Journal of Strategic Management Education 1(1).

The Tennessee Valley Authority: Competing in Markets for Capital and Electricity in Pursuit of Solvency

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Abstract. The Tennessee Valley Authority, as a federal corporation governed independently by a three-person board, undertook excessive investments in the 1980s based on erroneous projections of technology and demand growth for electricity. The required capital outlays financed by private debt, could not be recovered by sales revenues from uneconomic plants not put in operation; instead recovery has been achieved by arbitrary price increases for electricity. With electricity markets now beginning to open up to competition, inside and outside the TVA monopoly "fence," TVA cannot set prices as if it had a monopoly, but still expects to keep solvent and reduce excessive debt. Financial analysis undertaken here indicates that TVA's solvency scenario holds only under very narrow assumptions, and an array of equally plausible, and perhaps more realistic, scenarios leads to projections of insolvency for TVA within a very few years. If insolvent, after realization of one of the likely scenarios, TVA as a public enterprise would not go into bankruptcy. It might be able to generate increased revenues by price increases; only in a limited range given newly competitive markets for its power. Instead it may have to call for the Federal Financing Bank to redeem TVA bonds at full value even though these bonds would be redeemed at discounted value in the market for bankrupt securities. The impending threat of insolvency then makes a pressing case for determination as to whether the Federal Bank should bail out TVA from the consequences of investment errors. The alternative would be to treat this company the same as investor-owned utilities that made erroneous large-scale capital outlays over the last two decades. This would call for bankruptcy proceedings, write downs of debt and ultimate de facto privatization of the Tennessee Valley Authority.

We offer this case as an example of strategies of corporations both private and public (government owned) in their financial operations. These strategies can involve access to competitive advantages of both, even though they were meant to be exclusive to one or the other. In the TVA experience, straddling such a fence may be the worst result.

1. Introduction

The Tennessee Valley Authority (TVA) is America's largest wholesale supplier of electricity. It is a Federal Corporation, with the Federal government acting as owner of share equity and debt owned by private individuals and

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institutions.[3] There is a long history of inefficient management,[4] poor forecasting performances,[5] and, as we shall discuss, the real threat of bankruptcy were it not for an implicit guarantee of outstanding debt by the Federal Financing Bank. Despite its marginal operating performance TVA continues to carry an AAA credit rating and borrows in the bond markets at spreads of less than 40 basis points over equal maturity Treasury Bonds.[6] The resulting freedom from risk assessment in its bond interest rate creates a lack of realism in evaluating its operations. Internally this is indicated by its public relations effort to be held out as a model organization with the solution to California's current energy supply and distribution problems.[7]

This contradiction between marginal operations and secure financing can be resolved by the Federal Government bringing an end to its implicit guarantee of TVA's debt. The government is currently giving TVA investors a put option: if TVA cannot pay its debts, the Federal Financing Bank will cover them. Of course, since the guarantee is implicit, not explicit in the bond agreement, there is no assurance that investors will obtain the full value of their debt holdings should TVA's financial situation deteriorate. Should the perception vanish just as the evident equivalency of bankruptcy occurred the sheer extent of TVA bonds collapsing in price could be disruptive to debt markets. To forestall any such event, we propose ending the implicit debt guarantee, before any collapse, making it clear that the government seeks to privatize by stages and this is the first stage.

To determine whether this sequence of events dominates the choice of policy for this largest public enterprise, we examine the company's position relative to current and future financial and product market conditions. Section Two describes TVA, within the context of the regulated utility paradigm in order to define current limits on operational and financing policies. Key changes in this paradigm are taking place as the utility industry moves from prices regulated to achieve cost recovery to those set by competition in open markets. As a consequence of this change TVA has to shift to competitive pricing as well. Section Three considers two aspects of TVA's financial decision making and forecasting. The first is its nuclear program; TVA had nearly $18 billion in nuclear assets at the end of fiscal 2000, of which $6.3 billion consisted of what is euphemistically called "deferred nuclear generating units" that are not producing electricity and thus are not generating

3. TVA, "A comparison of TVA and Government Sponsored Enterprises," pp. 1-2.
4. Paul W. MacAvoy and George S. McIssac, "The Current File on the Case for Privatization of The Federal Government Enterprises," *The Hume Papers on Public Policy*, Vol. 3, No. 3, Autumn 1995, pp. 121-147.
5. U.S. General Accounting Office (GAO), *Tennessee Valley Authority: Debt Reduction Efforts and Potential Stranded Costs, (GAO-01-327)* February 2001.
6. TVA, *Competitive Comparison: Costs and Prices*, March 2000, p. 8.
7. See Jenny George (a TVA official) "California, Take a Look at the TVA," *Wall Street Journal*, Jan. 29, 2001.

revenues.[8] By holding these assets out of the depreciation process, in the price equal to unit cost recovery framework, the company now realizes a greater earnings rate of return. Only if prices are increased sufficient to generate higher earnings rates can these deferred depreciation outlays be recovered. Going forward, this is not assured.

The second aspect of TVA's performance considered here is its forecasting record. TVA forecast that it would reduce debt from $27 billion in 1997 to $14 billion by 2007, the year in which TVA assumed that it would lose monopoly status in its regional wholesale power market.[9] We develop a financial model to consider the effect on this forecast of TVA's financial assumptions, because there are large gaps between this forecast for 1998-2000 and actual results for these years. Further, we report on a General Accounting Office study that considers reasons why TVA's debt reduction forecasts are likely to be in error. Finally, we assess whether, if TVA's assumptions are optimistic, the 2007 debt reduction goal will not be realized.

In Section Four, based on this assessment, we indicate that TVA's near future financial status is extremely sensitive to specific cost and revenue projections, given that TVA is now nearly insolvent. With a model of TVA's likely future performance based on TVA's own 1997 projections, as modified by subsequent events, we indicate that the case for solvency in the next five years is specific to only a narrow range of assumptions, not including those most realistic.

Section Five discusses the policy implications of this financial outlook. One is that TVA investors should be assigned the risk of losses from realizing one of our more likely scenarios. This would motivate future investors to evaluate the soundness of government enterprise on its merits, not on the expectation of bond redemption by the Federal Financing Bank. More immediately, it would place investments in nuclear power in the Tennessee Valley on a status level equal to those in nuclear plants in other parts of the industry so that their specific financial risks are recognized. Those recommendations if implemented would be the first step in putting TVA in competitive markets with investor-owned power companies on equal risk-valuation terms.

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8. TVA, 2000 *Annual Report*, Note 2 to financial statements. An October 24, 2001 press release from TVA suggests that at least $2.6 billion of this total is to be written off, as the first step in TVA realizing the "solvency" scenario.
9. TVA, *Ten-Year Business Outlook*, July 27, 1997, p. 7

2. The Tennessee Valley Authority

The Tennessee Valley Authority is a wholly owned instrumentality of the Federal Government that functions in accordance with the TVA Act of 1933 to deliver a variety of public services including a reliable supply of electric power "at the lowest possible rates." A key project in Franklin Roosevelt's New Deal, the founding Act called for improving navigation, promoting regional economic development, and establishing flood control of the Tennessee River.[10] To meet these goals, TVA constructed dams with hydroelectric power facilities and, although power generation was not seen initially as the end product it is now the principal service supply. Whether TVA was created as a result of market failure, or was a regional governmental response to a national depression, is a matter of controversy which we leave for others to resolve.

Following the Second World War, TVA's line of business centered on power generation and transmission. Today it maintains a clear distinction between its power program and more limited non-power programs in accordance with the original objectives. The power programs are required to be self-supporting, recovering capital outlays on generating equipment from electricity sales revenues and from borrowings in the national debt market. The non-power programs are funded from federal appropriations and function similarly to Interior Department program funds for natural resource development.[11] Our appraisal of TVA performance and outlook focuses exclusively on the power programs.

2.1. System Characteristics

TVA owns, operates, and maintains 28,123 megawatts of generating capacity and 17,000 miles of transmission line. TVA supplies electricity to over seven million people in a service area covering 80,000 square miles, including most

10. David N. Smith, Chief Financial Officer of the TVA quoted Franklin D. Roosevelt in the March 24, 2000 TVA Financial Analysis and Investor Meeting thusly, "I, therefore, suggest to the Congress legislation to create a Tennessee Valley Authority - a corporation clothed with the power of government but possessed of the flexibility and initiative of private enterprise."
11. Accounts for power and non-power programs are kept independently. TVA's power program is included in the federal budget as a public enterprise revolving fund called the TVA fund. Revolving funds are generally intended to have their operating expenses covered by operating revenues. The non-power programs constitute less than 3 percent of 1997 Total Assets: $960 million of $34,644 million during 1996 and 1997, the non- power programs received $109 million and $106 million, respectively in congressional appropriations. The major non-power programs are Water and Land Stewardship, Economic Development, the Environmental Research Center, Land between the Lakes and the Columbia Dam.

of Tennessee and parts of Mississippi, Alabama, Georgia, North Carolina, Virginia, and Kentucky. It markets about one-half of the total Federal production of electricity amounting to 159,571 million kWh in 2000.[12] The power system as of September 30, 2000 included twenty-nine hydroelectric plants, eleven fossil plants, five operating nuclear units in three sites, one pumped storage hydroelectric plant, and four gas turbine plants. Fuel sources are predominantly fossil (63 percent), nuclear (31 percent), and hydro (6 percent).[13] Year 2000 revenues totaled $6.7 billion and book value assets were $33.2 billion.

Starting in the mid 1960s, TVA undertook a "clean energy strategy" involving an extensive program of nuclear plant construction. At the height of this program, in the 1970s, TVA had seventeen nuclear units under construction or in commercial operation. The program was plagued by a series of problems including demand overestimation, construction cost over-runs and escalating safety compliance costs to meet enhanced Nuclear Regulatory Commission standards. Today, nuclear assets account for close to 70 percent of net Property, Plant and Equipment (PPE), but only 20 percent of winter peak generating capacity. Financing for most of the program came from bonded indebtedness, with the result that the organization carries a heavy debt burden.

Unlike most Investor Owned Utilities (IOUs) of similar scale, TVA is a generator and transmitter of electricity but not a retail distributor. TVA's major customers are 160 municipal government-owned companies that purchase power wholesale and distribute it throughout their service areas.[14] The municipalities accounted for 80 percent of TVA sales, a proportion that has held in recent years,[15] and five of these municipalities accounted for a little over 30 percent of all final sales.[16] The municipal companies purchase power under rolling ten-year contracts that renew automatically each year so that they require a ten-year advance notice for cancellation. They are required to rely solely on TVA for purchases while theses contracts are in effect. The remaining 20 percent of TVA revenues come from sales to industrial

12. TVA, *Annual Report* 2000.
13. TVA, *Annual Report* 2000.
14. The 160 TVA distributors have an apex organization, The Tennessee Valley Public Power Association (TVPPA), that collectively represents them in bargaining with TVA.
15. See Energy Information Administration, *Financial Statistics of Major US Publicly Owned Electric Utilities* - 1995, Washington D.C., 1996, pp. 472-474.
16. The big five TVA distributors are Memphis, Knoxville, Chattanooga, Nashville, and Huntsville.

customers or Federal agencies,[17] that also are not able to go elsewhere for power within the TVA regional service area, enclosed by the so-called "fence".

This government company is *sui generis* among utilities. The impact of specific statute provisions on its operations and financing, its methods of governance, and its divergence from conventional financial structure, make it unique *vis a vis* private (investor owned) electric utilities. It is difficult to draw conclusions on TVA's performance based on comparisons with the actual performance of investor-owned companies producing and distributing electricity because it alone is only a wholesale supplier, it alone has a "fence" to keep other providers out of its markets, and it has semi-permanent contracts with the only retailers in the markets. We examine the organization on its own terms rather than through a comparative analysis.

2.2. Corporate Governance

The management of the company according to charter is to be provided by a three-member Board appointed by the President of the United States. Unlike a conventional Board of Directors at a private corporation, the TVA Board operates full-time with each member having certain line and staff responsibilities for strategic direction and day-to-day operations. Further, unlike other utilities that are subject to price or "rate" controls by a state or federal regulatory agency, the Board sets prices for the full array of TVA services. The power for determining financial performance centers on the Board; in effect it has monopoly power in its markets, constrained only by demand for power at various alternative prices (i.e. the elasticity of demand) and by its mission as a "public" enterprise to provide electricity at the "lowest possible" price.

