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# Power Annual Report

For the fiscal year ended September 30, 1978

## TENNESSEE VALLEY AUTHORITY

A corporation wholly owned by the United States of America

TVA is a corporate agency of the United States Government. It was established by Act of Congress in 1933 to develop the Tennessee River system and to assist in the development of other resources of the Tennessee Valley and adjoining areas.

The production and sale of electric power are part of TVA's resource development program. TVA supplies power at wholesale to 160 municipal and cooperative distributors and one privately owned electric system which in turn distribute power to about 2.7 million customers in parts of seven states. TVA also supplies power directly to 50 industrial customers with large or

unusual power requirements and several Federal nuclear, aerospace and military installations.

Financially, the power program is separate from other TVA programs. It is required to be self-supporting and self-liquidating. Power accounts are kept in accordance with the uniform system prescribed for electric utilities by the Federal Energy Regulatory Commission.

This report deals with TVA's electric power activities. Additional information about power or other activities may be obtained from the Director of Information, Tennessee Valley Authority, Knoxville, Tennessee 37902.

**Board of Directors** .....  
S. David Freeman, Chairman  
Richard M. Freeman, Director\*  
**General Manager** ... Leon E. Ring\*\*  
**Manager of Power** . . . Hugh G. Parrist†  
**General**  
**Counsel** . . . . Herbert S. Sanger, Jr.  
**Comptroller** . . . . . Willard R. Stinson

\*Appointed October 16, 1978.

\*\*Appointed November 29, 1978. R. Lynn Seeber resigned May 16, 1978.

†Effective January 1, 1979. Formerly Nat B. Hughes.

### Cover

Solar and home weatherization demonstrations lead TVA's new energy programs, helping people make better use of the energy resources at their disposal. Another major push is for more efficient and cleaner operation of the large coal-fired and nuclear generating plants that supply most of the region's electricity.

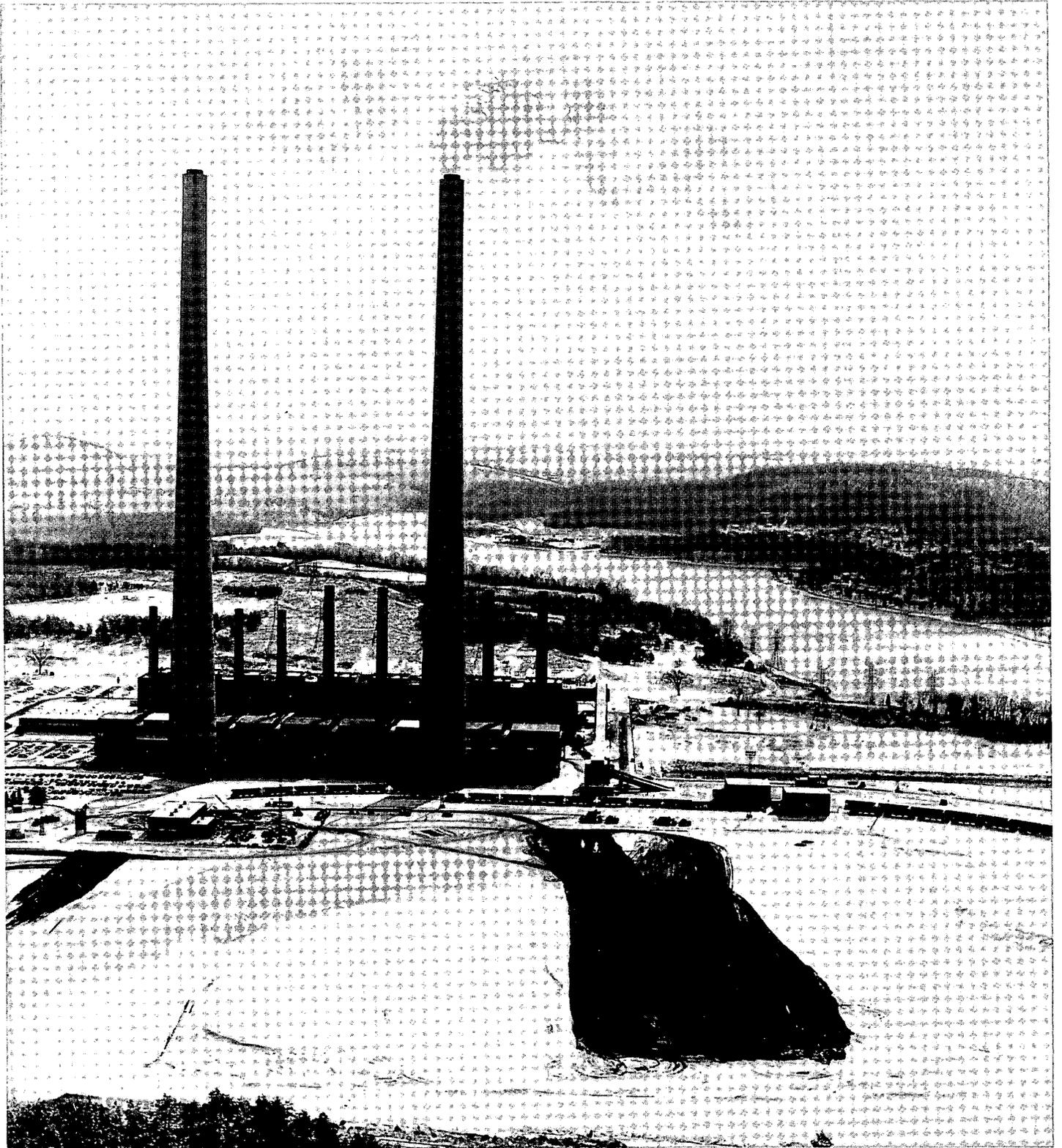
# Statistical Summary

	Fiscal Years	
	1978	1977
Sales (billion kWh)	118	122
Revenues (billions)	\$2.350	\$1.967
Payments in Lieu of Taxes to States and Counties (millions)	\$80	\$68
Total Operating Expenses (billions)	\$1.896	\$1.615
Net Interest Charges (millions)	\$238	\$201
Net Income (millions)	\$217	\$150
Increase in Retained Earnings (millions)	\$155	\$86
Total Payments to U.S. Treasury (millions)	\$82	\$84
Total Assets (billions)	\$9.910	\$8.289
Average Annual Residential Use (kWh)	16,190	16,400
Average Cost per Residential Kilowatthour (cents)	2.68	2.32

## Contents

	Page
Perspective on 1978 .....	3
Sales .....	5
Revenues and Earnings .....	7
Borrowings .....	8
Rates .....	9
Load Management .....	11
Solar Energy .....	13
Energy Conservation .....	14
Fuel and Power Supply .....	15
Energy Research .....	19
Map .....	40

Docket # ~~50-390~~ .....  
 Control # 7903160170  
 Page 3/16/79 of Documents  
**REGULATORY DOCKET FILE**



## Perspective on 1978

TVA is carrying out its traditional role as a leader in demonstrating approaches to help meet national energy needs. During the past year the agency has been gearing up new programs and expanding existing ones to encourage more effective conservation of energy by consumers, to demonstrate new energy resources, and to develop methods for operating existing power plants more cleanly and economically.

TVA completed its first full year's experience with its Home Insulation Program, which includes free energy surveys for homes and interest-free loans for attic insulation in homes using electric heat or cooling. Based on this experience, the program has been expanded to include no-interest loans for various other methods of weatherizing homes, and to raise to \$2,000 the maximum interest-free financing a consumer can obtain.

This program benefits all electricity users through lower rates than otherwise would be required and at the same time helps the individual consumer hold down electric bills. Conserving electricity used for heating and cooling helps hold down the extra cost to the power system of meeting peak demands. And in the long run conservation will help reduce or defer the need for costly investments in future power plants.

Solar energy can provide another valuable step toward those same goals. In September 1978 TVA and Memphis Light, Gas, and Water Division began a demonstration program to equip at least 1,000 Memphis area homes with solar water heaters. Low-interest

financing with fixed monthly repayments will give these consumers a nearly inflation-proof means of filling most of their hot water needs, with offpeak electric water heating supplying the rest. This demonstration can help open the door to widespread use of solar energy in the region as the cost of conventional fuels continues to increase.

Other energy developments that hold promise for early results include the use of heat rejected from power plant condensers, cogeneration, and more intensive conservation efforts in the commercial and industrial sectors.

For TVA and many other power suppliers dependent on coal, the 4-month strike by the United Mine Workers that began in December 1977 threatened power plant fuel supplies and brought about higher costs from efforts to stretch coal supplies. Further delays in completing new generating capacity also caused tight power supply conditions for TVA during the peak demand months.

However, TVA was able to meet its basic power supply commitments in 1978 through power purchases and with cooperation from power users and distributors. This included agreement by the Department of Energy to substantial cutbacks in its power requirements during the months of critical demands.

By July 1980 more than 5 million kilowatts of additional generating capacity is scheduled to be available to help meet TVA power loads. Getting these plants on line is a very high priority.

Power costs and rates continued to increase in 1978, but rates here continued to trail most other parts of the Nation. While the national average residential rate for the year approached 4 cents per kilowatthour, the TVA area average rose to 2.7 cents. It had been around 2.3 cents in 1976 and 1977.

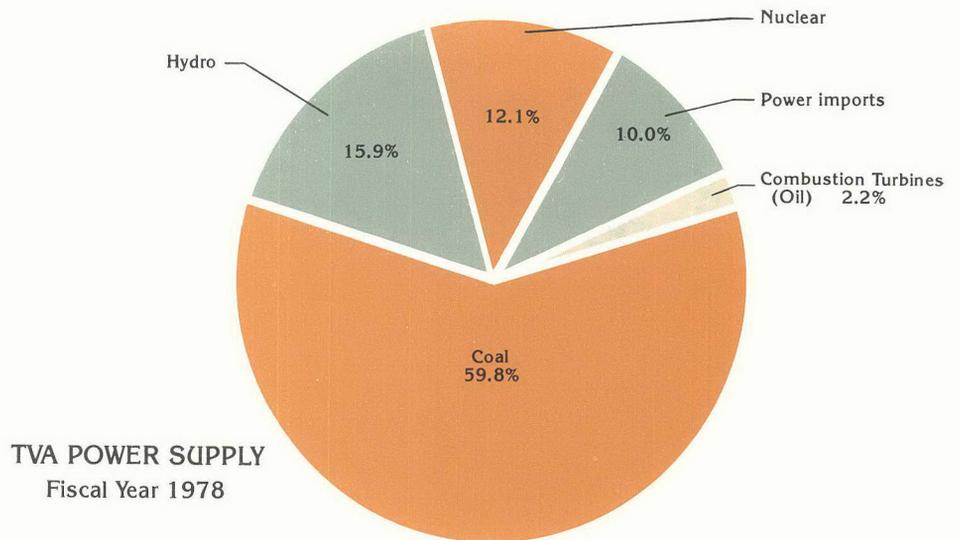
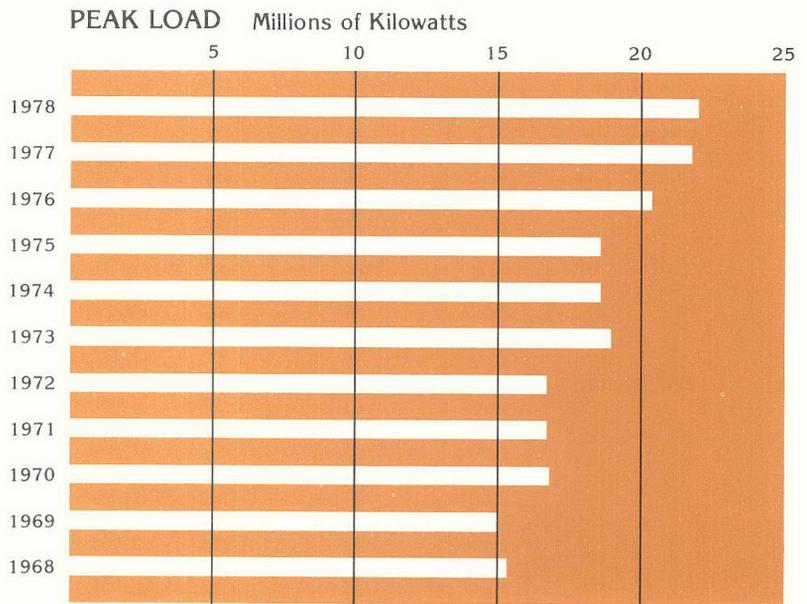
In August TVA Chairman S. David Freeman rejected a rate increase proposed by the agency's power staff for the start of fiscal year 1979, and indicated that a rate increase to cover projected cost increases for the new year should be held off until there were some actual financial results during the year. He indicated he hoped no increase would be necessary until after the winter heating season. Meanwhile, management consultants are reviewing TVA operations to make sure no areas for cost savings are overlooked. One area of particular emphasis is a program to improve reliability of TVA's coal-fired power plants, most of which were built in the 1950's and 1960's.

Over the years the favorable interest rates resulting from high ratings on TVA bonds sold in the market have meant millions of dollars in savings to our power consumers. TVA aims to maintain a record of financially sound operation and retain favorable bond ratings.

The TVA Act sets the objective of keeping electric rates as low as feasible, but specifies that rates are to be set at levels which will cover power system costs and financial obligations. Final operating results show TVA revenues did cover such costs, but the margin of revenues over revenue requirements was slightly less than the amount considered desirable in relation to the power system's fixed obligations and capital requirements.

In 1978 TVA continued moving toward compliance with Clean Air Act requirements at its coal-fired power plants, including massive purchases of compliance-grade coal supplies and design and construction of large pollution control facilities. In the litigation over TVA air quality compliance, a settlement was negotiated and after the end of the year was approved by the Board of Directors. In the meantime TVA was able to proceed on most of the compliance measures in the settlement.

TVA began working with the new Office of Surface Mining on plans for providing support for Federal and State agencies carrying out the national strip mine reclamation program, while phasing out TVA's own 13-year-old program of controls to avoid duplication.



## Sales

Reductions in power demands at Department of Energy (DOE) facilities brought a drop in total TVA power sales to 118 billion kilowatthours from 122 billion a year ago.

The load reductions at DOE uranium enrichment plants helped TVA maintain service through a long winter coal strike and during periods of heavy demands, when power supplies were tight because of delays in getting new generating capacity into service. Sales to Federal agencies were down by almost 6 billion kilowatthours to 17 billion, offsetting a modest rise in sales to local power distributors. Seasonal reductions in the DOE power demands will take place again this winter and next summer.

Sales to industries served directly by TVA were nearly flat at 23 billion kilowatthours, owing to conservation efforts by industries and a still-sluggish economy.

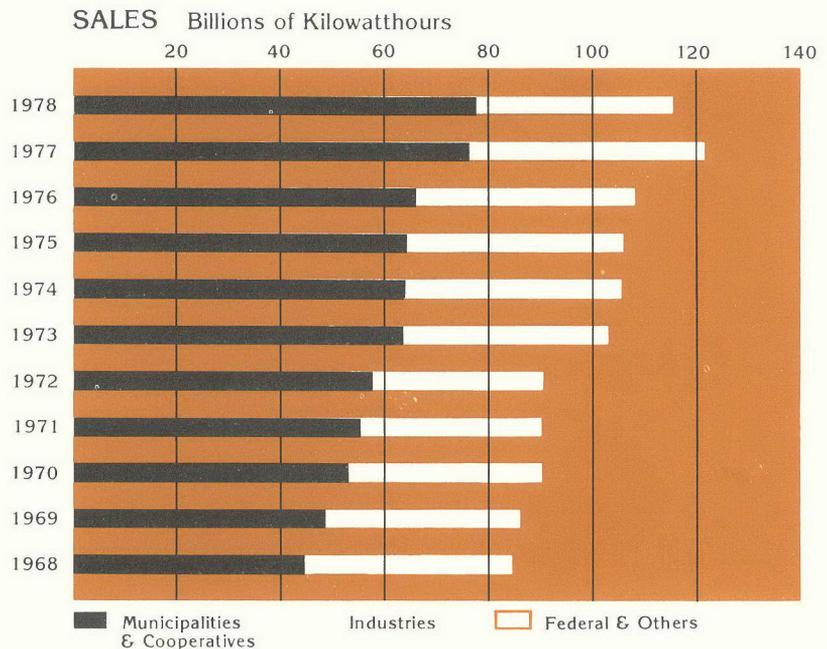
Jersey Miniere Zinc Company near Clarksville, Tennessee, the first new complete zinc operation in the United States in 35 years, was expected to be in full operation in November with a demand of 50,000 kilowatts served directly by TVA.

