renegotiation and escalation provisions, and applying the contract rates to the related plants' coal requirements.

---

<sup>1/</sup>The majority of TVA coal contracts of long duration contain a provision for renegotiation for price and volume at 5-year intervals.

To develop the new coal prices for the period prior to 1995, TVA contracted with an independent consulting firm to develop annual "real growth" rates 1/ on a regional basis. TVA then selected the "real growth" rates applicable to the mines where TVA coal is purchased and added the TVA Gross National Product (GNP) deflators. 2/ TVA's GNP deflator rates are basically the average of the GNP deflators provided by two econometric consulting firms. To develop new coal prices for the period 1996 through 2010, TVA used a trend analysis based on the contractor-provided data.

Based on a comparison with somewhat similar DOE projected rates, the annual "real growth" rates for coal used in TVA's benefit/cost ratios appear to be reasonable. In its annual report to the Congress, DOE forecasts annual "real growth" rates for all forms of energy including coal. The following table reflects the TVA "real growth" rates used in the benefit/cost analysis and the rates contained in the 1981 DOE Report to the Congress for the region from which TVA generally purchases its coal.

Projected growth rates for  
the price of coal

| <u>Period</u> | <u>TVA</u><br>(percent) | <u>DOE</u><br>(percent) |
|---------------|-------------------------|-------------------------|
| 1985-1990     | 1.66                    | 1.21                    |
| 1990-1995     | 2.2                     | 1.7                     |
| 1985-1995     | 1.93                    | 1.46                    |

As the table shows, TVA's rates are slightly higher than DOE's, but these differences can be explained. TVA's rates represent the weighted average of increases for the various types of coal (i.e., low sulfur, medium to high sulfur, and premium) TVA expects to purchase. However, DOE's rates represent the average "real growth" rates for the region where TVA generally purchases its coal. However, even if the TVA rates are overstated, this would only tend to understate the benefits of deferral, in which case, the deferral decision would be further justified.

---

1/"Real growth" is the cost of a specific item, in this case coal, less the general inflation rate.

2/The GNP deflator represents the general inflation rates.

## CHAPTER 4

### CONCLUSIONS AND TVA COMMENTS

#### CONCLUSIONS

Given the subjective nature of demand forecasting and the difficulty of predicting 20 years into the future, we believe that TVA's December 1981 demand forecast was based on reasonable methodology, assumptions, and data. Although certain portions of the forecast, particularly a few factors included in the economic growth projections, appear out of line with projections made by other organizations, we do not believe these disparities significantly affect the credibility of the forecast results. In fact, if anything, these differing projections appear to indicate that, on the whole, TVA may be slightly overstating projected demand. Consequently, we believe that TVA's conclusion concerning the timing and need for the Yellow Creek Unit 1 nuclear powerplant (i.e., plant capacity not needed prior to 1996 timeframe) is reasonable.

Moreover, TVA's benefit/cost analysis supports the agency's decision to defer the Yellow Creek Unit 1 nuclear powerplant, since the ratios showed a savings to TVA ratepayers under all circumstances. We found that the methodology TVA used to analyze the benefits of continuing versus deferring construction appears to be sound, since the criteria used, required revenues, measures the ultimate costs and benefits to TVA's ratepayers. Additionally, the methodologies the agency used to compute values of factors for which the benefit/cost ratios are sensitive appear to be reasonable when compared with similar data from independent sources.

In addition to providing savings, the deferral decision is also prudent because it gives the agency at least 5 additional years to determine when and if the plant's capacity will be needed. Because of the many uncertainties which currently exist concerning this issue, we believe this additional time will enable TVA to make a final decision based on more accurate and factual information than is currently available. In addition, the additional time available with a deferral decision is also advantageous to the ratepayers because it lessens the chances of them paying for electric capacity they may not need. Consequently, the power needs of the ratepayers will still be met, but because TVA will be in a better position 5 years from now to determine how best to meet these needs, the net result should be the most cost-effective power for the ratepayers.