The TVA board thus wears three hats, being responsible *a)* for broad strategic direction, *b)* for day-to-day operations, and *c)* for setting "public interest" yet compenatory prices. While (a) and (b) are the same as in private power companies (c) is the domain of an independent regulatory commission with respect to these private companies. The TVA strategy to acheive financing has to be based on the same core system advantages as in private operations but it can also use its price setting advantages to acheive a favorable position..

17. The Department of Energy was a major customer primarily for atomic research programs and facilities in the TVA area. When the programs wound down, TVA and DOE reached agreement in 1987, whereby DOE obligations were satisfied through a series of payments to TVA, totaling more than $1,800 million between 1987 and 1994. TVA's DOE revenues fell off significantly in 1994 when the payment period ended. See Tennessee Valley Authority, *Annual Report* 1996, p. 43.

2.3. Financing

Financing for TVA activities is subject to certain constraints originating in both the Act and in debt market acceptance of Federalization. Until 1959, TVA power programs were funded through congressional appropriations. In 1959, Congress passed the TVA Self-Financing Act that authorized the use of public market debt financing for capital improvements and additions to power generating capacity. TVA became no longer dependent on congressional appropriations but on internal cash flow and capital raised in public debt markets. As the Act never authorized the issuance of equity, capital requirements have been met through debt except for limited use of internally generated funds for a part of capacity expansion.

The 1959 Act placed a limit on TVA borrowing, a limit raised four times over the next two decades to $30 billion in 1979, the current ceiling.[18] To reach its current level of indebtedness TVA has accessed both federal and public bond markets. Federal financing originally came through the Federal Financing Bank but since 1989 all capital funding has been achieved through bond issuances in public markets. TVA debt is not officially guaranteed by the Federal Government, as its bond indentures make explicit;[19] nevertheless, bond markets respond as if TVA has government agency status i.e., assuming that the Federal Financing Bank will not allow TVA to default on its debt. Indeed, TVA debt is traded at the "Government Desk" at most bond-trading houses. The market seems to apply a "too big" (or too imprtant) to fail doctrine. The result is that TVA bonds have an AAA rating. The difference between the AAA interest rate and what would be paid for debt financing of a company with high leverage and cost over-runs without the implicit guarantee constitutes TVA's capital cost subsidy.

2.4. The "Fence"

Much of the TVA service area is currently devoid of competitive service overlap now sweeping the utility industry. The TVA has a "fence" consisting of a complex web of legislative restrictions that prevents wholesale power supply competition in its service region. In turn, TVA cannot go outside the

18. GAO, *Tennessee Valley Authority: Financial Problems Raise Questions of Long Term Viability*, Washington, D.C., 1995, p. 26. The debt ceilings were respectively: 1966 - $1.75 billion; 1970 - $5 billion; 1975 - $15 billion; 1979 - $30 billion; House Committee, *Operations of the Tennessee Valley Authority*, p. 10.
19. See for example, Tennessee Valley Authority, *Information Statement for Issue of First Installment Series Bonds* (Knoxville: TVA 1996), 1, which states that "The new power bonds will not be obligations of, nor will payment of interest thereof, or any interest thereon, be guaranteed by the Unites States of America."

fence given that the1959 amendments to the TVA Act allowed it to tap public bond markets only if it were restricted to providing service in the territorial limits it served on July 1, 1957. Privately owned IOUs, wary of TVA access to financing with implicit government guarantees, lobbied for this provision because it prevented TVA from competing with them outside its service area with its financing advantage. The protection held as long as TVA power was priced below that in other markets. In the 1980s, however, TVA undertook rate increases aimed at recovering construction costs for nuclear plants not in operation or ever going to be put into operation. TVA rates increased 88 percent between 1978 and 1984 as this recovery program got under way.[20] The organization's cost and price increases greatly negated the rationale for the fence from the inside to the outside. It was now TVA that needed protection; with the passage of the 1992 Energy Policy Act (EPAct), IOUs outside the fence were prohibited from selling within TVA territory.[21]

2.5. Limited Comparisons of TVA With Other Utilities

Financial comparison of TVA with other entities in the electric utility industry is difficult for reasons already made explicit. The electric power industry consists broadly of two types of entities, investor owned utilities and rural cooperatives. Rural cooperatives are so small as to be not comparable and they are mostly power retailing companies. TVA can be compared, to a limited extent, with generator and non-generator public utilities, as in Exhibit One opposite.

Most studies of TVA make comparisons of financial performance *vis a vis* other entities in the industry. As the table suggests, this is a near impossible exercise because TVA differs in its extent of integration from all three groups, does not share a profit motive with IOUs, and enjoys special financing and pricing options not applicable to other utilities. Untangling the effects of these differences in a company-to-company comparison often leads to dubious results.[22] It is our position that this organization has to be evaluated on its own terms; even so, later in this paper, we attempt to use financial metrics derived from IOUs that are TVA prospective competitors to develop a financial model of this public company. When and if it were to compete in both product and

20. Paul MacAvoy and George MacIssac, op. cit., p. 130.
21. An exemption is made to utilities that use TVA's transmission to wheel power through and out of the TVA service area. A utility to the south of the territory could thus wheel through the TVA system and onwards to buyers to the north of the system.
22. Some studies try to remove the distortions by adding distributor costs for those purchasing from TVA to TVA's results to facilitate a comparison of a fully integrated TVA with integrated IOUs. Such methods are used to create a "synthetic" IOU prototype to the Tennessee Valley Authority and we believe they do no more than simulate a synthetic prototype.

capital markets with these other companies, the model should indicate the relative prices and quantities it would have to display to become a competitive enterprise.

Exhibit 1:
Comparison of TVA with Other Electric Utilities

Comparison with	**Comparison Set**	**Vertical Integration**	**Profit Maximizing**	**Special Provisions**
Fully Integrated Utilities	Investor Owned	Generation, Transmission, Wholesale, *and* Retail Distribution	Constrained by Regulation	Taxes and debt interest treated as costs of service
	TVA	Generation, Transmission, Wholesale, Distribution	Constrained by Charter not to accumulate equity profits	Tax and Debt subsidy and rate setting power
Generator only Utilities	Investor Owned	Generation only; some transmission	Prices constrained by limited competition	
	TVA	Generation, Transmission, Wholesale, Distribution	Constrained by Charter not to accumulate equity profits	Tax and Debt subsidy has power to set own prices
Distribution only Utilities	Investor Owned	Retail Distribution	Rate Regulation	Tax and Debt interest as costs of service
	TVA	Generation, Transmission, Wholesale, Distribution	Constrained by Charter not to accumulate equity profits	Tax and Debt subsidy and rate setting power

2.6. The Utility Industry and TVA's Variation

Historically utilities were granted monopolies in separate service areas, purportedly to realize economies of scale and eliminate duplicate facilities, particularly in wireline transmission and distribution. While they were granted monopolies, they were denied the right to charge monopoly (best profit) prices by regulatory agencies requiring tariff rates that constrained earnings to competitive levels in terms of returns on investment. That is, regulatory

agencies approved rates that generated revenues sufficient to recover costs of operation, taxes, depreciation, and a fair (competitive) return on the utility's investment. In return for a franchise, in effect the utility accepted the "obligation to serve," with returns limited to the opportunity but not the guarantee of reimbursement for the cost of service. Over time, the "obligation" evolved into requirements to serve residential and small business customers at rates (prices) close to or even below marginal costs, with earnings from business customers high enough to cover the shortfalls in total costs. This rate structure provided incentives to over-invest in low-density residential areas relative to high-density business areas and to raise costs of service generally.

TVA's rate setting conforms to the standard utility pattern of cost recovery, but with three differences.[23] *First*, while TVA debt is not explicitly backed by the "full faith and credit" of the Government, financial markets act on the assumption that the Unites States Government will not allow TVA to default on its debt. This lowers its borrowing cost to the risk-free rate and results in a debt subsidy. *Second*, TVA does not pay corporate taxes on earnings, nor does it pay local or state property taxes (it does make payments equal to 5 percent of revenues in lieu of taxes to the counties and states which house the system). This results in a tax subsidy. *Third*, TVA is not subject to a regulatory rate setting process, but rather its revenue requirement and thus its rate schedule is determined by its three-member board of directors.

In recent history, utility markets have been impacted by deregulation by federal agency and state governments. Roughly similar across states, these strategies have separated the traditional vertically integrated company into its component parts of generation, transmission and distribution. This change sweeping generation and wholesale transmission has not extended to the TVA system. But in very few years separate generation-only companies will press to use TVA's transmission systems within the "fence" to get to customers both within and across the fence.

These regulatory changes began under the Public Utility Regulatory Policies Act (PURPA) of 1978 and the Energy Policy Act (EPAct) of 1992. PURPA was intended to encourage diversity in supply by allowing independent generation companies with non-coal or oil fuel sources and cogeneration facilities to occupy a market niche in the industry. Most if not all of the additional generating capacity coming on line since 1992 has been outside the traditional regulated utility framework and from just such variety of sources, including hydro and rubbish but principally gas fuel dual purpose 200 to 500 megawatt power plants.[24]

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23. Formally, the Act required TVA's Board to charge rates that covered operation, maintenance and administration of its power system; payments to states and counties in lieu of taxes; debt service (including provision of bond sinking funds); and annual payments to the Treasury in repayment of, and as a return on, the government's appropriation investment in TVA prior to 1959.

Further change occurred as a result of the Energy Policy Act of 1992. Two important provisions in the EPAct were to promote wholesale wheeling and a new category of power producers called "exempt wholesale generators."[25] Mandatory wholesale wheeling allowed the Federal Energy Regulatory Commission (FERC) to order the provision by incumbent transmission companies of wholesale transmission services to any applicant. This led to the development of open access power grids based on FERC comparability standards that required service providers to give others access to their networks on the same basis as for their own use.

Wheeling has affected TVA's regional market positions; while FERC cannot order TVA to comply with its transmission orders given the TVA fence, it can, however, order TVA to provide transmission access through its territory. This regulatory change, with new generating capacity from low cost, gas fired cogeneration plants, has led to an emerging long run competitive pressure on prices below by TVA rate ceilings.[26] But TVA prices for electricity actually increased more rapidly, by 50 percent as compared to 40 percent in counterpart private companies, from 1980 through 1986. TVA rates of investment increased relative to those in the private utilities between 1977-1984, which forced higher increases in prices due to increased costs of debt service.[27] The relatively rapid rates of price increase were reflected in adverse sales growth; increases in total dollar sales were not as large as those of private-sector firms indicating a much lower relative growth in kWh sales. This public-sector corporation was lagging behind those on the fence even though its mission was to achieve growth of kWh sales at higher levels than outside the fence.

In general, in this period one would expect that TVA prices and service offerings would mirror those of traditional investor-owned utilities, but with more service and lower prices. But TVA's benchmarks have been in the wrong direction - negative service growth and relatively high price increases. Moreover, the rate of growth of capital has been far greater. The accumulation of assets by TVA has been relatively rapid, in comparison to private firms; its fourfold growth of capital was more than twice the industry rate from 1975-1985 (from $4.8 to $19.4 billion a four-fold increase as compared to an industry group average from $2.9 to $8.9 billion a three fold increase). This over capitalization was no doubt due to a number of factors but most important it was to respond to higher predicted rates of demand growth in the

24. North American Electricity Reliability Council, *1994-1993 Electricity Supply and Demand Database*
25. See Energy Information Administration, *The Changing Structure of the Electric Power Industry; An Update*, Washington, D.C., 1996, pp. 21-28.
26. Ibid., pp. 77-87.
27. The rate of price increase was as shown in Table 1in Appendix C.

Tennessee Valley region (which were after the fact erroneous). Miscalculations of electricity demand growth resulted in the cancellation of eight of seventeen nuclear generating units originally planned. Plants partially completed on the shelf were financed by bond issues, and the bonds had to be redeemed.

