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FINREG:
A FINANCIAL/REGULATORY MODEL FOR UTILITY CAPACITY EXPANSION PLAN EVALUATION

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ABSTRACT

A corporate financial/regulatory model, called FINREG, is presented to simulate a utility's accounting practices, financial policy and constraints, and ratemaking environment. For each year of simulation FINREG will yield as output electricity rates, pro-forma accounting statements, selected accounting ratios, and the accumulated present value of dividends less common stock offerings. The model is used to perform a financial evaluation of two feasible expansion options for Boston Edison Company.

The two options are generated by OPTGEN, an MIT Energy Laboratory dynamic programming capacity expansion program. OPTGEN provides the capacity additions and annual fuel costs for each option. For the first plan, OPTGEN added an 800 MW coal unit in 1987 and a 250 MW coal unit in 1992 to the existing Boston Edison system. For the second, a 1000 MW nuclear unit was prespecified to begin operation in 1989, and OPTGEN added a 250 MW coal unit in 1987.

Financial and regulatory assumptions were specified for each option. FINREG generated selected statistics for the two options through 1998. The equity value associated with each option is estimated. Under the given assumptions, Boson Edison's shareholders are better off with the two coal unit expansion plan.

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1.0 Introduction

In evaluating any set of plant investments, normally called a capacity expansion plan, electric utilities utilize complicated planning models which attempt to minimize the present value of each plan's annual costs. The annual costs include fixed charges and variable operating expenses. A fixed charge rate for any investment can be prespecified. That rate will yield an equivalent annual charge which exactly covers the cost of the investment and provides a required rate of return. Or, the fixed charge is the periodic payment needed to amortize the investment over some prespecified lifetime at some required rate of return.

The planning model integrates the proposed new plants (either precisely prespecified or selected from a prespecified group) with the existing plants and then minimizes annual variable costs. The proposed new system must also satisfy some reliability or reserve margin constraint. The annual cost is equal to the sum of the minimized annual variable cost and the fixed charges. The model will then employ some screening technique to yield the optimal plan with the lowest present value of annual cost.

If, in a regulated environment, actual costs are passed on to the consumer and utilities earn their required return, the least cost plan is optimal both for the consumer and the utility stockholder. The plan meets expected demand at the lowest cost, rates are minimized and the shareholder anticipates that he will earn his required return. However, if regulation systematically works in such a manner that

costs are not recovered or that higher or lower returns on investment can be earned, the optimal plan may not minimize shareholder wealth. It may be in the stockholder's best interest for the utility to select a plan which does not minimize annual cost.

Fundamental finance theory argues that a manager should attempt to increase the market value of each shareholder's stake in the firm. He attempts to increase shareholder wealth either through capital gains, i.e. increased price per share, or through dividend payments. His task can be simplistically reduced to one instruction: maximize net present value. He will only choose investment opportunities that have a positive net present value (NPV) and he will reject those he estimates will yield a negative NPV.

It is naive to suggest that investment decisions will or should be made only on the basis of the net present value criterion. Management has wider responsibilities, particularly toward its consumers, its employees and society at large. This is particularly true in the electric utility industry where managers have legal responsibilities to provide low-cost, reliable service and to comply with national energy policy objectives. However, management still must analyze decisions from the shareholder's point of view to attempt to balance conflicting corporate objectives. Net present value calculations can inform management how much a particular decision affects stockholders and a methodology should be developed which yields shareholder cash flows.

Sophisticated Net Present Value models attempt to simulate investments, financing, revenues, costs, taxes, and in some cases, a rate of return, adjusted for systematic risk and financial leverage. The appropriate cash inflows and outflows can then be discounted. Similarly, the market equity value of a firm, given some proposed set of investments, can be estimated by adding the present value of dividends minus common stock offerings to the present value of the estimated terminal market equity value of the firm. Again, the firm's outflows and inflows must be simulated.

An identical approach can be used to simulate the cash flows of an electric utility. However, the utilities are unique in that the price of their product is determined from a structured regulatory process. If one assumes that the general inputs of the model, i.e. estimated costs, taxes, financing, sales, discount rate, etc., are correctly estimated, then the task of performing proper NPV project evaluation reduces to simulating the workings of the regulatory environment. This is analogous to estimating price projections in non-regulated industries.

A model is presented (see Appendices I through IV) which simulates the financing and regulation of an electric utility. Along with various financial information and the yearly average electricity rate, the model provides the present value of discounted dividend payouts and common stock offerings. The user can also utilize the output for the terminal year to estimate the market equity value of the firm at that terminal year. The sum of the present value of

of dividend payouts and common stock offerings and the present value of the terminal equity value will estimate the current equity value of the utility. The user can employ sensitivity analysis to rank the firm's equity value with various capacity expansion options under various financial and regulatory assumptions.

The model, called FINREG, will be tested with two plausible capacity expansion options for Boston Edison Company. The two options will be generated by OPTGEN, a dynamic programming capacity expansion program developed by Stone and Webster Engineering. OPTGEN will provide the capacity additions and annual fuel costs for each option. The simulation of Boston Edison's financing and regulation will be based on a set of inputs for the base year (1980) and a set of assumptions on sales growth, inflation, financing, capital market behavior and regulatory behavior. The operation of Boston Edison will be simulated for the years 1981 to 1999.

1.1 Structure of the Report

Following the introduction, an overview of Boston Edison is presented in Section 2.0. Section 3.0 provides a brief overview of OPTGEN. Section 3.1 outlines the assumptions involved for the two capacity expansion options. The OPTGEN results and a brief analysis of those results are presented in Section 3.2. The financial analysis of the two options is presented in Section 4.0. Appendices I, II, III, IV, V and VI present the detailed framework and equations, the input requirements, and the computer code for the financial/regulatory model.

2.0 Boston Edison - Existing System[1]

Boston Edision furnishes electricty to approximately 40 cities and towns in eastern Massachusetts, covering an area of about 590 square miles within 30 miles of Boston and servicing a population of about 1.6 million. Its generating facilities comprise three steam, one 670 MW nuclear and three gas turbine stations with a total installed capcity of 2799 MW. Its net system output in 1980 was 12,801,782 Mwh which provided about 17 percent of New England's electric energy requirements. Edison's territory hourly peak for 1980 was 2100 MW, resulting in a 33 percent reserve margin for 1980. Edison's total assets had a net book value on December 31, 1980 of approximately $1.78 billion. Its operating revenue for 1980 was $887 million. Its year-end market to book ratio (December 31, 1980) was .69.

In order that FINREG simulates accurate annual depreciation and amortization expenses, the existing Edison assets must be reasonably subdivided into accounts with unique service lives, tax lives and current years of operation. Boston Edison currently establishes ten classes of assets and each annual addition to each class qualifies as a unique account, with a unique book and tax life and method of tax depreciation.[2] Since this system has been in existence for over 30 years, there now exist at least 150 separate accounts. For the test cases, these accounts have been reduced into 13 accounts with unique tax and book characteristics so that the annual accumulated book and tax depreciation expenses are reasonably estimated. These accounts are listed in the Table 1.0.

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Table 1.0 Boston Edison Asset Accounts (1980)
(in thousands of dollars)

Account	Present Year of Service	Book Life	Tax Life	Book Cost	Tax Cost	Accumulated Book Depre-ciation
Pre-1971,Steam	10	33	26	55,000	54,535	16,500
Pre-1971,T+D	9	33	23	152,000	151,351	41,040
New Boston No. 1	9	33	24	30,000	29,783	8,100
Mystic No. 7	6	28	23	154,692	135,000	33,135
Post-1970,Steam	6	33	23	145,000	143,943	26,100
Post-1970,T+D	6	33	24	400,000	341,417	72,000
EHV	6	30	24	85,000	80,000	16,983
Pilgrim 1	5	28	16	332,700	276,986	59,387
Steam Plant	21	33	26	57,400	57,390	36,162
T+D	18	33	23	127,000	126,298	68,580
Mystic No. 4	17	33	24	24,050	24,046	12,265
Mystic No. 5	15	33	24	21,500	21,461	9,675
Mystic No. 6	14	33	24	24,100	24,078	10,122

Note: The Sum of the Years'-Digits method is used for accelerated depreciation for the first eight asset accounts. The straight-line method is used for tax depreciation for the last five accounts.

Source: The above assets are based on the existing Boston Edison asset accounts supplied by Thomas May of Boston Edison.

A majority of the base year inputs required for FINREG can be extracted from the firm's financial statements. These include current assets and liabilities, net nuclear fuel, end of period stock price, dividend per share, total interest expense and debt retirements. However, some additional assumptions are required to adequately represent the base year financial status of the utility.

(i) Capital structure - Existing short-term debt is regarded as long-term debt which is refundable in the first year of simulation. Preference stock is regarded as preferred stock.[3]

(ii) Electricity rate - the electricity rate for the first year of simulation is calculated as that rate which exactly covers fuel costs and the service costs established in the most recent rate decision.

(iii) Asset beta - A recent (April 3, 1981) calculation of Boston Edison's equity beta by Value Line yielded a beta of .60. It is assumed that the beta of Edison's preferred stock is .15 and the beta of Edison's debt of .07.[4] It is also assumed that the ratios of book debt, preferred, and common stock to total book value approximate the respective market ratios.[5] The ratios for debt, preferred and common stock are .58, .116 and .304 respectively.[6] Since,

$$\beta(\text{asset}) = \beta(\text{equity})(.304) + \beta(\text{preferred})(.116) + \beta(\text{debt})(.58)$$

$$\beta(\text{asset}) = (.6)(.304) + (.15)(.116) + (.07)(.58)$$

$$\beta(\text{asset}) = .24$$

Thus it is assumed that the asset beta for Boston Edison is .24.

3.0 OPTGEN

OPTGEN is a dynamic programming capacity-expansion program developed by Stone and Webster Engineering.[7] OPTGEN attempts to develop a generation expansion plan which minimizes the present worth of the revenue requirements subject to specified reliability and reserve constraints. Revenue requirements are made up of two components, the capital costs and the production or operating costs. The capital costs are the fixed charges and property taxes of new generating units. A fixed charge rate is used to represent the equivalent uniform annual cost of owning a particular facility. The operating costs include the fuel costs of all generating units and the operating and maintenance costs of new units. The present value of these annual cost are accumulated over the study period. For comparison of different expansion plans which have different capacities in the last year, the capacities in the last year of study are adjusted to an equal basis, either minimum reserve percentage or fixed Loss of Load Probability.

OPTGEN defines each particular year in the expansion period as a stage and considers the many combinations of new units which form feasible states, i.e. states which result in reserves between the specified minimum and maximum reserve margins. For each state the program simulates the production cost of the system and finds the state among all states in the previous year which, when proceeding to the present state, does not necessitate a deletion of a unit, and which results in a minimum accumulated present value cost incurred up

to the present year. The program "remembers" the transition from the prior state which yields the minimum. An "optimal" plan can be traced backward from each of the terminal states.

OPTGEN contains a production costing sub-model which attempts to simulate the effect of random forced outages, maintenance outages and other operating peculiarities of the system on the loading of units. The program will schedule the units so that energy demand for the year is met and fuel costs are minimized.[8]

3.1 OPTGEN Input Assumptions for Boston Edison

OPTGEN was utilized to produce two feasible expansion plans for the period 1981 to 2000. The first plan involved the specification of three different units as allowed plants. The second plan involved the same three units as plant options but included a committed 1000 MW nuclear unit to begin operation in 1989.[9] OPTGEN then produced each plan's annual fuel costs and a schedule of plant additions. The following assumptions were specified:[10]

Minimum Reserve Considered	20.0 percent
Maximum Reserve Considered	70.0 percent
Annual Load Growth	1.7 percent
Rate of Inflation (for all costs)	12.0 percent
Discount Rate	14.5 percent
Fixed Charge Rate (for all plants)	15.0 percent

(Note: The inflation and discount rates are consistent with the rates used in FINREG.)

Alternative Generating Units (1981 $'s)

Type	Capacity (MW)	Fuel Cost ($/MWH)	Forced Outage Rate	Capacity Cost($/KW)	Year Available
Nuclear	1000	7.84	.30	1450	1989
Coal	800	19.80	.15	900	1987
Coal	250	19.80	.10	1000	1986

A second computer program, ELECTRA,[11] available at the MIT Energy Laboratory, was used to convert 8760 hourly load observations for a recent year of Boston Edison operation to a load duration curve.[12] The specifications of that curve were then inputed into OPTGEN.

3.2 OPTGEN Results

Option No. 1 - No committed future units

OPTGEN yielded a plan which adds a 800 MW coal unit in 1987 and a 250 MW coal unit in 1992.

Option No. 2 - Committed 1000 MW nuclear unit in 1989

OPTGEN also adds a 250 MW coal unit in 1987.

Table 3.2 presents a comparison of the annual fuel costs and reserve margin for each option. It is assumed that Boston Edison's share of the 800 MW coal unit and 1000 MW nuclear unit is 59 percent.[13] For each plan the reserve margin increases when the large unit is added, and fuel costs decrease. The immediate increase in reserve margin for the large coal unit is 19 percent and the increase for the nuclear unit is 29 percent. However the annual fuel costs for Option No. 1 after 1992 are approximately 14 percent greater than the costs for Option No. 2.

Table 3.2

	Option No. 1		Option No. 2	
	Fuel Costs (million $'s)	Reserve Margin	Fuel Costs (million $'s)	Reserve Margin
1981	344	31	344	31
1982	395	29	395	29
1983	454	27	454	27
1984	522	24	522	24
1985	599	22	599	22
1986	688	20	688	20
1987	588	39	713	29
1988	677	36	821	27
1989	780	34	469	49
1990	898	32	542	47
1991	1035	30	627	44
1992	1057	37	725	42
1993	962	35	840	39
1994	1111	32	972	37
1995	1284	30	1125	35
1996	1483	28	1303	32
1997	1714	26	1509	30
1998	1981	24	1747	28
1999	2289	22	2024	26

Source: Summary of OPTGEN results from two simulations of Boston Edison.

4.0 Financial Analysis of Boston Edison

4.1 Overview

It is the goal of this analysis to rank the two alternate plans on the basis of the estimated equity value of the utility associated with each plan. The equity value of the firm can be defined as the present value of the dividend payouts minus the present value of stock offerings plus the present value of the terminal value of the firm. Under a given set of financial and regulatory assumptions and for a given time period, FINREG will accumulate the present value of each year's dividend payout and stock offering. The value of the firm's net plant, construction work in progress, AFUDC, and available cash in the last period can be used to estimate the terminal value of the firm.

The firm has considerable leeway in establishing its annual dividend payout and financing policy. However, under the assumptions in this model the utility cannot change the equity value of the firm by altering its dividend policy. In this model, for a given set of investments with a fixed schedule of expected cash requirements, the equity value of the firm will depend only on the expected cash outflows resulting from the operations of existing and future assets.

The cash outflow for any period is equal to the utility's actual revenues minus its costs. The cash profit that remains at the end of the period can be distributed to shareholders as a dividend or can be used to reduce next period's financing requirements. The user must first prespecify a number of constants and supply selected asset, liability, sales, costs and financial vectors. FINREG will then

simulate the regulatory process to yield average electricity rates, will calculate revenue, accumulate costs, calculate financing requirements, finance those requirements, and calculate the present value of each year's dividend payout and stock offering. Each of these areas is described below.

Electricity Rates

FINREG contains a rate sub-model which simulates the workings of the regulatory process. The model allows the simulation of a number of regulatory options. In the case of Boston Edison, the following assumptions are made to simulate the regulatory process of the Massachusetts Department of Public Utilities.[14]

- Rate base is set equal to net asset book value and the rate of return is the weighted average of a selected return on equity and the embedded costs of debt and preferred stock. No CWIP is allowed in the rate base but the rate base includes a working capital allowance equal to 8.33 percent of the year's fuel and operations and maintenance costs.
- Massachusetts employs normalized accounting for tax depreciation and interest tax savings and allows unamortized accumulated investment tax credits to earn the rate of return.
- The electricity rate for any particular year is based on the previous year's incurred operating costs and an estimated tax expense based on the previous year's estimated income. The DPU sets a rate in year (T) primarily based on year (T)

information. The rate is applicable in year (T+1). However fuel costs are entirely recoverable in year (T+1) and the rate base used in rate determination includes the value of new assets entering service in year (T+1).

Accounts are also established for existing assets and assets under construction which are used for the calculation of book and tax depreciation, deferred taxes, investment tax credits, and Allowance for Funds Used During Construction. The model transfers constructed assets and their accumulated accounts into the existing asset accounts. Information from these accounts is then used for rate-making calculations.

The allowed revenue for year (T+1), calculated in year (T), will then equal the allowed profit (rate of return times rate base) plus the allowed expenses. The rate for year (T+1) is equal to the allowed revenue calculated in year (T) divided by sales in year (T). FINREG allows the user to prespecify a rate increase limit, so that the allowed rate will never increase by more than a certain percentage. The rate used for calculating revenue will be the minimum of the rate determined by the regulatory process and the rate limited by the percentage increase.

Cash Profit

The cash profit for any period is equal to the utility's actual revenue minus its costs. The actual revenue is equal to sales times the allowed rate. The sales for each period must be prespecified by

the user. The incurred costs include fuel costs, O&M costs, purchase power costs, financing costs (e.g., lawyers' fees, etc.) and taxes.

The operating costs for each period must be prespecified by the user. However, FINREG wil calculate financing costs and taxes. The financing costs are expressed as a fraction of the total debt, common or preferred stock issued in any period. The taxes include revenue, construction, property, state and federal taxes. FINREG calculates the allowed "carryforward" of losses, the investment tax credits and the accumulated tax depreciation and interest expense. Each particular tax is then calculated and the total tax is added with the other costs to determine accumulated costs.

Financing Requirements

For each period, the utility must finance construction costs, nuclear fuel purchases, bond retirements and increases in net working capital. The construction outlays for any asset are prespecified and the nuclear fuel purchases are calculated as a function of the annual nuclear fuel expense. The bond retirement schedule is prespecified and the model calculates current net working capital as a function of the previous year's net working capital, sales growth, the inflation rate and prespecified constants.

The utility can finance its requirements with long-term debt, preferred and common stock and available cash after dividend payout from the previous year. In deciding on how to finance the requirements, the model attempts to maintain a constant year end book

debt to book capital ratio. However, since financing is accomplished at the beginning of the period and the capital structure is determined at the end of the period, the model incorporates the previous year's retained earnings increase or decrease as an approximation of the current year's change in retained earnings. The financing equations are presented in Appendix IV.

Present Value

FINREG calculates and accumulates the present value of each year's common stock dividend payout and stock offering. The dividend payout is prespecified by the user as a fraction of Earnings before Interest and Taxes, Net Income, Available Cash, or Net Income less Preferred Dividends. FINREG calculates each period's stock offering when the model meets the period's financing requirements. The payout and stock offering is then discounted to the first year of simulation at a discount rate equal to the firm's cost of equity capital.

The model utilizes the Capital Asset Pricing Model to estimate the firm's cost of equity capital for each period. The return on equity is set equal to the short-term risk free rate plus the beta of the stock times the market premium. The beta of the stock is calculated as a function of the betas of the firm's assets, debt and preferred stock and the firm's book capital structure (see Section 2.0). The betas of the firm's assets, the betas of the debt and preferred stock, the short-term riskless asset rate and the market premium are assumed

to remain constant over time. Each of the aforementioned parameters must be prespecified. The allowed return on equity can be prespecified or can be calculated as a function of the estimated return on equity. The calculated return on equity will be used as the period's discount rate. The return on equity should remain approximately constant over time since the book capital structure will not vary significantly among periods. The accuracy of the equity return calculation is suspect since the use of the CAPM equation requires market not book capital ratios. The model's book ratios serve as an approximation of the market ratios.[15]

For each year of simulation FINREG will yield as output accumulated present value, electricity rates, pro-forma accounting statements and selected accounting ratios. FINREG will generate selected statistics for the two feasible capacity expansion options for Boston Edison. The statistics will be used to test the model and to provide data for the financial analysis of the two options.

4.2 Financial/Regulatory Assumptions

The following parameters remain constant for each period of simulation:[16]

Inflation rate	12%
Cost of debt	14%
Cost of preferred stock	14%
Investment tax credit rate	7%

Percentage financing cost for debt, preferred and common stock	0.5%
Beta of assets	.24
Beta of debt	.07
Beta of preferred stock	.15
Market premium	.088
Short term riskless asset rate	.12
Corporate tax rate	.46
State tax rate	.065
Property tax rate	.068
Dividend payout (as a percentage of net income minus preferred dividends)	73%
Debt maturity (years)	20

Table 4.1 presents the debt retirement schedule for existing Edison bonds and the interest associated with the annual debt retirement.[17]

Table 4.1

Year	Amount (in $000's)	Interest Rate
1981	159340	.133
1982	16640	.039
1983	1640	.1125
1984	19640	.037
1987	25000	.04625
1992	15000	.0425
1995	25000	.0475
1997	40000	.06125
1998	50000	.06875
1999	50000	.09

Source: 1980 Boston Edison annual report.

The existing asset accounts presented in Table 1.0 remain "in-service" during the period of simulation. An additional account is created for 1981, the first year of simulation. This account, with an original cost of $290,532,000 reflects the amount of Construction Work in Progress and Accumulated Funds Used during Construction which was present on Edison's financial statements for 1980.

For each year of operation, construction costs are incurred to reflect the cost of plant additions and new transmission and distribution. Thus, for each year of simulation, an asset enters the rate base at a cost reflecting the construction costs of the plant

additions and new T and D. These assets require one year of construction. The following equation is used to estimate the costs:[18]

Cost (in $000's) = [109800 + .076 (Sales - Sales (T-1))
* (1 + Inflation Rate)

Each new account has a book life of 33 years and a tax life of 24 years.[19] The Sum of the Years' Digits method is used for tax depreciation.

Two sub-cases for each expansion option will be analyzed. The first involves a negative difference of 3% between the actual required return on equity and the return allowed each year for rate determination. In the second case, the allowed return on equity will equal the calculated required return on equity. Thus, in all, four cases will be analyzed.

It is assumed that Boston Edison is regulated under the assumptions of the "Cost of Service Method" presented in Appendix III and discussed in the previous section. The limit for an annual rate increase for any year is 100%.

4.3 FINREG Results and Analysis

Boston Edison's return on equity will remain approximately constant for each period at 17.4%.[20] Thus, for each option, the allowed return on equity will approximately be 17.4% and 14.4% for the two sub-cases.

A summary of the four cases is listed below.

Case A - Committed Plants:	1987	250 MW Coal
	1989	1000 MW Nuclear
Allowed ROE:	approximately 17.4%	
Case B - Committed Plants:	1987	250 MW Coal
	1989	1000 MW Nuclear
Allowed ROE:	approximately 14.4%	
Case C - Committed Plants:	1987	800 MW Coal
	1989	250 MW Coal
Allowed ROE:	approximately 17.4%	
Case D - Committed Plants:	1987	800 MW Coal
	1989	250 MW Coal
Allowed ROE:	approximately 14.4%	

The following tables present the significant results.

Table 4.1

Electricity Rate (cents/kwh)

	A	B	C	D
1981	8.8	8.8	8.8	8.8
1982	9.9	9.9	9.9	9.9
1983	11.2	10.8	11.1	10.9
1984	12.1	11.8	12.1	11.8
1985	13.1	12.7	13.1	12.7
1986	14.1	13.7	14.1	13.7
1987	16.0	15.5	16.3	15.7
1988	17.4	16.9	18.3	17.6
1989	21.9	20.6	19.4	18.7
1990	25.2	23.9	20.4	19.8
1991	25.7	24.5	21.6	20.9
1992	26.3	25.1	24.8	23.9
1993	27.1	25.9	25.1	24.2
1994	28.1	26.9	26.4	25.4
1995	29.3	28.1	27.9	26.9
1996	30.7	29.5	29.5	28.6
1997	32.4	31.2	31.5	30.5
1998	34.3	33.2	33.7	32.8

Source: FINREG simulations of Boston Edison

Table 4.2

Growth in Electricty Rate (Percent)

	A	B	C	D
1981	-	-	-	-
1982	12.4	12.4	12.2	12.4
1983	13.0	9.9	12.8	9.8
1984	8.7	8.8	8.6	8.7
1985	7.6	7.7	7.8	7.9
1986	7.6	7.7	8.2	8.2
1987	13.9	13.1	15.8	14.0
1988	8.7	8.9	12.0	12.3
1989	25.4	22.3	5.8	6.1
1990	15.2	15.6	5.5	5.7
1991	2.2	2.5	5.8	6.0
1992	2.4	2.5	14.8	14.0
1993	3.0	3.2	1.2	1.0
1994	3.6	3.8	5.0	5.3
1995	4.3	4.5	5.6	5.8
1996	4.8	5.1	6.1	6.3
1997	5.5	5.8	6.6	6.9
1998	6.1	6.3	7.1	7.3

Source: FINREG simulations of Boston Edison

Table 4.3

Earned Return on Equity (Percent)

	A	B	C	D
1981	10.0	10.0	10.0	10.0
1982	13.5	13.2	13.7	12.9
1983	17.7	14.6	17.7	14.3
1984	17.3	13.3	18.4	14.9
1985	15.4	10.8	19.4	15.3
1986	14.8	10.3	20.7	17.8
1987	15.3	10.6	15.3	12.4
1988	21.1	16.7	21.2	17.8
1989	20.7	15.6	21.6	18.2
1990	21.1	24.5	21.8	18.5
1991	19.1	16.4	22.0	19.1
1992	17.6	14.5	17.8	14.8
1993	16.3	13.8	20.8	18.1
1994	15.1	12.8	19.4	16.9
1995	14.1	11.9	18.2	15.8
1996	13.4	11.3	17.2	15.0
1997	12.7	10.7	16.3	14.2
1998	12.1	10.1	15.5	13.4
Average	16.0	13.4	18.1	15.5

Source: FINREG simulation of Boston Edison

Table 4.4

Interest Coverage Ratios

	A	B	C	D
1981	3.42	3.42	3.42	3.42
1982	3.63	3.61	3.55	3.55
1983	3.88	3.59	3.69	3.44
1984	3.42	3.17	3.40	3.17
1985	3.02	2.79	3.18	2.97
1986	2.74	2.53	3.11	2.91
1987	2.71	2.50	3.51	3.26
1988	2.75	2.55	3.91	3.65
1989	3.30	3.05	3.75	3.51
1990	4.03	3.76	3.55	3.33
1991	3.98	3.71	3.43	3.22
1992	3.89	3.62	3.77	3.51
1993	3.83	3.55	4.13	3.86
1994	3.77	3.49	4.09	3.82
1995	3.70	3.41	4.04	3.76
1996	3.66	3.37	4.02	3.73
1997	3.61	3.31	3.97	3.68
1998	3.55	3.25	3.92	3.61

Source: FINREG simulations of Boston Edison

An examination of Tables 4.1 through 4.4 indicates that the electricity rates, the interest coverage ratios, and the earned return on equity (except for one year) are lower in the cases where the allowed return on equity is lower. This, of course, was to be expected. The one year anomaly is explained by the tax carryforward mechanism in the model. The utility is allowed to carry tax losses and unused investment tax credits indefinitely into the future. The credits and losses incurred during the construction of the large units could be first utilized during the plant's first year of service when the electricity rate increases dramatically. However, in the case of a lower allowed rate of return, the utility has more carryforwards and will apply those carryforwards to a lower income during that first year of plant service. During the next year, the utility will still have a significant amount of tax losses and credits available for use. The actual paid tax will be lower, resulting in a higher earned book return, even though the allowed electricty rate is lower for that year.