#### TVA COMMENTS

We obtained formal, written comments from TVA on the matters discussed in this report, and, basically, TVA did not disagree



with the information and conclusions we present. In subsequent discussions, TVA suggested that we make a number of minor changes to improve the accuracy of the report. The body of the report has been revised to incorporate these changes, where appropriate. The full text of TVA's written comments is included in appendix II.

LIST OF NUCLEAR POWER PLANTSTVA MADE COMMITMENTS TO BUILD

| <u>Name of plant</u> | <u>Unit</u> | <u>Capacity<br/>(megawatts)</u> | <u>Date unit<br/>ordered</u> | <u>Actual or ex-<br/>pected data<br/>for start-up<br/>of commercial<br/>operation</u> | <u>Current<br/>status</u> |
|----------------------|-------------|---------------------------------|------------------------------|---|---------------------------|
| Browns Ferry         | 1           | 1152                            | 1966                         | 1974  | Operating                 |
| "                    | 2           | 1152                            | 1966                         | 1975  | Operating                 |
| "                    | 3           | 1152                            | 1966                         | 1977  | Operating                 |
| Sequoyah             | 1           | 1221                            | 1968                         | 1981  | Operating                 |
| "                    | 2           | 1221                            | 1968                         | 1982  | Operating                 |
| Watts Bar            | 1           | 1270                            | 1970                         | 1983-84   | Under<br>construction     |
| "                    | 2           | 1270                            | 1970                         | 1984-85   | Under<br>construction     |
| Bellefonte           | 1           | 1322                            | 1970                         | 1984-87   | Under<br>construction     |
| "                    | 2           | 1322                            | 1970                         | 1985-88   | Under<br>construction     |
| Hartsville           | A1          | 1287                            | 1972                         | -   | Deferred in 1982          |
| "                    | A2          | 1287                            | 1972                         | -   | Deferred in 1982          |
| "                    | B1          | 1287                            | 1972                         | -   | Deferred in 1979          |
| "                    | B2          | 1287                            | 1972                         | -   | Deferred in 1979          |
| Phipps Bend          | 1           | 1287                            | 1974                         | -   | Deferred in 1981          |
| "                    | 2           | 1287                            | 1974                         | -   | Deferred in 1979          |
| Yellow Creek         | 1           | 1375                            | 1974                         | -   | Deferred in 1982          |
| "                    | 2           | 1375                            | 1974                         | -   | Deferred in 1979          |

TENNESSEE VALLEY AUTHORITY  
KNOXVILLE, TENNESSEE 37901

OFFICE OF THE BOARD OF DIRECTORS

July 23, 1982

Mr. J. Dexter Peach, Director  
Energy and Minerals Division  
U.S. General Accounting Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Mr. Peach:

The Tennessee Valley Authority is pleased to comment on the General Accounting Office report, "TVA Has Reasonable Basis For Deferring The Yellow Creek Unit 1 Nuclear Power Plant" (EMD-82-114), which concludes that TVA's decision to hold off construction of unit 1 was soundly based.

TVA very much appreciated the opportunity to make corrections in the body of the GAO report prior to its issuance. We believe this process allows GAO the opportunity to insure that its reports are fair and accurate, which we know is the professional objective sought both by GAO and TVA.

As you know, the TVA Board is required by law to provide power to the 7-state area that it serves at the lowest feasible rates. We are therefore gratified to learn that GAO views the Yellow Creek deferral decision as one yielding "the most cost-effective power for the ratepayers."

Thank you again for your consideration in inviting comments on this report prior to publication.

Sincerely,



C. H. Dean, Jr.  
Chairman





22709

AN EQUAL OPPORTUNITY EMPLOYER

UNITED STATES  
GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID  
U. S. GENERAL ACCOUNTING OFFICE



THIRD CLASS