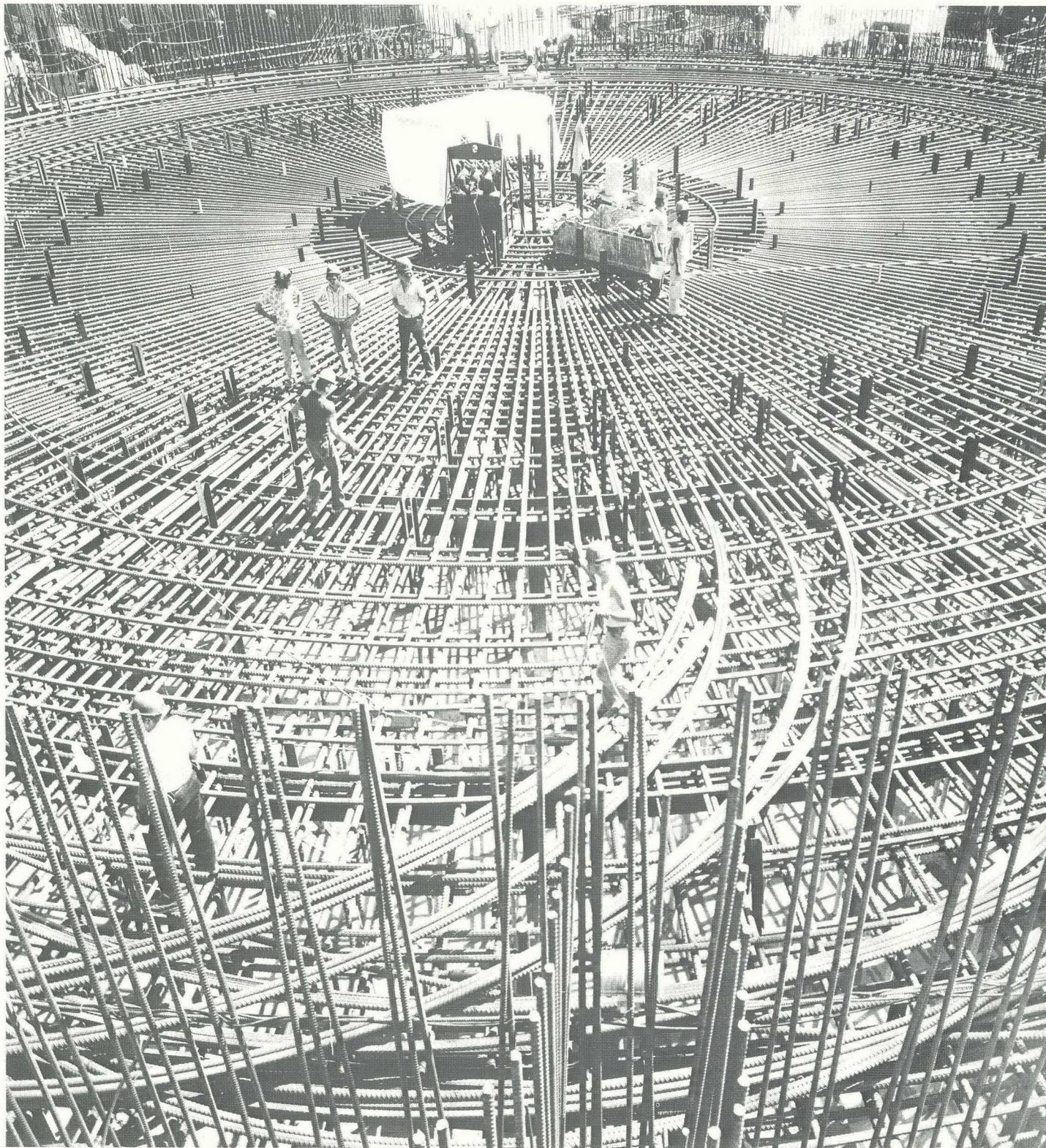
Sales to municipal and cooperative electric systems totaled 78 billion kilowatthours, about 2 percent more than for the preceding year.

Conservation and somewhat less extreme temperatures helped moderate power use by customers of the distributors of TVA power. The distributors' residential sales totaled 38 billion kilowatthours, an increase of less than 1 percent over the preceding year; their commercial and industrial sales increased 2 percent to 35 billion kilowatthours.

Average residential use of electricity was 16,190 kilowatthours for the year, 210 kilowatthours less than the record amount of last year. This is much more than the national average of about 8,800 kilowatthours, reflecting the more prevalent use here of electricity — rather than gas or oil — for winter heating and hot water. Heating is the biggest part of home energy use, and a

million homes in this region have electric heat. These homes used 22,230 kilowatthours on the average, down from the preceding year's 22,940. After taking account of weather variations, this average should generally decline as the impact of TVA and national conservation programs grows.





# Revenues and Earnings

Revenues increased \$383 million over the preceding year as rates and charges increased to cover rising costs. Total revenues for 1978 were nearly \$2.4 billion.

Production expenses were up in 1978 by \$231 million, led by an increase of \$186 million in expenses for fuel and purchased power. Fuel and power imports together cost \$1.2 billion, or more than half of total revenues.

Imported power expenses of nearly \$167 million were \$60 million higher than the year before. Both the lack of new generating capacity and the UMWA strike caused an increased need for imports.

Overall, system fuel expense was almost 11 mills per kilowatt-hour generated, up from last year's 9 mills.

Coal costs increased substantially in 1978, reflecting purchases of higher quality coal for environmental compliance as well as the impacts of the UMWA strike and subsequent increases in mine labor costs. Less coal was burned than during the preceding year, but the average cost per ton increased from \$21 to \$25. Higher costs can be expected in the future from these influences. The average delivered price expected for compliance coal is about \$9 more a ton than the coal it replaces.

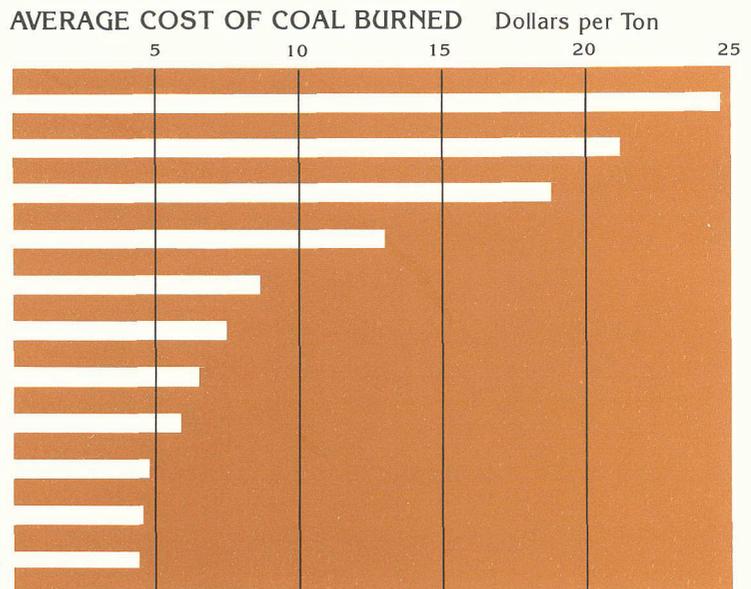
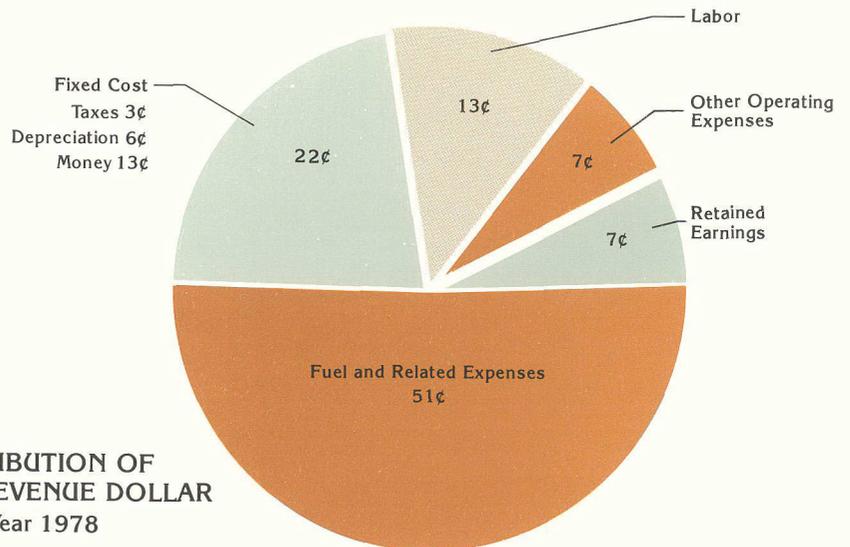
Although hydroelectric plants produced less than one-fifth of TVA's generation, they are invaluable in holding production costs down. They were also a critical source of power during the UMWA strike and the periods of heavy demand of the past two summers and winters. On the whole the year was better than average for

Hartsville Nuclear Plant, 14 percent complete at the end of the year, has record amounts of reinforcing steel densely woven in the reactor base mats. The 4-unit Hartsville complex is expected to cost \$3.5 billion.

hydroelectric production at nearly 21 billion kilowatt-hours. During the last quarter, however, rainfall was far below normal, depriving the system of significant low-cost generation and hindering cost-saving efforts.

TVA makes payments in lieu of taxes to states and counties equal to 5 percent of revenues from sales of electric energy for the previous year, excluding revenues from Federal

agencies. As revenues increase, these payments increase. In 1978, TVA paid \$80 million to states and counties, and next year these payments will total about \$100 million. In addition, the municipal and cooperative distributors of TVA power paid \$47 million to states and local governments in taxes and tax equivalents during their fiscal year, for a total of \$127 million in payments to state and local governments.



TVA also paid \$82 million to the Federal Government. Before Congress enacted the 1959 bond financing amendment to the TVA Act, TVA power facilities were financed largely by Federal appropriations. The TVA Act requires TVA to pay a return, or dividend, to the U.S. Treasury on outstanding appropriations invested in the power system and repay a portion of the appropriations each year. This year's dividend was \$62 million and the repayment amount was \$20 million, bringing the year's total payments to the Treasury to \$82 million.

Interest payments on the borrowed capital necessary to build generating plants and other power facilities came to more than one-fifth of revenues at \$487 million. Of that amount, \$249 million was allocated to plant costs and \$238 million to operations.

Net income improved to \$217 million, or 9 percent of revenues. Earnings, however, were still slightly below the amount desired for long-term coverage of fixed charges.

Retained earnings increased by \$155 million, or 7 percent of revenues.

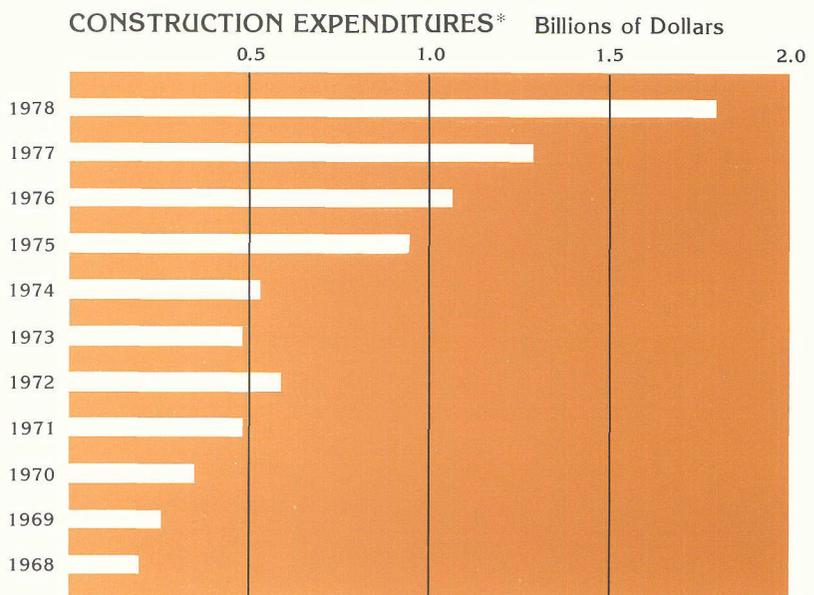
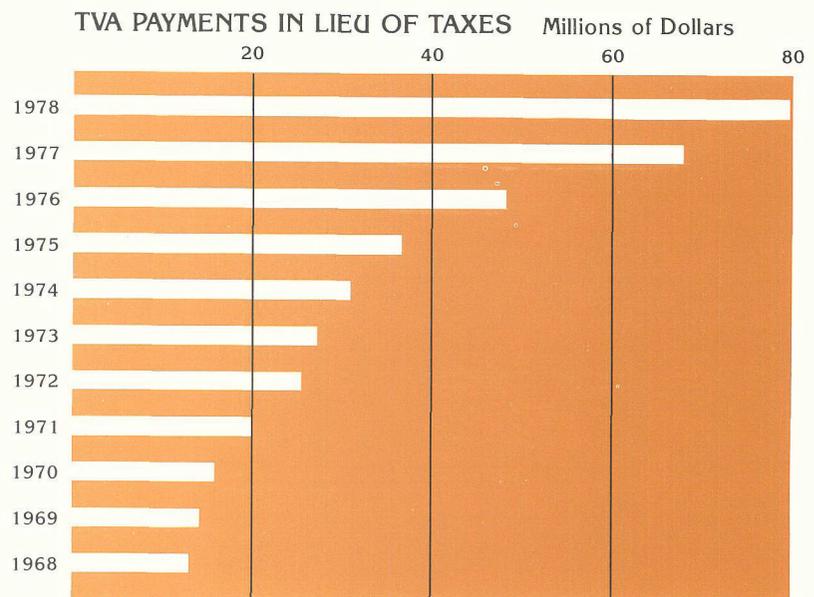
Of total net power proceeds of \$646 million, \$78 million remained for investment in the power system after paying interest on debt and making the required payments to the Treasury.

## Borrowings

Net borrowings to finance new power plants and other assets increased \$1.3 billion during the year to a total of \$7.2 billion outstanding. Two 25-year bond issues of \$400 million each were sold to the Federal Financing Bank, one at 8 percent and one at 8.375 percent. Short-term borrowings increased by \$540 million to a total of \$1.7 billion at the end of the year.

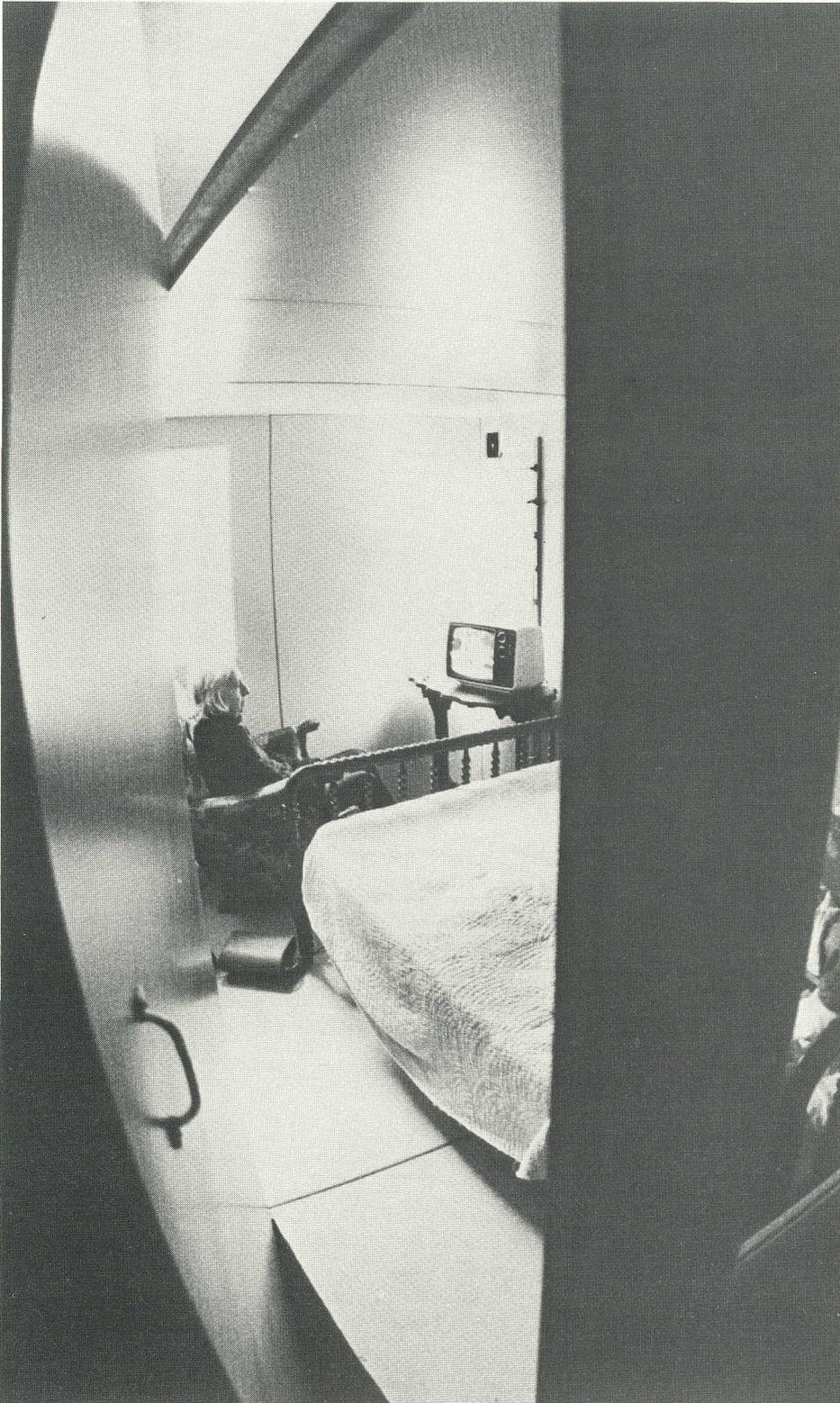
TVA power bonds have been sold only to the Federal Financing Bank in recent years. But the potential for resuming public sales in the primary market, and the continued trading of

TVA bonds in the secondary market, cause TVA to pay close attention to the quality of its public debt. TVA power bonds were sold to the public from 1960 to 1974.