3. TVA's Financing and Forecasting Decisions

TVA's thirty-year nuclear misadventure has been much documented; the issue is the program's current state and how it has been financed. We examine the organization's current capital structure and the effects of its debt repayment program on valuation of its assets.

3.1. Nuclear Plant Financing

TVA's nuclear plant construction program originated in decisions made in the mid-1960s. Nuclear generation was free of air pollution. But the efficiency of nuclear-based electricity generation, over other fuel-based systems, in ¢/kWh generating costs, was the main reason cited for an ambitious program of reactor construction. Most hydro sites in the valley had been exploited, and fossil plants were thought to have higher capital plus fuel costs when compared with nuclear plants with low fuel costs that more than compensated for capital intensity in the reactor.[28] At the height of the construction program in the 1970s, seventeen nuclear plants were under construction or operating at seven sites. Significant curtailment in the program however, took place between 1982 and 1984, when eight units were cancelled.[29]

By the end of 2000, $17.9 billion, constituting 63 percent of TVA Property, Plant and Equipment (PPE), had been invested in the nuclear program.[30] This program accounted for 63 percent of book value of assets while generating only 31 percent of electricity at full capacity from both fossil and nuclear plants.[31] Nuclear plants were not generating power; they

28. House Committee on Public Works and Transportation, *Operations of the Tennessee Valley Authority* 103rd Cong., 2nd sess., 1994, pp. 5-6.
29. An analysis from an administrative science perspective is Edwin Hargrove, *Prisoners of Myth: The Leadership of the Tennessee Valley Authority, 1933-1990* (Princeton: Princeton University Press, 1994), pp. 242-250. Hargrove outlines in some detail how TVA lost control of its nuclear building program, attributing the debacle to, among other things: lack of internal controls, failure of regulatory oversight, and technical difficulties. Hargrove also illustrates how the nuclear program exploded one of the most enduring of TVA myths: the ascendancy of professional expertise (particularly engineering judgment) and autonomy over political considerations.
30. Since inception, a total of $26.1 billion has been invested in the nuclear program.
31. TVA, *Financial Statements* 2000.

comprised a "sunk cost". By then some of the bond issues necessary for their financing caused ratios of debt to generation product to increase beyond levels where recovery from revenues from selling product was not feasible. That is these nuclear investments would become "stranded" if the company were pricing based on meeting competitive prices of other power sources wheeling product into the Tennessee Valley region.[32] TVA's outstanding debt reached $27 billion in 1997, when it was determined that total debt must be reduced if it were to operate at comparative costs and rates in future electricity markets.

The status of nuclear assets as of Fiscal 2000 was as shown in Exhibit Two:

Exhibit Two:
Status of TVA's Nuclear Program
($ million)

Nuclear Plant Construction (Numbers refer to Reactors at site)	Commercial Service Date	Current Status	Net PPE in rate base (amount for all units at site)	Construction in Progress	Fuel Inv.	Deferred Costs (amount for all units at site: Book Value)
Browns Ferry 1	1974	Inoperative	$2,995	$25	$168	
2	1975	In Service				
3	1977	In Service				
Sequoya 1	1981	In Service	$1,920	$445	$125	
2	1982	In Service				
Watts Bar 1	1996	In Service	$6,237	$14	$68	
2	None	Deferred				$1,719
Bellefonte 1	None	Deferred	-			$4,606
2	None	Deferred				
Phipps Bend 1 and 2	None	Cancelled 1982	-			
Hartsville 1, 2 3 and 4	None	Cancelled 1982 or 1984	-			
Yellow Creek 1 and 2	None	Cancelled 1984	-			
TOTAL			$11,152	$83	$379	$6,325

Sources: TVA Annual Report, 2000 Financial Statements, Note 2.

These nuclear plant investments can be divided into three historical categories. A large portion of the program at the Phipps, Bend, Hartsville and Yellow Creek sites was cancelled between 1982 and 1984 (four units were

32. A stranded cost is the "unamortized portion of the original, or historical cost of the plant, which becomes unrecoverable under conditions of competitive pricing of electricity."

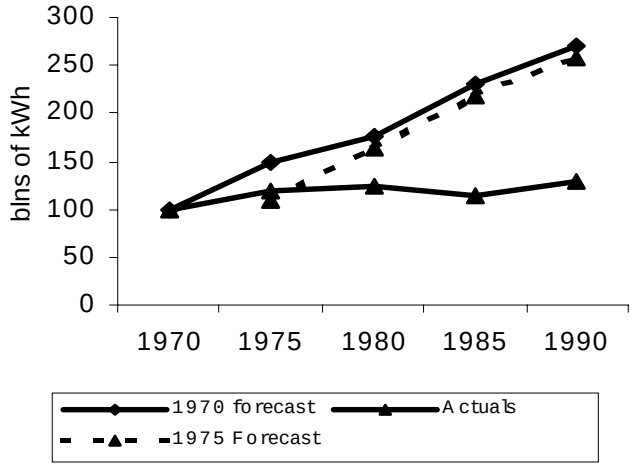
cancelled in 1982, and a further four in 1984). TVA incurred a $4.6 billion capital cost, which was recovered over a ten-year period from increases in its wholesale rates (rates increased 88 percent as this debt recovery was completed.)[33] A second block consists of the nuclear program investments with deferred costs - the Bellefonte complex and Watts Bar Two. These account for $6.3 billion in the 2000 balance sheet but are not in operating condition, and consequently are not entered in the operating asset base for depreciation and calculation of interest returns. A TVA Integrated Resource Plan has called for maintaining them as options for completion if demand growth ever calls for further capacity additions.[34] Analysts have called for the write-off of all "deferred costs" in Exhibit Two as is the usual result of decision errors by management.[35] These assets meet the criteria for write-offs under the *Statement of Financial Accounting Standards* 71; but TVA's prospective cash flow projections assume these asset values are to be recovered in rate increases. The third block consists of nuclear program assets, approximating $11.1 billion, that are in operation and in the rate base. A sizable portion - $9.5 billion - entered the rate base in 1996. Recovery is consequently commencing, and might be accelerated by increased use of these assets over fossil generation, to reduce operating costs. The question is how much price increase for recovery at a more rapid rate can be sustained. The response of power buyers in the wholesale market would surely be to lead to open entry for other sources of supply outside of the "fence."

In October 2001, TVA announced that $3.7 billion of retained earnings from 1999-2001 operations would be used to retire bonded indebtedness associated with non-performing assets in the nuclear program. Asset values being reduced included Watt Bar Unit Two ($1.72 billion), Bellefonte ($0.5 billion), the cancelled Hartsville Nuclear Plant Costs of ($0.4 billion), and deferred debt refinancing costs of ($0.7 billion). (Neither the Hartsville nor debt refinancing are shown in Exhibit Two). This write down leaves TVA with total assets of $29.7 billion, and a schedule of debt reduction in place since 1997 associated with TVA's plan (and what is below the TVA base case simulation).[36]

33. See Paul MacAvoy and George MacIssac, "Case File on Privatization," op. cit., p. 130.
34. See TVA, *Energy Vision 2020, Volume 2 Technical Documents – Integrated Resource Plan* (Knoxville: TVA, 1995), T8, and TVA *Financial Statements* 1997.
35. GAO, *TVA, Financial Problems,* pp. 30-35. In 2001, the TVA wrote off $2.2 billion as noted in TVA Annual Report 2001, p. 42.
36. TVA press release "TVA revenues Total Nearly $7 billion" October 24, 2001.

3.2. Some Causes of the Nuclear Cost Overruns

Exhibit 3: Electricity
Demand, Forecasts and Actual



Source: See Footnote 37

Proximate causes of the TVA high total cost of nuclear plants derive from a concatenation of events that affected the industry in the last half of the 1970s and 1980s. Following the Three Mile Island nuclear accident, the Nuclear Regulatory Commission significantly increased its technical requirements in safety standards for both new and old plants. Specification of performance standards for equipment modules according to "plant design" in the operating license significantly increased the capital and operating costs. This lessened any economic advantage of nuclear power, already made tenuous by high interest rates embedded in capital-intensive costs. These plants in fact probably were no longer lowest cost and when taken out of base load their low operating rates adversely affected unit costs kWh even more.[37] Additional cost outlays required to meet heightened safety requirements and interest rates, were followed by unbudgeted repair costs from forced outages that bordered on the catastrophic.[38]

Even so, there are three further causes for the TVA nuclear strategies failure - demand estimation, capital budgeting, and corporate governance - that

37. For a more complete account see Energy Information Administration, *The Changing Structure of the Electric Power Industry: An Update* (Washington, D.C., Department of Energy, 1996). Appendix A, pp. 103-113.

continue to be an issue. The TVA Integrated Resource Plan provided an indication of the extent of the forecast error (as in Exhibit Three). The 1970 forecast for 1990 was 270 billion kWh, and the 1975 forecast for 1990 demand was less, at 250 billion kWh.[39] But actual 1990 turned out to be less than half of either forecast at 120 billion kWh. Demand forecasting improved in the 1980s with the use of new econometric and end-use models, resulting in load forecasts within ± 5 percent of the actual. By then the most substantial outlays in nuclear construction had been undertaken based on the earlier forecasts.

Fundamental changes had affected power demand through the 1970s and 1980s; demand reductions in fossil fuels following the 1974 OPEC oil price "shocks," changes in relative prices for energy using inputs in manufacturing and rising prices for final goods based on energy content all contributed to demand for electricity lower than anticipated.[40] TVA forecasting failed to capture these effects; it was not alone, as most of the better known independent forecasters provided overly optimistic demand forecasts into the 1980s.[41] But as late as 1994, TVA's load forecast growth of 2.3 percent was still the second highest among North American Electric Reliability Council sub-regions. It was not justified by specific conditions in the Tennessee Valley industrial and residential markets.[42] TVA was persistently wrong.

3.3. Approaches to Valuation and Capital Budgeting

TVA's nuclear program provides a lesson on the consequences of not using an options-based approach to capital investment. Such an approach would have

38. For a description from a technical standpoint, see Ellis Merschoff, *The Tennessee Valley Authority's Nuclear Power Program*, testimony in House Committee, *Operations of the TVA*, pp. 188-206.
39. See TVA, "Resource Integration," in *Integrated Resource Plan*, pp. T5.1-T5.15.
40. In 1974, for the first time since World War II, sales of electricity actually declined from the prior year. In April 1974, Consolidated Edison omitted its regular quarterly dividend payment. This seminal industry event meant that utilities were no longer considered the quasi-governmental investments they had been for the past 40 years. The increased risk raised the cost of financing, which further contributed to upward pressure on rates.
41. A central question is whether TVA used its load forecasts to justify its massive construction program. Some analysts see this as a reason behind the aggressive forecasting. Former TVA Board member and Tennessee Congressman Bob Clement: "TVA uses its load forecasts to justify the need to build new nuclear units to meet baseload demand… With respect to TVA's load forecasts, they have never been accurate. Even TVA's current long-term load forecast is higher than load forecasts predicted in the states of Florida and Texas." House Committee, *Operations of the TVA*, pp. 8 and 43. Also see testimony of Ed Passerini on the above. Using his own models, Passerini shows how TVA has systematically overestimated demand, usually by shifting the forecasting base year. Passerini concludes that, "TVA forecasts were, and are, absurd." House Committee, *Operations of the TVA*, vol. 2, pp. 230-240.
42. House Committee, *Operations of the TVA*, vol. 2, p. 221.

begun with acknowledging that not making a single all-or-nothing decision had value,[43] because it allows for a reversal of initial erroneous decisions. Consider the stylized case of investment in a single nuclear plant as opposed to numerous smaller gas-fired plants that together provide the same level of megawatts capacity, but at higher ¢/kWh production costs. That is, the nuclear plant would have lower average costs in operation, due to economies of scale in fuel utilization. A straightforward NPV (net present value) calculation would rate it a superior investment to gas-fired plants with the same total capacity. But in the face of demand uncertainty the smaller gas-fired plants provide for a more flexible investing decision - the decision maker could add capacity in smaller amounts as and when needed. This flexibility would allow rejection of the nuclear plant if demand does not increase sufficiently to call for full capacity production in that plant.[44] Valuing this "option" in dollar terms as probability-based savings could make numerous small plants the preferred arrangement.