The pattern of electricity rates again confirms expectations. In all cases the electricity rate rises dramatically when a large plant is placed in service. The rate base approximately doubles when the nuclear unit is placed in service, and increases by approximately 50% when the large coal unit comes on line. The rate increase reflects this rise in the rate base.

The earned ROE is highest in the year immediately following the year of commission. Again, this is explained by the tax carryforward

mechanism. The estimated federal and state tax, calculated for rate purposes, does not account for the existence of any credits or applied tax loses. Thus in the years when those credits or losses are high and tax is low, the utility's earned profit will be high since rates reflect a normal tax in each year.[21]

A comparison of Cases A with C and B with D (approximately equal allowed returns on equity) indicates that, the average earned ROE for the years of simulation for the coal scenarios is approximately 2.1% greater than the nuclear scenarios. Two possible factors, regulatory lag and realized investment tax credits may explain this phenomenon. With the exception of fuel costs, the rate for any given year is calculated with information from the previous year. The resulting lag in cost recovery could affect capital intensive projects more severely. Secondly, it is assumed that Boston Edison is allowed to reduce its annual corporate income tax to a limit of 90% from investment tax credits[22]. FINREG also allows the carryforward of unused inverstment tax credits. Under the coal scenarios, plant construction outlays are distributed smoothly between the years 1982 and 1991. In the nuclear option, plant construction is limited to the years 1982 to 1988 and is heavily concentrated in the years 1985 and 1986. The annual construction outlays are also significantly greater in the nuclear case. Under the coal scenarios, Edison can utilize a higher percentage of the ITC as its accrues, thereby utilizing current dollar investment tax credits during the years of construction. Under the nuclear scenarios, Edison will realize a significant portion of

the ITC as carryforwards[23]. It is only during the years immediately following plant completion, when Edision can actually utilize the credits, that the earned ROE's of the nuclear scenarios exceed or approximately equate the returns of the coal scenarios.

The indicated pattern of earned returns on equity and interest coverage ratios suggest that the coal option is superior to the nuclear option. However, the uncertain financial effects associated with the tax credits and carryforwards suggest that the options can be best ranked by the equity values associated with each scenario.

FINREG calculates the accumulated present value (PV) of the firm's dividend payouts minus the common stock issues. The Terminal Value of the utility for the last period is estimated by assuming that the book value of the firm's assets consists of plant, construction work in progress and AFUDC. The Terminal Value is estimated by the following equation:

$$TV = (NP + CWIP + AFUDC)(\frac{\overline{ROE}}{R})(P) + ACASH$$

where

NP = Net utility plant, final period

CWIP = Construction work in progress, final period

AFUDC = Allowance for funds used during construction, final period

$\overline{ROE}$ = Estimated return on equity after the period of simulation

R = Return on equity

P = Percent of equity of total capital

ACASH = Balance for common stock, final period.

The estimated equity value associated with any scenario is the sum of the terminal value discounted to the start of the simulation at the equity rate, R, and the PV. The following table presents the equity value calculations for the four cases. It is assumed that $\overline{ROE}/R$ equals 1, or that investors expect fair regulation after the last year of simulation.[24]

Table 4.5

Equity Values (in thousands of dollars)

	A	B	C	D
Terminal Value	2553161	2508492	1991056	1956548
PV of TV	170671	167685	133096	130789
Simulation PV	318272	160034	436497	311235
Equity Value	488943	327719	569593	442024

Source: Equity values calculated from FINREG simulations of Boston Edison.

Although a calculated equity value is by itself not necessarily meaningful, the relative differences and ranking among scenarios is useful information. The difference in estimated equity value between Cases C and A is 80650 and between Cases D and B is 114305. The relative weight of these numbers can be ascertained by comparing the estimated equity values to the actual Boston Edison equity value of approximately 300000 (and a book equity value of 430000).

4.4 Summary and Extensions

Under the given financial and regulatory assumptions, the shareholders are significantly better off with the two coal units. The results also suggest that the tax laws and workings of the assumed regulatory process tend to penalize capital intensive expansion plans. In these simulations, the 1000 MW nuclear units required an investment of $2.1 billion for construction (in 1989 dollars) as compared with an investment of $0.8 billion (in 1987 dollars) for the 800 MW coal unit. Shareholders gain no benefits from the reduced fuel costs associated with the nuclear options, but earn less under the capital intensive scenarios.

If the allowed rate of return is systematically set below the required rate of return, the equity value will decrease as investment outlays increase. However, investment tax credits increase as investment increases. Under the Massachusetts system of rate regulation, Boston Edison can immediatly utilize the credits, but the credits are amortized and "flowed through" to the consumers over the life of the asset. The utility does earn a return on the unamortized accumulated ITC. Thus, some investment may be desirable under adverse or neutral regulatory conditions. Moreover, since earlier cash inflows are more highly valued, a utility benefits if it can immediately realize its ITC rather than carry the credits forward in time. It is likely that the relatively stable patterns of investment outlays and the earlier realization of tax credits associated with the coal scenarios accounts for a portion of the difference in calculated

equity values between the two cases[25].

The equity values arise, however, from a diverse set of assumptions and the difference between the equity values of the two options would lessen dramatically under other reasonable assumptions. For example, the capital costs of the nuclear unit may be overstated for Boston Edison, since the unit would be located on the site of an existing unit. Similarly, the capital costs of the coal units may be understated due to particular environmental requirements. The terminal date of the simulation and the calculated terminal value of the firm can change under other assumptions.[26] Sensitivity analysis can be employed to examine a wide range of assumptions.

The appendices contain a detailed descripton of the structure of the model, the model's equations, a description of the model's output, the input requirements and the model code. The outputs of the four Boston Edison cases are available for inspection at the MIT Energy Laboratory. The model software is the property of the Utility Systems Group at the MIT Energy Laboratory.

NOTES

1. The data on Boston Edison's existing system was extracted from Boston Edison's 1990 Annual Report and from data supplied by Mr. Thomas May of Boston Edison.

2. The various existing depreciation accounts were provided by Mr. May of Boston Edison.

3. Boston Edison issues set dividends of $1.175 and $1.46 per share on its two types of preference stock.

4. The preferred stock and debt betas are my own assumptions.

5. This appears to be a reasonable assumption, since it is likely that all Edison securities are trading below book value. Additional analysis would yield the actual market ratios.

6. The ratios are calculated from the Edison 1980 Balance Sheet.

7. OPTGEN is described in detail in MIT Energy Laboratory Report Number MIT-EL 80-020, June 1980, Section 5.

8. I have not been able to investigate if the yielded optimal plan is truly the least cost alternative. However, the plan is feasible and its system fuel costs are minimized.

9. The committed nuclear unit was chosen to represent Boston Edison's stated preference to build a second nuclear unit, Pilgrim 2, before 1990.

10. The fuel costs and forced outage rates for the existing Edison plants are based on data supplied to the Massachusetts Department of Public Utility. The annual load growth figure of 1.7% was suggested by Mr. May. Unless otherwise noted, all other OPTGEN assumptions are based on my own research.

11. ELECTRA is described in MIT Energy Laboratory Technical Report MIT-EL 79-025, August 1979.

12. The load data are stored at the MIT Energy Laboratory and were for 1978.

13. The 59% share represents Boston Edison's expected share of Pilgrim Unit 2, if it is constructed.

14. The assumptions are based on an analysis of recent rate decisions and on discussions with the Massachusetts DPU staff.

15. See note 5.

16. The value for these parameters are based on the author's own assumptions.

17. The bond retirement schedule and the associated interest rate was extracted from Boston Edison's 1980 annual report. The 1981 debt retirement includes $157,700,000 of short-term debt.

18. This equation is based on a regression of Boston Edison plant additions from 1975 to 1980.

19. The book and tax life reflects the average book and tax lives of recent Edison plant addition accounts.

20. The return on equity will vary for two reasons. First, the financing mix is partially based on the previous year's change in retained earnings (see Appendix IV). Secondly, the model does not allow the firm to repurchase stock. In years of little or no outside financing requirements, the firm's equity fraction will increase as retained earnings increase. This affects the calculated return on equity.

21. The increase in earned ROE is quite dramatic in 1990 in the nuclear scenarios due to the accumulation of carryforwards. In reality most utilities utilize their tax losses and ITC carryforwards in three to four years. In the nuclear cases the carryforwards have been accumualting for seven years prior to actual use (which is exactly the allowed IRS time limit of accumulation). It is also probable that regulators would not allow rates to double between 1988 and 1990, which would lessen the magnitude of the increase. However, the large increase is not unreasonable given the magnitude of the investment.

22. The taxable year ending in 1980 allows a 70 percent maximum deduction; but this percentage increases by 10 percent to a limit of 90 percent in 1982. The 90 percent limit is used for all simulation years.

23. The utility does not earn a return on the unused investment tax credits. If a utility can immediately utilize the credit, it can reduce its financing requirements, i.e. reinvest the credits or increase dividends. Since dividends are held constant, the utility is actually reinvesting the credits and earning a return on that investment. The utility would also prefer to minimize tax loss carryforwards for the identical reason.

24. Other assumptions are possible. $\overline{ROE}$ could be set equal to the average earned $\overline{ROE}$.

25. The model was tested with Boston Edison data by postulating the construction of one plant in a given year with varying levels of accumulated investment for that plant under different allowed rates of return. Equity values were then calculated. For each allowed rate of return there existed an optimal investment level which was greater than zero. This optimal level can best be explained as that level of investment which maximizes the present value of the combined effects of the tax credits and deductions and of the shortfalls in allowed returns on equity. Even under excellent regulation, i.e. the allowed return on equity is set equal to the market return on equity, the coal scenario may have a higher equity value if the tax credits and deductions are better utilized.

26. It may be reasonable to assume that regulators will provide fair ($\overline{ROE} = R$) regulation at an earlier date than 1999. Under such an assumption, the difference between the equity values of the two options would decrease.

APPENDIX I: MODEL SPECIFICATION AND DOCUMENTATION

INTRODUCTION

The purpose of this section is to provide a detailed description of the model used to project financing requirements, cash flows, electricity rates and other attributes to assess the impact of any electric capacity expansion plan. Three considerations must be addressed prior to the actual documentation of the model: timing, flexibility and inflation.

Time periods are specified as one year and the model will "loop" over each year. Assets are placed into service at the beginning of the year. Financing requirements are satisfied by financing at the beginning of the year (January 1). Interest payments and dividends are paid in the same year, on Dec. 31, on stock and debt issued in that year. Revenues, expenses, income and cash flows are calculated for output reporting purposes on December 31 of any year. The electricity rate (i.e. an equivalent "rate-hearing") is determined on December 31 of each year. That rate is applicable for the current year or the next year, depending on the regulatory option.

The model incorporates a large number of regulatory and financial options. These include

- alternative methods of tax-depreciation for existing assets
- switch option to straight line depreciation
- allowance for a percentage of CWIP in the rate base for each asset under construction
- One year or no regulatory lag

- Percentage allowance for fuel adjustment clause
- Future year rate base inclusion
- Normalization and flow-through regulatory options for deferred taxes, interest tax savings and Investment Tax Credits.

The prespecification of binary constants (equal to 0 or 1) and percentages (constants between 0.0 and 1.0) allows the user to simulate a desired financial and regulatory scenario.

All expenses, revenues, financial rates etc. are specified in nominal terms. All inputs should be expressed in nominal values.

A logic flow outline of the model is presented in Figure 1. The remainder of this section will be subdivided into descriptions of the model inputs and the systems of equations for each component of the flow diagram. Appendix II provides a description of the various model outputs. Appendix III provides a description of the "Cost-of-Service" ratemaking method applicable to the state of Massachusetts.

Note: Unless subscripted by a (T+1) or (T-1), all variables and parameters refer to an input or output for year T, either January 1 or December 31.

FIGURE 1 - MODEL FRAMEWORK

A. Estimate expenses

- Equations

B. Calculate AFDC Rate

- Before tax AFDC rate
- After tax AFDC rate

C. Existing Assets in Service (Plants, T and D)

- Book depreciation
- Tax depreciation
- Deferred taxes
- Deferred interest tax savings
- ITC amortization
- Retired assets

D. Nuclear Fuel

- Depreciation
- ITC amortization

E. Assets Under Construction

- AFUDC and CWIP calculations
- Allowance of CWIP in the rate base
- Interest tax savings
- ITC

F. Nuclear Fuel (Purchase)

- Required investment
- ITC

G. Transmission and Distribution Investments

- Equation

H. Estimate Current Assets and Liabilities

- Equations

FIGURE 1 - MODEL FRAMEWORK (continued)

I. Financial Sub-Model (A)

- Bond retirement
- Financing
- Debt
- Preferred stock
- Common stock
- Cost of equity capital
- New common stock issues
- Net present value calculations

J. Estimate Sales and Net Asset Values

- Equations

K. Rate Model

- Regulatory lag and allowance options
- Allowed rate of return
- Rate base
- Allowed revenue and rate calculations
- Rate increase constraint
- Normalization options

L. Financial Sub-Model (B)

- Revenues and income
- Taxes
- Available cash for dividends and retained earnings
- Dividends
- Available cash for next year's financing
- Year-end stock price

I UTILITY ASSET, EXPENSES AND SALES INPUTS

FULEX	=	Fuel expenses (not including nuclear fuel) for each year
PURPR	=	Purchased power expenses for each year
EXTEX	=	Extraordinary expenses for each year
OMPEX	=	Plant Operation and Maintenance expenses for each year
SALES	=	Estimated sales for each year
SERLF(J)	=	Service life (for book depreciation) of each asset, J
TXLF(J)	=	Tax life (for tax depreciation) of each asset, J
CNSTR(T,J)	=	Construction costs of each new asset, J, for each year
CWKPFR(J)	=	Percentage of CWIP allowed in rate base for asset J
TNFEX	=	Nuclear fuel expenses for each year
ARTKST(T,J)	=	Retirement date and cost of each retired asset

II FINANCIAL AND REGLATORY INPUTS

INFLR = Inflation rate

CSTD = Cost of debt

CSTP = Cost of preferred stock

RITC = Investment Tax Credit rate

FBDRT = Bond retirement schedule of original debt

FRCTD = Fraction of total financing from debt

FRCTP = Fraction of total financing from preferred stock

FRCTS = Fraction of total financing from common stock

FNCTD = Percentage financing cost for debt

FNCTP = Percentage financing cost for preferred stock

FNCTS = Percentage financing cost for common stock

BETAA = Beta of assets

BETAD = Beta of debt

BETAP = Beta of preferred stock

MRKP = Market premium

CSTRFD = Cost of risk free asset

DIFEQ = Regulatory difference between actual and allowed return on equity

RVTXR = Revenue tax rate

CPTXR = Corporate tax rate

STTXR = State tax rate

PRTXR = Property tax rate

CNTXR = Construction tax rate

FRADOM = Percentage allowance for fuel adjustment clause

FCSTD = Interest rate on retired debt

III BASE YEAR INPUTS

CA = Current assets

CL = Current liabilities

OMTEX = T&D O&M expense

BCSTD = Embedded cost of debt

TDEBT = Total book value of debt

BCSTP = Embedded cost of preferred stock

TPRF = Total book value of preferred stock

ARTEQ = Allowed return on equity

TCOMN = Total book value of common stock

TBDEP(J) = Accumulated book depreciation for each asset

BDEP(J) = Book depreciation expense for each asset

SBV(J) = Starting book value for each asset

TDITS(J) = Unamortized accumulated interest tax savings for each asset

TITC(J) = Unamortized accumulated ITC for each asset

CST(J) = Original cost (for tax purposes) of each asset

SLVGV(J) = Salvage value of each asset

NNF = Net book value - nuclear fuel

ACNSTR = Total construction costs

NWC = Net working capital

ACASH = Cash available for financing from base year

STPR = Stock Price

RATE = Electricty rate for operation calculated from base year

ASLOS = Accumulated deductions for state income taxes

III BASE YEAR INPUTS (continued)

AFLOS = Accumulated deductions for federal income taxes

CFITC = Available ITC carryforward

DIVPS = Specified dividends per share

TINT = Total interest expense

TCSTIS = Total number of common stock shares

DVPRF = Total dividend of preferred stock

KST(J) = Original cost (for book purposes) of each asset

NPUR(T,T-1) = Purchase cost of nuclear fuel asset

IV MODEL COMPONENTS

A. ESTIMATE EXPENSES

TOPEX = Total operating expenses, where TOPEX is the sum of all yearly fuel costs (excluding nuclear), O&M, T&D O&M, puchased power and extraordinary expenses

(1) TOPEX = FULEX + PURPR + EXTEX + OMPEX + OMTEX

OMTEX = Estimated T&D O&M expense, which is assumed to be a function of last year's OMTEX, the inflation rate, and sales growth.

$$(2) \quad OMTEX = K3 * \left(\frac{SALES}{SALES(T-1)}\right) * 1 + INFLR) * OMTEX(T-1)$$

K3 = prespecified constant

B. CALCULATE AFDC RATE

The before-tax AFDC Rate is used by regulatory agencies to approximate the financing costs for plants under construction.

ABTXR = Before-tax AFDC Rate

$$(3) \quad ABTXR = \frac{BCSTD(T-1) * TDEBT(T-1) + BCSTP(T-1) * TPRF\ (T-1) + ARTEQ(T-1) * TCOMN(T-1)}{TCAP(T-1)}$$

Define AATXR = The after-tax AFUDC rate

$$(3.5)\quad AARXR = \frac{[CPTXR * BCSTD(T-1) * TDEBT\ (T-1) + BCSTP(T-1) * TPRF(T-1) + ARTEQ(T-1) * TCOMN(T-1)]}{TCAP(T-1)}$$

where

BCSTD = Embedded cost of debt

TDEBT = Total debt

BDSTP = Embedded cost of preferred stock

TPRF = Total preferred stock

ARTEQ = Allowed return on equity

TCOMN = Total common stock

TCAP = Total capital

CPTXR = Corporate tax rate

C. EXISTING ASSETS IN SERVICE (PLANTS, TRANSMISSON AND DISTRIBUTION)

For each asset in service, (either existing or placed into service after construction), it is necessary to establish accounts for book depreciation, tax depreciation, accumulated book depreciation, accumulated tax depreciation, deferred taxes, interest tax savings amortization, ITC amortization, unamortized accumulated interst tax savings, and unamortized accumulated ITC. Assets are retired according to a pre-specified retirement schedule and all above accounts will be set to zero for that asset for each year after retirement. If the asset is retired prior to the end of its depreciation life, the depreciation expense shall still be recorded. [Note: The subscript J is assumed for each asset.]

Book depreciation

SERYR = Service year of asset J in Period T

$$(4) \quad SERYR = \frac{TBDEP(T-1)}{BDEPX(T-1)} + 1$$

If SERYR > SERLF then BDEPX = 0, otherwise,

(5) BDEPX = BDEPX(T-1) and

(6) TBDEP = BDEPX + TBDEP(T-1)

where TBDEP = Accumulated Book Depreciation

Tax depreciation

a) If the Sum of the Year Digits Method is used,

TXDEP = Tax depreciation expense

$$TXDEP = \frac{2(TXLF + 1 - SERYR)}{TXLF(TXLF + 1)} * [CST - SLVGV]$$

If TXDEP < 0 then TXDEP = 0

b) If the Double Declining Balance Method is used,

$$(8) \quad TXDEP = \frac{2}{TXLF}\left(1 - \frac{2}{TXLF}\right)^{(SERYR-1)} * CST$$

c) If the Straight-Line Method is used,

(9) TXDEP = BDEPX

TTDEP = Accumulated tax depreciation

(10) TTDEP = TXDEP + TTDEP(T-1)

SBV(T+1) = The Starting Book Value (for tax purposes) in period (T+1)

(11) SBV(T+1) = SBV - TXDEP

Finally, the utility may wish to switch to straight line depreciation in a prespecified year. If that is the case, if TXLF = SERYR, TXDEP = 0, otherwise

$$(12)\quad TXDEP = \frac{SBV}{TXLF-SERYR}$$

Deferred taxes

The deferred tax expense arises from the difference between tax and book depreciation. The deferred tax expense is important in regulatory accounting, and its calculation for each year implies that the utility will have taxable income.

DFTX = Deferred tax expense

(13) DFTX = (CPTXR - CPTXR * STTXR + STTXR)(TXDEP - BDEPX)

TDTX = Accumulated deferred tax expense for each asset

(14) TDTX = DFTX + TDTX(T-1)

Deferred interest tax savings (Normalized)

The interest expense applicable to an asset under construction is deductible immediately for tax purposes. However, in some regulatory jurisdictions, that expense is deferred and amortized over the life of the related asset.

DITS = Amortized deferred interet tax savings

TDITS = Unamortized accumulated deferred interest tax savings

If SERLF SERYR then DITS = 0 and TDITS = 0. Otherwise,

$$(15)\quad DITS = \frac{TDITS(T-1)}{SERLF - SERYR + 1}$$

and

(16) TDITS = TDITS(T-1) - DITS

Investment Tax Credit (Normalized)

Similarly, the Investment Tax Credit applicable to an asset may be amortized over the life of the asset.

ITC = Amortized investment Tax Credit

TITC = Unamortized accumulated Investment Tax Credit

If SERLF SERYR then ITC = 0 and TITC = 0. Otherwise,

$$(17)\quad ITC = \frac{TITC(T-1)}{SERLF - SERYR + 1}$$

and

(18) TITC = TITC(T-1) - ITC

Accumulation of accounts over all assets

ABDEP = Total book depreciation

ATBDEP = Total accumulated book depreciation

ATXDEP = Total tax depreciation

ATTDEP = Total accumulated tax depreciation

ADFTX = Total deferred tax expense

ATDTX = Total accumulated deferred tax expense

ADITS = Total amortized interest tax saving

ATDITS = Total accumulated unamortized interest tax saving

AITC = Total amortized ITC

ATITC = Total accumulated unamortized ITC

Retired Assets

For a retired asset all accounts are set to zero and define,

TBDRT = Accumulated book depreciation for the retired asset

RTKST = Original book cost of the retired asset

(19) TBDRT = TBDEP(T-1) and TDRT = 0 after the year of retirement

(20) RTKST = KST and RTKST = 0, after the year of retirement

Accumulation

ATBDRT = Total accumulated retired book depreciation

ARTKST = Total original cost of retired assets

D. NUCLEAR FUEL (DEPRECIATION)

Nuclear fuel is purchased as an asset and the nuclear fuel expense for the year is actually the booked depreciation or the value of the nuclear fuel burned. Nuclear fuel is approximated as an asset that is depreciated over a three year life. Nuclear fuel is loaded in batches and if one batch is loaded every year, and a batch has a three-year life, on average the amount of fuel in the reactor is equal to two years burnup. Thus net nuclear fuel in any given year is approximated to equal twice the nuclear fuel expense for that year.

NNF = Net nuclear fuel

TNFEX = Nuclear fuel expense

NDEP = Nuclear fuel depreciation

(21) NNF= 2 * TNFEX

(22) NDEP= TNFEX

Similar to other assets, the Investment Tax Credit associated with the purchase of nuclear fuel is amortized over the life of the asset, in this case three years. Thus for a purchase of nuclear fuel in a particular year, NPUR (See Section IV.F),

$$(22.5) \qquad ITCN = \frac{NITC(T-1)}{4 - SERYR}$$

where NITC is the total ITC associated with NPUR and NITC decreases over time by the amortized amount ITCN.

(22.8) NITC = NITC(T-1) - ITCN

If the SERYR > 3 then ITCN = 0 and NITC = 0.

ITCN is added to the ITC accounts and NITC is added to the ATITC accounts.

E. ASSETS UNDER CONSTRUCTION

Allowed Funds Used During Construction (AFUNDC) and Construction Work in Progress (CWIP)

AFUDC is a technique used to capitalize and thus defer the cost of funds used to finance ongoing construction projects. AFUDC represents an attempt to match the financing costs of a constructon project with the benefits generated by the project. An AFUDC rate is established by the utility and its rate making authority (see Secton IV.B), and is applied to the balance of construction work in progress (CWIP) excluded from the utility's rate base. The cost of the asset to be depreciated consists of the AFUDC added to the CWIP over the life of the project.

It is necessary that the user input the construction cost schedule of each asset, where CNSTR = Construction cost. The accumulation of construction cost is credited to the CWIP account for that asset.