\*Includes allowance for borrowed funds used during construction

## Rates



Costs for labor, materials, and especially interest have all gone up with higher prices and construction delays. Electric rates were adjusted, effective in July, to provide an additional \$60 million in revenues for fiscal year 1978 to meet the financial requirements of the TVA Act and the Basic Bond Resolution. The adjustment amounted to a 9.7 percent increase in TVA revenue. Corresponding adjustments to resale rate schedules increased distributors' revenues an average of 8.5 percent.

Monthly power charges continued to rise or fall to reflect changes in costs for fuel and purchased power. The first 500 kilowatthours of home use was exempt from those varying charges. Beyond the exempt level, this produced an increase at year-end of \$2.48 per 1,000 kilowatthours compared with September 1977.

Although fuel costs are high and rising, they are more predictable than they were in 1974 when TVA adopted the varying monthly charge for fuel and imported power. TVA rate analysts studied the possibility of ending the separate treatment of fuel and related costs. The Board adopted that approach after the end of the year.

Municipal and cooperative distributors of TVA power paid an average of 1.98 cents per kilowatthour for their wholesale power supplies, or 0.36 cents more than during fiscal year 1977. Their residential customers paid an average of 2.68 cents compared to 2.32 cents the preceding year. The national average was close to 4 cents.

*Warm-room modules are being tested as a way for people with uninsulated older homes who cannot afford sufficient whole-house insulation to cope with higher energy prices. The module is usually an insulated room for comfortable living during the coldest part of winter.*

Revenue from industries served directly by TVA averaged 1.99 cents per kilowatthour, compared to 1.56 cents the year before. Federal agencies paid 1.83 cents against the 1.45 cents of a year ago.

TVA carried out investigations of the effects of rates and rate structures on power use, and of ways to make rates more fully implement TVA's objectives of providing electricity at the lowest feasible price. Wider use of interruptible power contracts for industries is one example. Through interruptible power contracts TVA can make certain reductions in power supply requirements when appropriate. These arrangements are particularly useful in helping avoid tight supply conditions or excessive costs for meeting demands. In return, the customer receives a reduction on his monthly power bill. The amount of the reductions, which are specified in the contracts, are based on the anticipated value of the interruption rights. TVA now has about 740,000 kilowatts of interruptible power under contract with industrial customers served directly. Proposals under consideration would extend the use of interruptible power to industries served by distributors of TVA power. Potentially 400,000 additional kilowatts could be under interruptible power contracts in 10 years — making the total about equal to the capacity of one of TVA's largest generating units.

There are other approaches to reducing the need for peaking capacity. The cost of peaking power is much higher — often several times higher — than baseload power. Time-of-day rates can reflect this varying cost of service in electric bills. There are potential benefits to consumers who can shift some use of electricity to offpeak hours, while reducing power system costs for meeting peak loads. In January metering began in a test of time-of-day rates on a sample of residential customers of the Knoxville Utilities Board. Participants using time-of-day rates pay almost three times as much onpeak as offpeak, based on TVA's actual cost difference. This rate test will help determine the effect of time-of-day rates on monthly electricity consumption and bills and on shifting of electricity use to offpeak periods.

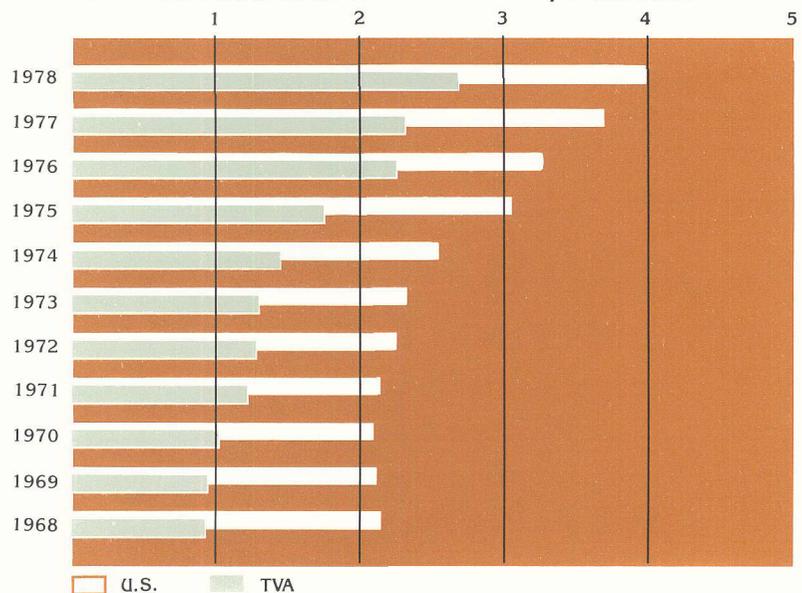
Preliminary results show that test customers have used 31 percent of their energy during peak hours, compared with 34 percent for customers in a control group. Some

test customers have made significant shifts of offpeak periods, and three-fourths of them have saved money — typically small amounts, though some people have saved as much as 20 percent on their regular monthly bills.

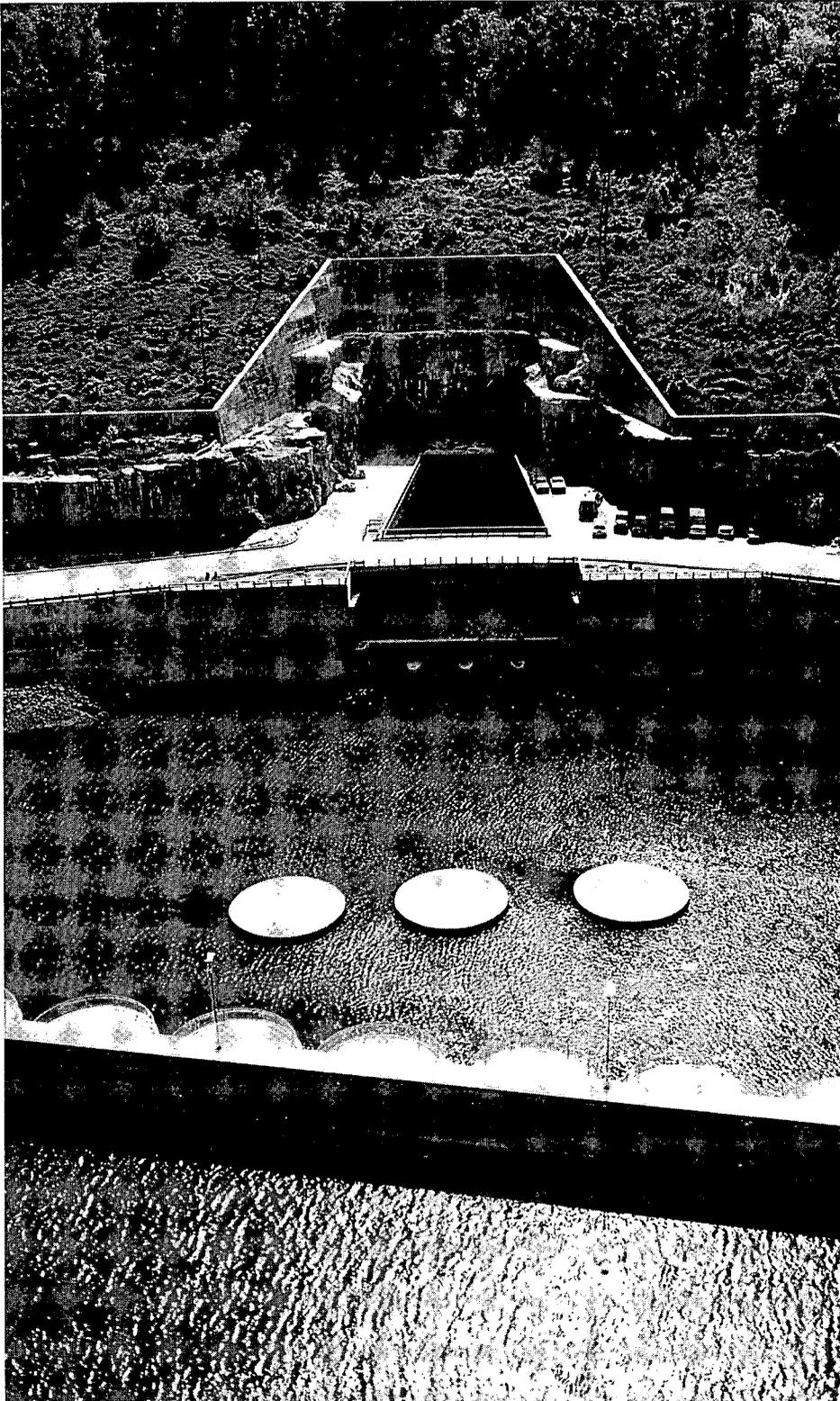
The cooperative load research program between the Chattanooga Electric Power Board and TVA continued to furnish detailed information on the daily patterns of power use for all classes of customers. The data collected are being used to determine the contribution of each service class to system peaks for cost-of-service studies, to check normal onpeak energy requirements for the time-of-day rate test in Knoxville, and to evaluate rate design and load management methods.

TVA's rate program follows the same directions as the National Energy Act passed in October 1978, which calls for the evaluation of electric rates in relation to their effect on energy conservation, efficient use of resources, and equity in charging for utility service.

AVERAGE RESIDENTIAL RATE Cents per Kilowatthour



## Load Management



The high cost of meeting peak demands is one of the reasons for higher electric rates, and TVA is experimenting with methods that may help hold down these peaks. Peak use in homes may be cut without serious inconvenience to consumers.

Work began on a project to determine costs, benefits, and consumer acceptance of water heating and space conditioning control during peak demand periods in cooperation with four local power distributors. Five hundred volunteer home consumers will be involved in the test, which includes radio control of peak use on 400 existing water heaters and 100 new super-insulated 120-gallon water heaters. Some of the consumers participating will also have electric heaters or air-conditioners controlled during peak use periods.

TVA will monitor a test of special heat pump units on the Middle Tennessee Electric Membership Corporation's system. Using offpeak energy, these units will heat or cool a large tank of water in test homes to provide seasonal heating or cooling as needed during peak hours. It will also test a new concept for using the heat pump to supply hot water for the home. A \$10,000 grant is being provided for this project by the National Rural Electric Cooperative Association.

Another offpeak thermal storage test was readied in Lenoir City, Tennessee. An electric furnace with a special brick thermal storage unit will be used to store about 200 kilowatt-hours of cheaper offpeak electric heat. This device can then maintain comfortable temperatures in a house for 16 hours.

**Despite problems revealed in testing, the Raccoon Mountain Pumped-Storage Plant neared completion. The 1.5 million kilowatt peaking plant stores cheaper offpeak energy to replace some of the expensive sources needed to meet peak demands.**



## Solar Energy

The region's first large-scale solar energy project was begun in September. At least 1,000 residential solar water heaters are expected to be installed in the Memphis area. When this project was announced, several hundred inquiries were received from people wanting to participate in the program.

Many applications of solar energy have been held back by the expense for equipment. TVA is overcoming the high initial cost of the demonstration equipment through an economical monthly payment plan. Participants in the program will pay back loans for the water heater installations at \$13 per month on their electric bills, including maintenance. They will get an inflation-proof energy source for most of their water heating, and the power system will save money through reductions in peak loads. A sample of the installed systems will be monitored to collect performance data.

This program will provide valuable experience with commercialization efforts, consumer acceptance, area-wide installation of small solar systems, and performance. It will also help demonstrate the jobs that can be created by widespread solar use.

The project is being carried out by TVA, the city of Memphis, the South Memphis Development Corporation, and Sun Harvester, Inc.

TVA is considering extending the program region-wide if the Memphis project is a success. TVA has also started investigating the possibilities of a region-wide solar home program, which includes solar uses besides water heating. TVA architects have developed alternative designs for these homes, and have also been working toward solar construction guidelines for the TVA region.

Work was underway on a 1,000-home demonstration of wood-burning heaters in cooperation with the North Georgia Electric Membership Corporation. Electric heating customers of North Georgia EMC may obtain interest-free loans for a TVA-approved wood heater installation to reduce peak demands for electricity. Modern wood-burning heaters are far more efficient, convenient, and safe than their antique counterparts.

More than half the land in the Tennessee Valley is forested, and wood residues alone can be a major energy source if there are practical ways to put this renewable resource to work. TVA foresters and energy specialists are working on projects that range from a sophisticated wood pyrolysis system to replace oil heating at Maryville College to wood-based industrial energy parks — as well as the practical home wood heaters now commercially available. A building at TVA's Land Between The Lakes is being both heated and cooled by energy from wood.

Beyond immediate applications, TVA launched a comprehensive 5-year, \$8 million solar research and development program to commercialize and encourage use of solar energy for the region's consumers. The program is divided into four main areas: development of solar space heating, space cooling, and water heating; production and use of solar biomass (wood and wood wastes primarily); industrial process heat and solar-electric applications; and commercial implementation of solar technologies.

Data collection continued on an experimental solar house in Knoxville, and an experimental test on solar water heating is being carried out at the Power Service Center in Chattanooga. Several TVA solar water heating installations are being monitored, and agreements have been made to monitor energy use at certain solar homes in the region.

Solar housing concepts will also be tested at Thomas Village, the town established for the flood victims of Clinchport, Virginia. One of the houses TVA is involved with will be monitored for at least a year.

Other solar uses offer possibilities for agricultural, commercial, and industrial applications. Solar-electric and wind energy conversion systems are also under study.

**A program of demonstrating at least 1,000 solar water heaters, like the one on the far left, was begun in Memphis.**

**Builder Howard Craig in Florence, Alabama, decided to show that a solar system could be built into a traditional home (upper and lower right, facing page). The solar collectors are in a notch on the back roof.**

## Energy Conservation



TVA and power distributors completed the first year's operation of the Home Insulation Program in 1978. About 170 energy advisors worked on free energy surveys of consumers' homes through 157 distributors of TVA power. With interest-free TVA financing available for attic insulation, 71,000 homes were surveyed for conservation prospects and 22,000 loans were made for attic insulation work through the end of the year. As a result, more than 62 million kilowatt-hours of electricity a year are being conserved. That is the energy equivalent of 140,000 barrels of oil per year, or 30,000 tons of coal.

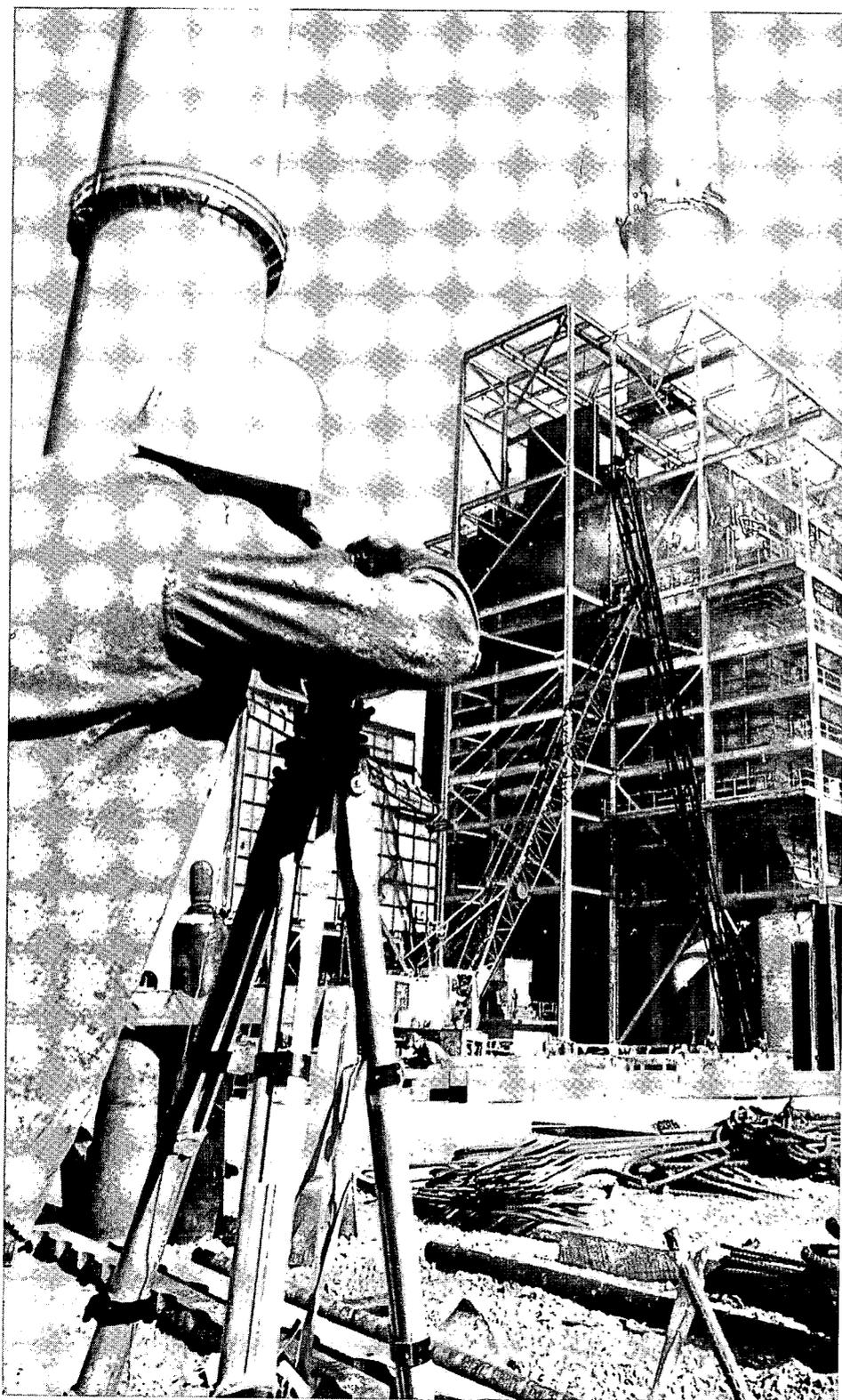
In 1978 the Home Insulation Program was expanded to include no-interest loans for other types of home weatherization. Floor insulation, weatherstripping, caulking, storm windows, and insulated doors have been added in the larger program. Residential consumers may obtain up to \$2,000 in TVA financing for conservation measures the energy survey shows to be cost-effective (except that financing for floor insulation and storm windows are limited to users of electric heat).