This approach was not taken at TVA. There was a tendency to make decisions taking the net present value approach given that *a)* the decision did not need to be reversible in any part of the total investment and *b)* even if *ir*reversible, the investment decision is a "now or never" proposition. The nuclear program illustrates how flawed both assumptions have been. Decisions on nuclear outlays were not reversible, and turned out to result in overbuilding. TVA found itself with having to continue investment to part of forecast revenues if capacity went on line. It opted for that course by finishing construction on plants with by then a negative net present value based on both past and current investment.

But the singular opportunity to set its own rates to generate additional revenues for now uneconomic cost recovery supported over-investing as the course of action. But even then these investment decisions were not a "now or never" proposition; delaying them would have added information on the attractiveness of alternate energy plants such as new gas-fired cogeneration plants.[45] Delaying would have uncovered new information, particularly on the demand side but also on new technologies which might have altered the nuclear decision.[46] But that was not the view of management: "[T]his *extra*

43. The basic idea is outlined in Avinash K. Dixit and Robert S. Pindyck, "The Options Approach to Capital Investment," *Harvard Business Review*, May-June 1995, pp. 105-115. For a more detailed exposition by the same authors, see *Investment Under Uncertainty*, (Princeton: Princeton University Press, 1994).
44. The approach is outlined in Thomas Kaslow and Robert S. Pindyck, "Valuing Flexibility in Utility Planning," *The Electricity Journal*, 7, (March 1994), pp. 60-65.
45. Former TVA Chairman, David Freeman, is quite explicit on this point, though he does not use an options adjusted NPV framework: "It is time to confess that we went too far too fast, in deploying a reactor we knew too little about. *It's also fairly clear that we moved too quickly to capture the economics of scale* (emphasis added)" cited in Hargrove, *Prisoners of Myth*, op. cit., p. 252.

expense [cost of construction] will pay large dividends in the 1990s. By the late 1980s, we expect that the impact of our construction program on rates will begin leveling off. At that time, TVA's nuclear program will start to look like a very good investment indeed, and our rates will become more and more attractive on a comparative basis."[47] This view was shared by TVA's nominal overseers in Congress: "Clearly, TVA had already invested huge sums in its nuclear plants when Chairman Crowell came on board. The board realizes *that with so much invested in these nuclear plants it makes economic sense to invest just a little bit more to finish the plants.*" [48]

Of course the "real options" approach to investment had not been highly developed at the time these decisions were undertaken. Moreover, it is not clear that TVA behaved in gerneral much differently than other utilities. However, few privately owned firms took so large a position in non-flexible, irreversible investments.

3.4. Corporate Governance and Strategy Formation

TVA and the nuclear program in particular serves as an illustration of a basic principal-agent problem endemic to state-owned enterprises.[49] Failures in the nuclear program to make productive investments went uncorrected for a considerable period of time because of this organization's governance. Those determining procedure were never provided rewards or even punishments for resulting performance. Congress as the nominal principal (owner) provided access to financing with its permissive charter legislation, but had no control on how that opportunity to finance large-scale projects was used. The TVA manager had control rights to capital raised in national capital markets; the manager however had no rights to residual cash flow. Hence there developed

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46. Using a higher hurdle rate might have implicitly valued the option, and is an increasingly common technique. But TVAs Integrated Resource Plan (IRP) gives little evidence that it used - or uses - higher hurdle rates to capture the option value of its investments. The 1995 IRP medium term projections use an 8 percent hurdle rate, not much higher than its cost of capital, of about 7 percent. It states: "TVA has chosen the long-term interest rate as the discount rate to be used in Energy Vision 2020." See TVA *Integrated Resource Plan*, op. cit., pp. T8.24-8.26, 8.34.
47. David Freeman, former TVA Chairman, in Hargrove, *Prisoners of Myth*, op. cit., p. 224.
48. Congressman and former TVA Board member, Bob Clement, (House Committee, *Operations of the TVA*, p. 43).
49. The basic agency problem deals with how a supplier of finance, the principal - owner, gets an agent, usually a manager, to act in the interests of the principal - owner, rather than pursue self-seeking behavior. A standard survey of corporate governance from an agency perspective is Andrei Shleifer and Robert Vishny, *A Survey of Corporate Governance*, Harvard University (mimeo), 1995. Indeed, the GAO criticizes governance at the TVA in its report, *Tennessee Valley Authority Financial Problems*, op. cit., pp. 71-72. TVA's response says that a three-member board of corporate insiders is more effective than the sorts of boards virtually all public corporations have. (Appendix 14, p. 16).

a basic division between ownership (cash flow rights) and manager (control rights). Such manager discretion lead to mistaken strategies to expand the firm beyond rational boundaries,[50] reinvest free cash,[51] or entrenchment of those who make mistakes.[52]

Corporate governance at TVA can be seen as exhibiting manifestation of this condition.[53] While in theory TVA is owned by Congress, in reality senior management exercised *de facto* control rights in the organization. Those control rights emerged from *a)* minimal congressional oversight and *b)* special provisions in the TVA Act. In fact *de facto* control rights of management replaced congressional oversight[54] dating from the 1959 Act that made TVA self-financing. Congress only intervened when issues were perceived as requiring political attention. Even when oversight did take place, it was procedural and hardly a substitute for the questions that a board of directors in an investor owned company would ask in determining whether management mistakes required replacement of those in control.[55]

Beside the *de facto* control rights arising from minimal oversight, management had *de jure* control rights from the TVA Act. The TVA Act set up a three-member board that served by Presidential appointment, and gave the board sole authority not only in management decisions but also in strategic matters such as in setting rates. Consequently, unlike other utilities which face an adversarial rate setting process with a state or Federal agency, TVA has been exempt from public review of the 'just and reasonable" rate in an open

50. See, for example, Randall Morck, Andrei Shleifer, and Robert Vishny, "Do Managerial Objectives Drive Bad Acquisitions," *Journal of Finance* (1990), XLV 31-48, on mergers and acquisitions as a source of agency costs for the bidder.
51. See Michael Jensen, "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review* 76 (1986), on managers' propensity to reinvest free cash flow rather than return it to shareholders. The usual reasons cited are growth and increasing firm size.
52. Incentive contracts are the usual mechanism to mitigate agency costs. Incentive contracts work by aligning manager's defacto control rights with additional cash flow rights. A typical incentive contract is a stock option. See Shleifer and Vishny, op. cit., pp. 11-14.
53. The phenomenon is worldwide. See Sunita Kikeri, John Nellis, and Mary Shirley, *Privatization: The Lessons of Experience* (Washington, D.C.: The World Bank 1992).
54. There is extensive evidence of this. Consider Subcommittee Chairman Clement's comment: "That's why I asked the basic question about to whom is TVA accountable. So you say, yes, Congress. Well, that's true, and to the extent that I have been Chair of this full Committee now for 14 months, it has been six years since one of our, I guess you might say operating entities, has come in to talk to this 63-member board of directors." House Committee, *Operations of the TVA*, op. cit., pp. 78 and 42.
55. "An account of a long meeting in Washington of the TVA board with Senator [Jim] Sasser revealed the great difficulty of exercising oversight. It was described as a friendly meeting, with all the politicians expressing support for TVA. The topic was whether rate increases could be justified by the nuclear program. Several members wondered aloud about the wisdom of an ambitious construction program that would only pay off much later. The board argued that it was worth it, but they were urged by the politicians to hold down costs and rates as much as they possibly could and to explain to the public why rate increases were necessary. But no one called for any kind of drastic action." Hargrove, Ibid.

and formal process.[56] TVA is also exempt from prudency tests for investment that govern cost recovery. Former TVA Chairman Marvin Runyon: "Investors in other utilities worry about whether public service commissions will approve rate hikes to cover unexpected nuclear power costs. TVA doesn't have that problem. If, in fact, a nuclear plant cost more money than anticipated, TVA wouldn't need anybody's permission to raise the rates to cover increased costs."[57]

Despite control of decision-making, TVA management has had negligible powers to divert net cash flow to their own interests. These powers are minimized by the nonprofit objective in the TVA Act and by the requirement that surpluses from electricity sales were to be given over to Treasury, or reinvested, or used to support rate reductions. There was no "pay for performance". Incentive problems inherent in standardized federal pay scales add to this disorientation from pursuit of corporate organizational objectives.[58] Private sector corrections such as incentive contracts and stock options that align the manager-agent's *de facto* control rights with firm objectives are not available for state-owned enterprise; realignment, when tried, comes through supplemental compensation arrangements that lack incentive effects.[59] The incentive schemes in place lack management performance standards.

With no incentive for maximizing gains to consumers, and negligible oversight, TVA bureaucracy indulged in large negative NPV projects in the nuclear program. TVA continued with its program long after most of the industry had moved away from nuclear construction. Indeed, following the Three Mile Island accident in the 1970s, very little nuclear construction was done by private utilities. TVA went on still with massive investment in unproductive assets.

3.5. Financing and the Debt Ceiling

The program of over-investment has been combined with a "soft" budget constraint in the organization's access to concessionary financing. TVA

56. De facto control rights may have resided below the Board level as well. Consider the statement from a former Board member: "When I was on the board, the TVA staff gave us the data and the analysis and you really had no choice but to accept the information. The Board simply did not have the staff nor the resources available to generate independent data and thus make, in my view, a truly informed decision." Ibid., p. 236.
57. House Committee, *Operations of the TVA*, op. cit., vol. 2, p. 224.
58. Salaries of management and regular employees are limited by a federal pay cap. This, by TVA's admission, has led to difficulties "in the recruitment and retention of top management talent and continues to be an issue which TVA must face in its recruitment and retention efforts." TVA, *Information Statement for Issue*, op. cit., p. 18.
59. Ibid., p. 18.TVA has recently developed these to reduce the impact of the pay caps and is in a dispute with the GAO about whether these arrangements are within TVA's authority.

borrows from public debt markets with an implicit "agency status" in bond rating parlance, without regard to TVA's own financial status.[60] One result is that, without regard to operating or investing results, TVA's ratings remain consistently AAA (to use a common bond rating).[61] This is not constrained by any absolute limit on borrowing: if TVA were to face financial distress, in which cash flow failed to meet interest payment requirements, it would borrow more cash, taking on more debt subject only to a limit on total debt negotiated with Congress. Seen from this perspective, the debt issue policy basically amounts to the organization having a blank check, subject to a far-out Congressional limit on total borrowing.

The debt financing of new capacity from the mid-1980s to 2000 went entirely into the nuclear program,[62] given that net generating capacity for non-nuclear sources actually declined. In 1987, generating capacity from hydro, fossil and nuclear sources were 6054, 17647 and 2510 megawatts, respectively; the corresponding figures for 2000 were 5544, 15042, and 3154 megawatts.[63] As the nuclear program ran into technical and financial difficulties, outlays were deferred or listed as Construction Work in Progress (CWIP). Total debt was $19.9 billion in 1987, and increased to $25.4 billion by the beginning of 2000. As of September 30, 2000, TVA had $21.8 billion in long-term debt (net) due to public markets, and $3.6 billion in short-term debt adding to debt placed by the Federal Financing Bank.[64] Borrowings since 1989 have been from public markets. The increase has led to a corresponding service cost of $1.74 billion in net interest costs in 2000.

3.6. The Profitability of the Nuclear Program

60. Standard and Poor's, a bond rating agency, attributes "agency status" to securities issued by entities related to the federal government because the securities have some of the attributes of U.S. Treasury securities, such as being exempt from Securities and Exchange Commission requirements.
61. Interest income for TVA's bondholders is generally exempt from state income taxes which further lowers TVA's cost of funds. See GAO, *Federal Electricity Activities – The Federal Government's Net Cost and Potential for Future Losses*, Washington, D.C., 1997, pp. 14-15.
62. One of the participants in these decisions remembers, "There was … no congressional scrutiny of the justifications for the increase…. [T]hat gave the nuclear program 5 more years before the right questions were asked." Hargrove, *Prisoners of Myth*, op. cit., p. 223.
63. TVA, *Financial Statements* 1991 and 2000.
64. The Federal Financing Bank (FFB), a branch of the U.S. Treasury, was established in 1973 to provide lower cost financing for certain Federal programs. Loans provided from the FFB are provided at the Treasury's net cost of borrowing plus a spread. See GAO, *Federal Electricity Activities*, op. cit., pp. 14-18.