(23) CWIP = CWIP(T-1) + CNSTR

Utilities may or may not be allowed to apply the AFUDC rate to previously capitalized AFUDC (i.e. compound the AFUDC). Define RTPA =

return on previously capitalized AFUDC and, TAFDC = capitalized AFUDC to date. If compounding,

(24) RTPA = ABTXR * TAFDC(T-1)

Otherwise, RTPA = 0.

Define RTEXA = the return on CWIP excluding previously captialized AFUDC

(25) RTEXA = ABTXR * CWIP

Define RADC = the total AFUDC for the year

(26) RAFDC = RTEXA + RTPA

and

(27) TAFDC = TAFDC(T-1) + RAFDC

If year T is the last year of construction, then the cost of the plant for next year's capitalization is KST(T+1) and

(28) KST(T+1) = CWIP + TAFDC

AFUDC is a device used solely for rate-making purposes and financial reporting purpose, not tax purposes. Thus, the cost of the asset for tax purposes is CST(T+1), and

(29) CST(T+1) = CWIP

CWIP allowed in the rate base

The model allows the inclusion of a prespecified percentage of the CWIP in the rate base for prespecified plants. Define CWPFR(N) = the fraction of CWIP allowed in the rate base for asset N for each year of construction. Define RBCWP(N) = the rate base inclusion for asset N and,

(30) RBCWP(N) = CWPFR(N) * CWIP(N)

and

(31) RTEXA = ABTXR * CWIP(1-CWPFR)

Note that if CWIP is not allowed in the rate base, CWPFR = 0 and all previous AFUDC equations apply.

Interest tax savings

Interest expenses are tax deductable. The regulatory commission may wish to defer the tax-interest savings on construction to those that benefit from the construction, the future rate-payers. Thus an account is established to accumulate the tax interest savings associated with each asset under construction.

Regulatory commissions estimate the interest tax savings by utilizing the previous year's embedded cost of debt and the fraction of book debt in the utility's capital structure. These parameters approximate the current year's embedded cost of debt and the fraction

of debt financing for construction. Define CITS = the interest tax savings on construction and,

$$(32)\quad CITS = CPTXR * BCASTD(T-1) * CNSTR * \frac{TDEBT(T-1)}{TCAP(T-1)}$$

Define TCITS = the accumulated consttuction interest tax savings.

$$(33)\quad TCITS = TCITS(T-1) + CITS$$

An after-tax AFUDC rate accounts for the normalization of interest tax savings and can be chosen by the user as an option.

Thus, the after-tax accounts become

RTTEXA = the after-tax return on CWIP exluding previously capitalized AFUDC

RTTPA = the after-tax return on previously capitalized AFUDC

RTAFC = the total after-tax AFUDC for the year

TTAFC = the accumulated after-tax AFUDC

KXST = the after tax capitalized book cost of the asset

$$(34)\quad RTTEXA = AATXR * CWIP$$

$$(35)\quad RTTPA = AATXR * TTAFC(T-1)$$

$$(36)\quad RTAFC = RTTEXA + RTTPA$$

$$(37)\quad TTAFC = TTAFC(T-1) + RTAFC$$

Investment Tax Credit

During construction investment tax credits are generated. It is assumed that all assets are allowed credits at the same rate. Define RITC = ITC rate and CITC = Allowed ITC for asset N for year T,

(38) CITC = RITC * CNSTR

The total ITC for each asset is accumulated for future amortization.

Define TCITC = Accumulated ITC for asset N.

(39) TCITC = TCITC(T-1) + CITC

Accumulation of accounts over all assets

ACNSTR	=	Total construction costs
ACWIP	=	Total CWIP
ARAFDC	=	Total before-tax AFUDC
ARTAFC	=	Total after-tax AFUDC
ACITS	=	Total construction interest tax savings
ATCITS	=	Total accumulated construction interest tax savings
ACITC	=	Total construction ITC
ATCITC	=	Total accumulated construction ITC
AKST(T+1)	=	Total cost of plants in service, year (T+1)
AKXST(T+1)	=	Total cost (after-tax AFUDC rate) of plants in service, year (T+1)
ARBCWP	=	Total CWIP allowed in the rate base

F. NUCLEAR FUEL (PURCHASE)

In accordance with the framework established earlier, it is possible to approximate the required investment for nuclear fuel. Define NPUR = investment in nuclear fuel.

(46) NPUR = 3(TNFEX) - NNF(T-1)

The nuclear fuel is eligible for Investment Tax Credit. Define CNITC = the ITC for nuclear fuel investment. CNITC is added to the ACITC account.

(41) NITC = RITC * NPUR

G. TRANSMISSION & DISTRIBUTION INVESTMENTS

The transmission and distribution investments for any year can be prespecified by the user or be estimated by an equation. One possible equation relates T&D investment as a fucntion of the difference in sales in the two previous periods. It is assumed that the T&D investment requires one year of construction. Define TDCST = the construction expenditure required for year T,

(42) TDCST = [C5 + C6 * (SALES - SALES(T-1))] * (1 + INFLR)

where C5 and C6 are prespecified constants.

H. ESTIMATE CURRENT ASSETS AND LIABILITIES

It is assumed that Current Assets and Current Liabilities are functions of sales growth, construction growth, inflation and the previous period's Current Assets or Current Liabilities. Define,

CA = Current Assets

CL = Current Liabilities

NWC = Net Working Capital

INCNWC= Increase in Net Working Capital

$$(43)\quad CA = \frac{(K1) * (SALES) *(ACNSTR) * (1 + INFLR) * CA(T-1)}{SALES(T-1) * ACNSTR(T-1)}$$

$$(44)\quad CL = \frac{(K2) * (SALES) * (ACNSTR) * (1 + INFLR) *CL(T-1)}{SALES(T-1) * ACNSTR(T-1)}$$

$$(45)\quad NWC = CA - CL$$

$$(46)\quad INCNWC = NWC - NWC(T-1)$$

K1 and K2 are prespecified constants.

I. FINANCIAL SUB-MODEL (A)

Bond Retirement

For any utility there is an existing bond retirement schedule, that is, an amount of debt which must be retired for any year T. Define FBDRT = Required debt retirement for year T. However, for each year of simulation bonds are created (and hence must be ultimately retired). This amount of debt retirement is added to the existing retirement schedule to determine the total bond retirement for year T. Define TBDRT = total bond retirement for year T. It is also

necessary to calculate the interest expense on the retired debt. Define INTRET = the interest expense on the retired debt.

The model assumes that the entire principal of an N year bond will be paid at the Nth year. All new debt issued has the same interest rate, CSTD and all bonds are N year bonds. Define NBDRT = the bond retirement on new debt. Define DEBT = the amount of debt issued in year T.

(47) NBDRT(T+N) = DEBT

(48) TBDRT = FBDRT + NBDRT

Define FCSTD = the interest rate on the retired debt in year T

(49) INTRET = FBDRT * FCSTD + NBDRT * CSTD

Financing

It is assumed that financing can be accomplished by long-term and preferred and common stock. Define,

TOTFIN = The amount of cash required from the capital market for financing in year T

ACASH = the cash availble for financing in period T+1

PREF = total amount of preferred stock financing in year T

COMN = total amount of common stock financing in year T

FRCTD, FRCTP, and FRCTS = the fractions of financing from debt preferred and common stock financing respectively.

FD, FP, and FS = the financing cost of debt, preferred and common stock respectively.

FTOT = the total financing costs

EXCESS = the excess cash available if no financing is required

Total financing must cover construction costs, nuclear fuel purchases, bond retirements and the increase in net working capital, less cash available from the previous year.

(50) TOTFIN = ACNSTR + NPUR + TBDRT + INCNWC - ACASH(T-1)

(50.2) DOTFIN = TOTFIN - TBDRT + NI(T-1) - CIV(T-1) - DVPRF(T-1)

(50.5) If DOTFIN < 0 then DOTFIN = 0.

(51) DEBT = FRCTD * DOTFIN + TBDRT

(52) PREF = FRCTP * DOTFIN

(53) COMN = TOTFIN - DEBT - PREF

(53.5) If TOTFIN < (DEBT + PREF) then EXCESS + (DEBT + PREF) - TOTFIN

Financing costs:

(54) FD = FNCTD * DEBT

(55) FP = FNCTP * PREF

(56) FS = FNCTS * COMN

(57) FTOT = FD + FP + FS

Debt

Define TINT = total interest expense for year T

(58) $TINT = TINT(T-1) + (DEBT)(CSTD) - INTRET$

Define TDEBT = the total book value of debt

(59) $TDEBT = TDEBT(T-1) + DEBT - TBDRT$

Define BCSTD = embedded cost of debt

(60) $BDSTD = \frac{TINT}{TDEBT}$

Preferred stock and common stock cannot be repurchased.

Define DVPRF = preferred stock dividends and

CSTP = cost of preferred stock

TPRF = total book value of preferred stock

BCSTP = embedded cost of preferred stock

(61) $DVPRF = DVPRF(T-1) + CSTP * PREF$

(62) $TPRF = TPRF(T-1) + PREF$

(63) $BCSTP = \frac{DVPRF}{TPRF}$

Define RETEQ = the opportunity cost of equity capital. The opportunity cost of equity capital can be prespecified as a constant or can be estimated by the Capital Asset Pricing Model using book values of debt and preferred and common stock.

Define TCOMN = the total book value of common stock
TCAP = the total book value of debt and stock
BETAA = the beta of the utility's assets
BETAD = the beta of the utility's debt
BETAP = the beta of the utility's preferred stock
MRKP = the market premium
CSTRFD = the return on the riskless asset
BETAS = the beta of the utility's common stock

(64) TCOMN = TCOMN(T-1) + COMN + NI - DIV - DVPRF

(65) TCAP = TDEBT + TPRF + TCOMN

(66) $$BETAS = \frac{BETAA * TCAP - BETAD * TDEBT - BETAP * TPRF}{TCOMN}$$

(67) RETEQ = CSTRFD + BETAS * MRKP

This calculation assumes that the beta's of the assets, the debt, and the preferred stock remain constant over time and over cash flows.

Define CSTIS = the amount of new common stock issues
STPR = the stock price at the end of the period

TCTIS = the total amount of shares of common stock

$$(68) \quad CSTIS = \frac{COMN}{STPR(T-1)}$$

$$(68.5) \quad TCTIS = TCTIS(T-1) + CSTIS$$

Define WAPR = the weighted average book return on capital

$$(69) \quad WABR = \frac{TINT + DVPRF + RETEQ * TCOMN}{TCAP}$$

Net Present Value

The Net Present Value (NPV) of the firm to stockholders during the years of simulation is the present value of each year's total dividend payout minus the common stock issuance. Due to the particular timing of dividend payouts and stock issuances, the dividend in period (T) and the stock issuance in period (T+1) can be regarded as occurring at the same time. The difference is discounted at the rate of return on equity capital calculated for period T. Thus define:

PV(T) = Present value of dividend minus issuance for period T

NPV(T) = The accumulated present values at the beginning of period T

$$(69.5) \quad PV(T) = \frac{-COMN(T) + DIV(T-1)}{(1 + RETEQ(T-1))^{T-1}}$$

$$(69.7) \quad NPV(T) = NPV(T-1) + PV(T)$$

J. ESTIMATE SALES AND NET ASSET VALUE

Estimated sales (in Kwh) are prespecified for each year.

Define SALES = Estimated sales for year T

The net value of the assets for year T is equal to the net value for year T-1 minus the book depreciation plus the change in net nuclear fuel plus the cost of new asset additions minus the cost of retired assets plus the accumulated depreciation of retired assets.

Define NV = Net value of assets

(70) NV = NV(T -1) - ABDEP + NNF - NNF(T-1) + AKST - ARTKST + ATBDRT

K. RATE MODEL

The rate model attempts to duplicate the regulatory process to forecast electricity prices. While state regulatory agencies often differ in their rate-making procedures, this model allows the user to prespecify rate-making parameters and options. The model replicates the regulatory accounting process, and except for one constraint, does not simulate the political process of any regulatory agency. However, the user can prespecify a systematic bias in the allowed return on equity capital. The calculated electricty rate is the average price of electricity for all consumers. It is assumed that a rate structure is available that provides the revenues associated with the estimated rate.

The model allows the choice of three regulatory scenarios.

Option (1). Rates determined in year T are applicable in year T (no regulatory lag).

Option (2). Rates determined in year T are not applicable until year (T+1) (one year reguatory lag). However the rates for year (T+1) are based primarily on year T estimates. The rates for year (T+1) are calculated with

(i) an allowance of a percentage of the extra fuel expenses incurred in year (T+1).

and (ii) a rate base which includes the value of the asset additions in year (T+1)

Option (3). Identical to (2) but with only the fuel expense adjustment

Another major issue subject to Commission discretion is the regulatory treatment of tax savings. Relevant tax savings are generated from three sources: 1) accelerated tax depreciation; 2) the investment tax credit; and 3) interest during construction. Regulatory commissions must decide whether to normalize or flow-through the tax savings. With normalization, the tax savings generated by accelerated depreciation and interest during construction accrue to the utilities but accumulated deferred accounts are subtracted from the rate base and interest tax savings are amortized. However, the normalized treatment of investment tax credits is not quite analogous. Specifically, two regulatory options exist for ITC normalization.

Option (1). Utilities are permitted to use their credits so that the immediate reduction in tax costs rebound to investors, not to ratepayers. The utility commission removes unamortized accumulated investment tax credits from the rate base but restores the reductions to rate base over the life of the asset.

Option (2). Unamortized accumulated investment tax credits are included in the rate base, but the tax credits are amortized over the life of the assets. Thus, utilities earn a rate of return on accumulated credits, but must return the tax credits to their customers over a period of time.

Finally, by prespecifying a constant, the user can model the inclusion of an amount of Construction Work in Progress (CWIP) in the rate base (see Section IV.E).

Allowed rate of return

The allowed rate of return is arrived at using a weighted average cost of capital.

Define ABOROR = Allowed rate of return

Define ARTEQ = Allowed return on equity

Define DIFEQ = The systematic difference between the allowed and actual return on equity

(71) ARTEQ = RETEQ - DIFEQ

$$(72)\quad \text{ABOROR} = \frac{\text{TINT} + \text{DVPRF} + \text{ARTEQ} * \text{TCOMN}}{\text{TCAP}}$$

Rate Base

The rate base is composed of the net valuation of the utility's assets and an allowance for working capital. The allowance for working capital is a function of O&M expenses and fuel expenses (lagged or non-lagged).

Define RBWKC = working capital allowance

(73) RBWCKC = K4*(TOMEX) + K5*(TFULEX) + K6*(TOMEX(T+1))
+ K7*(TFULEX(T+1))

Define RTBS = Rate base year T

(73.5) RTBS = NV + RBWKC + ARBCWP + ABDEP + NDEP

Allowed Revenue

The model first calculates a gross revenue allowance in year T based upon flow-through accounting. That allowance is then adjusted to account for options involving regulatory lag, fuel and rate base adjustments and normalization. In a simple model Gross Revenue = Profit + Operating Costs + Tax, where Tax = (Gross Revenue - Operating Costs) (Tax Rate). Solving for Gross Revenue yields

Gross Revenue = Profit/(1-Tax Rate) + Operating Costs

In a similar manner it is possible to solve for gross allowed revenue as a linear function of allowed profit, costs, tax and book

depreciation, property, revenue, contruction, state and federal tax, interest deduction and investment tax credit.

Define

TXFCT = the effective tax factor

RVTXR = the revenue tax rate

STTXR = the state income tax rate

CPTXR = the federal income tax rate

PRTXR = the property tax rate

CNTXR = the construction tax rate

NUMREV = the numerator in the allowed revenue equation

(74) TXFCT = RVTXR + STTXR - RVTXR * STTXR + CPTXR - CPTXR * RVTXR - CPTXR * STTXR + CPTXR * RVTXR * STTXR

(75) NUMREV = ABOROR * RTBS + PRTXR * NV - CPTXR * PRTXR * NV - STTXR + CPTXR * STTXR * PRTXR * NV + TOPEX * PRTZR * NV - STTXR* TOPEX - CPTXR * TOPEX + CPTXR * STTXR * TOPEX + ABDEP + NDEP + FTOT - STTXR * ATXDEP - CPTXR * ATXDEP + CPTXR * STTXR * ATXDEP - STTXR * TINT - CPTXR * TINT + CPTRX * STTXR * TINT + CNTXR * ACNSTR - STTXR * CNTXR * ACNSTR - ACITC - CPTXR * CNTXR * ACNSTR

Define ALREV = Calculated allowed revenue in year T

(76) $$ALREV = \frac{NUMREV}{1 - TXFCT}$$

Regulatory Lag

Define RATE = Average price of electricity

Options

(1) If prices determined in year T are applicable in year T then

(77) RATE = ALREV/SALES

(2) If regualtors allow a fraction of the change in next year's fuel cost to be included in this year's rate determination, then define

FRADOM = fuel adjustment fraction

NTOPEX = reviesed total operaing expenses

NNDEP = revised nuclear depreciation

(78) NTOPEX = TOPEX + FRADOM * (FULEX(T+1) - FULEX)

(78.5) NNDEP = NDEP + FRADOM * (TNFEX(T+1) - TNFEX)

ALREV is recalculated with NTOPEX and NNDP and

(79) $RATE(T+1) = \frac{ALREV}{SALES}$

(3) If regulators allow a rate base inclusion of the cost of new asset additions in year (T+1) than define NRTBS = revised rate base

(80) NRTBS = RTBS + AKST(T+1)

NTOPEX, NNDEP and NRTBS and used to recalculate ALREV and

$$(81) \quad RATE(T+1) = \frac{ALREV}{SALES}$$

Rate Increase Constraint

The user may prespecify a percentage limit (expressed as a whole number) in allowed rate increase by a regulatory commission.

Define 100 * K8 = the percentage rate increase limit

$$(81.5) \text{ If } \frac{RATE(T+1)}{RATE} > (1+K8) \text{ then}$$

$$RATE(T+1) = (1+K8) * RATE$$

Regulatory Normalization Options

(1) Normalization of tax depreciation savings

(82) RTBS = RTBS - ATDTX

(83) NUMREV = NUMREV + ADFTX

(2) Normalization of interest tax savings

(84) RTBS = RTBS - ATDITS - ATCITS

(85) NUMREV = NUMREV + ACITS - ADITS

(3) ITC options for Normalization

Option No. 1

(86) RTBS = RTBS - ATITC - ATCITC

(87) NUMREV = NUMREV + ACITC

Option No. 2

(88) RTBS = RTBS + ATITC + ATCITC

(89) NUMREV + ACITC - AITC

The user can prespecify any option, any combination of options, or no option (which will then result in flow-through accounting).

L. FINANCIAL SUB-MODEL(B)

The purpose of this sub-model is to calculate actual revenues, income, taxes, cash available for dividends and retained earnings, dividends, and the year-end stock price.

Define REV = Revenues for year T

(90) REV = SALES * RATE

Define EBIT = Book earnings before interest and taxes

(91) EBIT = REV - TOPEX - ABDEP - NDEP - FTOT + ARAFDC

Define INCT = taxable income

(92) INCT = REV - TOPEX - ATXDEP - TINT

Define PRTX = Property tax

RVTX = Revenue tax

CNTX = Construction tax

GENTX = General tax

(93) PRTX = PRTXR * NV

(94) RVTX = RVTXR * REV

(95) CNTX = CNTXR * ACNSTR

(96) GENTX = PRTX + RVTX + CNTX

It is possible that the utility can utilize accumulated tax losses to reduce the taxable income for state and federal purposes. The losses can reduce both the state and federal taxes. In the model losses can only be carried forward and there is no time restriction on carryforward.

Define ASLOS(T-1)= the accumulated losses available for state taxable income deduction for year T

AFLOS(T-1)= the accumulated losses available for federal taxable income deduction for year T

The losses if available will be used in entirety, to the point that the income tax is zero.

Define SINCT = State taxable income

Define STTX = State income tax

(97) SINCT = INCT - GENTX - ASLOS(T-1)

(98) If SINCT $\geq$ 0 then STTX = STTXR * SINCT and ASLOS = 0

If SINCT < 0 then STTX = 0 and ASLOS = -SINCT

Similarly the model allows the carryforward of unused investment tax credits. It is assumed that utility is allowed a limit of 90 percent of its corporate income tax that may be reduced by the ITC.

Define FINCT = Federal taxable income

CFITC(T-1) = the accumulated ITC available for federal tax deduction

CPTX = the corporate tax

LIM = the limit of tax reduction

(99) FINCT = INCT - GENTX - STTX - AFLOS(T-1)

(100) If FINCT < 0 then AFLOS = -FINCT

and

CFITC = CFITC(T-1) + ACITC

and

CPTX = 0

(101) IF FINCT $\geq$ 0 then LIM = .9 *CPTXR * FINCT

(102) If LIM > (CFITC(T-1) + ACITC) then CPTX = CPTXR * FINCT - CFITC(T-1) - ACITC and CFITC = 0 and AFLOS = 0

(103) If LIM $\leq$ (CFITC(T-1) + ACITC) then CPTX = LIM/9

and

CFITC = CFITC(T-1) + ACITC - LIM

and

AFLOS = 0

Define TTX = total taxes

(104) TTX = GENTX + STTX + CPTX

Define NI = Net Income

Net Income = Earnings before Interest and Taxes - Taxes - Deferred Income Taxes - Interest = Deferred investment tax credits - deferred interest tax savings. Under certain regulatory options some of the above terms are set to zero.

(105) NI = EBIT - TTX - ADFTX - TINT - (ACITC - AITC) - (ACITS - ADITS)

Define TCASH = Cash available for dividends and retained earnings

(106) TCASH = NI + ABDEP - ARAFDC + NDEP + ADFTX + (ACITC - AITC) + (ACITS - ADITS) + EXCESS * (1 + CSTRFD)

The total dividends paid out can be a function of EBIT, NI, TCASH, NI - DVPRF, or DIVPS(T-1).

Define DIV = the total dividend payout for year T.

Define DIVPS = the dividends per share

(107) DIV = C1 * EBIT + C2 * NI + C3 * TCASH + C4 * TCSTIS * DIVPS(T-1)

$$+ C5 * (NI - DVPRF)$$

where C1, C2, C3, C4 and C5 are prespecified.

$$(108) \quad DIVPS = \frac{DIV}{TCSTIS}$$

Define ACASH = total cash available for next year's financing

$$(109) \quad ACASH = TCASH - DIV - DVPRF$$

Define STPR = the stock price at the end of year T

$$(110) \quad STPR = STPR(T-1) * (1 + RETEQ) - DIVPS$$

APPENDIX II - PRO-FORMA STATEMENTS AND SUMMARY STATEMENTS

Define UPLNT = the historic cost of all utiltiy assets (excluding nuclear fuel)

NUCFL = the asset value of the nuclear fuel

APFDEP = the accumulated provison for depreciation for year (T)

(1) UPLNT = UPLNT(T-1) + AKST - ARTKST

(2) NUCFL = 3 * TNFEX

(3) APFDEP = ATBDEP - ATBDRT

Define STOCK = Common stock par and premium

(4) STOCK = STOCK(T-1) + COMN

INCOME STATEMENT

1	Operating Revenues	REV
	Operating Expenses	
2	Purchased Power	PURPR
3	Fuel	FULEX
4	Operation and Maintenance	OMPEX + OMTEX
5	Depreciation	ABDEP
6	Nuclear Fuel Amortization	NDEP
7	Taxes Other Than Income Taxes	GENTX
8	State Income Tax	STTX
9	Federal Income Tax	CPTX
10	Deferred Income Tax	ADFTX
11	Deferred Interest Tax Savings	ACITS - ASDITS
12	Deferred ITC	ACITC - AITC
13	Other Expenses	EXTEX + FTOT
14	Total Expenses	Sum of Items (2 to 13)
15	Net Operating Income	(1 - 14)
16	AFUDC	ARAFDC
17	Interest Expense	TINT
18	Net Income	(15 + 16 - 17)
19	Less Preferred Dividends	DVPRF
10	Balance for Common Stock	(18 - 19)

BALANCE SHEET (ASSETS)

1	Utility Plant	UPLNT
2	Construction Work in Progress	ACWIP
3	Total Utility Plant	(1 + 2)
4	Less Accumulated Provision for Depreciation	APFDEP
5	Net Utility Plant, Less Nuclear Fuel	(3 - 4)
6	Nuclear Fuel	NUCFL
7	Less Accumulated Amortization of Nuclear Fuel	NDEP
8	Net Nuclear Fuel	NNF
9	Net Utility Plant	(5 + 8)
10	Current Assets	CA
	Total Assets	(9 + 10)

BALANCE SHEET (LIABILITIES)

1	Common Stock	STOCK
2	Preferred Stock	TPRF
3	Retained Earnings	(TCOMN-STOCK)
4	Total Capital Stock	(1+2+3)
5	Long Term Debt	TDEBT
6	Current Liabilities	CL
7	Accumulated Deferred ITC	ATCITC + ATITC
8	Accumulated Deferred Income Taxes	ATDTX
9	Accumulated Deferred Interest Tax Savings	ATDITS + ATCITS
10	Total Liabilities	Sum of (4 to 9)

SOURCES AND USES OF FUNDS

Funds Generated Internally [Dec. 31]		
1	Net Income	NI
ADD		
2	Depreciation	ABDEP
3	Nuclear Fuel Amortization	NDEP
4	Deferred Income Taxes	ADFTX
5	Deferred ITC	ACITC-AITC
6	Deferred Interest Tax Savings	ACITS ADITS
LESS		
7	Allowance for Funds Used During Construction	ARAFDC
8	Total for Operations	Sum of (1 to 6-7)
LESS		
9	Preferred Dividends	DVPRF
10	Common Dividends	DIV
11	Funds Generated Internally	8-9-10
Funds Obtained From Outside Sources [Jan 1]		
12	Common Stock	COMN
13	Preferred Stock	PREF
14	Long Term Debt	DEBT
15	Less - Debt Retirement	TBDRT
16	Decrease in Net Working Capital	-INCNWC
17	Total	12+13+14-15+16

SOURCES AND USES OF FUNDS (cont.)