Ten-year loans, currently expected to be at 8.5 percent interest, for a certified heat pump installation will soon be made available through participating distributors under TVA's Certified Electric Heat Pump Installation Program.

TVA has been developing broader efforts in other areas of energy conservation. Business and industry use close to half of the region's power supply, and TVA is intensifying its conservation activities in this field. An energy survey and conservation program is being planned for these power users that will compare with the Home Insulation Program.

**TVA's expanded Home Insulation Program now makes interest-free financing available for certain weatherizing measures, such as storm windows, if the proper criteria are met.**

## Fuel and Power Supply



The job of buying new coal supplies that will allow TVA to comply with the Clean Air Act has been TVA's largest coal-purchasing effort ever, and perhaps one of the largest anywhere. Over the past two years TVA has awarded about \$7 billion in contracts for almost 225 million tons of coal to help control sulfur dioxide emissions from its power plants.

Construction began during the year on coal washing plants to remove sulfur from the coal being supplied to Cumberland and Paradise Steam Plants, and a contract was awarded for a sulfur dioxide scrubber for Widows Creek unit 7. Engineering and design work was started on sulfur dioxide scrubbers to be installed at the Johnsonville, Cumberland, and Paradise plants. The estimated cost of these and other new pollution control facilities is about a billion dollars.

Coal with less sulfur requires larger, more powerful equipment to control fly ash emissions. New electrostatic precipitators were operated at Widows Creek units 1-6 and at Bull Run. Work was nearly completed on new precipitators for Gallatin Steam Plant at a cost of \$37 million. A contract was awarded on a \$28 million project to install new precipitators for Paradise Steam Plant unit 3. Work also started on an \$80 million baghouse installation at Shawnee Steam Plant. Precipitators costing \$126 million are planned for Cumberland.

**Work has begun on a wet limestone sulfur dioxide scrubber on Widows Creek unit 7 to remove the gas from the stack discharge. New fly ash collectors were also operated there on Units 1-6.**

Tests at Raccoon Mountain Pumped-Storage Plant revealed operating problems — principally vibrations — that would take several months to solve. Steps are being taken by the supplier to correct this problem, but it will probably be at least spring of 1979 before modifications can be fully completed and the units run at full load. Some generation, however, should be available during the 1978-79 winter.

Progress continued on six nuclear power plants scheduled to contribute to power supplies between 1979 and 1986.

The U.S. Nuclear Regulatory Commission (NRC) authorized preliminary work on Phipps Bend Nuclear Plant near Surgoinsville, Tennessee, in October 1977. Full-scale construction began on the 2.6 million

kilowatt plant in January 1978 when the NRC issued a construction permit.

Preliminary work began on the 2.8 million kilowatt Yellow Creek Nuclear Plant near Iuka, Mississippi, when the NRC issued a limited work authorization in February 1978. Full construction was scheduled to begin in December 1978.

No orders were placed for new generating capacity, but all generating options are being kept open to meet future electricity requirements.

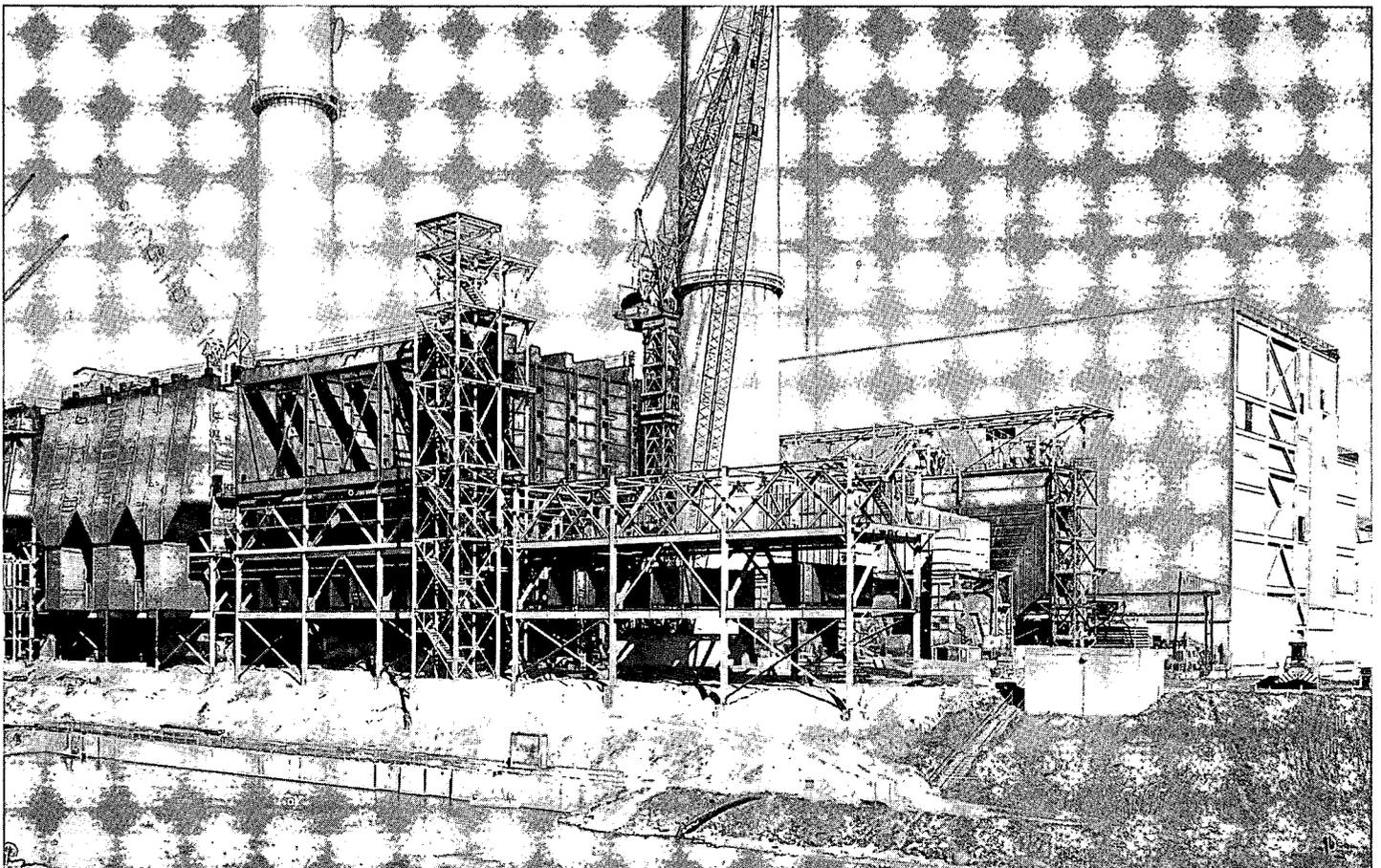
The total estimated cost for TVA generating plants under construction is more than \$11 billion. Construction expenditures in 1978 came to \$1.7 billion.

To obtain fuel for these nuclear power plants, TVA has been buying uranium concentrates from several

companies and has also been acquiring uranium property interests. Federal-American Partners began mining uranium ore for TVA on properties TVA has leased in the Gas Hills area of Wyoming. Production of uranium concentrates from this ore began in October 1978. TVA invested \$47 million in acquiring and developing uranium property interests in 1978, bringing the total for the past seven years to \$122 million.

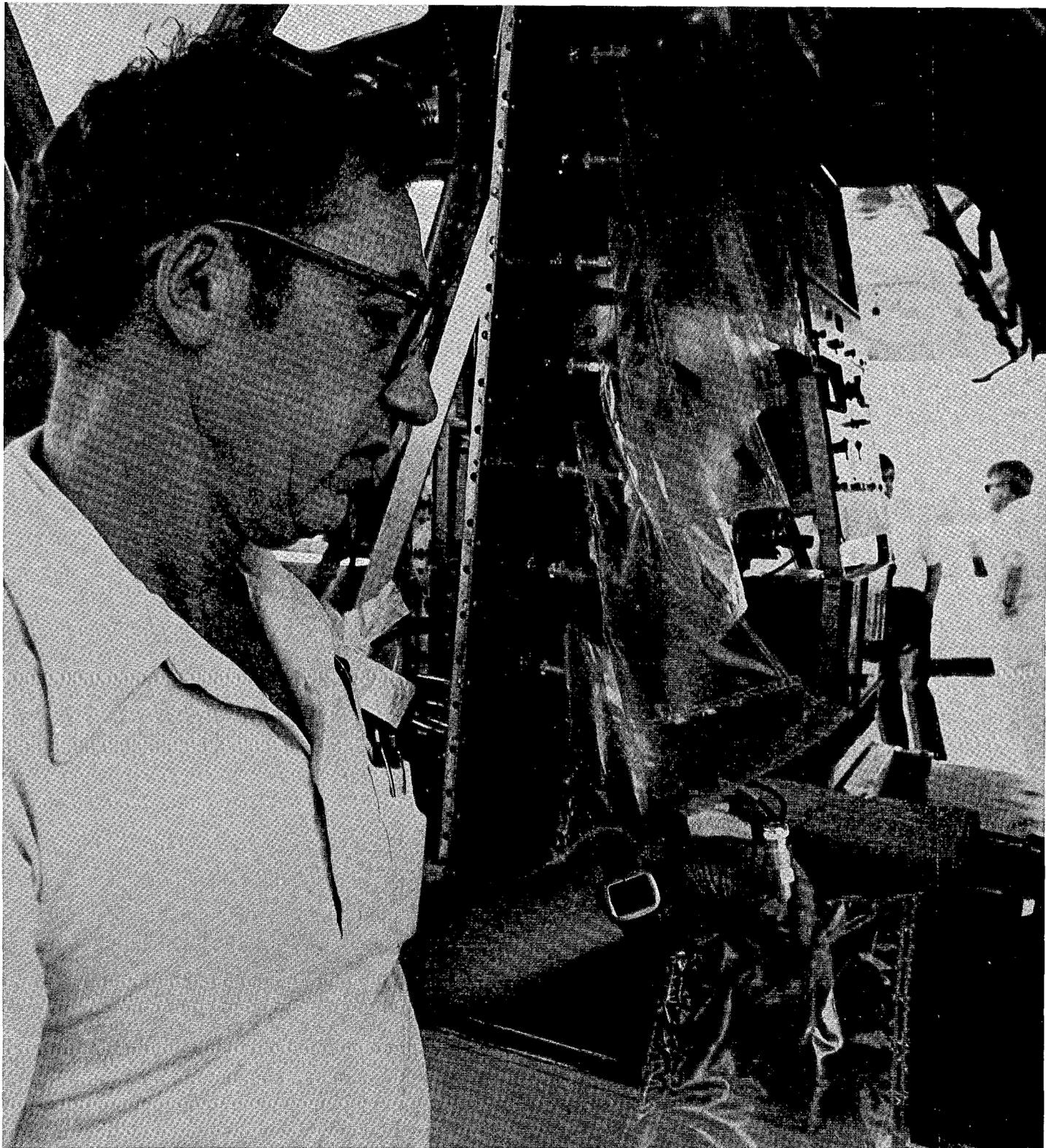
TVA has changed nuclear refueling schedules to reduce reactor downtime.

**To handle lower-sulfur coal, several plants have required much larger fly ash collectors. New electrostatic precipitators were almost completed at Gallatin Steam Plant (below).**



## Generating Capacity on September 30, 1978

<i>TVA Hydro Plants</i>	<i>No. Units</i>	<i>Installed Capacity-kW</i>	<i>TVA Coal-Fired Plants</i>	<i>No. Units</i>	<i>Installed Capacity-kW</i>
Apalachia	2	82,800	Allen	3	990,000
Blue Ridge	1	20,000	Bull Run	1	950,000
Boone	3	75,000	Colbert	5	1,419,750
Chatuge	1	10,000	Cumberland	2	2,600,000
Cherokee	4	135,180	Gallatin	4	1,255,200
Chickamauga	4	117,000	John Sevier	4	846,500
Douglas	4	120,600	Johnsonville	10	1,485,200
Fontana	3	238,500	Kingston	9	1,723,250
Fort Loudoun	4	139,140	Paradise	3	2,558,200
Fort Patrick Henry	2	36,000	Shawnee	10	1,750,000
Great Falls	2	31,860	Watts Bar	4	240,000
Guntersville	4	106,200	Widows Creek	<u>8</u>	<u>1,977,985</u>
Hiwassee	2	117,100	Total	63	17,796,085
Kentucky	5	175,000			
Melton Hill	2	72,000	<i>TVA Nuclear Plants</i>		
Nickajack	4	100,350	Browns Ferry	3	3,456,000
Norris	2	100,800			
Nottely	1	15,000	<i>TVA Combustion Turbine Plants</i>		
Ocoee #1	5	18,000	Allen	20	620,800
Ocoee #2	2	21,000	Colbert	8	476,000
Ocoee #3	1	28,800	Gallatin	4	325,200
Pickwick	6	220,040	Johnsonville	<u>16</u>	<u>1,088,000</u>
South Holston	1	35,000	Total	48	2,510,000
Tims Ford	1	45,000	Alcoa Dams (12)		423,715
Watauga	2	50,000	Corps of Engineers Dams (8)		<u>853,000</u>
Watts Bar	5	159,900	Total System in Service		<u>28,308,710</u>
Wheeler	11	359,100			
Wilbur	4	10,700			
Wilson	<u>21</u>	<u>629,840</u>			
Total	109	3,269,910			



## Energy Research

TVA has stepped up its traditional role of being a proving ground for demonstrating new approaches to solving our energy problems.

TVA contributed \$14 million — along with staff time and effort — to the Electric Power Research Institute (EPRI), an industry-supported research organization which complements research programs carried out by other agencies on national energy problems. That amount included contributions on behalf of the distributors of TVA power.

TVA spent an additional \$7 million in other power-related R&D for a total expenditure of \$21 million. In addition, TVA did research funded with \$9 million from other agencies.

No large outlays for R&D facilities have been made since the completion of the wet limestone scrubber on Widows Creek unit 8. This demonstration scrubber completed a year's operation with up to 94 percent sulfur dioxide removal. Tests on other scrubbing processes have continued at Colbert and Shawnee Steam Plants.

The scrubber test facility at Shawnee, which has provided much valuable information over the years in scrubbing technology, was recently used to begin the first tests of a pilot scale cocurrent scrubber and to test a magnesium oxide scrubbing method.

Also at Shawnee a \$1.5 million test of a 75,000-kilowatt ionizer was prepared. The ionizer is used to increase the effectiveness of electrostatic fly ash collectors. The ionizer could be particularly valuable in dealing with medium- to low-sulfur coal and stringent fly ash removal standards.

Other studies have also been performed on identifying or minimizing environmental impacts of routine power plant operations. For example, a 2-year series of tests completed at the John Sevier Steam Plant in 1978 showed that chlorine doses to prevent condenser fouling could be reduced considerably in some months with no loss of plant efficiency.

Evaluations of three preliminary designs for a 200,000-kilowatt fluidized bed combustion plant were nearly finished, but still required some updating in light of the more stringent requirements of the 1977 amendments to the Clean Air Act.

As part of its efforts to improve the use of existing energy resources TVA is paying close attention to power plant byproducts, such as rejected heat, boiler slag, and other materials.

TVA started work on designing an industrial park to use heat rejected from the Watts Bar Nuclear Plant. With the right applications, the heat equivalent of about 7 million barrels of oil per year could be provided to industries through warm water from the plant's cooling system.

In cooperation with private industry, TVA has tested the feasibility of using molten boiler slag combined with limestone for the production of mineral wool insulation. TVA is now studying the options for a demonstration plant for producing insulation at Allen Steam Plant in Memphis. This insulation can be produced for one-third of the energy of conventional production and will help meet the growing demand for mineral wool.

TVA is identifying the potential for cogeneration in the region, and several Valley industries have expressed interest. Cogeneration is the production of electricity and usable heat from the same energy source, or the use of high-temperature waste heat to generate electricity with more efficient fuel use.

A study by TVA in cooperation with the Institute of Gas Technology and United Technologies Corporation found potential in the use of a coal-based fuel cell for cogeneration. Cogenerating fuel cell power plants using medium-Btu coal gas distributed by pipeline appear to be feasible; further evaluations are being made, however.

TVA has been in contact with officials of Alabama, Kentucky, and Tennessee concerning the development of coal-based energy/industrial parks. In these parks, a central plant would convert coal to clean liquid or gaseous fuels for use by the industries or for cogeneration. Technical assistance has been given to several county governments to determine the feasibility of specific energy/industrial parks.

An energy/industrial park can of course be based on other fuels. For example, TVA and other groups are studying the possibilities of a wood-based energy system in Humphreys County, Tennessee, at the site of an industrial park already planned.