In 2000, total operating income for TVA was $1.743 billion.[65] If the nuclear facilities' contribution to operating income was 31 percent, equal to the profit margin on TVA's other productive assets, nuclear's share of operating income would have been $.54 billion. In 2000, TVA had a nuclear investment of $17.9 billion. The return on investment for nuclear power was thus roughly 3 percent below that of risk-free treasury bills. This return estimate is high; if the nuclear profit margin is half that of other plants, then the rate of return is 1.5 percent.

3.7. TVA's Debt Reduction Plan

TVA's debt burden has been the focus of political and economic analysis. Studies by the GAO in 1995 and 1997 found that TVA's debt burden would in time adversely affect the organization's competitiveness.[66] A TVA sponsored study not surprisingly reached the opposite conclusion;[67] this study, the Palmer Bellevue study, had serious flaws, not the least of which is that it compared TVA to rural cooperatives which had average total assets in 1994 of $70 million, although TVA had total assets of $31 billion. Even though TVA protested that its high debt level was not an emerging competitiveness problem, in 1997 it announced a "ten year plan" to cut its debt roughly in half by 2007.[68] In this plan, the TVA recognized that competition could develop within its market area with the consequent need for pricing flexibility below levels required for completing all interest payments. It wrote: "…this Ten Year Business Outlook is primarily focused on positioning the electric power operations to meet the challenges TVA will face in the coming restructured marketplace."[69]

To achieve its goal, TVA posited that certain market conditions would hold, affecting revenues and costs, as well as certain projected capital expenditures. These determinants of the ability to achieve debt reduction to sustainable levels included *energy prices*, *cost of producing power*, and *demand growth*. The estimates for these variables identified by the TVA can be used to evaluate this plan.[70] Using 1998 as a starting point, given that TVA raised its rates that year, we develop a spreadsheet of "TVA Plan Results" in Appendix A from these determinants, at the same time, we develop alternative "Results" for a range of values of these determinants also specified by TVA.

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65. See TVA *Annual Report* 2000.
66. See GAO, *TVA: Financial Problems*, op. cit., pp. 24-62 and GAO, *Federal Electricity Activities: The Federal Government's Net Cost and Potential for Future Losses*, Vol. 1.
67. Palmer Bellevue, *The Ties That Bind – TVA in a Competitive Electric Market* (Washington D.C.: Palmer Bellevue) 1995
68. TVA, *Ten Year Business Outlook*, July 22, 1997.
69. Ibid., p. 1.
70. Updates were based upon financial results reported in the TVA Bond Circular, December, 1998. We update certain components based upon actual 1998 results, as well.

The results of these sensitivity analyses are summarized in Exhibit Four. The assumptions regarding prices, costs, and demand were all taken from the TVA planning documents.[71] TVA's plan to cut its debt roughly in half by 2007 works only if the TVA "Plan" values for demand growth, prices, and costs are realized exactly. Even a slight deviation from the projections would leave TVA with more debt than specified to be sustainable.

Exhibit Four:
Debt Repayment Sensitivity Analyses -
Repay Debt with all Excess Cash*

Panel A: Demand Growth Sensitivity**

Scenario	Per Annum Growth	TVA Total Debt 2007	Total Debt / Total Assets (2007)
National Economy	3.10%	$13.4b	42.8%
TVA Baseline	1.96%	$16.4b	53.1%
Slow Growth	1.00%	$18.8b	61.5%

Panel B: Price Sensitivity **

Scenario	Estimated 2007 Market Price	TVA Total Debt 2007	Total Debt / Total Assets (2007)
TVA Baseline	4.22¢/kWh	$16.4b	53.1%
Upper Band	3.70¢/kWh	$21.5b	70.6%
Most Likely	3.45¢/kWh	$23.9b	79.2%
Lower Band	3.00¢/kWh	$28.3b	95.1%

Panel C: Variable Cost (i.e. Fuel and Purchased Power) Sensitivity **

Scenario	Estimated 2007 Variable Cost	TVA Total Debt 2007	Total Debt / Total Assets (2007)
TVA Baseline	1.28¢/kWh	$16.4b	53.1%
10% Underestimate	1.41¢/kWh	$17.8b	57.4%
20% Underestimate	1.54¢/kWh	$19.1b	61.7%
30% Underestimate	1.66¢/kWh	$20.4b	66.0%

* Appendix A shows representative Spreadsheets and underlying assumptions.
** Source of Assumptions: TVA Ten Year Business Outlook, July 22, 1997, pp 4-12, updated with TVA Bond Circular , December 1998.

71. TVA *Ten Year Business Outlook*, July 22, 1997, pp. 4-12, updated with TVA *Bond Circular*, December 1998.

Moreover, TVA assumes that debt is paid down as excess cash becomes available. As it turns out, the rate of debt reduction from this decision rule is slower than the rate projected by TVA; if the planned TVA pay-down schedule were to be followed, TVA would have negative cash balances in certain years.

TVA could achieve its Ten Year Plan debt reduction goals only if all the estimates of key variables are achieved as favorably as possible to its plan. The TVA presented what is a very unforgiving plan, in terms of having to realize quite optimistic market conditions. In fact TVA has failed to achieve the assumed conditions, but has stayed on track because of extraordinary market conditions associated with the severe winter of 2000-2001. The GAO released a report indicating that as of year-end 2000, the TVA actually had about $1.4 billion more debt than forecast for that year in the Plan.[72] The report also noted that the TVA acknowledged it would not achieve its 2007 goal of reducing debt to the $14 billion range.[73] It attributed its failure to reduce debt according to the original reduction schedule to four factors:[74] (1) greater than anticipated capital expenditures for new generating capacity; (2) greater than anticipated capital expenditures on environmental controls to meet requirements of the Clean Air Act; (3) greater than expected operating expenses; (4) lower sales revenues than originally forecast. Subsequent analysis by the GAO, and a TVA study cited by the GAO, suggest that TVA's debt in 2007 will total roughly $21 billion, nearly 50 percent greater than forecast. But in October of 2001 TVA announced that it was writing off assets of $3.4 billion in the nuclear program, by paying out debt with its $3.7 billion in retained earnings, "left over income" from sales of power outside the fence in the extraordinary cold winter of 2000-2001.[75]

As its prices and costs now dictate, the TVA in a projected "normal" year would have limited flexibility to compete if its markets were opened to competition. Its financial forecasting has been inaccurate, indeed it failed to project both capital expenditures and demand growth reasonably accurately, in both upside and downside years. Its debt burden is high for a company confronted by competitors not operating under cost recovery pricing. We can only conjecture about TVA's inability to forecast or make correct financial decisions regarding asset purchases and capital structure in the future. But this record should cause concern looking forward.

As further evidence of TVA's forecasting capacity we present Exhibit Five, comparing TVA's forecasts for several variables to the actual values for

72. GAO, Tennessee Valley Authority*: Debt Reduction Efforts and Potential Stranded Costs*, February 2001.
73. Ibid, p.11
74. Ibid, p.12 - 15.
75. See "TVA Weighs Using Surplus to Adjust Assets Downward" Staff Report of the *Wall Street Journal* 10/22/01.

those variables. It shows that TVA has more generally been over-estimating several of these values. However, actual revenues exceeded revenues forecast as of 1997, as business cycle conditions and thus demand were under-forecast for 1999 and 2000. The TVA's performance in 2001 approximated its performance in 2000.[76]

Exhibit Five:
TVA Forecast Versus Actual Performance

Plan	**1998 Forecast**	**1999**	**2000**	**1998 Actual**	**1999**	**2000**
Revenues						
kWh (billions)	147	150	152	163	156	160
Total operating revenue	6.2	6.3	6.4	6.6	6.5	6.7
Rates and Costs (cents per kWh)						
Rate	4.22	4.22	4.22	4.07	4.17	4.18
Costs (O&M and SG&A)	0.96	0.94	0.92	0.83	0.86	0.88
Fuel and purchased	0.97	0.97	1.00	1.16	1.09	1.25
Total operating costs	1.90	1.91	1.92	1.99	1.95	2.13
D&A	0.64	0.64	0.63	0.64	0.72	0.73
Total	2.54	2.55	2.55	2.63	2.67	2.86
Costs ($b)						
Costs (O&M and SG&A)	1.4	1.4	1.4	1.3	1.4	1.4
Fuel and purchased	1.4	1.5	1.5	1.9	1.8	1.9
D&A	0.9	1.0	1.0	1.0	1.2	1.2
Total	3.7	3.8	3.9	4.3	4.4	4.5
Debt ($b)						
STD	N/A	N/A	N/A	1.8	1.0	1.3
Current portion of LTD	N/A	N/A	N/A	1.5	1.0	2.4
LTD	N/A	N/A	N/A	23.4	24.4	22.4
Total debt	27.0	26.3	25.0	26.7	26.4	26.0

Source: TVA 10 Year Business Plan (1997-2007); TVA *Annual Reports*, for fiscal years ending September 30th

76. TVA Annual Report, 2001.

4. Insolvency at the Tennessee Valley Authority

Over the last half of the decade of the 1990s, the financial performance of the TVA has not met expectations. Operating costs have increased, reducing price-cost margins and increasing prices. The reduced margins have in the end resulted in less of a cash margin between book assets and debt. Estimates are as shown in Exhibit Six.

Exhibit Six:
TVA Financial Indicators

INDICATOR	1991	2000
Price per kWh	4.09¢	4.18¢
Cost per kWh	2.53¢	2.86¢
Operating Income / Revenue	40.5%	25.8%
Debt / Total Assets	66%	76%

Source: TVA *Annual Reports*, 1991 and 2000.

While none of these averages and ratios is decisive in assessing financial condition, the decline in operating income margins, due to both price and cost increases, implies that an increased debt to assets ratio presages increased corporate risk of insolvency. There are four formal approaches to determining the risk of insolvency: (1) The Economic Balance Sheet; (2) Comparable Company Analysis; (3) Discounted Cash Flow; (4) Altman's Z-Scores. We consider each, but before doing so a "quick and dirty" analysis might help to guide the way. Consider that in 2000, TVA had an EBITDA of $3.05 and in 2001 an EBITA of $2.98 billion. Interest expense in 2000 was $1.74 billion and in 2001 $1.63 billion, interest coverage was 1.75 and 1.83, respectively which is quite low, even for a utility. In addition in 2000, construction expenditures were $867 million and in 2001 were $1.015 billion. Free cash flows after interest, after construction expenditures, and after tax equivalents were respectively $135 million and $20 million. The average price was 4.16 cents per kilowatt, so that a price reduction of less than one cent could cause free cash flow to become negative. TVA had very little room for adversity of the sort associated with competitive entry in the fence. Our formal evaluations yield the same inference.

4.1. The Economic Balance Sheet

The first approach to valuation in determining company solvency is based on the balance sheet. Adjustments to the current balance sheet are made in the book values of various accounts to reflect economic reality, with a final determination as to whether liabilities then exceed the adjusted value of assets. This approach is generally fraught with judgments on the adjustments that are controversial. For instance, the appraiser decides how much each machine, or each account receivable, is worth. This has to take account of shutdown costs at the end of reactor life, and of market value while in operation in a hypothetical market if sold outright. In this case we have TVA's own estimates of adjusted asset values. The TVA estimates that the recoverable value of its deferred nuclear assets is $500 million, as opposed to the $6.2 billion at which they are carried on TVA's books.[77] Other nuclear assets are worth undepreciated book value.

Exhibit Seven shows TVA's balance sheet as of December 31, 2000 and how it would have looked had deferred nuclear assets been carried at market value. The exhibit indicates that after adjusting the value of the deferred nuclear generating units, the net worth of TVA falls from positive $4.2 billion to negative $1.5 billion. Were TVA a private company, this would be a state of insolvency.