Construction Expenditures [Jan 1]

18	Plant	ACNSTR
19	Nuclear Fuel	NPUR
20	Total	(18+19)

Ratios

Define ICR = Interest Coverage Ratio

EXICR = Interest Coverage Ratio excluding AFUDC

CTER = Cash to total earnings ratio

GRERAT = Growth in electricity rates

PRCR = Preferred coverage ratio

CFPS = Cash Flow Per Share

ENVR = Earning to Net Asset Value Ratio

EXENVR = Earning to Net Asset Value Ratio excluding AFUDC

ROE = Earned return on equity

PDBT = Fraction of debt

PCS = Fraction of common stock

(4) $$ICR = \frac{EBIT}{TINT}$$

(5) $$EXICR = \frac{EBIT - ARAFDC}{TINT}$$

(6) $$CTER = \frac{TCASH}{NI}$$

(7) $$GRERAT = \frac{RATE}{RATE(T-1)}$$

(8) $$PRCR = \frac{EBIT}{TINT + DVPRF}$$

(9) $$CFPS = \frac{TCASH - DVPRF}{TCSTIS}$$

(10) $$ENVR = \frac{NI}{NV}$$

(12) $$ROE = \frac{NI - DVPRF}{TCOMN}$$

(11) $$PDBT = \frac{TDEBT}{TCAP}$$

(12) $$PCS = \frac{TCOMN}{TCAP}$$

SUMMARY

1	Earnings per Share of Common Stock	(NI-DVPRF)/TCSTIS
2	Stock Price (Year End)	STPR
3	Electricity Rate	RATE or MRATE
4	Dividends per Share of Common Stock	DIVPS
5	Shares Outstanding (Common)	TCSTIS
6	Sales	SALES
7	Financing Costs	FTOT
8	Embedded Interest Rate	BCSTP
10	New Common Stock Issues	CSTIS
11	Return on Equity	RETEQ
12	Weighted Average Book Return	WABR
13	Allowed Return on Equity	ARTEQ
14	Allowed Book Return	ABOROR
15	Allowed Revenue	ALREV (or MALREV)
16	Rate Base	NRTBS (or RTBCR)
17	Interest Coverage Ratio	ICR
18	ICR (excluding AFDC)	EXICR
19	Cash to Total Earnings Ratio	CTER
20	Growth in Electricity Rates	GRERAT
21	Earnings to Net Asset Value Ratio	ENVR
22	Earnings to net Asset Value Ratio(excluding AFDC)	EXENVR
23	Preferred Coverage Ratio	PRCR
24	Cash Flow Per Share	CFPS

25	Dividends from Previous Year	DIV(T-1)
26	Net Present Value at Beginning of Period	NPV
27	Earned Return on Equity	ROE
28	Fraction of Debt	PDBT
29	Fraction of Comon Stock	PCS

APPENDIX III - COST OF SERVICE METHOD (MASSACHUSETTS)

The "cost of service method" for rate-making is fundamentally equivalent to the determination of rates described in the model. However, it is conceptually closer in format to the style of rate-making used by many Public Utility Commissions. The model will allow this method to be chosen as a rate-making option. [For the case of Massachusetts, the cost of service methods assumes normalization of tax depreciation and interest tax savings, and Option #2 ITC normalization.].

Cost of Service Method

Steps

(1) Calculate Rate Base

(2) Calculate Return on Rate Base (= rxRB)

(3) Calculate "Net" (= Return - Interest Expense)

(4) Calculate Estimated Taxable Income (= Net x $\frac{1}{1 - \text{Deferred Tax Rate}}$

(5) Calculate Estimated Federal Income Tax (= Taxable Income x Corporate Tax Rate x (1 - State Tax Rate))

(6) Calculate Estimated State Tax (= Taxable Income x State Tax Rate)

Computation of Allowed Revenue

Total Cost of Service = O&M Expense + Asset Depreciation Expense
+ Property Taxes + Estimated State Taxes + Estimated Federal Taxes
+ Deferred Interest Tax Savings + Return on Rate Base
- Amortized ITC + Fuel Expenses (T+1)
+ Nuclear Fuel Depreciation (T+1) + Financing Costs

The Allowed Revenues determined in year T is equal to the total cost of service. The rate for year (T+1) is equal to the total cost of service divided by sales in year T.

Model Equations

Define RTBRC = Rate Base for return calculation

(1) RTBRC = NRTBS - ATDTX - ATDITS - ATCITS + ATITC + ATCITC

Define CORT = Depreciation correction

Define TXINC = Taxable Income

(1.5) CORT = (ACDFTX - ADFTX)/(CPTXR - CPTXR*STTXR + STTXR)

(2) $$TXINC = \frac{(ABOROR)(RTBRC) - TINT + CORT - AITC}{(1 - (CPTXR - CPTXR * STTXR + STTXR))}$$

Define ESFITX = Estimated Federal Income Tax

(3) ESFITX = TXINC * CPTXR * (1-STTXR)

Define ESSITX = Estimated State Tax

(4) ESSITX = TXINC * STTXR

Define MALREV = Allowed Revenue for Massachusetts

$$MALREV = TOPEX - FULEX + ABDEP + PRTXR * NV + ESSITX + ESFITX + ACITS - ADITS - AITC + ABOROR * RTBRC + FULEX(T+1) + TNFEX(T+1) + FTOT$$

Define MRATE = The rate of electricity for Massachusetts

$$MRATE\ (T+1) = \frac{MALREV}{SALES}$$

APPENDIX IV - CALCULATION OF FINANCING MIX

Define:

D1 = Initial book value of debt

TCAP1 = Initial book capital

E1 = Initial book equity capital

P1 = Initial book preferred capital

TCAP2 = Book capital for period 1

D,P,S = Financing for period 2 met by issued debt, preferred and common sock respectively

RE1 = Initial retained earnings

N1 = Net income, period 1

DV = Total dividends issued, period 2

S1 = Initial book stock value

K1 = Initial debt to capital ratio

K2 = Initial preferred to capital ratio.

if K1 is to remain constant then,

$$\frac{TD1 + D}{TCAP2} = K1$$

or

$$\frac{TD1 + D}{TCAP1 + D + P + S + (NI - DV)} = K1$$

Dividing numerator and denominator by TCAP1 yields

$$1 + \frac{K1 + D/TCAP1}{\frac{D + P + S + (NI - DV)}{TCAP1}} = K1$$

Or,

$$K1 + \frac{D}{TCAP1} = K1 + K1 \left(\frac{D + P + S + (NI - DV)}{TCAP1}\right)$$

or

$$D = K1(D + P + S + (NI - DV))$$

$$P = K2(D + P + S + (NI - DV))$$

Define

D = Total financing requirements

C = Construction requirements

A = Cash available from previous period

Then,

$$F = C - A$$

$$F = D + P + S$$

Thus,

$$D = K1(C - A + (NI - DV))$$

$$P = K2(C - A + (NI - DV))$$

$$S = F - D - P$$

If $(C - A + NI - DV) < 0$ then

$D = P = 0$ and $S = F$

If $F < (D + P)$ then define

E = Excess cash, and

$$E = (D + P) - F$$

The excess cash is allowed to earn interest and is added to available cash at the end of the period. In FINREG, (NI - DV) is approximated by (NI - DV) from the previous period.

APPENDIX V - FINREG VARIABLES

The yearly data required for input are dimensioned as 30 element arrays. These arrays are found in YRDATA and IYRDAT common blocks. Base year data is located in the common block BASDAT.

Much of the data for specific asset accounts (i.e. service life, year of commission book cost, tax life, etc.) are located in common blocks REXPLT, IEXPLT, and COMDAT. These variables are dimensioned as 140 element arrays and the total number of accounts generated during simulation (existing and new) is limited to 140.

The program options are specified in the common block IOPTS.

The common block PARA contains the specified parameters used in FINREG. The common block CONVST contains the array CONSCH (10, 15), which is a 15 year construction schedule for each of one to ten prespecified plant types.

The common blocks ACCUM1 and ACCUM2 are declared in subroutines YEAR, EXPLT, and COMPLT. These blocks contain plant accounts which accumulate values during simulation. The last character of some variables in the argument list for ACCUM1 and ACCUM2 are changed to an "R". These dummy variables are set equal to the current year generated value of the corresponding variable.

Some output variables are not assigned a name. These variables begin with the three characters "OUT" and are followed by a number and a letter. The number and letter indicate the page number and entry letter of the information in the output file.

The location, format, variable name and description of each inputed data variable is listed below. The location refers to the line number of the input subroutine in FINREG for each variable.

Location	Format	Variable Name	Description
1001	17A4	TITLE	Header information to be printed at the beginning of the output
1001	17A4	DATE	Current date
1002	I4	NOGEN	Number of existing asset accounts
1003	I1	J	Asset account number
1003	I1	NTYPE	Asset account type
1003	F10.0	CST	Asset historical cost (excluding AFDC)
1003	F10.0	XKST	Asset historical cost (including AFDC)
1003	F10.0	SALVAG	Asset salvage value
1003	F10.0	TITC	Asset unamortized accumulated ITC
1003	F10.0	XITS	Annual amortized asset interest tax savings
1003	F10.0	BDEPX	Annual asset depreciation (including AFDC)
1003	I3	IOPT1	Tax depreciation method 1 = SYD 2 = Straight Line 3 = DDB
1004	I5	IYRCOM	Asset year of commission
1004	I5	ISERLF	Asset book depreciation life
1004	I5	ITXLF	Asset tax depreciation life

Location	Format	Variable Name	Description
1004	F10.0	TDTX	Accumulated deferred income tax
1004	F10.0	TDITS	Accumulated unamortized ITS
1004	F10.0	TTDEP	Accumulated tax depreciation
1004	F10.0	TBDEP	Accumulated book depreciation
1004	F10.0	SBV	Starting tax book value
1101	I2	NOFIX	Number of assets currently under construction
1102	I4	IYRCOM	Year of commission for asset currently under construction
1102	I3	ISERLF	Book depreciation life
1102	I3	ITXLF	Tax depreciation life
1102	I2	NTYPE	Asset type
1102	F10.0	CWIP	Accumulated construction work in progress
1102	F8.0	TAFDC	Accumulated AFDC
1102	F8.0	TTAFC	Accumulated after-tax AFDC
1102	F8.0	TCITS	Accumulated interest tax savings
1102	F8.0	TCITC	Accumulated ITC
1102	F10.0	CST	Set to 0
1102	I3	IOPT1	Tax depreciation method
1102	F4.3	CWPFR	Fraction of CWIP allowed in rate base
1103	I2	NOCOM	Number of plants that will start construction in the simulation period
1104	I4	FYROCM	Year of commission for asset that will start construction
1104	I3	NTYPE	Asset type

Location	Format	Variable Name	Description
1104	F10.0	CST	Asset cost (excluding AFCD) at time of commission
1104	I3	ISERLF	Book depreciation life
1104	I3	ITXLF	Tax depreciation life
1104	F8.4	CWPFR	Fraction of CWIP allowed in rate base
1201	I4	NYBNCH	Benchmark year
1201	I2	NYN	Number of years of simulation
1202	I4	IYEAR	Year
1202	F10.0	SALES	Sales
1202	F10.0	FBDRT	Debt retirement
1202	F10.0	FULEX	Non-nuclear fuel expense
1202	F10.0	TNFEX	Nuclear fuel expense
1203	F10.0	OMPEX	Operations and maintenance expense
1203	F10.0	ENTEX	Extraordinary expenses
1203	F10.0	PURPR	Purchase power expense
1203	F10.4	FCSTD	Cost of retired debt
1301	I2	NOTYPE	Number of plant types for future construction
1302	I2	MTYPE	Plant type
1303	F4.3	CONSCH	Fraction of total plant construction cost in a particular year
1401	F10.0	OMTEX(1)	Set to 0
1401	F10.0	NV	Base year net asset value
1401	F10.0	CA	Base year current assets
1401	F10.0	CL	Base year current liabilities

Location	Format	Variable Name	Description
1401	F10.0	NNF	Base year net nuclear fuel
1401	F10.0	NWC	Base year net working capital
1401	F10.2	CFITC	Available base year ITC carryforward
1401	F10.0	DVPRF	Base year preferred dividends
1401	F10.0	TPRF	Base year preferred stock
1401	F10.0	STPR	Base year stock price
1401	F10.0	TCOMN	Base year book equity
1401	10.2	DIVPS	Base year dividends per share
1404	F10.0	XNPV	Base year NPV
1404	F10.4	RETEQ	Base year return on equity
1404	F10.0	DIV	Base year dividends
1404	F10.0	STOCK	Base year book stock value
1404	F10.0	XNETI	Base year net income
1404	F10.0	RETAIN	Base year retained earnings
1404	F10.4	ASBOROR	Base year allowed rate of return
1404	F10.4	ABROR	Base year after-tax allowed rate of return (if after-tax ROR is used)
1402	F10.4	ACASH	Base year available cash
1402	F10.0	TINT	Base year total interest
1402	F10.0	AFLOS	Base year accumulated deductions for federal income taxes
1402	F10.0	UPLNT	Base year total utility plant
1402	F10.0	TDEBT	Base year book debt value
1402	F10.5	RATE(1)	Base year electricity rate
1402	F10.5	RATE(2)	Previous year electricity rate

Location	Format	Variable Name	Description
1403	F10.0	SALES(NYN1)	Previous year sales
1403	F10.0	FULEX(NYN1)	Previous year fossil fuel expenses
1403	F10.0	OMPEX(NYN1)	Previous year O&M expenses
1403	F10.0	TNFEX(NYN1)	Previous year nuclear fuel expenses
1403	F10.0	XNPUR0	Base year nuclear fuel purchase
1403	F10.0	XNPUR2	Previous year nuclear fuel purchase
1501	F8.4	CPTXR	Corporate tax rate
1501	F8.4	PRTXR	Property tax rate
1501	F8.4	CNTXR	Construction tax rate
1501	F8.4	RVTXR	Revenue tax rate
1501	F8.4	STTXR	State tax rate
1501	F8.4	FRTCD	Desired fraction of debt
1501	F8.4	FrctP	Desired fraction of preferred stock
1501	F8.4	FRCTS	Desired fraction of common stock
1501	F8.4	FNCTD	Percentage financing cost for debt
1501	F8.4	FNCTP	Percentage financing cost of preferred stock
1501	F8.4	FNCTS	Percentage financing cost for common stock
1501	F8.4	CSTD	Cost of debt
1501	F8.4	CSTP	Cost of preferred stock
1501	F8.4	BETAP	Beta of preferred stock
1501	F8.4	BETAA	Beta of assets
1501	F8.4	CSTRFD	Short term riskless asset rate

Location	Format	Variable Name	Description
1501	F8.4	MRKP	Market premium
1501	F8.4	FRREQ	Fraction of allowed return on equity
1501	F8.4	DIFEQ	Difference between actual and allowed return on equity
1501	F8.4	FRADF	Fractional allowance for fuel adjustment clause
1501	F8.4	FRADOM	Percentage allowance for fuel adjustment clause
1501	F8.4	LIMINC	Percentage limit for allowed rate increases
1501	F8.4	INFLR	Inflation rate
1501	F8.4	RITC	ITC rate
1501	F8.4	K1 ,K2	Net Working Capital constants K1 and K2
1501	F8.4	K3	O and M constant K3
1501	F8.4	K4,K5,K6,K7	Working Capital Allowance constants K4,K5,K6,K7
1501	F8.4	C1,C2,C3,C4, C5	Dividend constants C1,C2,C3,C4,C5
1501	F8.4	STPR1	Set equal to 0
1501	F8.4	PRCWP	Set equal to 0
1501	F8.4	PRETEQ	Allowed return on equity if prespecified
1509	F8.4	FRLFSW	Fraction of asset life for switch-over to straight-line depreciation
1509	F8.4	BDLIFE	Bond life
1509	F8.4	CWPFRT	Percentage of CWIP allowed in the rate base
1509	F8.0	B5,B6	Plant addition constants B5,B6