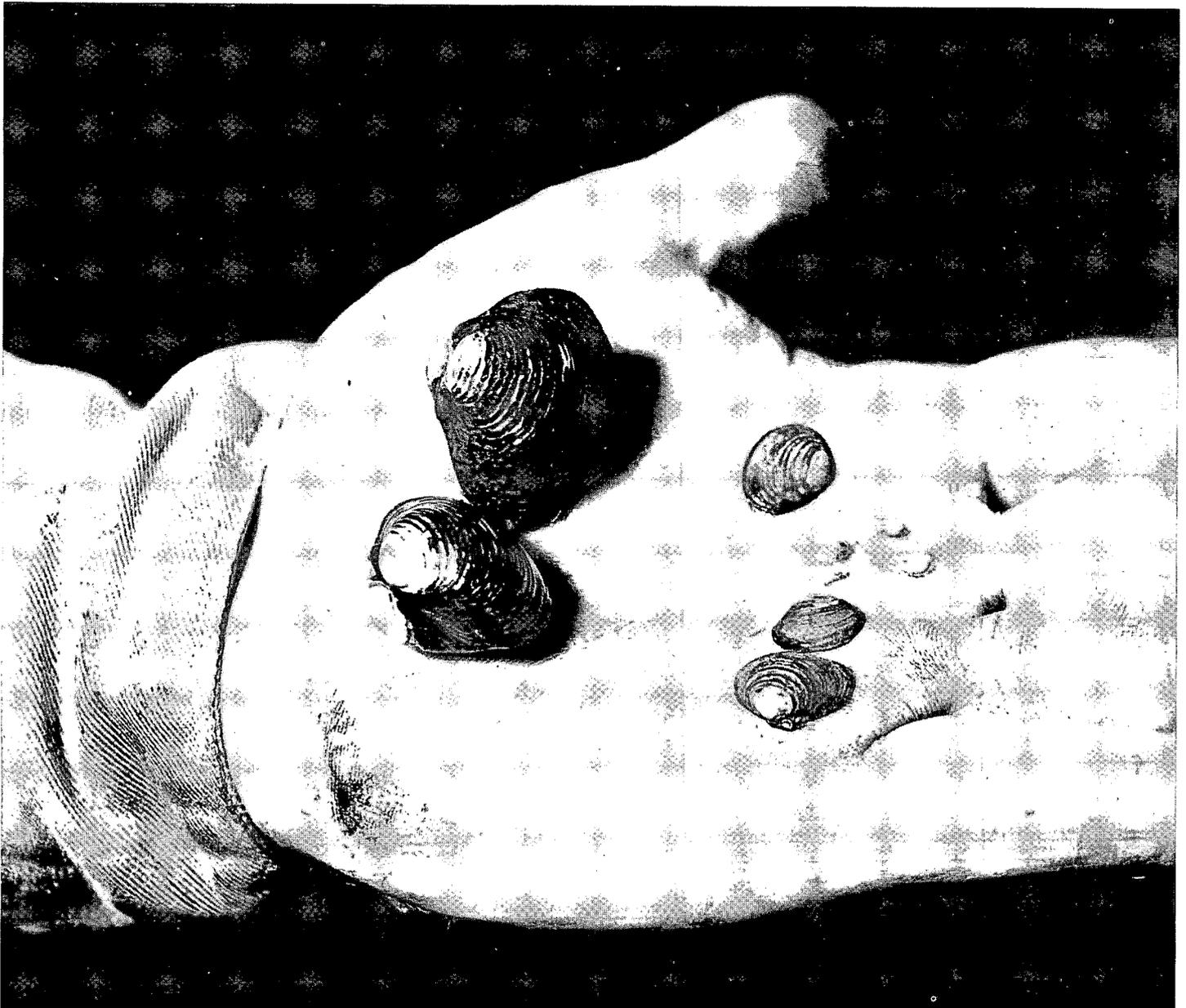
**EPA, TVA, and other scientists carried out unique tests measuring the transport of pollutants in the plumes of Cumberland and Widows Creek Steam Plants. These tests were part of the first major field experiment in an extensive EPA monitoring project.**

TVA is working on the development of electric vehicles for private and commercial transportation. EPRI has chosen TVA as the host utility in a 2-year, \$1,450,000 electric vehicle research, development, and demonstration program. TVA has purchased and is testing 6 small vans; EPRI will buy up to 20 larger vans with related equipment for test and

demonstration. It is hoped that this electric vehicle demonstration will be able to serve as a national model for the operation of an electric fleet and will help evaluate the demands of charging electric vehicles. The market potential for electric vehicles, which could help reduce dependence on foreign petroleum, will be examined.

A wide variety of other projects are underway including assessments of magnetohydrodynamics, fusion, and energy storage.

**Asiatic clams are among the organisms that can plug power plant water systems. This has become a national problem. TVA has been testing several ways of controlling this pest without adversely affecting water discharges.**



# Financial Statements

TENNESSEE VALLEY AUTHORITY:  
A corporation wholly owned by the United States of America

## COOPERS & LYBRAND

CERTIFIED PUBLIC ACCOUNTANTS

IN PRINCIPAL AREAS  
OF THE WORLD

To the Board of Directors of  
Tennessee Valley Authority:

We have examined the financial statements of TENNESSEE VALLEY AUTHORITY at September 30, 1978 and 1977 and for the years then ended which appear on pages 22 to 31 herein. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the aforementioned financial statements present fairly:

- (1) the financial position of the Authority at September 30, 1978 and 1977, and the results of operations and changes in financial position of its several programs for the years then ended; and
- (2) the financial position of the power program of the Authority at September 30, 1978 and 1977, and the results of operations and changes in financial position of that program for the years then ended,

all in conformity with generally accepted accounting principles applied on a consistent basis.

COOPERS & LYBRAND

New York, November 22, 1978.

# Balance Sheets

September 30, 1978 and 1977

## ASSETS

	Power program		All programs	
	1978	1977	1978	1977
	(Thousands)			
<b>Property, Plant, and Equipment,</b> substantially all at original cost				
Completed plant				
Multipurpose dams; note 1	\$ 495,407	\$ 494,264	\$1,092,715	\$1,075,850
Single-purpose dams	72,869	72,809	72,869	72,809
Steam production plants	2,534,622	2,428,760	2,534,622	2,428,760
Nuclear production plants	885,991	853,325	885,991	853,325
Other electric plant	1,876,347	1,765,136	1,876,347	1,765,136
Other plant	—	—	181,715	175,166
	<u>5,865,236</u>	<u>5,614,294</u>	<u>6,644,259</u>	<u>6,371,046</u>
Less accumulated depreciation and depletion; note 2	<u>1,746,118</u>	<u>1,609,282</u>	<u>1,909,207</u>	<u>1,763,160</u>
Completed plant, net	<u>4,119,118</u>	<u>4,005,012</u>	<u>4,735,052</u>	<u>4,607,886</u>
Construction and investigations in progress; note 3	<u>4,586,550</u>	<u>3,280,203</u>	<u>4,798,879</u>	<u>3,449,464</u>
Nuclear fuel	485,863	354,164	485,863	354,164
Less accumulated amortization; note 2	<u>92,817</u>	<u>54,614</u>	<u>92,817</u>	<u>54,614</u>
Nuclear fuel, net	<u>393,046</u>	<u>299,550</u>	<u>393,046</u>	<u>299,550</u>
Total property, plant, and equipment	<u>9,098,714</u>	<u>7,584,765</u>	<u>9,926,977</u>	<u>8,356,900</u>
<b>Current Assets</b>				
Cash	38,249	65,170	128,432	143,913
Accounts receivable	328,034	218,581	336,522	226,382
Inventories, principally at average cost	<u>359,502</u>	<u>372,997</u>	<u>374,087</u>	<u>386,281</u>
Total current assets	<u>725,785</u>	<u>656,748</u>	<u>839,041</u>	<u>756,576</u>
<b>Deferred Charges</b>				
Unamortized debt issue and reacquisition expense; note 2	9,338	9,905	9,338	9,905
Mine and mill development costs	<u>76,488</u>	<u>37,093</u>	<u>76,488</u>	<u>37,093</u>
Total deferred charges	<u>85,826</u>	<u>46,998</u>	<u>85,826</u>	<u>46,998</u>
<b>Total assets</b>	<u>\$9,910,325</u>	<u>\$8,288,511</u>	<u>\$10,851,844</u>	<u>\$9,160,474</u>

The notes on pages 27 through 31 are an integral part of the financial statements.

\*Deduct

## LIABILITIES AND CAPITALIZATION

	Power program		All programs	
	1978	1977	1978	1977
	(Thousands)			
<b>Proprietary Capital</b>				
Appropriation investment; note 4				
Congressional appropriations	\$1,383,721	\$1,384,140	\$3,155,915	\$3,017,405
Transfers of property from other Federal agencies	23,470	23,209	56,587	56,059
	1,407,191	1,407,349	3,212,502	3,073,464
Less repayments to General Fund of the U.S. Treasury; note 5	475,059	455,059	516,769	496,755
Appropriation investment	932,132	952,290	2,695,733	2,576,709
Retained earnings reinvested in the power program; page 24	1,227,762	1,072,910	1,227,762	1,072,910
Accumulated net expense of non-power programs; page 25	—	—	867,375*	794,960*
Total proprietary capital	<u>2,159,894</u>	<u>2,025,200</u>	<u>3,056,120</u>	<u>2,854,659</u>
<b>Long-Term Debt</b>				
Principal; note 6	5,425,000	4,725,000	5,425,000	4,725,000
Unamortized discount* and premium, net; note 2	6,465*	6,918*	6,465*	6,918*
Total long-term debt	<u>5,418,535</u>	<u>4,718,082</u>	<u>5,418,535</u>	<u>4,718,082</u>
<b>Current Liabilities</b>				
Short-term debt; note 6				
U.S. Treasury	150,000	150,000	150,000	150,000
Federal Financing Bank	1,520,000	980,000	1,520,000	980,000
Long-term debt due April 1, 1979	100,000	—	100,000	—
Short-term debt	1,770,000	1,130,000	1,770,000	1,130,000
Accounts payable	404,454	292,280	430,358	316,721
Employees' accrued leave	20,928	18,580	35,888	33,087
Payrolls accrued	22,095	15,447	26,524	19,003
Interest accrued	114,419	88,922	114,419	88,922
Total current liabilities	<u>2,331,896</u>	<u>1,545,229</u>	<u>2,377,189</u>	<u>1,587,733</u>
<b>Commitments; note 3</b>				
<b>Total liabilities and capitalization</b>	<u>\$9,910,325</u>	<u>\$8,288,511</u>	<u>\$10,851,844</u>	<u>\$9,160,474</u>

# Net Income and Retained Earnings — Power Program

For the Years Ended September 30, 1978 and 1977

	1978		1977	
	kWh	Amount	kWh	Amount
	(Thousands)			
<b>Operating Revenues</b>				
Sales of electric energy				
Municipalities and cooperatives	77,875,252	\$1,540,126	76,505,019	\$1,238,326
Federal agencies	16,722,347	305,805	22,268,048	322,615
Industries	22,877,485	455,957	22,738,679	355,713
Electric utilities	175,486	3,897	161,688	2,911
Total outside sales	117,650,570	2,305,785	121,673,434	1,919,565
Interdivisional	295,320	6,523	313,570	5,622
Total sales of electric energy	<u>117,945,890</u>	<u>2,312,308</u>	<u>121,987,004</u>	<u>1,925,187</u>
Rents		37,023		40,847
Discounts and penalties		100		76
Other miscellaneous revenues		703		579
Total operating revenues		<u>2,350,134</u>		<u>1,966,689</u>
<b>Operating Expenses</b>				
Production				
Fuel		1,035,056		909,192
Power purchased and interchanged, net		166,714		106,581
Other		338,154		293,429
Transmission		27,491		27,624
Customer accounts		706		658
Demonstration of power use		4,261		2,109
Administrative and general		81,559		59,939
Payments in lieu of taxes		79,872		68,179
Social security taxes		11,727		8,748
Provision for depreciation		150,447		138,398
Total operating expenses		<u>1,895,987</u>		<u>1,614,857</u>
Operating income		<u>454,147</u>		<u>351,832</u>
<b>Other Income and Deductions</b>				
Interest income		428		244
Other, net		127*		1,625*
Total other income and deductions		<u>301</u>		<u>1,381*</u>
Income before interest charges		<u>454,448</u>		<u>350,451</u>
<b>Interest Charges</b>				
Interest on long-term debt		419,434		336,414
Other interest expense		66,377		41,915
Allowance for borrowed funds used (construction and nuclear fuel); note 2		248,967*		178,621*
Amortization of long-term debt discount, expense, and premium, net; note 2		1,036		928
Net interest charges		<u>237,880</u>		<u>200,636</u>
<b>NET INCOME</b>		<u>216,568</u>		<u>149,815</u>
<b>Return on appropriation investment;</b> note 5		<u>61,716</u>		<u>64,017</u>
Increase in retained earnings reinvested		154,852		85,798
<b>Retained earnings reinvested at beginning of period</b>		<u>1,072,910</u>		<u>987,112</u>
<b>Retained earnings reinvested at end of period</b>		<u>\$1,227,762</u>		<u>\$1,072,910</u>

The notes on pages 27 through 31 are an integral part of the financial statements.

\*Deduct

# Net Expense and Accumulated Net Expense — Nonpower Programs

For the Years Ended September 30, 1978 and 1977

	<u>1978</u>	<u>1977</u>
	(Thousands)	
<b>Regional Resources Development</b>		
Navigation operations	\$ 7,306	\$ 7,104
System flood control operations	5,670	5,102
Recreation development	4,531	3,335
Tributary area development	2,925	6,698
Regional water quality management	1,290	1,226
Fisheries and waterfowl resources development	1,136	789
Preliminary surveys and engineering	306	213
Environmental education	374	280
Valley agricultural development	2,014	1,844
Waste heat utilization	503	370
Forest and wild land resources development	2,334	1,688
Strip mine reclamation demonstrations	3,677	1,410
Interagency health services demonstrations	324	214
Regional economic studies	726	730
Townlift community improvement	793	721
Human resources development	679	660
Mass transportation demonstration	106	499
Minerals resources projects	327	276
Special opportunities counties program	1,250	—
Minority economic development	111	—
Local flood damage prevention operations	7,014	2,919
Environmental quality projects	480	456
Net expense of regional resources development	<u>43,876</u>	<u>36,534</u>
<b>Fertilizer Development;</b> note 2		
Research and development	<u>10,893</u>	<u>8,870</u>
Fertilizer introduction		
Fertilizer industry demonstrations	2,845	2,648
Farm test demonstrations outside the Valley	<u>1,155</u>	<u>987</u>
Net expense of fertilizer introduction	<u>4,000</u>	<u>3,635</u>
Developmental production		
Cost of products distributed	<u>26,663</u>	<u>24,061</u>
General expenses		
Loss on retirements of manufacturing plant and equipment, net	139	5,650
Gain on sale of phosphate reserves, net	107*	224*
Writeoff of retired phosphate plant inventories	—	1,893
Administrative and general	582	555
Other	<u>430</u>	<u>351</u>
Total general expenses	<u>1,044</u>	<u>8,225</u>
Total production expense	<u>27,707</u>	<u>32,286</u>
Less transfers and sales of products		
Transfers to other TVA programs, at market prices	20,978	20,404
Direct sales	<u>335</u>	<u>848</u>
Total transfers and sales	<u>21,313</u>	<u>21,252</u>
Net expense of developmental production	<u>6,394</u>	<u>11,034</u>
Net expense of fertilizer development	<u>21,287</u>	<u>23,539</u>
<b>Land Between The Lakes Operations</b>	<u>5,509</u>	<u>4,251</u>
<b>Valley Mapping and Remote Sensing</b>	<u>771</u>	<u>557</u>
<b>Other Expense, Net</b>	<u>972</u>	<u>521</u>
NET EXPENSE	72,415	65,402
<b>Accumulated net expense at beginning of period</b>	794,960	729,558
<b>Accumulated net expense at end of period</b>	<u>\$867,375</u>	<u>\$794,960</u>

The notes on pages 27 through 31 are an integral part of the financial statements.