4.2. Comparable Company Analysis

A second approach frequently employed is comparable company analysis. Here the analyst identifies companies that are similar to the subject company, then using various valuation metrics for the comparable firm, such as Enterprise Value Or EV (Market Value of Interest Bearing Debt plus Market Value of Equity), relative to several earnings benchmarks, such as Revenues or Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA) or Earnings Before Interest and Taxes (EBIT), the comparable value for the prototype is constructed. In the case at hand, this is complicated by the fact that there are no public companies that are directly comparable. As noted earlier, TVA is a producer of power sold to distributors, and has no retail distribution facilities. Nonetheless, TVA views certain firms as potential competitors, so that these firms can be considered as the basis for such a comparison. Even if this analysis is not highly compelling, we include it as an "indicator" of value. Exhibit Eight shows results for this analysis.

77. GAO, TVA: *Debt Reduction Efforts*, February, 2001, p.7.

Exhibit Seven:
Economic Balance Sheet
($ million)

	Book Balance Sheet (Condensed) 12/2000	**Market Valued Balance Sheet** (Condensed) 12/2000
Current Assets	1,026	1,026
Net Completed Plant	20,476	20,476
Construction in Progress	916	916
Deferred Nuclear Generating Units	6,326	500*
Nuclear Fuel and Capital Leases	553	553
Total PP&E	28,271	22,498
Investment Funds	775	775
Deferred Charges, Other Assets	2,659	2,659
Total Assets	32,731	26,405
Current and Other Liabilities	7,163	7,163
Long Term Debt	21,322	21,322
Proprietary Capital	4,246	(1,580)
Total Liabilities and Proprietary Capital	32,731	26,405

* TVA's estimate of the market value of the defferred nuclear assets. See General Accounting Office, *Tennessee Valley Authority: Debt reduction Efforts and Potential Stranded Costs*, Feb. 2001, (GAO-01-327) p. 7.

Exhibit Eight:
Comparable Company* Multiple Analysis
as of December 31, 2000 (LTM)

	EV/ Revenues	**EV/ EBITDA**	**EV/ EBIT**
Ameren Corp.	2.45	7.02	10.05
Amer. Elec. Power	2.20	9.06	14.87
Energy Corp.	1.14	7.77[5]	11.14
Dominion Resources	3.28	10.87	19.88
Duke Energy	1.01	13.51	21.70
Entergy	1.74	7.49	11.30
First Energy	2.11	5.81	9.85
FPL Group Inc.	2.53	7.66	13.70
LG & E Energy Corp. (1999)**	1.69	6.87	10.20
Peco Energy Co./OLD (1999)***	1.13	3.52	4.50
Progress Energy Inc.	4.90	12.98	28.00
SCANA Corp.	1.72	7.42	10.60
The Southern Company	2.57	6.91	10.76
Mean Multiples	2.33	8.77	14.72
Median Multiples	2.11	7.66	11.30
TVA Denominator	6,949	2,937	1,746
TVA Long Term Debt	21,322	21,322	21,322
TVA Total Liabilities	27,823	27,823	27,823
TVA "Equity Value"			
Mean, with Long Term Debt	-5,131	4,436	4,379
Median, with Long Term Debt	-6,660	1,176	-1,592
Mean, with Liabilities	-11,632	-2,065	-2,122
Median, with Liabilities	-13,161	-5,325	-8.093

Source: Bloomberg Financial Data; TVA 2000 Annual Report, TVA IQ 2001 Report.

* The companies were listed by the TVA as competitors. See TVA Competitive Comparison: Costs and Prices, 1999.

**Not included in average or medians

*** Short Term & Long Term Debt & Other Liabilities

The valuation metrics are Enterprise Value (EV) relative to Revenues, EBITDA, and EBIT. To estimate EV for TVA, multiply TVA's revenues, EBITDA, or EBIT by the industry mean or median multiple; if that exceeds TVA's liabilities (as measured by long term debt or total liabilities) then TVA has at least an implied equity value on industry standards. Using mean values of these metrics from comparable companies, TVA is shown to be either quite insolvent or just barely solvent, for nine of twelve cases; for the remaining three, with implied equity values in the very low hundreds of millions, there is a very narrow positive equity base for a company with between $26.4 and

$32.7 billion in assets (depending upon what value is assigned to the deferred nuclear generating units). Specifically, with assumed median industry ratios, to eliminate the effect of outliers, TVA's implied equity value is significantly negative, ranging from negative $5.3 billion to negative $13.2 billion when considering all of TVA's short and long term debt plus other long term liabilities. If only TVA's long-term debt were considered, the median results imply equity values ranging from positive $1.2 billion to negative $6.7 billion. The weight of these estimates leads to the conclusion that TVA is insolvent; but as already noted, this analysis is not decisive because of differences in asset composition between TVA and its competitors. However, it leads to inferences not different from those from the Economic Balance Sheet.

4.3. Discounted Cash Flow Analysis

Valuation experts generally agree that the dominant valuation method is Discounted Cash Flow (DCF) analysis.[78] Using this method, the analyst forecasts future cash flows, then discounts these to the present. To use this method, the value of a company's debt is deducted from the present value of its free cash flows. The result is the implied equity value of the enterprise which, if positive, indicates the company is solvent.

For TVA, we began to build our financial model using the cash flow forecasts presented by TVA in the Ten Year Business Plan;[79] this cash flow equals operating cash flow less increases in working capital and additional capital investment. We modify the TVA forecasts in light of actual results through 2000[80] and revised 2000 forecasts of capital expenditures.[81] A representative spreadsheet model with assumptions appears in Appendix B.

The yearly estimates are discounted to present value; determination of an appropriate discount rate for TVA is not as straightforward as it would typically be in corporate valuation. In a standard model, the discount rate would be the weighted average cost of capital and as such would reflect the mix of debt and equity employed, the riskiness of each instrument, and the corporate tax rate. But TVA does not allow for the computation of a standard weighted average cost of capital because it is financed entirely by debt that carries an implicit government guarantee. The interest rate TVA must pay is significantly below the interest rate it would have to pay if there were no guarantee; in addition, TVA has no publicly traded equity and does not pay corporate taxes so that interest payments create no tax shields.

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78. See, for example, Bradford Cornell, *Corporate Valuation*, (New York, McGraw Hill, 1993)
79. TVA, *Ten Year Business Outlook*, 1997.
80. TVA, *Annual Report* 2000, and IQ 2001 *Quarterly Report.*
81. GAO, TVA: *Debt Reduction Efforts...op cit.*, February, 2001.

Given these conditions, to discount TVA's free cash flows, we utilize the Adjusted Present Value Method.[82] The discount rate that we employ is the unlevered, unsubsidized cost of equity, derived by computing an average cost of equity for the sample of comparable companies. If TVA's interest payments were tax deductible, we would add a value for the tax subsidy; however, they are not, so the amount of debt the TVA has is not important in determining the enterprise value.

Exhibit Nine shows the computations. We estimate TVA's unlevered, unsubsidized cost of equity as between 9 and 10 percent. This approach takes account of the riskiness of the underlying assets, but there is reason to believe that the TVA's assets may be riskier than its competitors because of over-investment in nuclear generating plants which, if working, require high operating rates, subject to plant forced outages, to attain competitive levels of costs per kWh. High fixed costs have the same influence on an unlevered risk coefficient as fixed interest payments have on a levered coefficient: both lead to high risk adjustment estimates. But rather than accounting for TVA's assets as inherently riskier than its competitors, in the interest of conservatism, we do not raise TVA's discount rate further. Here we provide a range of implied equity values based upon discount rates between 9 and 11 percent. We model TVA's free cash flows through the year 2007 since this was the TVA's original horizon date. At the end of 2007, we capitalize TVA's 2007 free cash flows after adjusting for future growth.

82. See Stewart Myers and Richard Brealey, *Principles of Corporate Finance*, 6th Edition (New York: Irwin McGraw Hill, 2000).

Exhibit Nine:
TVA's Cost of Capital:
Estimates of Risk Coefficient

Comparable Company	**Equity Beta[a]**	**Asset Beta[b]**
Ameren Corp.	.80	.62
Amer. Electric Power	.90	.56
Cinergy	.90	.62
Dominion Resources	.95	.64
Duke Energy	.75	.59
Entergy	.75	.47
First Energy Corp.	.75	.47
FPL Group	.75	.60
LG & E Energy Corp.	.95	.60
Peco Energy Co./OLD	.95	N.A.
Progress Energy Inc.	.90	.56
SCANA Corp.	.75	.46
The Southern Company	.90	.63
	Mean	.57
	Median	.6

TVA unsubsidized cost of equity

$= R_F^c + B_{asset}$ (Market Risk Premium)^d

$= .053 + .6$ (.056 to .075)

$= 8.7\%$ to 9.8%

a) Equity Betas from Bloomberg financials as of December 2000.
b) Asset Beta = E/(D(1-t) + E) * Equity Beta; Equity Beta from Bloomberg Financial as of December 2000.
c) Ten Year Government Bond Yield on June 11, 2001.
d.) Estimated as the historical geometric and arithmetic excess return of common stocks relative to Treasury Bonds. See Ibbotson Associates, *Stocks, Bonds, Bills and Inflation*, 2000.

Exhibit Ten shows the results of a series of scenario analyses of the TVA's implied equity value. Several alternative scenarios are chosen. Within each we compute a range of values using different discount rates and different terminal value growth rate assumptions. Only in the baseline case is the TVA solvent (and this case itself was questioned as to realism by the GAO studies).

Using alternative scenarios, as suggested by the TVA, this organization is insolvent by a wide margin.

Exhibit Ten:
DCF Scenario Analysis - Implied Equity Values*

		TVA Baseline			**Lower Bound**			**Most Likely**		
Discount Rate		9%	10%	11%	9%	10%	11%	9%	10%	11%
Growth Value	1%	$8.15b	$4.15b	$.96b	-$11.14b	-$12.53	-$13.68	-$8.39	-$10.71	-$11.59
Terminal Rate	2%	$11.44b	$6.75b	$2.79	-$10.08b	-$11.75	-$13.08	-$7.01	-$9.18	-$10.88

Note: Scenarios	**Demand (2007) bkWh**	**Price (2007) per kWh**	**Variable Cost per kWh**
TVA Baseline	175	4.22	1.28
Lower Bound	194	3.00	1.41
Most Likely	171	3.45	1.54

4.4. Altman's Z-Score

The Altman Z-score is a method for assessing the probability of bankruptcy;[83]the higher the Altman Z-score, the less likely the company is to become insolvent over the next five years. Exhibit Eleven, Panel A shows that Z scores for TVA's competitors range from 1.04 to 2.87. The credit rating for Duke Energy, the high scorer, is A+ and Altman's own score of financial health is A. The low score is Progress Energy Inc., with a credit rating of BBB+, and its Altman financial health is rated at C+. There is a rough correlation between Altman scores and credit ratings across the thirteen companies

Panel B shows the computation of a Z score for the TVA. For four of the five variables we used actual TVA values. The fifth variable requires the ratio of market value of equity to book value of equity. All of our previous results suggest the implied market value of equity is either negative or, most generously, very small relative to book value. Nonetheless, in the interest of conservatism, we use market to book ratios of .5 and 1.0 for illustrative purposes, along with nominal actual values of book equity (cash reserves). The results show a Z score for TVA that ranges from .57 to .87. This range corresponds to Altman's overlap area where it is impossible to distinguish a

83. Edward I. Altman, *Corporate Financial Distress and Bankruptcy*, 2nd Edition (New York; John Wiley & Sons, 1993), pp. 179-222.

future bankrupt from a non-bankrupt firm. However, using the comparable companies as guides and assuming that[84] if TVA were to be assigned a bond rating on the basis of comparability with its competitors, then the Z-score falls below this range. This once again reveals not only that investors in TVA bonds rely on the implicit government guarantee, but also that the TVA is not financially healthy as a stand-alone entity. As in the prior analyses TVA is virtually insolvent.