Location	Format	Variable Name	Description
1509	F8.4	ABTXR	Base year before-tax AFDC rate
1509	F8.4	AATXR	Base year after-tax AFDC rate
1601	I2	IOPTC	Set equal to 0
1601	I2	IOPT2	Set equal to 1
1601	I2	IOPT3	Ratemaking option
1601	I2	IOPT4	Regulatory Option
1601	I2	IOPT5	Set equal to 1
1601	I2	IOPT6	AFDC compounding option
1601	I2	IOPT7	Set equal to 0
1601	I2	IOPT8	Set equal to 0
1601	I2	IOPT9	Set equal to 0

```
C ***************************************************************FIN00010
C *      ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM              *FIN00020
C *                                                               *FIN00030
C *       ----MAIN PROGRAM----------                              *FIN00040
C *                                          ALBERT K. WONG       *FIN00050
C ***************************************************************FIN00060
      COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS,  FIN00070
     &            FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA,    FIN00080
     &            STPR1,CSTRFD,MRKP,PRETEQ,FRREQ,DIFEQ,FRADF,FRADOM, FIN00090
     &            LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,     FIN00100
     &            C1,C2,C3,C4,C5,FRLFSW                             FIN00110
      COMMON /YRDATA/SALES(30),BDRTS(30),FULEX(30),TNFEX(30),       FIN00120
     &              OMPEX(30),OMTEX(30),EXTEX(30),PURPR(30),RATE(30), FIN00130
     &               ABTXR,AATXR                                    FIN00140
      COMMON/IYRDAT/IYEAR(30)                                       FIN00150
C ---------------------------------------------------------------FIN00160
C     THE OUTDAT COMMON BLOCK STORES NECESSARY DATA FOR FIVE CONSECUTIVEFIN00170
C       YEARS SO THAT OUTPUT SUBROUTINE IS CALLED EVERY FIVE YEARS TO FIN00180
C       PRINT OUT RESULTS ON A FIVE YEAR BY FIVE YEAR BASIS.        FIN00190
C     TYPE (REAL) AND DIMENSION (5) ARE DECLARED BEFORE DECLARATION OF FIN00200
C       COMMON BLOCK                                                FIN00210
C ---------------------------------------------------------------FIN00220
      REAL                                                          FIN00230
     &    UPLNT(5),ACWIP(5),APFDEP(5),NDEP(5),NNF(5),CA(5),STOCK(5), FIN00240
     &    TPRF(5),TDEBT(5),CL(5),ATDTX(5),NI(5),ABDEP(5),           FIN00250
     &    ARAFDC(5),DVPRF(5),DIV(5),COMN(5),PREF(5),DEBT(5),        FIN00260
     &    INCNWC(5),ACNSTR(5),NPUR(5),STPR(5),                      FIN00270
     &    DIVPS(5),TCSTIS(5),FTOT(5),BCSTD(5),BCSTP(5),             FIN00280
     &    CSTIS(5),RETEQ(5),WABR(5),ARTEQ(5),ABOROR(5),ALREV(5),    FIN00290
     &    RTBCR(5),ICR(5),EXICR(5),CTER(5),GRERAT(5),ENVR(5),EXENVR(5), FIN00300
     &    PRCR(5),REV(5),GENTX(5),STTX(5),CPTX(5),TINT(5),          FIN00310
     &    OUT3(5),OUT5(5),OUT6(5),OUT9(5),OUT11(5),                 FIN00320
     &    OUTA3(5),OUTA4(5),OUTA7(5),OUTA9(5),OUTA10(5),            FIN00330
     &    OUTB5(5),OUTB6(5),OUTB8(5),OUTB11(5),OUTB17(5),OUTB20(5), FIN00340
     &    OUTC1(5),OUTC24(5),OUTD4(5),OUTD13(5),OUTD14(5),          FIN00350
     &     OUTD15(5),OUTD18(5),OUTD20(5),ROE(5),PDBT(5),PCS(5)      FIN00360
      COMMON /OUTDAT/                                               FIN00370
     &    UPLNT,ACWIP,APFDEP,NDEP,NNF,CA,STOCK,                     FIN00380
     &    TPRF,TDEBT,CL,ATDTX,NI,ABDEP,                             FIN00390
     &    ARAFDC,DVPRF,DIV,COMN,PREF,DEBT,                          FIN00400
     &    INCNWC,ACNSTR,NPUR,STPR,                                  FIN00410
     &    DIVPS,TCSTIS,FTOT,BCSTD,BCSTP,                            FIN00420
     &    CSTIS,RETEQ,WABR,ARTEQ,ABOROR,ALREV,                      FIN00430
     &    RTBCR,ICR,EXICR,CTER,GRERAT,ENVR,EXENVR,                  FIN00440
     &    PRCR,REV,GENTX,STTX,CPTX,TINT,                            FIN00450
     &    OUT3,OUT5,OUT6,OUT9,OUT11,                                FIN00460
     &    OUTA3,OUTA4,OUTA7,OUTA9,OUTA10,                           FIN00470
     &    OUTB5,OUTB6,OUTB8,OUTB11,OUTB17,OUTB20,                   FIN00480
     &    OUTC1,OUTC24,OUTD4,OUTD13,OUTD14,                         FIN00490
     &      OUTD15,OUTD18,OUTD20,ROE,PDBT,PCS                       FIN00500
      COMMON /IOPTS/IOPT1(140),IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7, FIN00510
     &              IOPT8,IOPT9                                     FIN00520
      COMMON /PVDAT/XINVST(5),PV(5),XNPV(5),BETAS(5),ADFTX(5)       FIN00530
C ---------------------------------------------------------------FIN00540
C     DUMMY NAMES XXXX ARE USED TO AVOID CONFLICT WITH DECLARATION IN FIN00550
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```
C       OUTDAT COMMON BLOCK                                                FIN00560
C ------------------------------------------------------------------------FIN00570
      COMMON /ACCUM1/XXXX1,XXXX2,XXXX3,XXXX4,XXXX5,XXXX6,                  FIN00580
     &                    AITC,ATITC,ADITS,ATDITS,XXXX11,XXXX12           FIN00590
      COMMON /ACCUM2/XXX11,XXX12,XXX13,XXX14,ACITS,ATCITS,                 FIN00600
     &                     ACITC,ATCITC,XXX19,XXX20,XXX21,XXX22           FIN00610
      INTEGER T                                                            FIN00620
      REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7                          FIN00630
C ------------------------------------------------------------------------FIN00640
C     CALL SUBROUTINE TO READ IN INPUT DATA                                FIN00650
C ------------------------------------------------------------------------FIN00660
      CALL INPUT(NYN)                                                      FIN00670
C ------------------------------------------------------------------------FIN00680
C     INITIALIZE LOOP TO GO THROUGH EVERY YEAR OF STUDY                    FIN00690
C ------------------------------------------------------------------------FIN00700
      K = 0                                                                FIN00710
      NCOUNT = 0                                                           FIN00720
      DO 1 T = 2,NYN,1                                                     FIN00730
      K = K + 1                                                            FIN00740
      IF(K.GT.5)CALL OUTPV(5,NCOUNT,DIV,COMN)                              FIN00750
      IF(K.GT.5.AND.IOPT8.EQ.0)CALL OUTPUT(5,NCOUNT)                       FIN00760
      IF(K.GT.5)NCOUNT = NCOUNT + 1                                        FIN00770
      IF(K.GT.5)K = 1                                                      FIN00780
      WRITE(6,1000)IYEAR(T)                                                FIN00790
C ------------------------------------------------------------------------FIN00800
C     SUBROUTINE YEAR IS CALLED EVERY YEAR. RESULTS GENERATED WILL BE      FIN00810
C       PASSED BACK THROUGH THE ARGUMENT LIST.                             FIN00820
C ------------------------------------------------------------------------FIN00830
1000  FORMAT(' YEAR = ',I5)                                                FIN00840
      CALL YEAR(T,IYEAR(T),                                                FIN00850
     &    UPLNT(K),ACWIP(K),APFDEP(K),NDEP(K),NNF(K),CA(K),STOCK(K),       FIN00860
     &    TPRF(K),TDEBT(K),CL(K),ATDTX(K),NI(K),ABDEP(K),                  FIN00870
     &    ARAFDC(K),DVPRF(K),DIV(K),COMN(K),PREF(K),DEBT(K),               FIN00880
     &    INCNWC(K),ACNSTR(K),NPUR(K),STPR(K),                             FIN00890
     &    DIVPS(K),TCSTIS(K),FTOT(K),BCSTD(K),BCSTP(K),                    FIN00900
     &    CSTIS(K),RETEQ(K),WABR(K),ARTEQ(K),ABORDR(K),ALREV(K),           FIN00910
     &    RTBCR(K),ICR(K),EXICR(K),CTER(K),GRERAT(K),ENVR(K),EXENVR(K),    FIN00920
     &    PRCR(K),REV(K),GENTX(K),STTX(K),CPTX(K),TINT(K),TCASH,           FIN00930
     &    XINVST(K),PV(K),XNPV(K),BETAS(K),ADFTX(K),                       FIN00940
     &     ROE(K),PDBT(K),PCS(K))                                          FIN00950
      OUTA7(K) = ATCITC + ATITC                                            FIN00960
      OUTA9(K) = ATDITS + ATCITS                                           FIN00970
      OUTB5(K) = ACITC - AITC                                              FIN00980
      OUTB6(K) = ACITS - ADITS                                             FIN00990
      OUTC24(K) = (TCASH - DVPRF(K))/TCSTIS(K)                             FIN01000
1     CONTINUE                                                             FIN01010
      CALL OUTPV(K,NCOUNT,DIV,COMN)                                        FIN01020
      IF(IOPT8.EQ.0)CALL OUTPUT(K,NCOUNT)                                  FIN01030
      STOP                                                                 FIN01040
      END                                                                  FIN01050
```

```
      SUBROUTINE INPUT(NYN)                                                 INP00010
C ***********************************************************************INP00020
C *       ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM                     *INP00030
C *                                                                       *INP00040
C *                                          SUBROUTINE TO READ           *INP00050
C *                                          DATA FROM INPUT FILE         *INP00060
C *                                            -ALBERT K. WONG-           *INP00070
C *                                              MAR 16, 1981             *INP00080
C ***********************************************************************INP00090
      COMMON /HEADER/TITLE(17),DATE(17)                                     INP00100
      COMMON /IEXPLT/NTYPE(140),IYRCOM(140),IYRRET(140),ISERLF(140),        INP00110
     &               ITXLF(140),NOPLT                                       INP00120
      COMMON /REXPLT/CST(140),XKST(140),SALVAG(140),TITC(140),XITS(140),    INP00130
     &          BDEPX(140),TDTX(140),TDITS(140),TTDEP(140),TBDEP(140),     INP00140
     &           XKXST(140),SBV(140),CTDTX(140)                             INP00150
      COMMON /YRDATA/SALES(30),BDRTS(30),FULEX(30),TNFEX(30)                INP00160
     &              ,OMPEX(30),OMTEX(30),EXTEX(30),PURPR(30),RATE(30),     INP00170
     &               FBDRT(30),XNBDRT(30),FCSTD(30),ABTXR,AATXR            INP00180
      COMMON /COMDAT/CWIP(140),TAFDC(140),TTAFC(140),TCITS(140),            INP00190
     &           TCITC(140),CWPFR(140)                                      INP00200
      COMMON /IYRDAT/IYEAR(30)                                              INP00210
      COMMON /CONVST/CONSCH(10,15)                                          INP00220
      COMMON /RETEAR/RETAIN                                                 INP00230
      COMMON /BASDAT/NV,CA,CL,NNF,NWC,DVPRF,TPRF,STPR,TDEBT,TCOMN,          INP00240
     &               TCSTIS,ASLOS,ACASH,TINT,AFLOS,UPLNT,DIVPS,CFITC      INP00250
     &               ,ACNSTR,BCSTD,XNPV,RETEQ,DIV,XNPUR0,XNPUR2,          INP00260
     &                STOCK,ABORCR,ABROR,XNETI                            INP00270
      COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS,         INP00280
     &          FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA,             INP00290
     &          STPR1,CSTRFD,MRKP,PRETEQ,FRREQ,DIFEQ,FRADF,FRADOM,         INP00300
     &          LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,              INP00310
     &          C1,C2,C3,C4,C5,FRLFSW,BDLIFE,CWPFRT,B5,B6                  INP00320
      COMMON /IOPTS/IOPT1(140),IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7,IOPT8    INP00330
     &             ,IOPT9                                                 INP00340
      REAL NV,NNF,NWC                                                       INP00350
      REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7                           INP00360
      INTEGER T                                                             INP00370
      READ(31,1001)(TITLE(I),I=1,17)                                        INP00380
      WRITE(6,1001)(TITLE(I),I=1,17)                                        INP00390
      READ(31,1001)(DATE(I),I=1,17)                                         INP00400
      WRITE(6,1001)(DATE(I),I=1,17)                                         INP00410
1001  FORMAT(17A4)                                                          INP00420
      READ(31,1002)NOGEN                                                    INP00430
1002  FORMAT(I4)                                                            INP00440
C -----------------------------------------------------------------------INP00450
C     THERE MUST BE TWO INPUT FILES, ONE LINKED TO UNIT# 31 AND THE         INP00460
C     OTHER TO UNIT# 32(THIS FILE CONTAINS ONLY THE PARAMTERS & OPTIONS)  INP00470
C -----------------------------------------------------------------------INP00480
      DO 1 I = 1,NOGEN                                                      INP00490
      READ(31,1003)J,NTYPE(I),CST(I),XKST(I),SALVAG(I),TITC(I),XITS(I),     INP00500
     &             BDEPX(I),IOPT1(I)                                      INP00510
      WRITE(6,1003)J,NTYPE(I),CST(I),XKST(I),SALVAG(I),TITC(I),             INP00520
     &             XITS(I),BDEPX(I),IOPT1(I)                              INP00530
1003  FORMAT(2(1X,I1),6F10.0,I3)                                            INP00540
      READ(31,1004)IYRCOM(I),ISERLF(I),ITXLF(I),TDTX(I),TDITS(I),           INP00550
```

```
     &              TTDEP(I),TBDEP(I),SBV(I)                          INP00560
      CTDTX(I) = TDTX(I)                                               INP00570
      WRITE(6,1004)IYRCOM(I),ISERLF(I),ITXLF(I),TDTX(I),TDITS(I),      INP00580
     &              TTDEP(I),TBDEP(I),SBV(I)                          INP00590
1004  FORMAT(3I5,5F10.0)                                               INP00600
C ---------------------------------------------------------------------INP00610
C     IF SBV IS NOT SPECIFIED, IT CAN BE CALCULATED FROM ORIGINAL COST  INP00620
C       TOTAL TAX DEPRECIATION.                                        INP00630
C ---------------------------------------------------------------------INP00640
      IF(SBV(I).EQ.0)SBV(I)=XKST(I)-TTDEP(I)                           INP00650
1     CONTINUE                                                         INP00660
C ---------------------------------------------------------------------INP00670
C     READ DATA FOR COMMITTED PLANTS                                   INP00680
C ---------------------------------------------------------------------INP00690
      READ(31,1101)NOFIX                                               INP00700
      WRITE(6,1111)NOFIX                                               INP00710
1101  FORMAT(I2)                                                       INP00720
1111  FORMAT('  NUMBER OF PLANTS UNDER CONSTRUCTION =',I4)             INP00730
      N = NOGEN + NOFIX                                                INP00740
      NI = NOGEN + 1                                                   INP00750
      IF(NOFIX.EQ.0)GOTO 2                                             INP00760
      DO 2 I = NI,N                                                    INP00770
C ---------------------------------------------------------------------INP00780
C       FOR PLANTS ALREADY UNDER CONSTUCTION AT FIRST YEAR, EXISTING   INP00790
C      DATA MUST BE SUPPLIED                                           INP00800
C ---------------------------------------------------------------------INP00810
      READ(31,1102)IYRCOM(I),ISERLF(I),ITXLF(I),NTYPE(I),CWIP(I),      INP00820
     &              TAFDC(I),TTAFC(I),TCITS(I),TCITC(I),CST(I),IOPT1(I),INP00830
     &                 CWPFR(I)                                        INP00840
      WRITE(6,1102)IYRCOM(I),ISERLF(I),ITXLF(I),NTYPE(I),CWIP(I),      INP00850
     &              TAFDC(I),TTAFC(I),TCITS(I),TCITC(I),CST(I),IOPT1(I) INP00860
     &                 ,CWPFR(I)                                       INP00870
1102  FORMAT(I4,2I3,I2,F10.0,4F8.0,F10.0,I3,F4.3)                      INP00880
2     CONTINUE                                                         INP00890
      READ(31,1103)NOCOM                                               INP00900
      WRITE(6,1114)NOCOM                                               INP00910
1103  FORMAT(I2)                                                       INP00920
1114  FORMAT('  NUMBER OF PLANTS THAT WILL START CONSTRUCTION',        INP00930
     &       /,'   IN THE PERIOD OF STUDY = ',I4)                      INP00940
      NI = N + 1                                                       INP00950
      NOPLT  = N + NOCOM                                               INP00960
      IF(NOCOM.EQ.0)GOTO 3                                             INP00970
      DO 3 I = NI,NOPLT                                                INP00980
      READ(31,1104)IYRCOM(I),NTYPE(I),CST(I),ISERLF(I),ITXLF(I),CWPFR(I)INP00990
      WRITE(6,1104)IYRCOM(I),NTYPE(I),CST(I),ISERLF(I),ITXLF(I),CWPFR(I)INP01000
1104  FORMAT(I4,I3,3X,F10.0,2I3,F8.4)                                  INP01010
3     CONTINUE                                                         INP01020
C ---------------------------------------------------------------------INP01030
C     READ YEARLY DATA                                                 INP01040
C ---------------------------------------------------------------------INP01050
C ---------------------------------------------------------------------INP01060
C     NYBNCH IS THE BASE YEAR. NYBNCH+1 WILL BE THE FIRST YEAR OF STUDY.INP01070
C      NYN IS THE NUMBER OF YEAR OF STUDY. IT MUST NOT EXCEED 29.      INP01080
C ---------------------------------------------------------------------INP01090
      READ(31,1201)NYBNCH,NYN                                          INP01100
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      WRITE(6,1211)NYBNCH,NYN                                          INP01110
1201  FORMAT(I4,4X,I2)                                                 INP01120
1211  FORMAT('  BENCHMARK YEAR =',I5,' NO. OF YEAR OF STUDY =',I4)     INP01130
      DO 4 T = 1, NYN                                                  INP01140
      READ(31,1202)IYEAR(T),SALES(T),FBDRT(T),FULEX(T),TNFEX(T)        INP01150
      WRITE(6,1202)IYEAR(T),SALES(T),FBDRT(T),FULEX(T),TNFEX(T)        INP01160
1202  FORMAT(I4,1X,4F10.0)                                             INP01170
      READ(31,1203)OMPEX(T),EXTEX(T),PURPR(T),FCSTD(T)                 INP01180
      WRITE(6,1203)OMPEX(T),EXTEX(T),PURPR(T),FCSTD(T)                 INP01190
1203  FORMAT(5X,3F10.0,F10.4)                                          INP01200
4     CONTINUE                                                         INP01210
C -----------------------------------------------------------------    INP01220
C     READ CONSTRUCTION SCHEDULES OF DIFFERENT PLANT TYPES             INP01230
C -----------------------------------------------------------------    INP01240
      READ(31,1301)NOTYPE                                              INP01250
      WRITE(6,1311)NOTYPE                                              INP01260
1301  FORMAT(I2)                                                       INP01270
1311  FORMAT(' NO. OF PLANT TYPES = ',I4)                              INP01280
      DO 5 K = 1,NOTYPE                                                INP01290
      READ(31,1302)MTYPE,(CONSCH(K,I),I=1,15)                          INP01300
      WRITE(6,1302)MTYPE,(CONSCH(K,I),I=1,15)                          INP01310
1302  FORMAT(I2,3X,15F4.3)                                             INP01320
5     CONTINUE                                                         INP01330
C -----------------------------------------------------------------    INP01340
C     READ NECESSARY BASE YEAR DATA                                    INP01350
C -----------------------------------------------------------------    INP01360
      READ(31,1401)OMTEX(1),NV,CA,CL,NNF,NWC,CFITC                     INP01370
      WRITE(6,1401)OMTEX(1),NV,CA,CL,NNF,NWC,CFITC                     INP01380
      READ(31,1401)DVPRF,TPRF,STPR,TCOMN,TCSTIS,ASLOS,DIVPS            INP01390
      WRITE(6,1401)DVPRF,TPRF,STPR,TCOMN,TCSTIS,ASLOS,DIVPS            INP01400
      READ(31,1404)XNPV,RETEQ,DIV,STOCK,XNETI,RETAIN,ABOROR,ABROR      INP01410
      WRITE(6,1404)XNPV,RETEQ,DIV,STOCK,XNETI,RETAIN,ABOROR,ABROR      INP01420
      READ(31,1402)ACASH,TINT,AFLOS,UPLNT,TDEBT,RATE(1),RATE(2)        INP01430
C -----------------------------------------------------------------    INP01440
C     SOME DATA FOR THE YEAR FOLLOWING LAST YEAR MUST ALSO BE SUPPLIED. INP01450
C -----------------------------------------------------------------    INP01460
      WRITE(6,1402)ACASH,TINT,AFLOS,UPLNT,TDEBT,RATE(1),RATE(2)        INP01470
      NYN1 = NYN + 1                                                   INP01480
      READ(31,1403)BCSTD,SALES(NYN1),FULEX(NYN1),OMPEX(NYN1),TNFEX(NYN1)INP01490
     &                   ,XNPUR0,XNPUR2                                INP01500
      WRITE(6,1403)BCSTD,SALES(NYN1),FULEX(NYN1),OMPEX(NYN1),TNFEX(NYN1)INP01510
     &                   ,XNPUR0,XNPUR2                                INP01520
1401  FORMAT(6F10.0,F10.2)                                             INP01530
1402  FORMAT(5F10.0,2F10.5)                                            INP01540
1403  FORMAT(F10.4,6F10.0)                                             INP01550
1404  FORMAT(F10.0,F10.4,4F10.0,2F10.4)                                INP01560
C -----------------------------------------------------------------    INP01570
C     READ PARAMETER LIST FROM PARAMETER FILE                          INP01580
C -----------------------------------------------------------------    INP01590
      READ(32,1501)CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS     INP01600
      WRITE(6,1501)CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS     INP01610
      READ(32,1501)FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA       INP01620
      WRITE(6,1501)FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA       INP01630
      READ(32,1501)CSTRFD,MRKP,FRREQ,DIFEQ,FRADF,FRADOM,LIMINC,INFLR   INP01640
      WRITE(6,1501)CSTRFD,MRKP,FRREQ,DIFEQ,FRADF,FRADOM,LIMINC,INFLR   INP01650
```

```
      READ(32,1501)RITC,K1,K2,K3,K4,K5,K6,K7                                INP01660
      WRITE(6,1501)RITC,K1,K2,K3,K4,K5,K6,K7                                INP01670
      READ(32,1501)C1,C2,C3,C4,C5,STPR1,PRCWP,PRETEQ                        INP01680
      WRITE(6,1501)C1,C2,C3,C4,C5,STPR1,PRCWP,PRETEQ                        INP01690
      READ(32,1509)FRLFSW,BDLIFE,CWPFRT,B5,B6,ABTXR,AATXR                   INP01700
      WRITE(6,1509)FRLFSW,BDLIFE,CWPFRT,B5,B6,ABTXR,AATXR                   INP01710
1501  FORMAT(8F8.4)                                                         INP01720
1509  FORMAT(3F8.4,F8.0,4F8.4)                                              INP01730
C -------------------------------------------------------------------------INP01740
C     READ OPTIONS LIST                                                     INP01750
C -------------------------------------------------------------------------INP01760
      READ(32,1601)IOPTC,IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7,IOPT8,IOPT9    INP01770
      WRITE(6,1611)                                                         INP01780
1611  FORMAT('  SPECIFICATION OF OPTIONS:')                                 INP01790
      WRITE(6,1601)IOPTC,IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7,IOPT8,IOPT9    INP01800
1601  FORMAT(9I2)                                                           INP01810
      RETURN                                                                INP01820
      END                                                                   INP01830
```

```
      SUBROUTINE OUTPUT(K,NCOUNT)                                       OUT00010
      INTEGER T,T1                                                      OUT00020
      COMMON /RETEAR/RETAIN                                             OUT00030
      COMMON /HEADER/TITLE(17),DATE(17)                                 OUT00040
      COMMON /YRDATA/SALES(30),BDRTS(30),FULEX(30),TNFEX(30),           OUT00050
     &               OMPEX(30),OMTEX(30),EXTEX(30),PURPR(30),RATE(30)   OUT00060
      COMMON /IYRDAT/IYEAR(30)                                          OUT00070
      COMMON /OUTDAT/                                                   OUT00080
     &    UPLNT(5),ACWIP(5),APFDEP(5),XNDEP(5),XNNF(5),CA(5),STOCK(5),  OUT00090
     &    TPRF(5),TDEBT(5),CL(5),ATDTX(5),XNI(5),ABDEP(5),              OUT00100