\*Deduct

# Changes in Financial Position

For the Years Ended September 30, 1978 and 1977

	Power program		All programs	
	1978	1977	1978	1977
	(Thousands)			
<b>Source of Funds</b>				
Program sources				
Net power income; page 24	\$ 216,568	\$ 149,815	\$ 216,568	\$ 149,815
Items not requiring funds; note a	58,821*	5,555*	58,821*	5,555*
Funds from power operations	157,747	144,260	157,747	144,260
Sale of power facilities	2,171	1,290	2,171	1,290
Funds from power program; note b	159,918	145,550	159,918	145,550
Net expense of nonpower programs; page 25			72,415*	65,402*
Add items not requiring funds; note a			8,232	13,145
Funds used in nonpower operations			64,183*	52,257*
Sale of nonpower facilities			342	899
Funds used in nonpower programs			63,841*	51,358*
Debt sources				
Long-term bonds				
Issues	800,000	900,000	800,000	900,000
Redemptions	—	150,000*	—	150,000*
Short-term notes				
Issues	4,280,000	3,815,000	4,280,000	3,815,000
Redemptions	3,740,000*	3,570,000*	3,740,000*	3,570,000*
Total debt sources	1,340,000	995,000	1,340,000	995,000
Other sources				
Congressional appropriations	320	204	138,510	125,930
Property transfers	261	621	528	744
Total other sources	581	825	139,038	126,674
<b>Total source of funds</b>	<b>\$1,500,499</b>	<b>\$1,141,375</b>	<b>\$1,575,115</b>	<b>\$1,215,866</b>
<b>Disposition of Funds</b>				
Expended for plant and equipment, excluding allowance for borrowed funds used	\$1,460,951	\$1,108,767	\$1,527,033	\$1,161,692
Less:				
Depreciation and amortization of nuclear fuel charged to construction and clearing accounts	3,620	10,407	5,766	12,370
Cost of removing retired facilities and salvage from retained materials	329	895*	302	965*
Less:	1,457,002	1,099,255	1,520,965	1,150,287
Payments to U.S. Treasury; note 5				
Return on appropriation investment	61,716	64,017	61,716	64,017
Repayment of appropriation investment	20,000	20,000	20,014	20,029
Less:	81,716	84,017	81,730	84,046
Unamortized debt discount and expense and other deferred charges				
Mine and mill development cost	39,395	25,074	39,395	25,074
Debt issue and reacquisition expense	16	9,468	16	9,468
Less:	39,411	34,542	39,411	34,542
Changes in working capital (increase or decrease*)				
Cash	26,921*	92,268*	15,481*	62,711*
Accounts receivable	109,453	53,792	110,140	47,990
Inventories	13,495*	14,930	12,194*	17,740
Less:	69,037	23,546*	82,465	3,019
Less other current liabilities (excluding short-term debt)	146,667	52,893	149,456	56,028
Less:	77,630*	76,439*	66,991*	53,009*
<b>Total disposition of funds</b>	<b>\$1,500,499</b>	<b>\$1,141,375</b>	<b>\$1,575,115</b>	<b>\$1,215,866</b>

\*Deduct

**Notes:**

a. Items not requiring funds:

	<b>Power</b>		<b>Nonpower</b>	
	<u>1978</u>	<u>1977</u>	<u>1978</u>	<u>1977</u>
	(Thousands)			
Provision for depreciation	\$150,447	\$138,398	\$8,200	\$ 7,719
Provision for depletion	333	184	—	—
Amortization of nuclear fuel charged to operations	38,203	31,931	—	—
Net loss on retirements and disposals of property, plant, and equipment	127	1,625	32	5,426
Amortization of long-term debt discount, premium, and expense; and deferred charges	1,036	928	—	—
Allowance for borrowed funds used (construction and nuclear fuel)	248,967*	178,621*	—	—
	<u>\$ 58,821*</u>	<u>\$ 5,555*</u>	<u>\$8,232</u>	<u>\$13,145</u>

b. Net power proceeds (see note 6) may be derived as follows:

	<b>Year ended September 30</b>	
	<u>1978</u>	<u>1977</u>
	(Thousands)	
Funds from power program	\$159,918	\$145,550
Add back interest charges	<u>485,811</u>	<u>378,329</u>
Net power proceeds	<u>\$645,729</u>	<u>\$523,879</u>

The notes on pages 27 through 31 are an integral part of the financial statements.

\*Deduct

**Notes to Financial Statements**

1. **Allocation of cost of multipurpose projects** — Section 14 of the TVA Act requires TVA's Board of Directors to allocate the cost of completed multipurpose projects, subject to the approval of the President of the United States. The cost of facilities installed exclusively for a single purpose is assigned directly to that purpose; the cost of multiple-use facilities is allocated among the various purposes served.

The total investment of \$1,092,715,000 in completed multipurpose dams at September 30, 1978, is classified as follows:

	<b>Investment</b>		
	<u>Direct</u>	<u>Multiple-use</u>	<u>Total</u>
	(Thousands)		
Power	\$317,992	\$177,415	\$ 495,407
Navigation	152,954	137,447	290,401
Flood control	61,608	151,782	213,390
Recreation	1,319	45,856	47,175
Tributary area development	<u>19</u>	<u>46,323</u>	<u>46,342</u>
Total	<u>\$533,892</u>	<u>\$558,823</u>	<u>\$1,092,715</u>

2. **Summary of significant accounting policies** — Power accounts are kept in accordance with the uniform system prescribed by the Federal Energy Regulatory Commission.

Plant additions and retirements — Additions to plant are recorded at cost, which includes material, labor, overhead, and allowance for funds used. The costs of generation including amortization of nuclear fuel, less credit for the fair value of energy generated during preliminary operations prior to commercial acceptance, are also included in the recorded cost of steam and nuclear generating plants. Except for chemical plant, plant retirements (including original cost and removal cost less salvage) are charged against appropriate accumulated depreciation accounts. Because of the experimental nature of fertilizer development, losses on early retirement of chemical plant are included in current year operations.

Depreciation and depletion — Straight-line depreciation is provided for substantially on a composite basis. Rates of depreciation are derived from engineering studies of useful life and are reviewed each year. Depletion of coal land and land rights and phosphate land and mineral rights is provided on a unit of production basis.

Allowance for funds used — The practice of capitalizing an allowance for funds used during construction and during the fabrication of nuclear fuels is followed in the power program. The method used is to calculate each month the interest on the most recent debt issues that is equivalent to the average construction work in progress and nuclear fuel in fabrication base. The equivalent average capitalization rate for fiscal years 1978 and 1977 was 7.57 percent and 7.09 percent, respectively.

Repairs and maintenance — The cost of current repairs and minor replacements is charged to appropriate operating expense and clearing accounts, and the cost of renewals and betterments is capitalized.

Nuclear fuel amortization — The amortization of nuclear fuel is provided on a unit of production basis. Rates are established to amortize the costs over the useful life.

Operating revenues and energy costs — Revenues from the sale of electric energy, including amounts resulting from the application of an adjustment addendum providing for monthly billing charges to reflect increases or decreases in fuel and purchased power costs, are recorded only when billed. Costs of fuel consumed and of purchased power are reflected in operating expenses as incurred. About \$49.7 million of these costs recorded in fiscal year 1977 were used in calculating the adjustment to power billings for October and November 1977; and about \$80.2 million of these costs recorded in fiscal year 1978 were used in calculating the adjustment to power billings for October and November 1978.

Borrowing expenses — Issue and reacquisition expenses, discounts, and premiums on power borrowings from the public are amortized on a straight-line basis over the term of the related securities. Issue expenses on power borrowings from Federal Financing Bank are amortized over a five-year period except that amounts under \$6,000 are expensed.

Research and development — Research and development costs are expensed as incurred (approximately \$31,868,000 in 1978 and \$25,224,000 in 1977) except for those costs which relate to specific power program capital projects.

Sales of fertilizer — Sales of fertilizer materials are not made on a commercial basis, but are made to organizations collaborating in an experimental and educational program aimed at improving the manufacture, distribution, and use of fertilizers.

**3. Construction projects, commitments, and rental expenses** — The construction budgets for fiscal year 1979 are \$1,655,498,000 for power projects and \$95,189,000 for multipurpose and nonpower projects. Substantial commitments have been incurred for these projects.

The total rentals charged to power operating expenses and other operating clearing accounts for the years ending September 30, 1978 and 1977, amounted to approximately \$20,484,021 and \$17,990,000, respectively. At September 30, 1978, the aggregate minimum gross rental commitments of TVA under all noncancelable leases for the periods shown are as follows:

<u>Year</u>	<u>Amount</u>
	(Thousands)
1979	\$14,357
1980	13,990
1981	12,865
1982	11,774
1983	11,191
1984-88	28,265
1989-93	15,171
1994-98	8,358
Thereafter	282

Minimum gross rental commitments include rentals paid under agreements with the City of Memphis, Tennessee, which provide that (1) TVA sells to the City all the power and energy requirements of its electric distribution system, and (2) the City leases to TVA the Thomas H. Allen steam-electric generating plant with an installed capacity of 990,000 kilowatts. Each agreement is for a term of 20 years, beginning January 1, 1965. The lease agreement provides for annual rental payments of \$6,900,000 and grants TVA an option to buy the plant for \$2,000,000 at the end of the lease term.

**4. Appropriation investment** — Changes in appropriation investment during the years ended September 30, 1978 and 1977, were as follows:

	<b>Power program</b>		<b>All programs</b>	
	<b>1978</b>	<b>1977</b>	<b>1978</b>	<b>1977</b>
		(Thousands)		
Congressional appropriations, net	\$ 419*	\$ 394	\$ 138,510	\$ 125,930
Transfers of property from other Federal agencies	261	621	528	744
	158*	1,015	139,038	126,674
Less repayments to General Fund of the U.S. Treasury	20,000	20,000	20,014	20,029
Increase or decrease* for the period	20,158*	18,985*	119,024	106,645
Balance, beginning of period	952,290	971,275	2,576,709	2,470,064
Balance, end of period	<u>\$932,132</u>	<u>\$952,290</u>	<u>\$2,695,733</u>	<u>\$2,576,709</u>

\*Deduct

An appropriation request of \$154,531,000 was made by Public Law No. 95-482, approved October 18, 1978, for the fiscal year beginning October 1, 1978.

**5. Payments to the U.S. Treasury** — Section 15d of the TVA Act requires the payment from net power proceeds of a return on the net appropriation investment in power facilities plus repayments of such investment, beginning with fiscal year 1961. The amount of return payable during each year is based on the appropriation investment as of the beginning of that year and the computed average interest rate payable by the U.S. Treasury on its total marketable public obligations as of the same date. The repayment schedule calls for payment of not less than \$10 million for each of the first five years (1961-1965), \$15 million for each of the next five years (1966-1970), and \$20 million for each year thereafter until a total of \$1 billion shall have been repaid. The payments required by Section 15d may be deferred under certain circumstances for not more than two years.

Required payments have been made as follows:

	<b>Return</b>	<b>Repayment</b>	<b>Total</b>
		(Thousands)	
Total to September 30, 1977	\$903,188	\$270,000	\$1,173,188
Year ended September 30, 1978	61,716	20,000	81,716
	<u>\$964,904</u>	<u>\$290,000</u>	<u>\$1,254,904</u>

For fiscal year 1979 the required payments will be \$68,868,000 as a return on the appropriation investment at the computed average interest rate of 7.3882 percent and \$20,000,000 as a repayment, a total of \$88,868,000.

In addition to the payments from net power proceeds, \$14,000 of nonpower proceeds was paid to the U.S. Treasury in fiscal year 1978 under the provisions of Section 26 of the TVA Act. This brought the total payments from nonpower proceeds to \$41,710,000.

Prior to 1961, under then existing legislation, TVA paid to the Treasury \$185,059,000 of power proceeds. In addition to the repayments indicated in Exhibit I, \$65,072,000 of bonds sold to the Treasury and Reconstruction Finance Corporation in fiscal years 1939-1941 have been fully repaid from power proceeds. Section 26 of the TVA Act provides for annual payments to the Treasury of any power or nonpower proceeds not needed for the operation of dams and reservoirs, the conduct of the power program, and the manufacture and distribution of fertilizers.

6. **Borrowing authority** — Section 15d of the TVA Act authorizes TVA to issue bonds, notes, and other evidences of indebtedness up to a total of \$15 billion outstanding at any one time to assist in financing its power program. Debt service on these obligations, which is payable solely from TVA's net power proceeds, has precedence over the payment to the U.S. Treasury described in note 5. Issues outstanding on September 30, 1978, consist of the following:

	(Thousands)
Long-term debt	
4.40% 1960 Series A, due November 15, 1985	\$ 50,000
4-5/8% 1961 Series A, due July 1, 1986	50,000
4-1/2% 1962 Series A, due February 1, 1987	45,000
5.70% 1967 Series A, due May 15, 1992	70,000
6-3/8% 1967 Series B, due November 1, 1992	60,000
8-1/4% 1969 Series B, due October 15, 1994	100,000
7.30% 1971 Series B, due October 1, 1996	150,000
7% 1972 Series A, due January 1, 1997	150,000
7.35% 1972 Series B, due May 1, 1997	150,000
7.35% 1972 Series C, due July 1, 1997	150,000
7.40% 1972 Series D, due October 1, 1997	150,000
7.35% 1973 Series A, due January 1, 1998	100,000
7.35% 1973 Series B, due April 1, 1998	150,000
7-3/4% 1973 Series C, due July 1, 1998	150,000
7.70% 1973 Series D, due October 1, 1998	100,000
8.05% 1974 Series A, due January 1, 1999	100,000
8.50% 1974 Series C, due October 31, 1979 (FFB)	300,000
8.05% 1975 Series A, due January 31, 1990 (FFB)	200,000
8.70% 1975 Series B, due March 31, 2000 (FFB)	100,000
8.35% 1975 Series C, due May 31, 1988 (FFB)	200,000
8.47% 1975 Series D, due July 31, 2000 (FFB)	200,000
8.485% 1975 Series E, due October 31, 2000 (FFB)	300,000
8.175% 1976 Series A, due February 28, 2001 (FFB)	300,000
7.97% 1976 Series B, due November 30, 2001 (FFB)	400,000
7.625% 1976 Series C, due January 31, 2002 (FFB)	200,000
7.975% 1977 Series A, due February 28, 2002 (FFB)	300,000
7.935% 1977 Series B, due May 31, 2002 (FFB)	400,000
8% 1977 Series C, due October 31, 2002 (FFB)	400,000
8.375% 1978 Series A, due January 31, 2003 (FFB)	400,000
Total long-term debt	<u>5,425,000</u>
Short-term debt	
U.S. Treasury	150,000
Federal Financing Bank (FFB)	1,520,000
Long-term debt due April 1, 1979	100,000
Total short-term debt	<u>1,770,000</u>
	<u>\$7,195,000</u>

7. **Retirement plan** — TVA has a contributory retirement plan which covers substantially all of its salaried employees. The cost of currently accruing benefits is funded currently. The cost of the plan to TVA was \$38,060,000 in 1978 and \$30,426,000 in 1977, including amortization of unfunded prior service costs over the average future careers of active members. The actuarially computed pension fund assets as of September 30, 1977, the latest actuarial valuation date, exceeded the actuarially computed value of vested benefits of the plan.

8. **Litigation** — Six citizens' suits have been filed in six different district courts under the Clean Air Act, alleging that the sulfur dioxide emissions from 10 of TVA's coal-fired steam plants and the particulate emissions from one unit at Widows Creek Steam Plant violate the emission standards set by the states. Plaintiffs include the states of Kentucky and Alabama and the United States of America at the request of the Environmental Protection Agency. Five of the cases have been consolidated in the United States District Court for the Middle District of Tennessee and one is pending in the United States District Court for the Northern District of Alabama. Plaintiffs are asking that the courts order TVA to comply with the applicable emission standards as expeditiously as possible. In addition, the State of Alabama is specifically asking the court to restrict operation of Widows Creek and Colbert Steam Plants until final compliance is achieved and assess a State penalty of \$10,000 per day per

violation. A proposed settlement agreement has been drafted by all the parties and awaits approval by the TVA Board of Directors. This proposed agreement specifies compliance schedules to control both sulfur dioxide and particulate emissions at TVA steam plants and provides for stipulated daily penalties if TVA does not meet these schedules. In addition, TVA acknowledges in the proposed agreement that the economic benefit of noncompliance for the entire TVA power system for the period August 7, 1977, to August 7, 1979, is \$260 million; and in lieu of penalties based on such amount, TVA agrees to install scrubbers to treat 600 megawatts of flue gas at the Cumberland Steam Plant. The proposed agreement is in full satisfaction of all state or Federal civil penalties, with the exception that TVA will still be subject to the mandatory noncompliance penalties under section 120 of the Clean Air Act Amendments of 1977 which will be levied separate and apart from this action on all sources not in compliance after July 1, 1979. Several of TVA's steam plants will not be in compliance until after July 1979. The amount of these mandatory noncompliance penalties is based on the economic value of noncompliance to the owner, less any amounts actually expended by the source toward achieving compliance. The amount of these payments cannot be determined until EPA issues guidelines and regulations.

A residential electric consumer of the Memphis Light, Gas and Water Division (Memphis) filed a class action suit against it and its governing Board in the Chancery Court of Shelby County, Tennessee, on June 9, 1978. Plaintiff claims that the fuel cost and purchased power automatic adjustment formula contained in the TVA resale rate schedule applied to him and his class violates the Fourteenth Amendment's due process clause and the Tennessee statutes which require rate changes by Memphis to receive prior approval by the Memphis City Council. In addition to declaratory and injunctive relief, plaintiff seeks a judgment for over \$110 million allegedly collected by Memphis under the automatic adjustment formula since 1974. The case has been removed to Federal court, and the court has joined TVA as a party and upheld its jurisdiction on removal. TVA and Memphis have answered and moved for judgment on the pleadings. In TVA's opinion there is little likelihood of a recovery against it.

The judgment of the United States Court of Appeals for the Sixth Circuit, ordering an injunction against the Tellico project, was affirmed by the United States Supreme Court. Congress subsequently amended the Endangered Species Act to provide for a review of the Tellico project by a special 7-member committee, with the project being automatically exempted from the act if the committee takes no action by February 8, 1979. Under the statute, such review is automatic and requires no request for exemption by TVA.