Exhibit Eleven:
Panel A - Altman's Z Scores for Comparable Companies

Grade	Financial Z Score	Credit Rating	Corporate Health
Ameren Corp.	2.07	A+	B+
Amer. Electric Power	1.33	A-	C+
Cinergy	1.66	BBB+	C+
Dominion Resources	1.14	BBB+	C+
Duke Energy	2.87	A+	A
Entergy	1.37	N.A.	C+
First Energy Corp.	1.27	N.A.	C+
FPL Group	2.10	AA-	A
LG & E Energy Corp.	1.48	BBB+	C+
Peco Energy Co./OLD	1.58	A-	B
Progress Energy Inc.	1.04	BBB+	C+
SCANA Corp.	1.30	A	C+
The Southern Company	1.64	A	B

Source: Bloomberg Financial

Panel B - Altman's Z Score for TVA

$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$

TVA Values as of 12/00		
X_1 = Working Capital/Total Assets	-3,763/32,731 =	-.115
X_2 = Retained Earnings/Total Assets	-3,689/32,731 =	-.113
X_3 = EBIT/Total Assets	1,746/32,731 =	.05
X_4 = Market Value Equity/Book Value of Equity		1.0 (PLUG)
X_5 = Sales/Total Assets	6,949/32,731 =	.2123

$Z = 1.2(-.115) + 1.4(.113) + 3.3(.05) + .6(1.0) + 0.999(.2123) = .87$*

Source: Edward I. Altman, op. cit., Chapter 9.
*This falls within Altman's overlap zone; Altman, p. 219.

84. Ibid., p. 252.

5. Policy Implications of Insolvency

TVA's poor financial performance, based on gross errors in investment, have resulted in operations going forward in a virtual insolvent state. That TVA is in that state suggests it is appropriate to consider how its corporate form, the source of that condition, should be dealt with. The continuation of TVA as a public corporation, as compared to a private corporation with bond and stock investors, is the central issue.

Confronting a condition in which liabilities exceed the value of assets, in which debt holders express concern for redemption, TVA can utilize its monopoly position in wholesale electricity markets in the Tennessee Valley region to develop a solution. Still inside a secure "fence," it can increase prices. It would have to use its legal resources to prevent incursions of other power suppliers within the "fence," and resist state and consumer group attempts to require TVA price increases to be in line with cost increases. This entrenchment by price increase should increase revenues, at least for a limited number of years, predictably to levels that allow reduction of debt sufficient to achieve solvency. Thus the consuming public finances solvency for TVA. This is the opposite result from what is achieved from bankruptcy, where the investor is responsible for financing, not the ratepayer. The ratepayer should then resist this strategy by calling for opening the fence and/or privatization of TVA power operations.[85] Attempts to shift the burden from consumers by privatizing would be strongly resisted by TVA management. Whether the congressional delegation from within the "fence" also resists depends on whether they consider the company or the ratepayer as their constituency. And with the rest of the electric power industry undergoing deregulation, proceeding toward even lower prices, more rapid capacity expansion, and faster growth, this plan would disadvantage those in the region supposedly benefiting from TVA's public status. The mistake would be partly rectified by exit from the region by energy intensive industries previously sought out by TVA .

Another alternative is that the TVA would be partially privatized, with its generation facilities auctioned off to investor owned companies. This is where competition could occur and where costs would rebound to the level of marginal cost for the least efficient service provider. TVA would keep its transmission network, by nature a sole operator (or network monopoly) facility. The proceeds of the auction would be used to pay down TVA's debt, with any shortfall absorbed once and for all by the FFB, in order to leave the Transmission Company in a state of solvency. Conceptually the organization would be the same except that it would be paid for transmission services as a

85. Charles E. Bayless, "Time's Up For Public Power," *Public Utility Fortnightly*, July 1, 1988, pp. 32-38.

"system operator", not for competitive supply of electricity. An alternative would be to shift the risks of bond repayment from the Federal Financing Bank to the bondholder in the capital markets. This privatization, i.e. selling TVA to private equity sources, at a price inclusive of compensation to current bondholders would leave all investors better off. Then the commitment could be made to take down the "fence," thereby setting competitive market limits on price increases for power in the region. To have TVA begin to serve the interest of the investor, so as to ration capital to only those projects with positive net present value; and to restructure and reduce the excessive debt/ equity ratio, would result in putting the region on an equal competitive status as a source of electricity with other southern power regions.

These steps involve confronting the current state of ownership. The sale of TVA equity, or just its plants, would involve zero or negative prices, as the market determines that, in effect, TVA is insolvent. There would have to be plant write-offs, and plant sales at less than book value, that result in a realistic scenario asset sales. But as plants sell at less than book value. Doing the auction now would be less expensive than later, given that a privatization accompanied by restructuring would more efficiently utilize existing TVA resources over the next five to ten years. But whether now is better than later, in the politics of privatization, is of course another issue in financial and political options.

Appendix A

This Appendix contains a representative financial model based upon the TVA's own projections. Its intent is to determine whether the TVA could meet its debt-reduction goals under a variety of alternative scenarios.

APPENDIX A: ASSUMPTIONS

		National Economy	TVA Baseline	Slow Growth				
Demand Growth Rate	1.96%	3.10%	1.96%	1.00%				
		Upper Bound	TVA Baseline	Lower Bound	Most Likely	Actual		
Ave. Selling Price (cents per kWh in 2000)	4.18	3.70	4.22	3.00	3.45	4.18		
Ave. Selling Price (cents per kWh in 2007)	4.18	3.70	4.22	3.00	3.45	4.18		
Cost of Fuel & Purchased Power (cents per kWh in 2000)	1.14	1.66	1.28	1.41	1.54	1.14		
Cost of Fuel & Purchased Power (cents per kWh in 2007)	1.54	1.66	1.28	1.41	1.54	1.14		
		Low	Middle	High				
Discount Rate	10.00%	8%	10%	12%		7.18%		
Terminal Value Growth	1.00%	1%	2%	3%				
Key Assumptions	**2000A**	**2001E**	**2002E**	**2003E**	**2004E**	**2005E**	**2006E**	**2007E**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Demand Growth Rate		1.96%	1.96%	1.96%	1.96%	1.96%	1.96%	1.96%
Load Requirements	160	163	166	169	172	176	179	183
Ave. Selling Price (cents per kWh)	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18
Cost of Fuel & Purchased Power (cents per kWh)	1.14	1.20	1.26	1.31	1.37	1.43	1.48	1.54
(Fuel & Purchased Power)/ Sales								
O&M Fixed Costs (cents per kWh)	0.88	0.86	0.84	0.82	0.80	0.78	0.76	0.74
Depreciation & Amortization Expense	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Tax Equiv./Sales	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%
Weighted Ave. Cost of TVA Debt	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
Construction Expenditures / Capital Expenditures		1,000	1,160	1,000	500	490	480	480
Discount Rate		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%

APPENDIX A: ASSUMPTIONS

Key Assumptions	**2000A**	**2001E**	**2002E**	**2003E**	**2004E**	**2005E**	**2006E**	**2007E**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Balance Sheet Assumptions								
Account Rec. (net)	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%
Inventories (fuel)	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
Inventories (other)	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Accounts Payable	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Accrued Liabilities	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Accrued Interest	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%
Discount Notes	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%
Current maturities of LT Debt	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%
Deferred Charges and Other Assets				No change				
Investment Funds				No change				
Total Proprietary Capital				Changes with net income				

APPENDIX A: INCOME STATEMENT

	2000A	2001E	2002E	2003E	2004E	2005E	2006E	2007E
YEAR		1	2	3	4	5	6	7
Operating Revenue	$ 6,670	6,801	6,934	7,070	7,209	7,350	7,494	7,641
Fuel & Purchase Power (net)	1,862	1,950	2,082	2,219	2,361	2,508	2,659	2,815
Gross Profit	$ 4,808	$ 4,851	$ 4,852	$ 4,851	$ 4,847	$ 4,842	$ 4,835	$ 4,826
Operations & Maintenance	$ 1,443	1,407	1,401	1,395	1,387	1,379	1,371	1,361
EBITDA	$ 3,365	$ 3,445	$ 3,451	$ 3,456	$ 3,460	$ 3,463	$ 3,464	$ 3,465
Dep. & Amortization	$ 1,185	1,182	1,205	1,229	1,253	1,277	1,302	1,328
Tax Equivalents	308	314	320	326	333	339	346	353
Operation Income	$ 1,872	1,949	1,926	1,901	1,874	1,846	1,816	1,784
Other Income (Expenses)								
Earnings Before Interest		1,949	1,926	1,901	1,874	1,846	1,816	1,784
Charges (Operating Income)								
Int. on Total Capital at 6.5%		1,577	1,573	1,553	1,500	1,445	1,348	1,327
Net Income		372	353	348	374	402	468	457

APPENDIX A: INCOME STATEMENT

	2000A	2001E	2002E	2003E	2004E	2005E	2006E	2007E
		1	**2**	**3**	**4**	**5**	**6**	**7**
Operating Income		1,949	1,926	1,901	1,874	1,846	1,816	1,784
- Capital Expenditures		1,000	1,160	1,000	500	490	480	480
- Additions to Working Capital		73	74	76	77	79	80	82
+ Depreciation and Amortization		1,182	1,205	1,229	1,253	1,277	1,302	1,328
FCF		2,058	1,896	2,054	2,550	2,555	2,558	2,550
Terminal Value								28,619
Discount Rate		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Present Value		$ 1,871	$ 1,567	$ 1,543	$ 1,742	$ 1,586	$ 1,444	$ 15,995
NPV		$ 25,747						

Changing Assumptions:

Demand Growth Rate	1.96%
Discount Rate	10.0%
Terminal Value Growth	1.0%

Constant Assumptions:

Ave. Selling price (cents per kWh in 2000)	4.18
Ave. Selling price (cents per kWh in 2007)	4.18
Cost of Fuel & Purchased Power (cents per kWh in 2000)	1.14

APPENDIX A: BALANCE SHEET

	2000A	2001E	2002E	2003E	2004E	2005E	2006E	2007E
YEAR		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cash & Cash Equiv.	348	348	348	348	348	348	348	348
Account Rec. (net)	688	701	715	729	744	758	773	788
Inventories (fuel)	141	144	147	149	152	155	158	162
Inventories (other)	249	254	259	264	269	274	280	285
Total Current Assets	**1,426**	**1,447**	**1,469**	**1,491**	**1,513**	**1,536**	**1,559**	**1,583**
Completed Plant (net)	20,637	20,455	20,410	20,181	19,428	18,641	17,119	16,971
Construction in Progress	793	793	793	793	793	793	793	793
Deferred Nuclear Generating Units	6,325	6,325	6,325	6,325	6,325	6,325	6,325	6,325
Nuclear Fuel and Capital Leases	559	559	559	559	559	559	559	559
Total Operating Assets	29,740	29,579	29,556	29,349	28,618	27,854	26,355	26,231
Accounts Payable	531	541	552	563	574	585	597	608
Accrued Liabilities	200	204	208	212	216	220	225	229
Accrued Interest	438	447	455	464	473	483	492	502
Discount Notes	1,274	1,299	1,324	1,350	1,377	1,404	1,431	1,459
Constant Maturities of LT Debt	2,350	2,396	2,443	2,491	2,540	2,590	2,640	2,692
Total Current Liabilities	**4,793**	**4,887**	**4,983**	**5,080**	**5,180**	**5,281**	**5,385**	**5,491**
Total Long-Term Debt	**20,767**	**20,118**	**19,669**	**18,950**	**17,677**	**16,337**	**14,331**	**13,471**
Total Liabilities								
Appropriation Investment	528	528	528	528	528	528	528	528
Retained Earnings Reinvested in Power Program	3,652	3,996	4,376	4,789	5,233	5,708	6,211	6,741
Proprietary Capital	0	0	0	0	0	0	0	0
Total Proprietary Capital	4,180	4,524	4,904	5,317	5,761	6,236	6,739	7,269
Total Liabilities and Proprietary Capital	**24,947**	**24,642**	**24,573**	**24,269**	**23,438**	**22,573**	**21,070**	**20,740**
Net working capital	(3,367)	(3,440)	(3,514)	(3,590)	(3,667)	(3,746)	(3,826)	(3,908)
Change in NWC		73	74	76	77	79	80	82
Construction Expenditures	588	1000	1160	1000	500	490	480	480
Depreciation & Amortization	758	1182	1205	1229	1253	1277	1302	1328
Net PP&E Flows	-170	-182	-45	-229	-753	-787	-822	-848

* Used only to estimate net working capital changes

APPENDIX A: PROJECTED vs. ACTUALS

	Projected			Actuals		
	1998	1999	2000	1998	1999	2000
Plan						
Revenues						
kWh (billions)	147	150	152	163	156	160
Rate (cents per kWh)	4.22	4.22	4.22	4.07	4.17	4.18
Total operating revenue ($B)	6.2	6.3	6.4	6.6	6.5	6.7
Costs (cents per kWh)						
O&M and SG&A	0.96	0.94	0.92	0.83	0.86	0.88
Fuel & purchased power	0.94	0.97	1.00	1.16	1.09	1.14
Total operating costs	1.90	1.91	1.92	1.99	1.95	2.03
D&A	0.64	0.64	0.63	0.64	0.72	0.73
Total	2.54	2.55	2.55	2.63	2.67	2.75
Costs ($B)						
O&M and SG&A	1.4	1.4	1.4	1.3	1.4	1.4
Fuel and purchased power	1.4	1.5	1.5	1.9	1.8	1.9
D&A	0.9	1.0	1.0	1.0	1.2	1.2
Total	3.7	3.8	3.9	4.3	4.4	4.5
Debt ($B) - Read off chart on page 7 of 10 Year Plan						
STD				1.8	1.0	1.3
Current portion of LTD				1.5	1.0	2.4
LTD				23.4	24.4	22.4
Total debt	27.0	26.3	25.0	26.7	26.4	26.0

Source: TVA 10 Year Business Plan (1997 - 2007; TVA Annual Reports Years ending September 30th.