     &    ARAFDC(5),DVPRF(5),DIV(5),COMN(5),PREF(5),DEBT(5),            OUT00110
     &    XINCNW(5),ACNSTR(5),XNPUR(5),STPR(5),                         OUT00120
     &    DIVPS(5),TCSTIS(5),FTOT(5),BCSTD(5),BCSTP(5),                 OUT00130
     &    CSTIS(5),RETEQ(5),WABR(5),ARTEQ(5),ABOROR(5),ALREV(5),        OUT00140
     &    RTBCR(5),XICR(5),EXICR(5),CTER(5),GRERAT(5),ENVR(5),EXENVR(5),OUT00150
     &    PRCR(5),REV(5),GENTX(5),STTX(5),CPTX(5),TINT(5),              OUT00160
     &    OUT3(5),OUT5(5),OUT6(5),OUT9(5),OUT11(5),                     OUT00170
     &    OUTA3(5),OUTA4(5),OUTA7(5),OUTA9(5),OUTA10(5),                OUT00180
     &    OUTB5(5),OUTB6(5),OUTB8(5),OUTB11(5),OUTB17(5),OUTB20(5),     OUT00190
     &    OUTC1(5),OUTC24(5),OUTD4(5),OUTD13(5),OUTD14(5),              OUT00200
     &      OUTD15(5),OUTD18(5),OUTD20(5),ROE(5),PDBT(5),PCS(5)         OUT00210
      COMMON /PVDAT/XINVST(5),PV(5),XNPV(5),BETAS(5),ADFTX(5)           OUT00220
C ------------------------------------------------------------------  OUT00230
C     CALCULATE ALL NECESSARY DATA FOR OUTPUT                           OUT00240
C ------------------------------------------------------------------  OUT00250
      J = 5*NCOUNT + 2                                                  OUT00260
      K1 = 5*NCOUNT + K + 1                                             OUT00270
C ------------------------------------------------------------------  OUT00280
C     T WILL BE FROM ONE TO FIVE, PERTAINING TO THE FIVE YEAR BY FIVE   OUT00290
C      YEAR OUTPUTING FORMAT. T1 WILL BE FROM ONE TO THIRTY, PERTAINING OUT00300
C      TO THE ACTUAL NUMBER OF YEAR IN STUDY.                           OUT00310
C ------------------------------------------------------------------  OUT00320
      DO 101 T = 1,K                                                    OUT00330
      T1 = J + T -1                                                     OUT00340
C                                                                       OUT00350
C     TOTAL UTILITY PLANT                                               OUT00360
      OUT3(T) = UPLNT(T) + ACWIP(T)                                     OUT00370
C                                                                       OUT00380
C     NET UTILITY PLANT, LESS NUCLEAR FUEL                              OUT00390
      OUT5(T) = OUT3(T) - APFDEP(T)                                     OUT00400
C                                                                       OUT00410
C     NUCLEAR FUEL                                                      OUT00420
      OUT6(T) = 3.*TNFEX(T1)                                            OUT00430
C                                                                       OUT00440
C     NET UTILITY PLANT                                                 OUT00450
      OUT9(T) = OUT5(T) + XNNF(T)                                       OUT00460
C                                                                       OUT00470
C     TOTAL ASSETS                                                      OUT00480
      OUT11(T) = OUT9(T) + CA(T)                                        OUT00490
C                                                                       OUT00500
C     RETAINED EARNING                                                  OUT00510
CCC   OUTA3(T) = OUT11(T)-STOCK(T)-TPRF(T)-TDEBT(T)-CL(T)               OUT00520
CCC  &          -OUTA7(T)-ATDTX(T)-OUTA9(T)                           OUT00530
      OUTA3(T) = RETAIN + XNI(T) - DVPRF(T) - DIV(T)                    OUT00540
      RETAIN = OUTA3(T)                                                 OUT00550
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C                                                                       OUT00560
C     TOTAL PROPIETARY CAPITAL                                          OUT00570
      OUTA4(T) = STOCK(T) + TPRF(T) + OUTA3(T)                          OUT00580
C                                                                       OUT00590
C     TOTAL LIABILITIES                                                 OUT00600
      OUTA10(T) = OUT11(T)                                              OUT00610
C                                                                       OUT00620
C     TOTAL FROM OPERATIONS LESS                                        OUT00630
      OUTB8(T) = XNI(T)+ABDEP(T)+XNDEP(T)+ADFTX(T)                      OUT00640
     &             +OUTB5(T)+OUTB6(T)-ARAFDC(T)                         OUT00650
C                                                                       OUT00660
C     FUNDS GENERATED INTERNALLY                                        OUT00670
      OUTB11(T) = OUTB8(T) - DVPRF(T) - DIV(T)                          OUT00680
C                                                                       OUT00690
C     DECREASE IN NET WORKING CAPITAL                                   OUT00700
      XINCNW(T) = -XINCNW(T)                                            OUT00710
C                                                                       OUT00720
C     TOTAL FUNDS FROM OUTSIDE                                          OUT00730
      OUTB17(T) = COMN(T) + PREF(T) + DEBT(T) - BDRTS(T1) + XINCNW(T)   OUT00740
C                                                                       OUT00750
C     TOTAL CONSTRUCTION EXPENDITURE                                    OUT00760
      OUTB20(T) = ACNSTR(T) + XNPUR(T)                                  OUT00770
C                                                                       OUT00780
C     EARNING PER SHARE OF COMMON STOCK                                 OUT00790
      OUTC1(T) = (XNI(T) - DVPRF(T))/TCSTIS(T)                          OUT00800
C                                                                       OUT00810
C     OPERATION & MAINTENANCE                                           OUT00820
      OUTD4(T) = OMPEX(T1) + OMTEX(T1)                                  OUT00830
C                                                                       OUT00840
C     OTHER EXPENSES                                                    OUT00850
      OUTD13(T) = EXTEX(T) + FTOT(T)                                    OUT00860
C                                                                       OUT00870
C     TOTAL EXPENSES                                                    OUT00880
      OUTD14(T) = PURPR(T1) + FULEX(T1) + OUTD4(T) + ABDEP(T) + XNDEP(T)OUT00890
     &       + GENTX(T) + STTX(T) + CPTX(T) + ADFTX(T) + OUTB6(T)       OUT00900
     &        + OUTB5(T)                                                OUT00910
C                                                                       OUT00920
C     NET OPERATING INCOME                                              OUT00930
      OUTD15(T) = REV(T) - OUTD14(T)                                    OUT00940
C                                                                       OUT00950
C     NET INCOME                                                        OUT00960
      OUTD18(T) = OUTD15(T) + ARAFDC(T) - TINT(T)                       OUT00970
C                                                                       OUT00980
C     BALANCE FOR COMMON STOCK                                          OUT00990
      OUTD20(T) = OUTD18(T) - DVPRF(T)                                  OUT01000
101   CONTINUE                                                          OUT01010
C -------------------------------------------------------------------  OUT01020
C *******************************************************************  OUT01030
C     NOW OUTPUT DATA 5 YEARS BY 5 YEARS                                OUT01040
C *******************************************************************  OUT01050
C -------------------------------------------------------------------  OUT01060
C     INCOME STATEMENT                                                  OUT01070
C -------------------------------------------------------------------  OUT01080
      WRITE(6,6601)(TITLE(I),I=1,17)                                    OUT01090
      WRITE(6,6601)(DATE(I),I=1,17)                                     OUT01100
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      WRITE(6,6614)                                                     OUT01110
6614  FORMAT(18X,'  INCOME STATEMENT')                                  OUT01120
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT01130
      WRITE(6,6401)(REV(I),I=1,K)                                       OUT01140
      WRITE(6,6402)(PURPR(I),I=J,K1)                                    OUT01150
      WRITE(6,6403)(FULEX(I),I=J,K1)                                    OUT01160
      WRITE(6,6404)(OUTD4(I),I=1,K)                                     OUT01170
      WRITE(6,6405)(ABDEP(I),I=1,K)                                     OUT01180
      WRITE(6,6406)(XNDEP(I),I=1,K)                                     OUT01190
      WRITE(6,6407)(GENTX(I),I=1,K)                                     OUT01200
      WRITE(6,6408)(STTX(I),I=1,K)                                      OUT01210
      WRITE(6,6409)(CPTX(I),I=1,K)                                      OUT01220
      WRITE(6,6410)(ADFTX(I),I=1,K)                                     OUT01230
      WRITE(6,6411)(OUTB6(I),I=1,K)                                     OUT01240
      WRITE(6,6412)(OUTB5(I),I=1,K)                                     OUT01250
      WRITE(6,6413)(OUTD13(I),I=1,K)                                    OUT01260
      WRITE(6,6414)(OUTD14(I),I=1,K)                                    OUT01270
      WRITE(6,6415)(OUTD15(I),I=1,K)                                    OUT01280
      WRITE(6,6416)(ARAFDC(I),I=1,K)                                    OUT01290
      WRITE(6,6417)(TINT(I),I=1,K)                                      OUT01300
      WRITE(6,6418)(OUTD18(I),I=1,K)                                    OUT01310
      WRITE(6,6419)(DVPRF(I),I=1,K)                                     OUT01320
      WRITE(6,6420)(OUTD20(I),I=1,K)                                    OUT01330
C -----------------------------------------------------------------------OUT01340
C     BALANCE SHEET (ASSETS)                                            OUT01350
C -----------------------------------------------------------------------OUT01360
      WRITE(6,6601)(TITLE(I),I=1,17)                                    OUT01370
      WRITE(6,6601)(DATE(I),I=1,17)                                     OUT01380
      WRITE(6,6610)                                                     OUT01390
6610  FORMAT(18X,' BALANCE SHEET (ASSETS)')                             OUT01400
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT01410
      WRITE(6,6001)(UPLNT(I),I=1,K)                                     OUT01420
      WRITE(6,6002)(ACWIP(I),I=1,K)                                     OUT01430
      WRITE(6,6003)(OUT3(I),I=1,K)                                      OUT01440
      WRITE(6,6004)(APFDEP(I),I=1,K)                                    OUT01450
      WRITE(6,6005)(OUT5(I),I=1,K)                                      OUT01460
      WRITE(6,6006)(OUT6(I),I=1,K)                                      OUT01470
      WRITE(6,6007)(XNDEP(I),I=1,K)                                     OUT01480
      WRITE(6,6008)(XNNF(I),I=1,K)                                      OUT01490
      WRITE(6,6009)(OUT9(I),I=1,K)                                      OUT01500
      WRITE(6,6010)(CA(I),I=1,K)                                        OUT01510
      WRITE(6,6011)(OUT11(I),I=1,K)                                     OUT01520
C -----------------------------------------------------------------------OUT01530
C     BALANCE SHEET (LIABILITIES)                                       OUT01540
C -----------------------------------------------------------------------OUT01550
      WRITE(6,6601)(TITLE(I),I=1,17)                                    OUT01560
      WRITE(6,6601)(DATE(I),I=1,17)                                     OUT01570
      WRITE(6,6611)                                                     OUT01580
6611  FORMAT(18X,' BALANCE SHEET (LIABILITIES)')                        OUT01590
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT01600
      WRITE(6,6101)(STOCK(I),I=1,K)                                     OUT01610
      WRITE(6,6102)(TPRF(I),I=1,K)                                      OUT01620
      WRITE(6,6103)(OUTA3(I),I=1,K)                                     OUT01630
      WRITE(6,6104)(OUTA4(I),I=1,K)                                     OUT01640
      WRITE(6,6105)(TDEBT(I),I=1,K)                                     OUT01650
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      WRITE(6,6106)(CL(I),I=1,K)                                        OUT01660
      WRITE(6,6107)(OUTA7(I),I=1,K)                                     OUT01670
      WRITE(6,6108)(ATDTX(I),I=1,K)                                     OUT01680
      WRITE(6,6109)(OUTA9(I),I=1,K)                                     OUT01690
      WRITE(6,6110)(OUTA10(I),I=1,K)                                    OUT01700
C -----------------------------------------------------------------------OUT01710
C     FUNDS GENERATED INTERNALLY (DEC 31)                               OUT01720
C -----------------------------------------------------------------------OUT01730
      WRITE(6,6601)(TITLE(I),I=1,17)                                    OUT01740
      WRITE(6,6601)(DATE(I),I=1,17)                                     OUT01750
      WRITE(6,6612)                                                     OUT01760
6612  FORMAT(18X,' FUNDS GENERATED INTERNALLY (DEC 31)')                OUT01770
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT01780
      WRITE(6,6201)(XNI(I),I=1,K)                                       OUT01790
      WRITE(6,6202)(ABDEP(I),I=1,K)                                     OUT01800
      WRITE(6,6203)(XNDEP(I),I=1,K)                                     OUT01810
      WRITE(6,6204)(ADFTX(I),I=1,K)                                     OUT01820
      WRITE(6,6205)(OUTB5(I),I=1,K)                                     OUT01830
      WRITE(6,6206)(OUTB6(I),I=1,K)                                     OUT01840
      WRITE(6,6207)(ARAFDC(I),I=1,K)                                    OUT01850
      WRITE(6,6208)(OUTB8(I),I=1,K)                                     OUT01860
      WRITE(6,6209)(DVPRF(I),I=1,K)                                     OUT01870
      WRITE(6,6210)(DIV(I),I=1,K)                                       OUT01880
      WRITE(6,6211)(OUTB11(I),I=1,K)                                    OUT01890
C -----------------------------------------------------------------------OUT01900
C     FUNDS OBTAINED FROM OUTSIDE SOURCES (JAN 1)                       OUT01910
C -----------------------------------------------------------------------OUT01920
      WRITE(6,6622)                                                     OUT01930
6622  FORMAT(18X,' FUNDS FROM OUTSIDE SOURCES (JAN 1)')                 OUT01940
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT01950
      WRITE(6,6212)(COMN(I),I=1,K)                                      OUT01960
      WRITE(6,6213)(PREF(I),I=1,K)                                      OUT01970
      WRITE(6,6214)(DEBT(I),I=1,K)                                      OUT01980
      WRITE(6,6215)(BDRTS(I),I=J,K1)                                    OUT01990
      WRITE(6,6216)(XINCNW(I),I=1,K)                                    OUT02000
      WRITE(6,6217)(OUTB17(I),I=1,K)                                    OUT02010
C -----------------------------------------------------------------------OUT02020
C     CONSTRUCTION EXPENDITURES (JAN 1)                                 OUT02030
C -----------------------------------------------------------------------OUT02040
      WRITE(6,6632)                                                     OUT02050
6632  FORMAT(18X,' CONSTRUCTION EXPENDITURES (JAN 1)')                  OUT02060
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT02070
      WRITE(6,6218)(ACNSTR(I),I=1,K)                                    OUT02080
      WRITE(6,6219)(XNPUR(I),I=1,K)                                     OUT02090
      WRITE(6,6220)(OUTB20(I),I=1,K)                                    OUT02100
C -----------------------------------------------------------------------OUT02110
C     SUMMARY                                                           OUT02120
C -----------------------------------------------------------------------OUT02130
      WRITE(6,6601)(TITLE(I),I=1,17)                                    OUT02140
      WRITE(6,6601)(DATE(I),I=1,17)                                     OUT02150
      WRITE(6,6613)                                                     OUT02160
6613  FORMAT(18X,' SUMMARY ')                                           OUT02170
      WRITE(6,6602)(IYEAR(I),I=J,K1)                                    OUT02180
      WRITE(6,6301)(OUTC1(I),I=1,K)                                     OUT02190
      WRITE(6,6302)(STPR(I),I=1,K)                                      OUT02200
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      WRITE(6,6303)(RATE(I),I=J,K1)                                    OUT02210
      WRITE(6,6304)(DIVPS(I),I=1,K)                                    OUT02220
      WRITE(6,6305)(TCSTIS(I),I=1,K)                                   OUT02230
      WRITE(6,6306)(SALES(I),I=J,K1)                                   OUT02240
      WRITE(6,6307)(FTOT(I),I=1,K)                                     OUT02250
      WRITE(6,6308)(BCSTD(I),I=1,K)                                    OUT02260
      WRITE(6,6309)(BCSTP(I),I=1,K)                                    OUT02270
      WRITE(6,6310)(CSTIS(I),I=1,K)                                    OUT02280
      WRITE(6,6311)(RETEQ(I),I=1,K)                                    OUT02290
      WRITE(6,6332)(BETAS(I),I=1,K)                                    OUT02300
      WRITE(6,6312)(WABR(I),I=1,K)                                     OUT02310
      WRITE(6,6313)(ARTEQ(I),I=1,K)                                    OUT02320
      WRITE(6,6314)(ABCROR(I),I=1,K)                                   OUT02330
      WRITE(6,6315)(ALREV(I),I=1,K)                                    OUT02340
      WRITE(6,6316)(RTBCR(I),I=1,K)                                    OUT02350
      WRITE(6,6317)(XICR(I),I=1,K)                                     OUT02360
      WRITE(6,6318)(EXICR(I),I=1,K)                                    OUT02370
      WRITE(6,6319)(CTER(I),I=1,K)                                     OUT02380
      WRITE(6,6320)(GRERAT(I),I=1,K)                                   OUT02390
      WRITE(6,6321)(ENVR(I),I=1,K)                                     OUT02400
      WRITE(6,6322)(EXENVR(I),I=1,K)                                   OUT02410
      WRITE(6,6323)(PRCR(I),I=1,K)                                     OUT02420
      WRITE(6,6324)(OUTC24(I),I=1,K)                                   OUT02430
      WRITE(6,6325)(ROE(I),I=1,K)                                      OUT02440
      WRITE(6,6326)(PDBT(I),I=1,K)                                     OUT02450
      WRITE(6,6327)(PCS(I),I=1,K)                                      OUT02460
C                                                                      OUT02470
6401  FORMAT(/,'   1  OPERATING REVENUES              ',5F15.0)         OUT02480
6402  FORMAT(/,'   2  PURCHASE POWER                  ',5F15.0)         OUT02490
6403  FORMAT(/,'   3  FUEL                            ',5F15.0)         OUT02500
6404  FORMAT(/,'   4  OPERATION AND MAINTENANCE       ',5F15.0)         OUT02510
6405  FORMAT(/,'   5  DEPRECIATION                    ',5F15.0)         OUT02520
6406  FORMAT(/,'   6  NUCLEAR FUEL AMORTIZATION       ',5F15.0)         OUT02530
6407  FORMAT(/,'   7  TAXES OTHER THAN INCOME TAX     ',5F15.0)         OUT02540
6408  FORMAT(/,'   8  STATE INCOME TAX                ',5F15.0)         OUT02550
6409  FORMAT(/,'   9  FEDERAL INCOME TAX              ',5F15.0)         OUT02560
6410  FORMAT(/,'  10  DEFERRED INCOME TAX             ',5F15.0)         OUT02570
6411  FORMAT(/,'  11  DEFERRED INTEREST TAX SAVINGS   ',5F15.0)         OUT02580
6412  FORMAT(/,'  12  DEFERRED ITC                    ',5F15.0)         OUT02590
6413  FORMAT(/,'  13  OTHER EXPENSES                  ',5F15.0)         OUT02600
6414  FORMAT(/,'  14  TOTAL EXPENSE                   ',5F15.0)         OUT02610
6415  FORMAT(/,'  15  NET OPERATING INCOME            ',5F15.0)         OUT02620
6416  FORMAT(/,'  16  ALLOWANCE FOR FUNDS USED DURING',/,               OUT02630
     &       '        CONSTRUCTION                   ',5F15.0)         OUT02640
6417  FORMAT(/,'  17  INTEREST CHARGES               ',5F15.0)         OUT02650
6418  FORMAT(/,'  18  NET INCOME                     ',5F15.0)         OUT02660
6419  FORMAT(/,'  19  LESS PREFERRED DIVIDENDS       ',5F15.0)         OUT02670
6420  FORMAT(/,'  20  BALANCE FOR COMMON STOCK       ',5F15.0)         OUT02680
6601  FORMAT(17A4)                                                     OUT02690
6602  FORMAT(/,34X,5(6X,I4,5X))                                        OUT02700
6001  FORMAT(/'   1 UTILITY PLANT                  ',5F15.0)           OUT02710
6002  FORMAT(/'   2 CONSTRUCTION WORK IN PROGRESS  ',5F15.0)           OUT02720
6003  FORMAT(/'   3 TOTAL UTILITY PLANT            ',5F15.0)           OUT02730
6004  FORMAT(/'   4 LESS ACCUM. PROVISION FOR      ',                  OUT02740
     &       /'     DEPRECIATION                   ',5F15.0)           OUT02750
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6005  FORMAT(/'  5 NET UTILITY PLANT, LESS     ',                    OUT02760
     &       /'      NUCLEAR FUEL                ',5F15.0)          OUT02770
6006  FORMAT(/'  6 NUCLEAR FUEL                  ',5F15.0)          OUT02780
6007  FORMAT(/'  7 LESS ACCUM. PROVISION FOR     ',                 OUT02790
     &       /'      OF NUCLEAR FUEL INVESTMENT  ',5F15.0)          OUT02800
6008  FORMAT(/'  8 NET NUCLEAR FUEL             ',5F15.0)          OUT02810
6009  FORMAT(/'  9 NET UTILITY PLANT            ',5F15.0)          OUT02820
6010  FORMAT(/' 10 CURRENT ASSETS               ',5F15.0)          OUT02830
6011  FORMAT(/' 11 TOTAL ASSETS                 ',5F15.0)          OUT02840
6101  FORMAT(/,'  1  COMMON STOCK               ',5F15.0)          OUT02850
6102  FORMAT(/,'  2  PREFERRED STOCK            ',5F15.0)          OUT02860
6103  FORMAT(/,'  3  RETAINED EARNINGS          ',5F15.0)          OUT02870
6104  FORMAT(/,'  4  TOTAL PROPIETARY CAPITAL   ',5F15.0)          OUT02880
6105  FORMAT(/,'  5  LONG TERM DEBT             ',5F15.0)          OUT02890
6106  FORMAT(/,'  6  CURRENT LIABILITIES        ',5F15.0)          OUT02900
6107  FORMAT(/,'  7  ACCUMULATED DEFERRED ITC   ',5F15.0)          OUT02910
6108  FORMAT(/,'  8  ACCUM. DEFERRED INCOME TAXES ',5F15.0)        OUT02920
6109  FORMAT(/,'  9  ACCUM. DEPRECIATED INTEREST  ',               OUT02930
     &       /,'      TAX SAVINGS                 ',5F15.0)       OUT02940
6110  FORMAT(/,' 10  TOTAL LIABILITIES          ',5F15.0)          OUT02950
6201  FORMAT(/,'  1  NET INCOME                 ',5F15.0)          OUT02960
6202  FORMAT(/,'  2  ACCUMULATED BOOK DEPRECIATION',5F15.0)        OUT02970
6203  FORMAT(/,'  3  NUCLEAR FUEL AMORTIZATION  ',5F15.0)          OUT02980
6204  FORMAT(/,'  4  DEFERRED INCOME TAXES      ',5F15.0)          OUT02990
6205  FORMAT(/,'  5  DEFERRED ITC               ',5F15.0)          OUT03000
6206  FORMAT(/,'  6  DEFERRED INTEREST TAX SAVINGS',5F15.0)        OUT03010
6207  FORMAT(/,'  7  ALLOWANCE FOR FUNDS USED   ',                 OUT03020
     &       /,'      DURING CONSTRUCTION       ',5F15.0)         OUT03030
6208  FORMAT(/,'  8  TOTAL FROM OPERATIONS      ',5F15.0)          OUT03040
6209  FORMAT(/,'  9  PREFERRED DIVIDENDS        ',5F15.2)          OUT03050
6210  FORMAT(/,' 10  COMMON DIVIDENDS           ',5F15.2)          OUT03060
6211  FORMAT(/,' 11  FUNDS GENERATED INTERNALLY ',                 OUT03070
     &       /,'      FOR FINANCING NEXT YEAR   ',5F15.0)         OUT03080
6212  FORMAT(/,' 12  COMMON STOCK               ',5F15.0)          OUT03090
6213  FORMAT(/,' 13  PREFERRED STOCK            ',5F15.0)          OUT03100
6214  FORMAT(/,' 14    LONG TERM DEBT           ',5F15.0)          OUT03110
6215  FORMAT(/,' 15  DEBT RETIREMENT            ',5F15.0)          OUT03120
6216  FORMAT(/,' 16  DECREASE IN NET WORKING    ',                 OUT03130
     &       /,'      CAPITAL                   ',5F15.2)         OUT03140
6217  FORMAT(/,' 17  TOTAL                      ',5F15.0)          OUT03150
6218  FORMAT(/,' 18  PLANTS                     ',5F15.0)          OUT03160
6219  FORMAT(/,' 19  NUCLEAR FUEL               ',5F15.0)          OUT03170
6220  FORMAT(/,' 20  TOTAL                      ',5F15.0)          OUT03180
6301  FORMAT(/,'  1  EARNINGS PER SHARE OF COMMON ',               OUT03190