On October 20, 1975, TVA filed a suit against Westinghouse Electric Corporation in the United States District Court for the Eastern District of Tennessee based on Westinghouse's repudiating in major part certain contracts for the sale of nuclear fuel to TVA for the Sequoyah and Watts Bar Nuclear Plants. Westinghouse based its repudiation on the doctrine of "commercial impracticability" found in Uniform Commercial Code §2-615. TVA brought the action seeking, in addition to injunctive relief, a declaratory judgment as to the continuing validity, effectiveness, and enforceability of these contracts; in the alternative the action requests the court to adopt an allocation plan for the nuclear fuel presently under Westinghouse's control which is fair and reasonable to all Westinghouse customers as of September 8, 1975, the date of the repudiation. The case was transferred and consolidated for discovery with similar cases brought by other utilities to the Eastern District of Virginia under 28 U.S.C. § 1407. The evidentiary trial of the case began on September 12, 1977, and ended on March 9, 1978. On October 27, 1978, the court rendered an oral opinion finding that Westinghouse had not carried its burden of proof on its defense under UCC §2-615 or the contracts' force majeure clauses. No written decision has been entered, and certain "special issues" as to liability, as well as the question of damages, remain to be tried. Westinghouse has also raised in the case a subsequently arising dispute over the scheduled delivery date for the uranium, contending that it has been released from liability by slippages in the date. It is TVA's position that this controversy is subject to the contractual disputes mechanism, and is not within the district court's jurisdiction at this time. The court disagreed, holding that TVA had waived the disputes mechanism as to this later arising issue by originally filing the lawsuit in 1975. An injunction against the dispute proceeding was issued. TVA has appealed the matter to the United States Court of Appeals for the Fourth Circuit, where the case has been fully briefed and is set for oral argument on December 6, 1978.

On November 18, 1977, TVA filed antitrust suits against 10 foreign uranium producers and 3 domestic firms. The complaints were filed in United States District Courts in Chattanooga, Denver, and New York City, and alleged unlawful agreements among the defendants to fix uranium price and allocate world uranium markets, which resulted in damages to TVA in an amount which cannot yet be determined. The cases were consolidated in Chicago for pretrial purposes by the Judicial Panel on Multidistrict Litigation. The consolidated proceeding is being coordinated with the *Westinghouse v. Rio Algom Ltd., et al.* antitrust litigation currently pending in Chicago. Discovery is now underway.

# Operating Statistics

TENNESSEE VALLEY AUTHORITY:

A corporation wholly owned by the United States of America

## Power Earnings (Millions)

<b>OPERATING REVENUES</b>	<b>1978</b>	<b>1977</b>	<b>1976</b>	<b>1975</b>	<b>1974</b>
Sales of electric energy					
Municipalities and cooperatives	\$1,540.1	\$1,238.3	\$1,057.4	\$ 737.2	\$556.1
Federal agencies	305.8	322.6	300.1	182.5	121.5
Industries	456.0	355.7	303.6	227.6	179.8
Electric utilities	3.9	2.9	1.9	1.6	1.2
Interdivisional	6.5	5.6	8.0	6.7	5.0
Total sales of electric energy	2,312.3	1,925.1	1,671.0	1,155.6	863.6
Rents and other miscellaneous revenues	37.8	41.6	21.5	20.7	20.0
Total operating revenues	<u>2,350.1</u>	<u>1,966.7</u>	<u>1,692.5</u>	<u>1,176.3</u>	<u>883.6</u>
<b>OPERATING EXPENSES</b>					
Production	1,539.9	1,309.2	1,161.5	750.8	494.2
Transmission	27.5	27.6	24.6	22.2	20.8
Customer accounts	.7	.7	.6	.5	.5
Demonstration of power use	4.3	2.1	1.4	1.3	1.3
Administrative and general	81.6	60.0	48.6	34.0	29.9
Payments in lieu of taxes	79.9	68.2	48.4	36.8	31.1
Social security taxes	11.7	8.7	6.7	5.2	4.6
Depreciation	150.4	138.4	122.0	110.3	97.1
Other	—	—	—	—	—
Total operating expenses	<u>1,896.0</u>	<u>1,614.9</u>	<u>1,413.8</u>	<u>961.1</u>	<u>679.5</u>
Operating income	454.1	351.8	278.7	215.2	204.1
<b>Other Income and Deductions</b>	<u>.3</u>	<u>1.4*</u>	<u>.3*</u>	<u>.2*</u>	<u>.4</u>
Income before interest charges and extraordinary item	454.4	350.4	278.4	215.0	204.5
<b>Interest Charges</b>	<u>237.8</u>	<u>200.6</u>	<u>152.4</u>	<u>111.6</u>	<u>98.4</u>
Income before extraordinary item	216.6	149.8	126.0	103.4	106.1
<b>Extraordinary Item</b>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Net Income	<u>\$ 216.6</u>	<u>\$ 149.8</u>	<u>\$ 126.0</u>	<u>\$ 103.4</u>	<u>\$106.1</u>
<b>NET POWER PROCEEDS FROM OPERATIONS</b>					
Income before interest charges and extraordinary item	\$ 454.4	\$ 350.4	\$ 278.4	\$ 215.0	\$204.5
Add back noncash items	189.1	172.2	123.1	117.9	97.1
Total	<u>\$ 643.5</u>	<u>\$ 522.6</u>	<u>\$ 401.5</u>	<u>\$ 332.9</u>	<u>\$301.6</u>

\*Deduct

**Fiscal Years**

<u>1973</u>	<u>1972</u>	<u>1971</u>	<u>1970</u>	<u>1969</u>	<u>1968</u>	<u>1967</u>	<u>1966</u>	<u>1965</u>	<u>1964</u>
\$476.3	\$415.3	\$379.2	\$285.5	\$222.2	\$197.2	\$172.0	\$158.2	\$136.8	\$118.2
103.2	73.3	61.9	59.4	63.6	78.9	83.9	84.0	82.4	100.7
144.7	124.3	125.0	106.0	92.2	84.2	79.6	71.5	67.1	59.7
.8	6.3	10.1	7.6	7.3	8.6	10.1	7.9	4.8	3.1
4.0	3.4	3.1	3.0	2.8	2.7	3.1	3.0	3.0	2.8
<u>729.0</u>	<u>622.6</u>	<u>579.3</u>	<u>461.5</u>	<u>388.1</u>	<u>371.6</u>	<u>348.7</u>	<u>324.6</u>	<u>294.1</u>	<u>284.5</u>
20.3	19.2	18.7	18.1	15.2	12.1	2.4	2.2	1.9	1.9
<u>749.3</u>	<u>641.8</u>	<u>598.0</u>	<u>479.6</u>	<u>403.3</u>	<u>383.7</u>	<u>351.1</u>	<u>326.8</u>	<u>296.0</u>	<u>286.4</u>
408.7	325.6	306.1	246.1	210.3	191.1	187.8	170.4	139.9	134.3
18.9	17.8	16.9	15.1	14.3	13.9	12.9	12.4	12.2	12.0
.5	.4	.4	.3	.3	.2	.2	.2	.2	.3
1.3	1.2	1.2	1.1	1.0	1.0	.9	.8	.8	.8
27.4	24.0	22.0	18.0	15.6	14.4	13.3	12.1	11.5	10.9
27.3	25.7	20.0	16.1	14.5	13.1	11.9	10.5	9.1	8.2
3.8	3.2	2.9	2.4	2.2	1.8	1.7	1.2	1.0	1.0
89.5	83.4	80.0	75.1	71.6	70.7	65.7	62.6	59.1	56.8
—	—	—	—	—	—	—	—	—	—
<u>577.4</u>	<u>481.3</u>	<u>449.5</u>	<u>374.2</u>	<u>329.8</u>	<u>306.2</u>	<u>294.4</u>	<u>270.2</u>	<u>233.8</u>	<u>224.3</u>
171.9	160.5	148.5	105.4	73.5	77.5	56.7	56.6	62.2	62.1
.4	.1*	.1	—	—	—	—	—	—	—
172.3	160.4	148.6	105.4	73.5	77.5	56.7	56.6	62.2	62.1
65.9	48.3	29.6	30.8	22.8	18.4	16.0	8.7	7.2	3.9
106.4	112.1	119.0	74.6	50.7	59.1	40.7	47.9	55.0	58.2
—	—	—	—	—	\$ 10.3*	—	—	—	—
<u>\$106.4</u>	<u>\$112.1</u>	<u>\$119.0</u>	<u>\$ 74.6</u>	<u>\$ 50.7</u>	<u>\$ 48.8</u>	<u>\$ 40.7</u>	<u>\$ 47.9</u>	<u>\$ 55.0</u>	<u>\$ 58.2</u>
\$172.3	\$160.4	\$148.6	\$105.4	\$ 73.5	\$ 77.5	\$ 56.7	\$ 56.6	\$ 62.2	\$ 62.1
89.4	83.8	80.0	75.1	71.6	70.7	65.7	62.6	59.1	56.8
<u>\$261.7</u>	<u>\$244.2</u>	<u>\$228.6</u>	<u>\$180.5</u>	<u>\$145.1</u>	<u>\$148.2</u>	<u>\$122.4</u>	<u>\$119.2</u>	<u>\$121.3</u>	<u>\$118.9</u>

# Net Power Assets

NET ASSETS	At September 30				
	1978	1977	1976	1975	1974
Completed plant	\$5,865.2	\$5,614.3	\$5,017.0	\$4,778.6	\$4,061.9
Less accumulated depreciation	1,746.1	1,609.3	1,458.9	1,344.4	1,242.4
Net completed plant	4,119.1	4,005.0	3,558.1	3,434.2	2,819.5
Construction in progress	4,586.6	3,280.2	2,470.9	1,714.2	1,552.0
Nuclear fuel	393.0	299.6	227.3	169.0	129.9
Inventories	359.5	373.0	377.4	273.2	128.7
Other current assets less other current liabilities	195.6*	131.5*	290.6*	47.6*	22.6
Deferred charges, net	92.3	53.9	17.3	11.2	23.9
Total	<u>\$9,354.9</u>	<u>\$7,880.2</u>	<u>\$6,360.4</u>	<u>\$5,554.2</u>	<u>\$4,676.6</u>
<b>DERIVED FROM</b>					
U.S. Treasury funds, gross	\$1,472.3	\$1,472.5	\$1,471.1	\$1,470.9	\$1,470.3
Less Treasury funds repaid	540.2	520.2	475.1	475.1	455.1
Net U.S. Treasury funds	932.1	952.3	996.0	995.8	1,015.2
Long-term debt	5,425.0	4,725.0	3,575.0	2,875.0	2,125.0
Short-term notes payable to U.S. Treasury	150.0	150.0	150.0	150.0	100.0
Short term debt payable to others	1,620.0	980.0	680.0	635.0	570.0
Advances and contributions	—	—	—	—	—
Retained earnings	1,227.8	1,072.9	959.4	898.4	866.4
Total	<u>\$9,354.9</u>	<u>\$7,880.2</u>	<u>\$6,360.4</u>	<u>\$5,554.2</u>	<u>\$4,676.6</u>

Note: In all years, the amounts for "U.S. Treasury funds, gross" include the full \$65.1 million of bonds issued by TVA to the Treasury and to the RFC, and the amounts for "Less Treasury funds repaid" include the amounts redeemed. All of these bonds were redeemed by June 30, 1956.

\*Deduct

At June 30

1973	1972	1971	1970	1969	1968	1967	1966	1965	1964
\$3,820.5	\$3,404.4	\$3,317.9	\$3,202.9	\$2,977.3	\$2,900.7	\$2,792.5	\$2,602.6	\$2,466.8	\$2,335.2
<u>1,156.2</u>	<u>1,075.4</u>	<u>-998.0</u>	<u>924.5</u>	<u>856.0</u>	<u>789.3</u>	<u>727.2</u>	<u>671.9</u>	<u>614.3</u>	<u>563.8</u>
2,664.3	2,329.0	2,319.9	2,278.4	2,121.3	2,111.4	2,065.3	1,930.7	1,852.5	1,771.4
1,318.6	1,294.3	822.4	481.9	386.4	216.3	150.0	203.5	220.6	259.0
93.1	63.9	41.5	24.8	13.2	—	—	—	—	—
140.8	109.3	83.1	37.5	44.2	51.5	44.9	32.4	39.1	33.3
17.4*	26.3*	34.9*	16.6	2.2	3.6	23.8	7.3	8.4	.5*
15.0	11.5	10.0	6.8	6.9	5.1	3.3	2.5	1.4	1.1
<u>\$4,214.4</u>	<u>\$3,781.7</u>	<u>\$3,242.0</u>	<u>\$2,846.0</u>	<u>\$2,574.2</u>	<u>\$2,387.9</u>	<u>\$2,287.3</u>	<u>\$2,176.4</u>	<u>\$2,122.0</u>	<u>\$2,064.3</u>
\$1,469.9	\$1,470.0	\$1,466.4	\$1,463.5	\$1,462.0	\$1,461.0	\$1,455.2	\$1,455.1	\$1,454.7	\$1,454.4
<u>435.1</u>	<u>415.2</u>	<u>395.2</u>	<u>375.2</u>	<u>360.1</u>	<u>345.1</u>	<u>330.1</u>	<u>315.1</u>	<u>300.1</u>	<u>290.1</u>
1,034.8	1,054.8	1,071.2	1,088.3	1,101.9	1,115.9	1,125.1	1,140.0	1,154.6	1,164.3
1,775.0	1,225.0	675.0	675.0	375.0	275.0	215.0	145.0	145.0	145.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	95.0	85.0
480.0	630.0	680.3	321.0	352.7	250.0	202.2	140.0	80.0	35.0
.9	.9	.8	.8	.7	.7	.7	.7	.7	.6
823.7	771.0	714.7	660.9	643.9	646.3	644.3	650.7	646.7	634.4
<u>\$4,214.4</u>	<u>\$3,781.7</u>	<u>\$3,242.0</u>	<u>\$2,846.0</u>	<u>\$2,574.2</u>	<u>\$2,387.9</u>	<u>\$2,287.3</u>	<u>\$2,176.4</u>	<u>\$2,122.0</u>	<u>\$2,064.3</u>

# System Input, System Output

(Millions of kilowatthours)

<b>SYSTEM INPUT</b>	<b>1978</b>	<b>1977</b>	<b>1976</b>	<b>1975</b>	<b>1974</b>
System generation					
Hydro					
TVA plants	15,500.7	14,318.0	14,606.8	17,176.0	17,485.3
ALCOA plants	2,015.2	1,949.4	2,048.3	2,393.4	2,408.0
Cumberland plants	3,178.2	1,929.7	2,541.7	3,380.7	3,643.0
Total hydro	20,694.1	18,197.1	19,196.8	22,950.1	23,536.3
Pumped-storage	(12.5)	—	—	—	—
TVA coal-fired plants	77,939.6	82,493.1	81,764.8	71,699.4	84,084.1
TVA nuclear plants	15,795.2	20,003.2	(100.1)	7,429.0	1,947.6
Combustion turbine plants	2,940.9	2,111.9	1,119.9	506.8	291.7
Total net generation	117,357.3	122,805.3	101,981.4	102,585.3	109,859.7
Purchased	901.1	601.8	4,952.3	5,276.4	1,046.7
Interchange received	12,140.1	10,949.8	11,373.7	8,150.0	8,520.9
Total input	<u>130,398.5</u>	<u>134,356.9</u>	<u>118,307.4</u>	<u>116,011.7</u>	<u>119,427.3</u>
<b>SYSTEM OUTPUT</b>					
Sales					
Municipalities and cooperatives	77,875.3	76,505.0	66,536.9	64,468.1	64,182.5
Federal agencies	16,722.3	22,268.0	21,609.8	19,389.3	17,388.1
Industries	22,877.5	22,738.7	19,941.7	21,822.4	23,790.1
Electric utilities	175.5	161.7	97.1	115.8	122.2
Total outside sales	117,650.6	121,673.4	108,185.5	105,795.6	105,482.9
Interdivisional	295.3	313.6	532.9	637.6	661.8
Total sales	117,945.9	121,987.0	108,718.4	106,433.2	106,144.7
Returned to ALCOA*	1,825.2	1,709.0	1,844.8	1,718.8	1,849.5
Interchange delivered	7,134.3	7,228.8	4,666.1	4,738.0	8,408.2
Losses	3,493.1	3,432.1	3,078.1	3,121.7	3,024.9
Total output	<u>130,398.5</u>	<u>134,356.9</u>	<u>118,307.4</u>	<u>116,011.7</u>	<u>119,427.3</u>
Generating capacity, fiscal year end — kilowatts	28,308,710	28,294,960	27,071,480	26,726,630	23,319,030
Area peak load — kilowatts	21,992,000	21,803,000	20,381,000	18,633,000	18,611,000

\*In return for energy delivered to the TVA system from the ALCOA plants.