APPENDIX B: ASSUMPTIONS

		National Economy	TVA Baseline	Slow Growth		
Demand Growth Rate	3.10%	3.10%	1.96%	1.00%		
		Upper Bound	TVA Baseline	Lower Bound	Most Likely	Actual
Ave. Selling Price (cents per kWh in 2000)	4.18	3.70	4.22	3.00	3.45	4.18
Ave. Selling Price (cents per kWh in 2010)	4.18	3.70	4.22	3.00	3.45	4.18
Cost of Fuel & Purchased Power (cents per kWh in 2000)	1.14	1.66	1.28	1.41	1.54	1.14
Cost of Fuel & Purchased Power (cents per kWh in 2010)	1.54	1.66	1.28	1.41	1.54	1.14
		Low	Middle	High		
Discount Rate	12.00%	8%	10%	12%		7.18%
Terminal Value Growth	3.00%	1%	2%	3%		

Key Assumptions	**2000A**	**2001E**	**2002E**	**2003E**	**2004E**	**2005E**	**2006E**	**2007E**	**2008E**	**2009E**	**2010E**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Demand Growth Rate		3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%	3.10%
Load Requirements	160	165	170	175	180	186	192	198	204	210	217
Ave. Selling Price (cents per kWh)	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18
Cost of Fuel & Purchased Power (cents per kWh)	1.14	1.18	1.22	1.26	1.30	1.34	1.38	1.42	1.46	1.50	1.54
(Fuel & Purchased Power)/Sales											
O&M Fixed Costs (cents per kWh)	0.88	0.86	0.84	0.82	0.80	0.78	0.76	0.74	0.72	0.70	0.68
Depreciation & Amortization Expense	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Tax Equiv./Sales	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%
Weighted Ave. Cost of TVA Debt	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
Construction Expenditures / Capital Expenditures		1,000	1,160	1,000	500	490	480	480	480	480	480
Discount Rate		12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%

Key Assumptions	**2000A**	**2001E**	**2002E**	**2003E**	**2004E**	**2005E**	**2006E**	**2007E**	**2008E**	**2009E**	**2010E**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Balance Sheet Assumptions											
Account Rec. (net)	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%
Inventories (fuel)	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
Inventories (other)	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Accounts Payable	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Accrued Liabilities	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Accrued Interest	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%
Discount Notes	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%	19.1%
Current maturities of LT Debt	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%
Deffered Charges and Other Assets	$260					No change					
Investment Funds	$840					No Change					
Total Proprietary Capital	$4,180					Growth with Net Income					

APPENDIX B : INCOME STATEMENT

YEAR	2000A	2001E 1	2002E 2	2003E 3	2004E 4	2005E 5	2006E 6	2007E 7	2008E 8	2009E 9	2010E 10
Operating Revenue	$ 6,670	6,877	7,090	7,310	7,536	7,770	8,011	8,259	8,515	8,779	9,051
Fuel & Purchase Power (net)	1,862	1,943	2,071	2,205	2,345	2,492	2,646	2,807	2,975	3,151	3,335
Gross Profit	$ 4,808	$ 4,933	$ 5,019	$ 5,105	$ 5,191	$ 5,278	$ 5,365	$ 5,453	$ 5,540	$ 5,629	$ 5,717
Operations & Maintenance	$1,443	1,422	1,432	1,442	1,451	1,458	1,465	1,471	1,476	1,480	1,482
EBITDA	$ 3,365	$ 3,511	$ 3,586	$ 3,663	$ 3,741	$ 3,820	$ 3,900	$ 3,982	$ 4,065	$ 4,149	$ 4,234
Dep. & Amortization	$ 1,185	1,195	1,232	1,270	1,310	1,350	1,392	1,435	1,480	1,526	1,573
Tax Equivalents	308	318	327	338	348	359	370	381	393	405	418
Operation Income	$ 1,872	1,999	2,027	2,055	2,083	2,111	2,138	2,165	2,192	2,218	2,244
Other Income (Expenses)											
Earnings Before Interest Charges		1,999	2,027	2,055	2,083	2,111	2,138	2,165	2,192	2,218	2,244
Int. on Debt		1,577	1,565	1,578	1,477	1,414	1,347	1,277	1,204	1,128	1,048
Net Income		377	440	515	583	651	770	788	856	923	990

APPENDIX B: INCOME STATEMENT

	2001E 1	**2002E 2**	**2003E 3**	**2004E 4**	**2005E 5**	**2006E 6**	**2007E 7**	**2008E 8**	**2009E 9**	**2010E 10**
Operating Income	1,999	2,027	2,055	2,083	2,111	2,138	2,165	2,192	2,218	2,244
- Capital Expenditures	1,000	1,160	1,000	500	490	480	480	480	480	480
- Additions to Working Capital	115	119	122	126	130	134	138	143	147	152
+ Depreciation and Amortization	1,195	1,232	1,270	1,310	1,350	1,392	1,435	1,480	1,526	1,573
FCF	2,079	1,980	2,203	2,766	2,841	2,916	2,982	3,049	3,116	3,185
Terminal Value										36,449
Discount Rate	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%
Present Value	$ 1,856	$ 1,579	$ 1,568	$ 1,758	$ 1,612	$ 1,477	$ 1,349	$ 1,231	$ 1,124	$ 12,761
NPV	$ 26,315									

Changing Assumptions:

Demand Growth Rate	3.10%
Discount Rate	12.0%
Terminal Value Growth	3.0%

Constant Assumptions:

Ave. Selling Price (cents per kWh in 2000)	4.18
Ave. Selling Price (cents per kWh in 2010)	4.18
Cost of Fuel & Purchased Power (cents per kWh in 2000)	1.14
Cost of Fuel & Purchased Power (cents per kWh in 2010)	1.54

APPENDIX B: BALANCE SHEET

YEAR	**2000A**	**2001E 1**	**2002E 2**	**2003E 3**	**2004E 4**	**2005E 5**	**2006E 6**	**2007E 7**	**2008E 8**	**2009E 9**	**2010E 10**
Cash & Cash Equiv.	348	348	348	348	348	348	348	348	348	348	348
Account Rec. (net)	688	709	731	754	777	801	826	852	878	906	934
Inventories (fuel)	141	145	150	155	159	164	169	175	180	186	191
Inventories (other)	249	257	265	273	281	290	299	308	318	328	338
Total Current Assets	**1426**	**1,459**	**1,494**	**1,529**	**1,566**	**1,604**	**1,643**	**1,683**	**1,724**	**1,767**	**1,811**
Completed Plant (net)	20,637	20,442	20,370	20,100	19,250	18,390	17,478	16,523	15,523	14,477	13,384
Construction in Progress	793	793	793	793	793	793	793	793	793	793	793
Deferred Nuclear Generating Units	6,325	6,325	6,325	6,325	6,325	6,325	6,325	6,325	6,325	6,325	6,325
Nuclear Fuel and Capital Leases	554	554	554	554	554	554	554	554	554	554	554
Total Operating Assets	**29,740**	**29,578**	**29,541**	**29,306**	**28,493**	**27,671**	**26,798**	**25,883**			
Accounts Payable	531	547	564	582	600	619	638	658	678	699	721
Accrued Liabilities	200	206	213	219	226	233	240	248	255	263	271
Accrued Interest	438	452	466	480	495	510	526	542	559	577	594
Discount Notes	1274	1,313	1,354	1,396	1,439	1,484	1,530	1,578	1,626	1,677	1,729
Constant Maturities of LT Debt	2350	2,423	2,498	2,575	2,655	2,738	2,822	2,910	3,000	3,093	3,189
Total Current Liabilities	**4793**	**4,942**	**5,095**	**5,253**	**5,416**	**5,583**	**5,757**	**5,935**	**6,119**	**6,309**	**6,504**
Total Long-Term Debt	**20767**	**20,079**	**19,449**	**19,141**	**16,982**	**15,341**					
Total Liabilities											
Appropriation Investment	528	528	528	528	528	528	6,989	7,777	8,633	9,556	10,546
Retained Earnings Reinvested in Power Program	3,652	4,029	4,469	4,984	5,567	6,219					
Proprietary Capital	0	0	0	0	0	0	0	0	0	0	0
Total Proprietary Capital	4180	4557	4997	5512	6095	6747	6989	7777	8633	9556	10546
Total Liabilities and Proprietary Capital	**24,947**	**24,636**	**24,446**	**24,653**	**23,077**	**22,088**	**21,041**	**19,948**	**18,805**	**17,632**	**16,368**
Net working capital	(3,367)	(3,482)	(3,601)	(3,723)	(3,850)	(3,980)	(4,114)	(4,252)	(4,395)	(4,542)	(4,693)
Change in NWC		115	119	122	126	130	134	138	143	147	152
Construction Expenditures		1000	1160	1000	500	490	480	480	480	480	480
Depreciation & Amortization		1195	1232	1270	1310	1350	1392	1435	1480	1526	1573
Net PP&E Flows		-195	-72	-270	-810	-800	-912	-995	-1000	-1046	-1093

Appendix C

Table 1

	National Average Price Increase	
Year	**TVA**	**US average**
1977	-3%	4%
1978	8%	-1%
1979	2%	-1%
1980	1%	4%
1981	15%	4%
1982	11%	3%
1983	22%	4%
1984	9%	5%

Source: MacAvoy and McIsaac, op. cit.

This behavior in electricity prices continued throughout the 1990s as shown below in Table .But relative rates of growth of sales declined. The sales increase level for TVA was negative over the decade, while prices increased 8 percent; the sales level industry wide increased 22 percent and prices decreased 4 percent.

Table 2

	Sales (% of 1990 sales)		Average Revenue (%of 1990 prices)	
Year	**Industry**	**TVA**	**Industry**	**TVA**
1991	101.81	100.22	102.74	95.96
1992	101.84	103.02	101.04	96.96
1993	105.46	106.98	101.61	98.80
1994	108.18	103.58	99.71	98.29
1995	111.06	101.32	99.71	97.52
1996	114.30	95.71	99.56	113.49
1997	115.96	119.52	99.85	83.41
1998	120.31	103.02	99.39	110.22
1999	122.08	95.02	98.81	103.17

Source: TVA *Annual Report*, 2000.

Sources: Energy Information Administration Annual Energy Review - industry data; Moody's Public Utility Manual (1988 - 1999) - TVA data; 2000 Annual Report - TVA data.
Source: US Energy Information Administration. Electric sales and revenue, 1997 and 1998 editions - for Alabama, Georgia, Kentucky, South Carolina, and West Virginia; 2000 Annual Report - for TVA.