     &       /,'      STOCK                     ',5F15.2)         OUT03200
6302  FORMAT(/,'  2  YEAR END STOCK PRICE       ',5F15.2)          OUT03210
6303  FORMAT(/,'  3  ELECTRICITY RATE           ',5F15.5)          OUT03220
6304  FORMAT(/,'  4  DIVIDENDS PER SHARE OF     ',                 OUT03230
     &       /,'      COMMON STOCK              ',5F15.2)         OUT03240
6305  FORMAT(/,'  5  SHARES OUTSTANDING (COMMON) ',5F15.0)         OUT03250
6306  FORMAT(/,'  6  SALES                      ',5F15.0)          OUT03260
6307  FORMAT(/,'  7  FINANCING COSTS            ',5F15.2)          OUT03270
6308  FORMAT(/,'  8  EMBEDDED INTEREST RATE     ',5F15.4)          OUT03280
6309  FORMAT(/,'  9  EMBEDDED PREFERRED RATE    ',5F15.4)          OUT03290
6310  FORMAT(/,' 10  NEW COMMON STOCK ISSUES    ',5F15.2)          OUT03300
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6311  FORMAT(/,' 11  RETURN ON EQUITY              ',5F15.4)          OUT03310
6332  FORMAT(/,' 12  BETAS                         ',5F15.4)          OUT03320
6312  FORMAT(/,' 13  WEIGHTED AVER. BOOK RETURN    ',5F15.4)          OUT03330
6313  FORMAT(/,' 14  ALLOWED RETURN ON EQUITY      ',5F15.4)          OUT03340
6314  FORMAT(/,' 15  ALLOWED  BOOK RETURN          ',5F15.4)          OUT03350
6315  FORMAT(/,' 16  ALLOWED REVENUE               ',5F15.0)          OUT03360
6316  FORMAT(/,' 17  RATE BASE                     ',5F15.0)          OUT03370
6317  FORMAT(/,' 18  INTEREST COVERAGE RATIO       ',5F15.2)          OUT03380
6318  FORMAT(/,' 19  ICR EXCLUDING AFDC            ',5F15.2)          OUT03390
6319  FORMAT(/,' 20  CASH TO TOTAL EARNINGS        ',                 OUT03400
     &       /,'       RATIO                      ',5F15.4)          OUT03410
6320  FORMAT(/,' 21  GROWTH IN ELECTRICITY RATE    ',5F15.4)          OUT03420
6321  FORMAT(/,' 22  EARNINGS TO NET ASSET         ',                 OUT03430
     &       /,'       VALUE RATIO                ',5F15.4)          OUT03440
6322  FORMAT(/,' 23  EARNINGS TO NET ASSET VAL     ',                 OUT03450
     &       /,'       RATIO (EXCLUDING AFDC)     ',5F15.4)          OUT03460
6323  FORMAT(/,' 24  PREFERRED COVERAGE RATIO      ',5F15.2)          OUT03470
5324  FORMAT(/,' 25  CASH FLOW PER SHARE           ',5F15.2)          OUT03480
6325  FORMAT(/,' 26  EARNED RETURN ON EQUITY       ',5F15.4)          OUT03490
6326  FORMAT(/,' 27  PERCENT OF DEBT               ',5F15.4)          OUT03500
6327  FORMAT(/,' 28  PERCENT OF COMMON             ',5F15.4)          OUT03510
      RETURN                                                          OUT03520
      END                                                             OUT03530
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C ***************************************************************YEA00010
C *           ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM         *YEA00020
C *                                                               *YEA00030
C *      -------SUBROUTINE TO LOOP THROUGH YEARS-----------       *YEA00040
C ***************************************************************YEA00050
      SUBROUTINE YEAR(T,NYR,                                       YEA00060
     &    UPLNT,ACWIPR,APFDEP,NDEP,NNF,CA,STOCK,                   YEA00070
     &    TPRF,TDEBT,CL,ATDTXR,NI,ABDEPR,                          YEA00080
     &    ARAFDR,DVPRF,DIV,COMN,PREF,DEBT,                         YEA00090
     &    INCNWC,ACNSRR,NPUR,STPR,                                 YEA00100
     &    DIVPS,TCSTIS,FTOT,BCSTD,BCSTP,                           YEA00110
     &    CSTIS,RETEQ,WABR,ARTER,ABORRR,ALREV,                     YEA00120
     &    RTBS,ICR,EXICR,CTER,GRERAT,ENVR,EXENVR,                  YEA00130
     &    PRCR,REV,GENTX,STTX,CPTX,TINT,TCASH,XINVST,PV,XNPV,BETAS,YEA00140
     &       ADFTXR,ROE,PDBT,PCS)                                  YEA00150
      COMMON /HEADER/TITLE(17),DATE(17)                            YEA00160
      COMMON /IEXPLT/NTYPE(140),IYRCOM(140),IYRRET(140),ISERLF(140),YEA00170
     &               ITXLF(140),NOPLT                              YEA00180
      COMMON /REXPLT/CST(140),XKST(140),SALVAG(140),TITC(140),XITS(140),YEA00190
     &            BDEP(140),TDTX(140),TDITS(140),TTDEP(140),TBDEP(140),YEA00200
     &             XKXST(140),SBV(140),CTDTX(140)                  YEA00210
      COMMON /COMDAT/CWIP(140),TAFDC(140),TTAFC(140),TCITS(140),   YEA00220
     &                        TCITC(140),CWPFR(140)                 YEA00230
      COMMON /YRDATA/SALES(30),BDRTS(30),FULEX(30),TNFEX(30)       YEA00240
     &              ,OMPEX(30),OMTEX(30),EXTEX(30),PURPR(30),RATE(30)YEA00250
     &               ,FBDRT(30),XNBDRT(30),FCSTD(30),ABTXR,AATXR   YEA00260
      COMMON /IYRDAT/IYEAR(30)                                     YEA00270
      COMMON /CONVST/CONSCH(10,15)                                 YEA00280
      COMMON /BASDAT/NV0,CA0,CL0,NNF0,NWC0,DVPRF0,TPRF0,STPR0,TDEBT0,YEA00290
     &               TCOMN0,TCSTI0,ASLOS0,ACASH0,TINT0,AFLOS0,UPLNT0YEA00300
     &                ,DIVPS0,CFITC0,ACNST0,BCSTD0,XNPV0,RETEQ0,DIV0,YEA00310
     &                 NPUR0,NPUR2,STOCK0,ABOR0R,ABR0R,XNI0        YEA00320
      COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRCTD,FRCTP,FRCTS,YEA00330
     &          FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA,     YEA00340
     &          STPR1,CSTRFD,MRKP,PRETEQ,FRREQ,DIFEQ,FRADF,FRADOM, YEA00350
     &          LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,      YEA00360
     &          C1,C2,C3,C4,C5,FRLFSW,BDLIFE,CWPFRT,B5,B6          YEA00370
      COMMON /ACCUM1/ABDEP,ATBDEP,ATXDEP,ATTDEP,ADFTX,ATDTX,       YEA00380
     &           AITC,ATITC,ADITS,ATDITS,ATBDRT,ARTKST,            YEA00390
     &          ACDFTX,ACTDTX                                     YEA00400
      COMMON/IOPTS/IOPT1(140),IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7,IOPT8,YEA00410
     &             IOPT9                                          YEA00420
      COMMON /ACCUM2/ACNSTR,ACWIP,ARAFDC,ARTAFC,ACITS,ATCITS,      YEA00430
     &           ACITC,ATCITC,AKST,AKXST,AKST1,AKXST1,ARBCWP       YEA00440
      REAL NDEP,NNF,INCNWC,NPUR,NPUR0,NPUR2,ICR                    YEA00450
      INTEGER T, SERYR                                             YEA00460
      REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7,C1,C2,C3,C4      YEA00470
      REAL NV,NWC,NI,NITC,NUCFL,NDEP,INCT                          YEA00480
      REAL NNF0,NV0,NWC0,NPUR0,NPUR2                               YEA00490
C -------------------------------------------------------------------YEA00500
C     INITIALIZE FOR YEAR T = T                                    YEA00510
C -------------------------------------------------------------------YEA00520
      ACNST0 = ACNSTR                                              YEA00530
C -------------------------------------------------------------------YEA00540
C     THESE ACCOUNTS MUST BE SET TO ZERO OR LAST YEAR'S VALUES WILL BE YEA00550
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C      ACCUMULATED                                                      YEA00560
C ------------------------------------------------------------------- YEA00570
      ABDEP = 0.                                                       YEA00580
      ATBDEP = 0.                                                      YEA00590
      ATXDEP = 0.                                                      YEA00600
      ATTDEP = 0.                                                      YEA00610
      ADFTX = 0.                                                       YEA00620
      ATDTX = 0.                                                       YEA00630
      AITC = 0.                                                        YEA00640
      ATITC = 0.                                                       YEA00650
      ADITS = 0.                                                       YEA00660
      ATDITS = 0.                                                      YEA00670
      ATBDRT = 0.                                                      YEA00680
      ARTKST = 0.                                                      YEA00690
      ACNSTR = 0.                                                      YEA00700
      ACWIP = 0.                                                       YEA00710
      ARAFDC = 0.                                                      YEA00720
      ARTAFC = 0.                                                      YEA00730
      ACITS = 0.                                                       YEA00740
      ATCITS = 0.                                                      YEA00750
      ACITC = 0.                                                       YEA00760
      ATCITC = 0.                                                      YEA00770
      AKST = 0.                                                        YEA00780
      AKXST = 0.                                                       YEA00790
      AKST1 = 0.                                                       YEA00800
      AKXST1 = 0.                                                      YEA00810
      ARBCWP = 0                                                       YEA00820
      ACDFTX = 0.                                                      YEA00830
      ACTDTX = 0.                                                      YEA00840
C ------------------------------------------------------------------- YEA00850
C**   NOW LOOP THROUGH POWER PLANTS                                    YEA00860
C ------------------------------------------------------------------- YEA00870
      DO 201 J = 1,NOPLT,1                                             YEA00880
C ------------------------------------------------------------------- YEA00890
C     SUM OF YEAR DIGITS METHOD FOR TAX DEPRECIATION AND NO CWIP IN    YEA00900
C       RATE BASE IS ASSUMED BY DEFAULT                                YEA00910
C ------------------------------------------------------------------- YEA00920
      IF(IOPT1(J).EQ.0)IOPT1(J) = 1                                    YEA00930
C**   CHECK IF ALREADY COMMITTED                                       YEA00940
      SERYR = NYR - IYRCOM(J) + 1                                      YEA00950
      IF(SERYR.LT.-14)GOTO 201                                         YEA00960
C ------------------------------------------------------------------- YEA00970
C**   IF IT IS AN RETIRED PLANT, GO TO NEXT PLANT                      YEA00980
C ------------------------------------------------------------------- YEA00990
      IF(SERYR.GT.(ISERLF(J)+1))GOTO 201                               YEA01000
C ------------------------------------------------------------------- YEA01010
C**   IF THE PLANT RETIRES AT THAT YEAR, CLEAR ACCOUNTS                YEA01020
C ------------------------------------------------------------------- YEA01030
      IF(SERYR.NE.(ISERLF(J)+1))GOTO 11                                YEA01040
      TBDRT = TBDEP(J)                                                 YEA01050
      TBDEP(J) = 0                                                     YEA01060
      RTKST = XKST(J)                                                  YEA01070
      XKST(J) = 0                                                      YEA01080
      XKXST(J) = 0                                                     YEA01090
C*    ACCUMULATE RETIRED BOOK DEPRECIATION & RETIRED CAPITAL COST      YEA01100
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      ATBDRT = ATBDRT + TBDRT                                          YEA01110
      ARTKST = ARTKST + RTKST                                          YEA01120
      GOTO 201                                                         YEA01130
C -------------------------------------------------------------------YEA01140
C*    IF IS AT FIRST YEAR OF SERVICE, ACCUMULATE CAPITAL COST          YEA01150
C -------------------------------------------------------------------YEA01160
11    IF(SERYR.NE.1)GOTO 12                                            YEA01170
C                                                                      YEA01180
      CST(J) = CWIP(J)                                                 YEA01190
C*    INCLUDING AFDC:                                                  YEA01200
      XKST(J) = CWIP(J) + TAFDC(J)                                     YEA01210
C*    INCLUDING AFTER TAX AFDC                                         YEA01220
      XKXST(J) = CWIP(J) + TTAFC(J)                                    YEA01230
C*    ACCUMULATE FOR YEAR T                                            YEA01240
      AKST = AKST + XKST(J)                                            YEA01250
      AKXST = AKXST + XKXST(J)                                         YEA01260
C                                                                      YEA01270
      BDEP(J) = XKST(J)/ISERLF(J)                                      YEA01280
C*                                                                     YEA01290
      SBV(J) = XKST(J)                                                 YEA01300
C*    ESTABLISH TITC AND TITS ACCOUNTS                                 YEA01310
      TITC(J) = TCITC(J)                                               YEA01320
      TDITS(J) = TCITS(J)                                              YEA01330
C -------------------------------------------------------------------YEA01340
C**   IF IS AN EXISTING PLANT, CALL SUBROUTINE EXPLT                   YEA01350
C -------------------------------------------------------------------YEA01360
C                                                                      YEA01370
C     FIRST CHECK IF SERVICE YEAR IS SPECIFIED                         YEA01380
      IF(IYRCOM(J).EQ.0)SERYR=0                                        YEA01390
C -------------------------------------------------------------------YEA01400
C     EXPLT IS CALLED WITH ARRAY ELEMENTS APPROPRIATE TO THAT PLANT.   YEA01410
C -------------------------------------------------------------------YEA01420
12    IF(SERYR.GE.1)CALL EXPLT(T,SERYR,BDEP(J),TBDEP(J),ISERLF(J),     YEA01430
     &                   ITXLF(J),SALVAG(J),TTDEP(J),SBV(J),DFTX,     YEA01440
     &                 TDTX(J),TDITS(J),TITC(J),CST(J),IOPT1(J),      YEA01450
     &                  XKST(J),CTDTX(J))                             YEA01460
      IF(SERYR.GE.1)GOTO 201                                           YEA01470
C -------------------------------------------------------------------YEA01480
C**   IF IT IS A PLANT UNDER CONSTRUCTION, CALL SUBROUTINE COMPLT      YEA01490
C -------------------------------------------------------------------YEA01500
      IX = 15 + SERYR                                                  YEA01510
C -------------------------------------------------------------------YEA01520
C     CALCULATE CONSTR, CONSTRUCTION COST FOR A COMMITTED PLANT, FROM  YEA01530
C      EXPECTED COST OF PLANT AND CONSTRUCTION SCHEDULE SPECIFIED.     YEA01540
      CONSTR = CONSCH(NTYPE(J),IX)*CST(J)                              YEA01550
      CALL COMPLT(CONSTR,CWIP(J),TAFDC(J),TTAFC(J),TCITS(J),TCITC(J),  YEA01560
     &                 SERYR,BCSTDO,CWPFR(J))                          YEA01570
201   CONTINUE                                                         YEA01580
C -------------------------------------------------------------------YEA01590
C     NOW CONSIDER T & D INVESTMENT FOR YEAR T                         YEA01600
C -------------------------------------------------------------------YEA01610
C -------------------------------------------------------------------YEA01620
C     CALCULATE T & D EXPANSION FOR NEXT YEAR. THIS WILL BE THE T & D  YEA01630
C       CONSTRUCTION COST FOR THIS YEAR. COMPLT WILL BE CALLED WITH THISYEA01640
C       CONSTRUCTION COST.                                             YEA01650
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C     BY SETTING NOPLT = NOPLT + 1 AND                                  YEA01660
C                   J  =  NOPLT, THE NEW T & D UNIT WILL BECOME THE LASTYEA01670
C     PLANT UNIT. TOTAL NUMBER OF PLANT UNITS WILL BE INCREASED BY ONE. YEA01680
C -------------------------------------------------------------------YEA01690
      TDCNTR = (B5 + B6*(SALES(T+1)-SALES(T)))*(1+INFLR)                YEA01700
      IF(TDCNTR.EQ.0)GOTO 13                                            YEA01710
      NOPLT = NOPLT + 1                                                 YEA01720
      J = NOPLT                                                         YEA01730
      IYRCOM(J) = NYR + 1                                               YEA01740
      ISERLF(J) = 33                                                    YEA01750
      ITXLF(J)  = 24                                                    YEA01760
      IOPT1(J)  = 1                                                     YEA01770
      CALL COMPLT(TDCNTR,CWIP(J),TAFDC(J),TTAFC(J),TCITS(J),TCITC(J),   YEA01780
     &          0,BCSTD0,CWPFRT)                                        YEA01790
13    TDCST = (B5 + B6*(SALES(T)-SALES(T-1)))*(1 + INFLR)               YEA01800
C-------------------------------------------------------------------YEA01810
C     NOW CONSIDER NUCLEAR FUEL DEPRECIATION FOR YEAR T = T             YEA01820
C -------------------------------------------------------------------YEA01830
C*    IF NUCLEAR FUEL IS ELIGIBLE FOR ITC                              YEA01840
      NITC = RITC*(3*TNFEX(T) - NNF0)                                   YEA01850
      NNF = 2*TNFEX(T)                                                  YEA01860
      NDEP = TNFEX(T)                                                   YEA01870
      ACITC = ACITC + NITC                                              YEA01880
      ATXDEP = ATXDEP + NDEP                                            YEA01890
      NUCFL = 3*TNFEX(T)                                                YEA01900
      NPUR = NUCFL - NNF0                                               YEA01910
C                                                                       YEA01920
C     CALCULATE ITC FOR NUCLEAR FUEL                                    YEA01930
      NPITC = (NPUR + NPUR0 + NPUR2)*RITC/3                             YEA01940
      AITC = AITC + NPITC                                               YEA01950
C                                                                       YEA01960
C     CALCULATE TITC FOR NUCLEAR FUEL                                   YEA01970
      NPTITC = (2*NPUR + NPUR0)*RITC/3                                  YEA01980
      ATITC = ATITC + NPTITC                                            YEA01990
C -------------------------------------------------------------------YEA02000
C     CALCULATE NET VALUE OF ASSET FOR YEAR T                           YEA02010
C -------------------------------------------------------------------YEA02020
      NV = NV0 - ABDEP + NNF - NNF0 + AKST - ARTKST + ATBDRT            YEA02030
C                                                                       YEA02040
C CALCULATE UTILITY PLANT FOR BOOK KEEPING PURPOSE                      YEA02050
      UPLNT = UPLNT0 + AKST - ARTKST                                    YEA02060
C                                                                       YEA02070
C ******************************************************************YEA02080
C *      ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM                 *YEA02090
C *                                                                  *YEA02100
C *                                                                  *YEA02110
C *             -----FINANCIAL SUB-MODEL A----------                 *YEA02120
C ******************************************************************YEA02130
C -------------------------------------------------------------------YEA02140
C     ESTIMATE CURRENT ASSETS & LIABILITIES                             YEA02150
C -------------------------------------------------------------------YEA02160
C*    CHECK FOR ZERO DEMONINATOR                                        YEA02170
      IF(ACNST0.EQ.0.0.OR.ACNSTR.EQ.0.)FACT = 1.0                       YEA02180
      IF(ACNST0.EQ.0.0.OR.ACNSTR.EQ.0.)GOTO 211                         YEA02190
C*    FACT IS NOW ALWAYS SET TO ONE                                     YEA02200
```

```
      FACT = 1.                                                          YEA02210
211   CA = K1*(SALES(T)/SALES(T-1))*FACT*(1+INFLR)*CA0                   YEA02220
      CL = K2*(SALES(T)/SALES(T-1))*FACT*(1+INFLR)*CL0                   YEA02230
      NWC = CA - CL                                                      YEA02240
      INCNWC = NWC - NWC0                                                YEA02250
C -------------------------------------------------------------------   YEA02260
C     CALCULATE TOTAL AMOUNT OF CASH REQUIRED FROM CAPITAL MARKET        YEA02270
C       SUBSEQUENCE FINANCING OF DEBT, PREFERED STOCKS & COMMON EQUITY   YEA02280
C -------------------------------------------------------------------   YEA02290
      BDRTS(T) = FBDRT(T) + XNBDRT(T)                                    YEA02300
      TOTFIN = ACNSTR + NPUR + BDRTS(T) + INCNWC - ACASH0                YEA02310
      ADJST = XNIO - DVPRF0 - DIV0                                       YEA02320
      DOTFIN = ACNSTR + NPUR + INCNWC - ACASH0 + ADJST                   YEA02330
      IF(DOTFIN.LT.0)DOTFIN = 0                                          YEA02340
      DEBT = FRCTD*DOTFIN + BDRTS(T)                                     YEA02350
      PREF = FRCTP*DOTFIN                                                YEA02360
      COMN = TOTFIN - DEBT - PREF                                        YEA02370
      IF(COMN.LT.0)EXCESS = -COMN                                        YEA02380
      IF(COMN.LT.0)COMN = 0                                              YEA02390
      STOCK = STOCK0 + COMN                                              YEA02400
      FDT = FNCTD*DEBT                                                   YEA02410
      FPT = FNCTP*PREF                                                   YEA02420
      FST = FNCTS*COMN                                                   YEA02430
      FTOT = FDT + FPT + FST                                             YEA02440
C                                                                        YEA02450
C**   CALCULATE TOTAL DEBT                                               YEA02460
      TDEBT = TDEBT0 + DEBT - BDRTS(T)                                   YEA02470
C -------------------------------------------------------------------   YEA02480
C     INTEREST EXPENSE ON RETIRED DEBT                                   YEA02490
C -------------------------------------------------------------------   YEA02500
      TINRET = FBDRT(T)*FCSTD(T) + XNBDRT(T)*CSTD                        YEA02510
C                                                                        YEA02520
C -------------------------------------------------------------------   YEA02530
C     INTEREST EXPENSE FOR THE YEAR                                      YEA02540
C -------------------------------------------------------------------   YEA02550
      TINT = TINT0 + DEBT* CSTD - TINRET                                 YEA02560
C                                                                        YEA02570
C                                                                        YEA02580
C -------------------------------------------------------------------   YEA02590
C     ADD TO BOND RETIREMENT AMOUNT N YEARS LATER                        YEA02600
C -------------------------------------------------------------------   YEA02610
      N1 = T + BDLIFE                                                    YEA02620
      IF(N1.LE.NYN)XNBDRT(N1)=XNBDRT(N1)+DEBT                            YEA02630
C                                                                        YEA02640
C**   CALCULATE EMBEDDED INTEREST RATE                                   YEA02650
      BCSTD = TINT/TDEBT                                                 YEA02660
C                                                                        YEA02670
C**   CALCULATE PREFERRED STOCK DIVIDENDS                                YEA02680
      DVPRF = DVPRF0 + CSTP*PREF                                         YEA02690
C                                                                        YEA02700
C**   CALCULATE TOTAL PREFERRED STOCK                                    YEA02710
      TPRF = TPRF0 + PREF                                                YEA02720
C                                                                        YEA02730
C**   CALCULATE EMBEDDED PREFERRED INTEREST RATE                         YEA02740
      IF(TPRF.NE.0.)BCSTP = DVPRF/TPRF                                   YEA02750
```