**Fiscal Years**

<u>1973</u>	<u>1972</u>	<u>1971</u>	<u>1970</u>	<u>1969</u>	<u>1968</u>	<u>1967</u>	<u>1966</u>	<u>1965</u>	<u>1964</u>
18,141.5	15,915.2	12,733.6	12,313.2	11,595.4	15,187.8	13,317.9	11,024.4	14,615.5	13,255.3
2,623.2	2,119.7	1,811.7	1,779.3	1,813.3	2,283.8	1,868.9	1,777.1	2,163.0	2,044.4
<u>3,693.1</u>	<u>3,257.7</u>	<u>2,737.1</u>	<u>2,447.2</u>	<u>1,579.2</u>	<u>3,361.6</u>	<u>2,555.3</u>	<u>1,338.0</u>	<u>2,023.6</u>	<u>1,532.6</u>
24,457.8	21,292.6	17,282.4	16,539.7	14,987.9	20,833.2	17,742.1	14,139.5	18,802.1	16,832.3
—	—	—	—	—	—	—	—	—	—
84,384.0	73,439.8	74,332.1	76,144.6	75,600.9	69,619.4	68,114.0	67,941.9	55,651.7	56,535.5
—	—	—	—	—	—	—	—	—	—
<u>253.9</u>	<u>71.1</u>	<u>18.3</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
109,095.7	94,803.5	91,632.8	92,684.3	90,588.8	90,452.6	85,856.1	82,081.4	74,453.8	73,367.8
670.3	266.1	593.2	459.2	4.3	—	79.7	23.7	—	—
<u>7,288.0</u>	<u>7,075.4</u>	<u>8,889.6</u>	<u>8,141.8</u>	<u>7,354.8</u>	<u>5,156.2</u>	<u>5,141.0</u>	<u>2,676.9</u>	<u>2,765.4</u>	<u>3,041.2</u>
<u>117,054.0</u>	<u>102,145.0</u>	<u>101,115.6</u>	<u>101,285.3</u>	<u>97,947.9</u>	<u>95,608.8</u>	<u>91,076.8</u>	<u>84,782.0</u>	<u>77,219.2</u>	<u>76,409.0</u>
63,822.0	57,820.3	55,534.6	53,692.9	49,008.2	44,575.0	40,705.9	37,783.5	32,161.3	27,848.1
17,112.5	12,501.8	11,773.5	13,069.6	14,826.9	18,801.8	20,226.3	20,638.2	20,391.9	25,361.8
21,864.7	19,592.0	21,278.3	22,012.6	20,568.1	19,213.4	18,589.8	16,765.1	15,773.7	14,077.4
92.1	539.7	1,407.3	1,273.7	1,300.5	1,462.1	1,768.1	1,150.1	769.8	441.8
<u>102,891.3</u>	<u>90,453.8</u>	<u>89,993.7</u>	<u>90,048.8</u>	<u>85,703.7</u>	<u>84,052.3</u>	<u>81,290.1</u>	<u>76,336.9</u>	<u>69,096.7</u>	<u>67,729.1</u>
581.3	636.6	653.9	673.5	670.2	667.8	796.6	768.4	764.1	720.7
103,472.6	91,090.4	90,647.6	90,722.3	86,373.9	84,720.1	82,086.7	77,105.3	69,860.8	68,449.8
1,820.3	1,857.6	1,846.7	1,847.5	1,756.2	1,863.5	1,688.1	1,694.7	1,638.5	1,865.7
8,202.7	5,998.1	5,049.4	5,379.7	6,808.5	6,204.9	4,614.3	3,430.6	3,490.4	3,839.0
<u>3,558.4</u>	<u>3,198.9</u>	<u>3,571.9</u>	<u>3,335.8</u>	<u>3,009.3</u>	<u>2,820.3</u>	<u>2,687.7</u>	<u>2,551.4</u>	<u>2,229.5</u>	<u>2,254.5</u>
<u>117,054.0</u>	<u>102,145.0</u>	<u>101,115.6</u>	<u>101,285.3</u>	<u>97,947.9</u>	<u>95,608.8</u>	<u>91,076.8</u>	<u>84,782.0</u>	<u>77,219.2</u>	<u>76,409.0</u>
21,892,480	19,880,420	19,828,380	19,422,480	18,239,280	18,202,090	18,111,860	17,149,500	14,675,615	13,353,615
18,888,000	16,664,000	16,745,000	16,797,000	15,017,000	15,266,000	14,634,000	14,263,000	12,801,000	12,218,000

## Customer Statistics

In the following tables, the sales and related statistics for TVA and for the local distributors have been combined to portray total sales to ultimate customers.

### Ultimate Customers

SEPT	TOTAL	RESIDENTIAL	COMMERCIAL AND INDUSTRIAL	FEDERAL AGENCIES	OUTDOOR LIGHTING
1978	2,664,412	2,371,064	290,132	11	3,205
1977	2,601,415	2,316,414	281,906	11	3,084
<b>JUNE</b>					
1976	2,521,956	2,248,475	270,532	11	2,938
1975	2,458,822	2,192,972	263,056	11	2,783
1974	2,401,581	2,139,476	259,417	11	2,677
1973	2,325,134	2,068,150	254,423	11	2,550
1972	2,236,153	1,987,724	245,965	11	2,453
1971	2,158,423	1,919,208	236,687	11	2,517
1970	2,096,544	1,863,578	230,654	11	2,301
1969	2,047,338	1,817,982	227,179	11	2,166
1968	1,994,065	1,769,141	222,870	11	2,043
1967	1,946,594	1,726,382	218,257	11	1,944
1966	1,895,082	1,679,342	213,927	11	1,802
1965	1,840,791	1,630,547	208,533	10	1,701
1964	1,589,238	1,408,899	178,821	9	1,509

### Electricity Sales — Millions of kilowatthours

FISCAL YEAR	TOTAL	RESIDENTIAL	COMMERCIAL AND INDUSTRIAL	FEDERAL AGENCIES	OUTDOOR LIGHTING
1978	113,418	37,874	57,522	17,018	1,004
1977	117,764	37,648	56,552	22,582	982
1976	104,925	31,985	49,884	22,143	913
1975	102,778	31,785	50,117	20,027	849
1974	102,618	30,602	53,125	18,050	841
1973	99,670	30,637	50,557	17,694	782
1972	87,333	27,474	46,005	13,138	716
1971	85,930	27,291	45,553	12,427	659
1970	86,380	26,835	45,200	13,743	602
1969	82,111	24,449	41,610	15,497	555
1968	80,600	22,174	38,448	19,470	508
1967	77,708	19,945	36,276	21,023	464
1966	73,649	18,736	33,087	21,407	419
1965	67,050	16,501	29,043	21,156	350
1964	66,149	15,069	24,722	26,082	276

### Revenue from Electric Sales — Thousands of dollars

FISCAL YEAR	TOTAL	RESIDENTIAL	COMMERCIAL AND INDUSTRIAL	FEDERAL AGENCIES	OUTDOOR LIGHTING
1978	2,747,716	1,015,406	1,379,852	312,328	40,130
1977	2,324,976	873,061	1,087,537	328,237	36,141
1976	1,978,805	724,011	915,431	308,071	31,292
1975	1,448,320	559,439	672,806	189,187	26,888
1974	1,138,887	442,644	545,319	126,544	24,380
1973	992,421	398,253	465,323	107,154	21,691
1972	860,669	352,116	412,374	76,685	19,494
1971	796,426	332,544	381,299	65,010	17,573
1970	667,418	277,153	312,574	62,459	15,232
1969	576,589	231,391	265,294	66,323	13,581
1968	539,668	206,112	239,740	81,669	12,147
1967	492,374	177,055	217,543	87,026	10,750
1966	464,555	168,902	199,281	86,981	9,391
1965	418,705	151,007	174,808	85,344	7,546
1964	397,474	138,555	149,638	103,503	5,778

### Residential Statistics

FISCAL YEAR	AVERAGE ANNUAL USE	AVERAGE ANNUAL BILL	AVERAGE RATE
1978	16,190 kWh	\$434.03	2.68¢
1977	16,400	380.34	2.32
1976	14,370	325.35	2.26
1975	14,540	255.92	1.76
1974	14,480	209.37	1.45
1973	15,080	196.07	1.30
1972	14,040	179.92	1.28
1971	14,400	175.53	1.22
1970	14,560	150.39	1.03
1969	13,600	128.71	.95
1968	12,668	117.74	.93
1967	11,680	103.68	.89
1966	11,294	101.81	.90
1965	10,831	99.12	.92
1964	10,818	99.47	.92

**Notes:** The City of Memphis ceased to be a regular distributor of TVA power in 1958 and its customer statistics are excluded beginning in fiscal year 1959. The City again became a regular distributor January 1, 1965, and its customers' statistics are included thereafter.

Federal agencies include only TVA's direct service and interdivisional sales.

To avoid overstating the number of customers in the region, the number of Outdoor Lighting customers excludes the customers who supplement regular service with the special outdoor lighting fixture. Only public street lighting and athletic field lighting customers are counted. However, the energy sales and revenue figures under Outdoor Lighting do include data for the special fixtures.

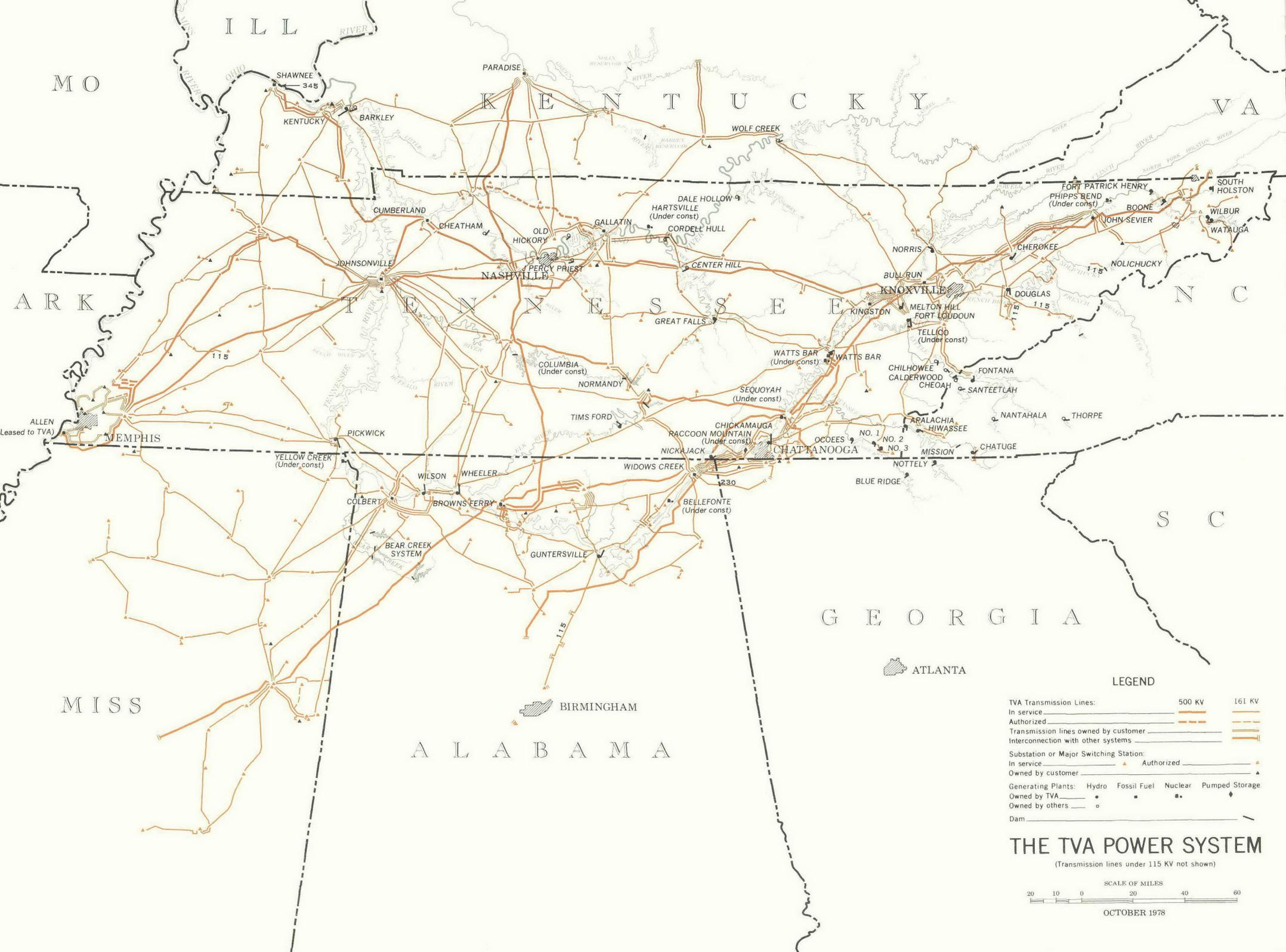
### Fuel Statistics

Fuel Burned	1978	1977	1976	1975	1974
<b>Steam plants</b>					
Coal — tons	36,061,379	37,946,797	37,158,293	33,139,949 <sup>4</sup>	37,367,286 <sup>1 3</sup>
Oil — gallons	18,961,477	13,887,791	13,762,479	14,447,738	11,816,450
Gas — MCF	—	—	—	—	9,207,045
Total fuel expense	\$897,590,341	\$809,284,973	\$699,978,978	\$435,157,927	\$327,662,665
Coal expense per ton	\$24.672	\$21.177	\$18.715	\$12.993	\$8.611
Oil expense per gallon	\$ .416	\$ .408	\$ .333	\$ .316	\$ .247
Gas expense per MCF	—	—	—	—	.325
<b>Nuclear plants</b>					
Total fuel expense	\$ 38,355,587	\$ 32,023,437	\$ 118,052 <sup>7</sup>	\$ 7,109,516	—
<b>Gas turbine plants</b>					
Oil — gallons	270,004,262	193,032,102	102,083,371	47,090,948	26,854,964
Gas — MCF	—	—	—	—	443,725
Total fuel expense	\$ 99,110,531	\$ 67,883,653	\$ 31,206,773	\$ 13,116,621 <sup>5</sup>	\$ 4,676,032
Oil expense per gallon	\$ .367	\$ .352	\$ .306	\$ .278	\$ .167
Gas expense per MCF	—	—	—	—	\$ .431
<b>Fuel Ratios</b>					
<b>Steam plants</b>					
Fuel expense per kWh generation — mills	11.516	9.810	8.561	6.069	3.927
Btu per kWh net generation	10,140	10,120	9,960	9,880	9,770
Cents per million Btu burned	113.57	96.96	85.91	61.41	40.18
Btu per pound of coal fired	10,920	10,970	10,940	10,660	10,760
<b>Gas turbine plants</b>					
Fuel expense per kWh net generation — mills	33.70	32.145	27.864	25.879	16.033
Btu per kWh net generation	12,800	12,760	12,640	12,950	14,510
Cents per million Btu burned	263.28	251.80	220.39	199.86	110.51
<b>Nuclear plants</b>					
Fuel expense per kWh net generation — mills	2.428	1.856	—	1.525	—
Btu per kWh net generation	10,810	10,720	—	10,570	—
Cents per million Btu burned	22.46	17.32	241.02 <sup>7</sup>	14.42	—
<b>Coal Received</b>					
Tons	32,892,169	37,284,557	40,907,840	36,717,599 <sup>6</sup>	34,060,316 <sup>2</sup>
Mine cost plus transportation	\$842,033,551	\$781,474,331	\$767,163,347	\$539,980,917	\$290,693,725
Cents per million Btu	115.94	95.75*	85.68	68.89	39.69

1. Includes 44,464 tons of petroleum coke costing \$449,838, which is estimated at 14,160 Btu per pound.
2. Includes 111,045 tons of petroleum coke costing \$1,193,630.
3. Does not include 291,537 tons burned during initial operation of unit 2 of Cumberland Steam Plant.
4. Includes 62,006 tons of petroleum coke costing \$673,924, which is estimated at 13,780 Btu per pound.
5. Includes \$47,054 amortization for Allen Gas Turbine Plant pipeline cost.
6. Includes 14,693 tons of petroleum coke costing \$197,689.
7. Cost of fuel oil fired for auxiliary steam and testing of emergency generators.

TENNESSEE VALLEY AUTHORITY: A corporation wholly owned by the United States of America

\*corrected



**LEGEND**

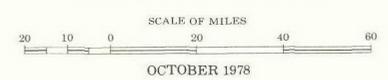
TVA Transmission Lines:  
 In service ———— 500 KV ———— 161 KV  
 Authorized ————  
 Transmission lines owned by customer ————  
 Interconnection with other systems ————

Substation or Major Switching Station:  
 In service —●— Authorized —▲—  
 Owned by customer —▲—

Generating Plants: Hydro Fossil Fuel Nuclear Pumped Storage  
 Owned by TVA ● Owned by others ○

Dam ————

**THE TVA POWER SYSTEM**  
 (Transmission lines under 115 KV not shown)



A L A B A M A

G E O R G I A

M I S S

M O

A R K

I L L

K E N T U C K Y

V A

T E N N E S S E E

N C

S C

BIRMINGHAM

ATLANTA

SHAWNEE 345

KENTUCKY

BARKLEY

PARADISE

WOLF CREEK

CUMBERLAND

CHEATHAM

OLD HICKORY

GALLATIN

DALE HOLLOW 9

HARTSVILLE (Under const)

CORDELL HULL

FORT PATRICK HENRY

PHIPPS BEND (Under const)

BOONE

SOUTH HOLSTON

WILBUR

WATAUGA

JOHNSONVILLE

NASHVILLE

PERCY PRIEST

CENTER HILL

NORRIS

CHEROKEE

NOBLESVILLE

115

BULL RUN

DOUGLAS

115

KINGSTON

MELTON HILL

FORT LOUDOUN

TELLICO (Under const)

COLUMBIA (Under const)

NORMANDY

WATTS BAR (Under const)

WATTS BAR

CHILHOWEE

CALDERWOOD

CHEOAH

SANTEETLAH

TIMS FORD

SEQUOYAH (Under const)

ARALACHIA

HIWASSEE

NO. 1

NO. 2

NO. 3

MISSION

CHATUGE

ALLEN (Leased to TVA)

MEMPHIS

PICKWICK

YELLOW CREEK (Under const)

WILSON

WHEELER

BROWNS FERRY

NICKAJACK

WIDOWS CREEK

CHICKAMAUGA (Under const)

RACCOON MOUNTAIN

1230

BELLEFONTE (Under const)

BLUE RIDGE

COLBERT

BEAR CREEK SYSTEM

GUNTERSVILLE

115