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      IF(TPRF.EQ.0.)BCSTP = 0.                                          YEA02760
C                                                                       YEA02770
C**   CALCULATE NEW COMMON STOCK ISSUES                                 YEA02780
      CSTIS = COMN/STPRO                                                YEA02790
C                                                                       YEA02800
C**   CALCULATE TOTAL COMMON STOCK ISSUES                               YEA02810
      TCSTIS = TCSTIO + CSTIS                                           YEA02820
C                                                                       YEA02830
C                                                                       YEA02840
C ********************************************************************YEA02850
C *      ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM                 *YEA02860
C *                                                                  *YEA02870
C *       -------ACCOUNTING AND OUTPUT SECTION--------              *YEA02880
C ********************************************************************YEA02890
C ---------------------------------------------------------------------YEA02900
C*    ESTIMATE T & D O & M EXPENSE FOR YEAR T                           YEA02910
C ---------------------------------------------------------------------YEA02920
      OMTEX(T) = K3*(SALES(T)/SALES(T-1))*(1+INFLR)*OMTEX(T-1)          YEA02930
C ---------------------------------------------------------------------YEA02940
C     CALCULATE TOTAL OPERATING EXPENSE                                 YEA02950
C ---------------------------------------------------------------------YEA02960
      TOPEX = FULEX(T) + PURPR(T) + EXTEX(T) + OMTEX(T) + OMPEX(T)      YEA02970
C                                                                       YEA02980
C ---------------------------------------------------------------------YEA02990
C     CALCULATE ARTEQ FOR THIS YEAR RATE MAKING                         YEA03000
C ---------------------------------------------------------------------YEA03010
      ARTEQ = RETEQ0 - DIFEQ                                            YEA03020
      ARTER = ARTEQ                                                     YEA03030
C ---------------------------------------------------------------------YEA03040
C*   CALCULATE RATE BASE WORKING CAPITAL                                YEA03050
C ---------------------------------------------------------------------YEA03060
      OMTEX(T+1) = K3*(SALES(T+1)/SALES(T))*(1+INFLR)*OMTEX(T)          YEA03070
      TOMEX = OMTEX(T) + OMPEX(T)                                       YEA03080
      TOMEX1 = OMTEX(T+1) + OMPEX(T+1)                                  YEA03090
      RBWKC = K4*TOMEX+K5*FULEX(T)+K6*TOMEX1+K7*FULEX(T+1)              YEA03100
C**   TAX FACTOR                                                        YEA03110
      TXFCT = RVTXR + STTXR - RVTXR*STTXR + CPTXR - CPTXR*RVTXR         YEA03120
     &       - CPTXR*STTXR + CPTXR*RVTXR*STTXR                          YEA03130
C ---------------------------------------------------------------------YEA03140
C     CALCULATE RATE BASE                                               YEA03150
C ---------------------------------------------------------------------YEA03160
      RTBS = NV + RBWKC + ARBCWP + ABDEP + TNFEX(T)                     YEA03170
C ---------------------------------------------------------------------YEA03180
C     REGULATORY OPTIONS (IOPT4) :                                      YEA03190
C       I) FLOW-THROUGH                                                 YEA03200
C      II) LIBERALIZED DEPRECIATION (LD)                                YEA03210
C     III) NORMALIZED REGULATION OF INTEREST EXPENSE (IC)               YEA03220
C      IV) ITC NORMALIZATION - OPTION 1                                 YEA03230
C       V) ITC NORMALIZATION - OPTION 2                                 YEA03240
C     VI) II),III),IV) INCLUSIVE                                        YEA03250
C    VII) II),III),V) INCLUSIVE                                         YEA03260
C ---------------------------------------------------------------------YEA03270
      IF(IOPT4.EQ.2)RTBS = RTBS - ATDTX                                 YEA03280
      IF(IOPT4.EQ.3)RTBS = RTBS - ATDITS - ATCITS                       YEA03290
      IF(IOPT4.EQ.4)RTBS = RTBS - ATITC - ATCITC                        YEA03300
```

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      IF(IOPT4.EQ.5)RTBS = RTBS + ATITC + ATCITC                        YEA03310
      IF(IOPT4.EQ.6)RTBS = RTBS - ATDTX - ATDITS - ATCITS - ATITC       YEA03320
     &                   - ATCITC                                       YEA03330
      IF(IOPT4.EQ.7)RTBS = RTBS - ATDTX - ATDITS - ATCITS + ATITC       YEA03340
     &                   + ATCITC                                       YEA03350
      IF(IOPT4.LT.1.OR.IOPT4.GT.7)WRITE(6,26)IOPT4                      YEA03360
26    FORMAT('  ERROR? - IOPT4 =',I2)                                   YEA03370
C ---------------------------------------------------------------------YEA03380
C**   CALCULATE ALLOWED REVENUE                                         YEA03390
C ---------------------------------------------------------------------YEA03400
C ---------------------------------------------------------------------YEA03410
C     RATE MAKING OPTIONS(IOPT3):                                       YEA03420
C       I) NO LAG OF RATE                                               YEA03430
C      II) ONE YEAR LAG OF RATE AND A PERCENTAGE OF EXTRA FUEL EXPENSE  YEA03440
C          IS ALLOWED                                                   YEA03450
C     III) ONE YEAR LAG OF RATE AND BOTH A PERCENTAGE OF EXTRA FUEL     YEA03460
C          EXPENSE AND A RATE BASE INCLUSION ARE ALLOWED                YEA03470
C      IV) COST OF SERVICE METHOD                                       YEA03480
C          METHOD FOR MASSACHUSETTS                                     YEA03490
C ---------------------------------------------------------------------YEA03500
C*    IF A % OF EXTRA FUEL EXPENSES IS ALLOWED,                         YEA03510
      IF(IOPT3.EQ.2.OR.IOPT3.EQ.3)TOPEX = TOPEX + FRADOM*(FULEX(T+1)    YEA03520
     &          -FULEX(T) + TNFEX(T+1) - TNFEX(T))                      YEA03530
C*    IF BOTH % OF EXTRA FUEL EXPENSES AND A RATE BASE INCLUSION        YEA03540
C        ARE ALLOWED,                                                   YEA03550
      IF(IOPT3.EQ.3)RTBS = RTBS + AKST1                                 YEA03560
      IF(IOPT3.EQ.4)GOTO 134                                            YEA03570
      X1 = ABORDR*RTBS + PRTXR*NV - STTXR*PRTXR*NV                      YEA03580
     &   -CPTXR*PRTXR*NV +CPTXR*STTXR*PRTXR*NV                          YEA03590
      X2 = TOPEX -STTXR*TOPEX -CPTXR*TOPEX                              YEA03600
      X3 = CPTXR*STTXR*TOPEX +ABDEP +NDEP                               YEA03610
      X4 = FTOT -STTXR*ATXDEP -CPTXR*ATXDEP                             YEA03620
      X5 = CPTXR*STTXR*ATXDEP -STTXR*TINT -CPTXR*TINT                   YEA03630
      X6 = CPTXR*STTXR*TINT +CNTXR*ACNSTR                               YEA03640
      X7 = -STTXR*CNTXR*ACNSTR -CPTXR*CNTXR*ACNSTR -ACITC               YEA03650
      XNUMRV = X1-X2+X3+X4+X5+X6+X7                                     YEA03660
      IF(IOPT4.EQ.2)XNUMRV = XNUMRV + ADFTX                             YEA03670
      IF(IOPT4.EQ.3)XNUMRV = XNUMRV + ACITS - ADITS                     YEA03680
      IF(IOPT4.EQ.4)XNUMRV = XNUMRV + ACITC                             YEA03690
      IF(IOPT4.EQ.5)XNUMRV = XNUMRV + ACITC - AITC                      YEA03700
      IF(IOPT4.EQ.6)XNUMRV = XNUMRV + ADFTX + ACITS - ADITS + ACITC     YEA03710
      IF(IOPT4.EQ.7)XNUMRV = XNUMRV + ADFTX + ACITS - ADITS + ACITC     YEA03720
     &                        -AITC                                     YEA03730
C**   ALLOWED REVENUE:                                                  YEA03740
      ALREV = XNUMRV/(1-TXFCT)                                          YEA03750
C ---------------------------------------------------------------------YEA03760
C CALCULATE RATE FOR YEAR T ( 3 OPTIONS, PAGE 19)                       YEA03770
C ---------------------------------------------------------------------YEA03780
      IF(IOPT3.EQ.1)GOTO 101                                            YEA03790
      IF(IOPT3.EQ.2.OR.IOPT3.EQ.3)GOTO 102                              YEA03800
      WRITE(6,16)                                                       YEA03810
16    FORMAT(' ERROR IN OPTION FOR RATE SETTING - IOPT3')               YEA03820
101   RATE(T) = ALREV/SALES(T)                                          YEA03830
      IF(((RATE(T)-RATE(T-1))/RATE(T-1)).GT.LIMINC)RATE(T) =            YEA03840
     &            RATE(T-1)*(1. + LIMINC)                             YEA03850
```

```
      GOTO 103                                                          YEA03860
C -----------------------------------------------------------------------YEA03870
C     FOR IOPT3 = 2 OR 3, THERE WILL BE AN ONE YEAR LAG IN RATE         YEA03880
C -----------------------------------------------------------------------YEA03890
102   RATE(T+1) = ALREV/SALES(T)                                        YEA03900
      IF(((RATE(T+1)-RATE(T))/RATE(T)).GT.LIMINC)RATE(T+1) =            YEA03910
     &             RATE(T)*(1. + LIMINC)                                YEA03920
      GOTO 103                                                          YEA03930
C -----------------------------------------------------------------------YEA03940
C     COST OF SERVICE METHOD FOR RATE MAKING                            YEA03950
C -----------------------------------------------------------------------YEA03960
C     RATE BASE FOR RETURN CALCULATION (RTBS)                           YEA03970
134   RTBS = RTBS + AKST1 - ACTDTX - ATDITS + ATITC + ATCITC -ATCITS    YEA03980
C     TAXABLE INCOME(TXINC)                                             YEA03990
C                                                                       YEA04000
      CORT = (ACDFTX - ADFTX)/(CPTXR-CPTXR*STTXR+STTXR) - AITC          YEA04010
      TXINC = (ABOROR*RTBS-TINT+CORT-AITC)/(1-(CPTXR-CPTXR*STTXR+STTXR))YEA04020
C     ESTIMATED FEDERAL INCOME TAX(ESFITX)                              YEA04030
      ESFITX = TXINC*CPTXR*(1 - STTXR)                                  YEA04040
C     ESTIMATED STATE TAX                                               YEA04050
      ESSITX = TXINC*STTXR                                              YEA04060
C     ELECTRIC COST OF SERVICE(ELCOS):                                  YEA04070
      ELCOS = TOPEX - FULEX(T) + ABDEP + PRTXR*NV + ESSITX + ESFITX     YEA04080
     &        + (ACITS - ADITS) - AITC + ABOROR*RTBS                    YEA04090
C     ELECTRIC REVENUES:                                                YEA04100
      EREV = SALES(T)*RATE(T)                                           YEA04110
C     REVENUE DEFICIENCY:                                               YEA04120
      REVDEF = ELCOS - EREV                                             YEA04130
C     MASSACHUSETTS ALLOWED REVENUE:                                    YEA04140
      ALREV = ELCOS + FULEX(T+1) + TNFEX(T+1) + FTOT                    YEA04150
      RATE(T+1) = ALREV/SALES(T)                                        YEA04160
      IF(((RATE(T+1)-RATE(T))/RATE(T)).GT.LIMINC)RATE(T+1) =            YEA04170
     &             RATE(T)*(1. + LIMINC)                                YEA04180
C                                                                       YEA04190
C                                                                       YEA04200
103   CONTINUE                                                          YEA04210
C ***********************************************************************YEA04220
C *      ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM                   *YEA04230
C *                                                                    *YEA04240
C *                                                                    *YEA04250
C *       -------FINANCIAL SUB-MODEL B----------                       *YEA04260
C ***********************************************************************YEA04270
C                                                                       YEA04280
      IF(IOPT3.EQ.2.OR.IOPT3.EQ.3)TOPEX = TOPEX -FRADOM*(FULEX(T+1)     YEA04290
     &          -FULEX(T) + TNFEX(T+1) - TNFEX(T))                      YEA04300
      REV = SALES(T)*RATE(T)                                            YEA04310
C                                                                       YEA04320
C**   BOOK EARNING BEFORE INTEREST AND TAXES                            YEA04330
      EBIT = REV - TOPEX - ABDEP - NDEP - FTOT + ARAFDC                 YEA04340
C                                                                       YEA04350
C**   THE TAXABLE INCOME,                                               YEA04360
      INCT = REV - TOPEX - ATXDEP - TINT                                YEA04370
C                                                                       YEA04380
C**   PROPERTY TAX:                                                     YEA04390
      PRTX = PRTXR*NV                                                   YEA04400
```

```
C                                                                       YEA04410
C**   REVENUE TAX:                                                      YEA04420
      RVTX = RVTXR*REV                                                  YEA04430
C                                                                       YEA04440
C**   CONSTRUCTION TAX:                                                 YEA04450
      CNTX = CNTXR*ACNSTR                                               YEA04460
C                                                                       YEA04470
C**   GENERAL TAX:                                                      YEA04480
      GENTX = PRTX + RVTX + CNTX                                        YEA04490
C                                                                       YEA04500
C ---------------------------------------------------------------------YEA04510
C**   NOW CONSIDER THE ACCUMULATED LOSSES AVAILABLE FOR STATE INCOME    YEA04520
C       TAX DEDUCTION, ASLOS(T-1)                                       YEA04530
C ---------------------------------------------------------------------YEA04540
      SINCT = INCT - GENTX - ASLOS0                                     YEA04550
      IF(SINCT.GE.0)STTX = STTXR*SINCT                                  YEA04560
      ASLOS = 0                                                         YEA04570
      IF(SINCT.LT.0)STTX = 0                                            YEA04580
      IF(SINCT.LT.0)ASLOS = -SINCT                                      YEA04590
C ---------------------------------------------------------------------YEA04600
C*    DEFINE AFLOS(T-1) AS FOR FEDERAL INCOME TAX DEDUCTION FOR YEAR T  YEA04610
C ---------------------------------------------------------------------YEA04620
      FINCT = INCT - GENTX - STTX - AFLOS0                              YEA04630
      IF(FINCT.GE.0)GOTO 21                                             YEA04640
      AFLOS = -FINCT                                                    YEA04650
      CFITC = CFITC0 + ACITC                                            YEA04660
      CPTX = 0                                                          YEA04670
      GOTO 22                                                           YEA04680
21    XLIM = .9*CPTXR*FINCT                                             YEA04690
      IF(CFITC+ACITC.GT.XLIM)GOTO 33                                    YEA04700
      CPTX = CPTXR*FINCT - CFITC0 - ACITC                               YEA04710
      CFITC = 0                                                         YEA04720
      AFLOS = 0                                                         YEA04730
      GOTO 22                                                           YEA04740
33    CPTX = XLIM/9                                                     YEA04750
      CFITC = CFITC0 + ACITC - XLIM                                     YEA04760
      AFLOS = 0                                                         YEA04770
C                                                                       YEA04780
C**   TOTAL TAXES:                                                      YEA04790
22    TTX = GENTX + STTX + CPTX                                         YEA04800
C                                                                       YEA04810
C**   NET INCOME:                                                       YEA04820
      NI = EBIT - TTX - TINT - ADFTX - (ACITC - AITC)                   YEA04830
     &          - (ACITS - ADITS)                                      YEA04840
C                                                                       YEA04850
C**   CASH AVAILABLE FOR DIVIDENDS & RETAINED EARNINGS:                 YEA04860
      TCASH = NI - ARAFDC + ABDEP + NDEP + ADFTX + (ACITC - AITC)       YEA04870
     &          + (ACITS - ADITS) + EXCESS*(1+CSTRFD)                  YEA04880
C                                                                       YEA04890
C**   DIV(T), TOTAL DIVIDENDS PAID OUT:                                 YEA04900
      DIV = C1*EBIT + C2*NI + C3*TCASH + C4*TCSTIS*DIVPS0               YEA04910
     &         + C5*(NI - DVPRF)                                        YEA04920
C                                                                       YEA04930
C**   WHERE DIVPS IS THE DIVIDEND PER SHARE OF PREVIOUS PERIOD          YEA04940
      DIVPS = DIV/TCSTIS                                                YEA04950
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C                                                                       YEA04960
C**   CASH AVAILABLE FOR NEXT YEARS FINANCING:                          YEA04970
      ACASH = TCASH - DIV - DVPRF                                       YEA04980
C                                                                       YEA04990
C     CALCULATE TOTAL COMMON STOCK                                      YEA05000
      TCOMN = TCOMN0 + COMN + NI - DIV - DVPRF                          YEA05010
C                                                                       YEA05020
C     TOTAL CAPITAL                                                     YEA05030
      TCAP = TDEBT + TPRF + TCOMN                                       YEA05040
C                                                                       YEA05050
C                                                                       YEA05060
C     EARNED RETURN ON EQUITY                                           YEA05070
      ROE = (NI - DVPRF)/TCOMN                                          YEA05080
C                                                                       YEA05090
C     PERCENT OF DEBT                                                   YEA05100
      PDBT = TDEBT/TCAP                                                 YEA05110
C                                                                       YEA05120
C     PERCENT OF COMMON                                                 YEA05130
      PCS = TCOMN/TCAP                                                  YEA05140
C                                                                       YEA05150
C -------------------------------------------------------------------- YEA05160
C     CALCULATE RETEQ FOR NEXT YEAR IF NOT PRESPECIFIED                 YEA05170
C -------------------------------------------------------------------- YEA05180
C                                                                       YEA05190
      IF(PRETEQ.EQ.0)CALL CRETEQ(RETEQ,TCAP,TDEBT,TPRF,TCOMN,BETAS)     YEA05200
      IF(PRETEQ.NE.0)RETEQ = PRETEQ                                     YEA05210
C                                                                       YEA05220
C     WEIGHTED AVERAGE BOOK RETURN                                      YEA05230
      WABR = (TINT+DVPRF+RETEQ*TCOMN)/TCAP                              YEA05240
C                                                                       YEA05250
C -------------------------------------------------------------------- YEA05260
C     ALLOWED RATE OF RETURN ON EQUITY                                  YEA05270
C -------------------------------------------------------------------- YEA05280
      ARTEQ = RETEQ - DIFEQ                                             YEA05290
C -------------------------------------------------------------------- YEA05300
C     ALLOWED BOOK RATE OF RETURN FOR NEXT YEAR                         YEA05310
C -------------------------------------------------------------------- YEA05320
C                                                                       YEA05330
      ABORRR = ABORR                                                    YEA05340
      ABRR = (TINT+DVPRF+FRREQ*RETEQ*TCOMN)/TCAP                        YEA05350
      ABORR = (TINT+DVPRF+(RETEQ-DIFEQ)*TCOMN)/TCAP                     YEA05360
C                                                                       YEA05370
C -------------------------------------------------------------------- YEA05380
C     NET PRESENT VALUE                                                 YEA05390
C -------------------------------------------------------------------- YEA05400
C     INVESTMENT ATTRIBUTED TO SHAREHOLDERS                             YEA05410
      IF(EXCESS.GT.0)XINVST = ACASH0 - EXCESS                           YEA05420
      IF(EXCESS.LE.0)XINVST = COMN + ACASH0                             YEA05430
      IF(XINVST.LT.0)XINVST = 0                                         YEA05440
      PV = (DIV0 - COMN)/( 1 + RETEQ0)**(T-2)                           YEA05450
      XNPV = XNPV0 + PV                                                 YEA05460
C                                                                       YEA05470
C**   STOCK PRICE:                                                      YEA05480
      STPR = STPR0*(1 + RETEQ) - DIVPS                                  YEA05490
C                                                                       YEA05500
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C                                                                       YEA05510
C                                                                       YEA05520
C**   INTEREST COVERAGE RATIO                                           YEA05530
      ICR = EBIT/TINT                                                   YEA05540
C                                                                       YEA05550
C**   INTEREST COVERAGE RATIO EXCLUDING AFDC:                           YEA05560
      EXICR = (EBIT - ARAFDC)/TINT                                      YEA05570
C                                                                       YEA05580
C**   CASH TO TOTAL EARNINGS RATIO:                                     YEA05590
      CTER = TCASH/NI                                                   YEA05600
C                                                                       YEA05610
C**   GROWTH IN ELECTRICITY RATE                                        YEA05620
      GRERAT = RATE(T)/RATE(T-1)                                        YEA05630
C                                                                       YEA05640
C**   EARNING TO NET ASSET RATIO:                                       YEA05650
      ENVR = NI/NV                                                      YEA05660
C                                                                       YEA05670
C**   EARNING TO NET ASSET VALUE RATIO:                                 YEA05680
      EXENVR = (NI - ARAFDC)/NV                                         YEA05690
C                                                                       YEA05700
C**   PREFERRED COVERAGE RATIO:                                         YEA05710
      PRCR = EBIT/(TINT+DVPRF)                                          YEA05720
C                                                                       YEA05730
C     ACCUMULATED PROVISION FOR DEPRECIATION                            YEA05740
      APFDEP = ATBDEP - ATBDRT                                          YEA05750
C                                                                       YEA05760
C -------------------------------------------------------------------- YEA05770
C     CALCULATE AFDC RATES FOR NEXT YEAR'S USE                          YEA05780
C -------------------------------------------------------------------- YEA05790
      ABTXR = (BCSTD*TDEBT + BCSTP*TPRF + ARTEQ*TCOMN)/TCAP             YEA05800
      AATXR = (CPTXR*BCSTD*TDEBT + BCSTP*TPRF + ARTEQ*TCOMN)/TCAP       YEA05810
C -------------------------------------------------------------------- YEA05820
C     DUMMY VARIABLES ENDED WITH 'R' ARE USED TO AVOID NAME CONFLICTS IN YEA05830
C      COMMON BLOCK DECLARATION AND SUBROUTINE ARGUMENT LIST. THEY MUST  YEA05840
C      BE SET TO CORRESPONDING VALUES                                    YEA05850
C -------------------------------------------------------------------- YEA05860
      ACWIPR = ACWIP                                                    YEA05870
      ATDTXR = ATDTX                                                    YEA05880
      ABDEPR = ABDEP                                                    YEA05890
      ARAFDR = ARAFDC                                                   YEA05900
      ACNSRR = ACNSTR                                                   YEA05910
      ADFTXR = ADFTX                                                    YEA05920
C                                                                       YEA05930
C -------------------------------------------------------------------- YEA05940
C     RETURN CURRENT YEAR DATA TO BASDAT                                YEA05950
C -------------------------------------------------------------------- YEA05960
      NVO = NV                                                          YEA05970
      CAO = CA                                                          YEA05980
      CLO = CL                                                          YEA05990
      NNFO = NNF                                                        YEA06000
      NWCO = NWC                                                        YEA06010
      DVPRFO = DVPRF                                                    YEA06020
      TPRFO = TPRF                                                      YEA06030
      STPRO = STPR                                                      YEA06040
      TDEBTO = TDEBT                                                    YEA06050
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      TCOMNO = TCOMN                                                    YEA06060
      TCSTIO = TCSTIS                                                   YEA06070
      ASLOSO = ASLOS                                                    YEA06080
      ACASHO = ACASH                                                    YEA06090
      TINTO = TINT                                                      YEA06100
      AFLOSO = AFLOS                                                    YEA06110
      UPLNTO = UPLNT                                                    YEA06120
      DIVPSO = DIVPS                                                    YEA06130
      CFITCO = CFITC                                                    YEA06140
      BCSTDO = BCSTD                                                    YEA06150
      XNPVO = XNPV                                                      YEA06160
      RETEQO = RETEQ                                                    YEA06170
      DIVO = DIV                                                        YEA06180
      STOCKO = STOCK                                                    YEA06190
      XNIO = NI                                                         YEA06200
C                                                                       YEA06210
C     ACNSTO = ACNSTR                                                   YEA06220
      RETURN                                                            YEA06230
      END                                                               YEA06240
```

```
      SUBROUTINE EXPLT(IT,ISERYR,BDEP,TBDEP,ISERLF,ITXLF,SALVAG,TTDEP,   EXP00010
     &                 SBV,DFTX,TDTX,TDITS,TITC,CST,IOPT1,XKST,CTDTX)    EXP00020
      COMMON /ACCUM1/ABDEP,ATBDEP,ATXDEP,ATTDEP,ADFTX,ATDTX,             EXP00030
     &               AITC,ATITC,ADITS,ATDITS,ATBDRT,ARTKST,              EXP00040
     &               ACDFTX,ACTDTX                                       EXP00050
      COMMON /ACCUM2/ACNSTR,ACWIP,ARAFDC,ARTAFC,ACITS,ATCITS,            EXP00060
     &               ACITC,ATCITC,AKST,AKXST,AKST1,AKXST1                EXP00070
      COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS,      EXP00080
     &             FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAS,        EXP00090
     &             STPR1,CSTRFD,MRKP,RETEQ,FRREQ,DIFEQ,FRADF,FRADOM,     EXP00100
     &             LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,         EXP00110
     &             C1,C2,C3,C4,C5,FRLFSW,BDLIFE,CWPFRT,B5,B6             EXP00120
      REAL NDEP,NNF,INCNWC,NPUR,ICR                                      EXP00130
      REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7,C1,C2,C3,C4            EXP00140
      REAL NV,NWC,NI                                                     EXP00150
C                                                                        EXP00160
C ---------------------------------------------------------------------EXP00170
C     IF SERVICE YEAR NOT SPECIFIED BY YRCOM, CALCULATE FROM TBDEP       EXP00180
C ---------------------------------------------------------------------EXP00190
      IF(ISERYR.EQ.0)ISERYR = TBDEP/BDEP + 1                             EXP00200
C*    TOTAL BOOK DEPRECIATION:                                           EXP00210
      TBDEP = TBDEP + BDEP                                               EXP00220
C                                                                        EXP00230
C*    TAX DEPRECIATION:                                                  EXP00240
C ---------------------------------------------------------------------EXP00250
C     OPTIONS FOR TAX DEPRECIATION( IOPT1):                              EXP00260
C        I) SUM OF YEAR DIGITS METHOD                                    EXP00270
C       II) DOUBLE DECLINING METHOD                                      EXP00280
C ---------------------------------------------------------------------EXP00290
      IF(IOPT1.EQ.1)TXDEP = 2.*(ITXLF+1-ISERYR)*                         EXP00300
     &            (CST-SALVAG)/(ITXLF*(ITXLF+1))                       EXP00310
      IF(IOPT1.EQ.2)TXDEP = 2./ITXLF*(1-2./ITXLF)**                      EXP00320
     &           (ISERYR-1)*CST                                        EXP00330
C                                                                        EXP00340
C*    SWITCH TO STRAIGHT-LINE DEPRECIATION IF NEEDED                     EXP00350
      IF(ITXLF.EQ.ISERYR)GOTO 12                                         EXP00360
      IF(IOPT1.EQ.2.AND.ISERYR.GT.(ITXLF*FRLFSW))TXDEP =                 EXP00370
     &                       SBV/(ITXLF-ISERYR)                        EXP00380
12    IF(TXDEP.LT.0.)TXDEP=0.                                            EXP00390
C                                                                        EXP00400
C*    ACCUMULATE TXDEP                                                   EXP00410
      TTDEP = TTDEP + TXDEP                                              EXP00420
C                                                                        EXP00430
C*    CALCULATE START BOOK VALUE FOR NEXT YEAR                           EXP00440
      SBV = SBV - TXDEP                                                  EXP00450
      RTKST = 0.                                                         EXP00460
C                                                                        EXP00470
C     CALCULATE CORRECTED BOOK DEPRECIATION                              EXP00480
      CBDEPX = CST/XKST*BDEP                                             EXP00490
C                                                                        EXP00500
C*    CALCULATE DEFERRED TAXES:                                          EXP00510
      DFTX = (CPTXR-CPTXR*STTXR+STTXR)*(TXDEP-BDEP)                      EXP00520
C                                                                        EXP00530
C     CALCULATE CORRECTED DEFERRED TAXES                                 EXP00540
      CDFTX = (CPTXR - CPTXR*STTXR + STTXR)*(TXDEP-CBDEPX)               EXP00550
```

```
C                                                                       EXP00560
C     CALCULATE TOTAL CORRECTED DEFERRED TAXES                          EXP00570
      CTDTX = CDFTX + CTDTX                                             EXP00580
C                                                                       EXP00590
C     TOTAL DEFERRED TAXES                                              EXP00600
      TDTX = TDTX + DFTX                                                EXP00610
      IF(TDTX.LT.0.)TDTX = 0                                            EXP00620
C                                                                       EXP00630
C*    DEFERRED INTEREST SAVINGS                                         EXP00640
      DITS = TDITS/(ISERLF-ISERYR+1)                                    EXP00650
C                                                                       EXP00660
C*    TOTAL DEFERRED TAXES                                              EXP00670
      TDITS = TDITS - DITS                                              EXP00680
C                                                                       EXP00690
C*    NORMALIZATION OF INVESTMENT TAX CREDIT:                           EXP00700
      XITC = TITC/(ISERLF-ISERYR+1)                                     EXP00710
C                                                                       EXP00720
C*    TOTAL INVESTMENT TAX CREDIT                                       EXP00730
      TITC = TITC - XITC                                                EXP00740
      IF(TITC.LT.0)TITC = 0                                             EXP00750
C ----------------------------------------------------------------------EXP00760
C*    ACCUMULATE ACCOUNTS                                               EXP00770
C ----------------------------------------------------------------------EXP00780
      ABDEP = ABDEP + BDEP                                              EXP00790
      ATBDEP = ATBDEP + TBDEP                                           EXP00800
      ATXDEP = ATXDEP + TXDEP                                           EXP00810
      ATTDEP = ATTDEP + TTDEP                                           EXP00820
      ADFTX = ADFTX + DFTX                                              EXP00830
      ATDTX = ATDTX + TDTX                                              EXP00840
      ADITS = ADITS + DITS                                              EXP00850
      ATDITS = ATDITS + TDITS                                           EXP00860
      AITC = AITC + XITC                                                EXP00870
      ATITC = ATITC + TITC                                              EXP00880
      ACDFTX = ACDFTX + CDFTX                                           EXP00890
      ACTDTX = ACTDTX + CTDTX                                           EXP00900
      RETURN                                                            EXP00910
      END                                                               EXP00920
```

```
C*    SUBROUTINE COMPLT                                                    COM00010
C ***************************************************************************COM00020
C *           ELECTRIC UTILITY FINANCIAL MODELLING SYSTEM                   *COM00030
C *                                                                         *COM00040
C *      --------SUBROUTINE COMPLT-----------------                        *COM00050
C *                                SUBROUTINE FOR PLANT UNDER               *COM00060
C *                                  CONSTRUCTION   (FEB 23, 81)            *COM00070
C ***************************************************************************COM00080
      SUBROUTINE COMPLT(CONSTR,CWIP,TAFDC,TTAFC,TCITS,TCITC,ISERYR,         COM00090
     &                  BCSTXX,CWPFR)                                       COM00100
      COMMON /ACCUM1/ABDEP,ATBDEP,ATXDEP,ATTDEP,ADFTX,ATDTX,                COM00110
     &              AITC,ATITC,ADITS,ATDITS,ATBDRT,ARTKST                   COM00120
      COMMON /ACCUM2/ACNSTR,ACWIP,ARAFDC,ARTAFC,ACITS,ATCITS,               COM00130
     &              ACITC,ATCITC,AKST,AKXST,AKST1,AKXST1,ARBCWP             COM00140
      COMMON /YRDATA/SALES(30),BDRTS(30),FULEX(30),TNFEX(30),               COM00150
     &             OMPEX(30),ONTEX(30),EXTEX(30),PURPR(30),RATE(30),       COM00160
     &              FBDRT(30),XNBDRT(30),FCSTD(30),ABTXR,AATXR              COM00170
      COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRCTD,FRCTP,FRCTS,         COM00180
     &            FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAS,          COM00190
     &            STPR,CSTRFD,MRKP,RETEQ,FRREQ,DIFEQ,FRADF,FRADOM,        COM00200
     &            LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,           COM00210
     &            C1,C2,C3,C4,C5,FRLFSW,BDLIFE                            COM00220
      COMMON /IOPTS/IOPT(140),IOPT2,IOPT3,IOPT4,IOPT5,IOPT6,IOPT7,          COM00230
     &             IOPT8,IOPT9                                            COM00240
      COMMON /BASDAT/NV0,CA0,CL0,NNF0,NWC0,DVPRF0,TPRF0,STPR0,TDEBT0,       COM00250
     &            TCOMN0,TCSTI0,ASLOS0,ACASH0,TINT0,AFLOS0,UPLNT0,        COM00260
     &             DIVPS0,CFITC0,ACNST0,BCSTD0,XNPV0,RETEQ0,DIV0           COM00270
      REAL NDEP,NNF,INCNWC,NPUR,ICR                                         COM00280
      REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7,C1,C2,C3,C4               COM00290
      REAL NV,NWC,NI                                                        COM00300
      REAL NV0,NNF0,NWC0                                                    COM00310
C -------------------------------------------------------------------------COM00320
C*    FOR A PLANT UNDER CONSTRUCTION                                        COM00330
C -------------------------------------------------------------------------COM00340
C**   ADD CONSTRUCTION COST TO CONSTRUCTION WORK IN PROGRESS                COM00350
      CWIP = CWIP + CONSTR                                                  COM00360
C                                                                           COM00370
      RBCWP = CWPFR*CWIP                                                    COM00380
C                                                                           COM00390
C**   RETURN ON CWIP EXCLUDING PREVIOULY CAPITALIZED AFUDC                  COM00400
      RTEXA = ABTXR*CWIP*(1- CWPFR)                                         COM00410
C                                                                           COM00420
C**   RETURN ON PREVIOULY CAPITALIZED AFUDC                                 COM00430
C**   IF NO COMPOUNDING RTPA = 0                                            COM00440
      RTPA = ABTXR*TAFDC                                                    COM00450
      IF(IOPT6.EQ.0)RTPA = 0.                                               COM00460
      RAFDC = RTEXA + RTPA                                                  COM00470
      TAFDC = TAFDC + RAFDC                                                 COM00480
      RTTEXA = AATXR*CWIP*(1-CWPFR)                                         COM00490
      RTTPA = AATXR*TTAFC                                                   COM00500
      RTAFC = RTTEXA+RTTPA                                                  COM00510
      TTAFC = TTAFC + RTAFC                                                 COM00520
C -------------------------------------------------------------------------COM00530
C**   INTEREST TAX SAVING                                                   COM00540
C -------------------------------------------------------------------------COM00550
```

```
C     CALCULATING LAST YEAR TCAP                                        COM00560
      TCAPO = TPRFO + TCOMNO + TDEBTO                                   COM00570
      CITS = CPTXR*BCSTDO*CONSTR*(TDEBTO/TCAPO)                         COM00580
      TCITS = CITS + TCITS                                              COM00590
C**   INVESMENT TAX CREDIT                                              COM00600
      CITC = RITC*CONSTR                                                COM00610
      TCITC = CITC + TCITC                                              COM00620
C -------------------------------------------------------------------- COM00630
C*    FINALLY, AGGREGATE ACCOUNTS FOR ALL PLANTS FOR THE ENTIRE YEAR    COM00640
C -------------------------------------------------------------------- COM00650
      ACNSTR = ACNSTR + CONSTR                                          COM00660
      ACWIP = ACWIP + CWIP                                              COM00670
      ARAFDC = ARAFDC + RAFDC                                           COM00680
      ARTAFC = ARTAFC + RTAFC                                           COM00690
      ACITS = ACITS + CITS                                              COM00700
      ATCITS = ATCITS + TCITS                                           COM00710
      ACITC = ACITC + CITC                                              COM00720
      ATCITC = ATCITC + TCITC                                           COM00730
      ARBCWP = ARBCWP + RBCWP                                           COM00740
C -------------------------------------------------------------------- COM00750
C     IF AT LAST YEAR OF CONSTRUCTION, CALCULATE KST FOR NEXT YEAR      COM00760
C -------------------------------------------------------------------- COM00770
      IF(ISERYR.EQ.0)AKST1=AKST1 + CWIP + TAFDC                         COM00780
      IF(ISERYR.EQ.0)AKXST1 = AKXST1 + CWIP + TTAFC                     COM00790
      RETURN                                                            COM00800
      END                                                               COM00810
```

```
C******SUBROUTINE TO CALCULATE RETEQ FOR EACH YEAR                    CRE00010
       SUBROUTINE CRETEQ(RETEQ,TCAP,TDEBT,TPRF,TCOMN,BETAS)          CRE00020
       COMMON /PARA/CPTXR,PRTXR,CNTXR,RVTXR,STTXR,FRTCD,FRCTP,FRCTS, CRE00030
      &             FNCTD,FNCTP,FNCTS,CSTD,CSTP,BETAD,BETAP,BETAA,  CRE00040
      &             STPR,CSTRFD,MRKP,PRETEQ,FRREQ,DIFEQ,FRADF,FRADOM,CRE00050
      &             LIMINC,INFLR,PRCWP,RITC,K1,K2,K3,K4,K5,K6,K7,    CRE00060
      &             C1,C2,C3,C4,FRLFSW,BDLIFE                        CRE00070
       REAL MRKP,LIMINC,INFLR,K1,K2,K3,K4,K5,K6,K7                   CRE00080
       BETAS = (BETAA*TCAP - BETAD*TDEBT - BETAP*TPRF)/TCOMN         CRE00090
       RETEQ = CSTRFD + BETAS*MRKP                                   CRE00100
       RETURN                                                        CRE00110
       END                                                           CRE00120
```

```
C -------------------------------------------------------------------OUT00010
C     BY SETTING IOPT8 = 1, OUTPUT WILL NOT BE CALLED AND OUTPV WILL BE OUT00020
C      THE ONLY SUBROUTINE CALLED TO PRINT OUT SEVERAL ITEMS OF RESULT  OUT00030
C -------------------------------------------------------------------OUT00040
      SUBROUTINE OUTPV(K,NCOUNT,DIV,COMN)                               OUT00050
      REAL DIV(5),COMN(5)                                               OUT00060
      COMMON /PVDAT/XINVST(5),PV(5),XNPV(5),BETAA(5)                    OUT00070
      COMMON /HEADER/TITLE(17),DATE(17)                                 OUT00080
      COMMON /IYRDAT/IYEAR(20)                                          OUT00090
      J = 5*NCOUNT + 2                                                  OUT00100
      K1 = 5*NCOUNT + K + 1                                             OUT00110
      WRITE(6,7001)TITLE                                                OUT00120
      WRITE(6,7001)DATE                                                 OUT00130
7001  FORMAT(17A4)                                                      OUT00140
      WRITE(6,7002)(IYEAR(I),I=J,K1)                                    OUT00150
7002  FORMAT(/,34X,5(6X,I4,5X))                                         OUT00160
      WRITE(6,7101)(XINVST(I),I=1,K)                                    OUT00170
      WRITE(6,7105)(COMN(I),I=1,K)                                      OUT00180
      WRITE(6,7102)(PV(I),I=1,K)                                        OUT00190
      WRITE(6,7103)(XNPV(I),I=1,K)                                      OUT00200
      WRITE(6,7104)(DIV(I),I=1,K)                                       OUT00210
7101  FORMAT(/,'   INVESTMENT ATTRIBUTED TO          ',                OUT00220
     &       /,'      SHAREHOLDERS                  ',5F15.0)          OUT00230
7105  FORMAT(/,'   COMMON STOCK (COMN)              ',5F15.2)          OUT00240
7102  FORMAT(/,'   PRESENT VALUE OF NET CASH FLOW   ',5F15.0)          OUT00250
7103  FORMAT(/,'   ACCUMULATED PRESENT VALUES       ',5F15.0)          OUT00260
7104  FORMAT(/,'   COMMON DIVIDENDS                 ',5F15.0)          OUT00270
      RETURN                                                            OUT00280
      END                                                               OUT00290
```

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