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ACFAC—A Cash Flow Analysis Code for Estimating Product Price from an Industrial Operation

J. G. Delene

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DEPARTMENT OF ENERGY

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J. G. Delene

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ABSTRACT

A computer code is presented which uses a discounted cash flow methodology to obtain an average product price for an industrial process. The general discounted cash flow method is discussed. Special code options include multiple treatments of interest during construction and other preoperational costs, investment tax credits, and different methods for tax depreciation of capital assets. Two options for allocating the cost of plant decommissioning are available.

The FORTRAN code listing and the computer output for a sample problem are included.

1. INTRODUCTION

The computer program ACFAC* was originally written to calculate weighted-average (or levelized) nuclear fuel fabrication and reprocessing unit costs. These costs, in units of dollars per kilogram of heavy metal, were to be used in a comparative economic analysis of alternative nuclear fuel systems. An example of the use of this code to estimate the fabrication cost of low-enriched uranium fuel for pressurized-water reactors is given in Ref. 1.

The ACFAC code uses discounted cash flow techniques to obtain a levelized average cost of product in dollars per unit of product. The discounted cash flow approach is widely used by industry to evaluate alternative investments. The method is used here to obtain a constant unit price such that the revenue received from the sale of product throughout the life of the project (e.g., fuel fabrication plant) will pay all expenses, taxes, and return on outstanding capital investment and will pay back the investment by the end of the plant life. ACFAC

*ACFAC — A Cash Flow Analysis Code.

is useful for obtaining consistent sets of unit costs for use in comparative analyses or for comparing alternative methods of producing a similar product.

The ACFAC program produces a single, constant, levelized unit cost. In reality, the unit cost may not be constant over the plant life. However, the present worth of the income produced by this unit cost is equal to that produced by the incomes obtained by the actual string of unequal unit costs. Also, note that the unit cost calculated by ACFAC is not market price; market price results from market action and will not necessarily be the same as the cost estimate.

In addition to the single unit cost, a breakdown of this cost by cost component is given. A period-by-period cash flow table is also given in the output.

The ACFAC code has considerable flexibility in its treatment of capital investments, construction money, tax depreciation methods, expenses, and capital structure. Provisions are made for preoperational costs, investment tax credits, federal and state income taxes, property taxes and insurance, interim equipment replacement, materials costs, and tax loss carry forward.

Interest on construction money may be capitalized or expensed. There may be multiple groupings of capital investments, with each having its own construction schedule and in-service date. The plant's on-line capacity factor and the operating costs may vary with time. The code user can input the desired corporate financial structure and desired or expected returns on equity and debt capital.

The ACFAC code is similar to the PRP code,² which was developed independently by Royes Salmon and used in the Department of Energy's coal programs. The two computer codes have features in common but are different in several ways; thus, a user of ACFAC should be aware of PRP and vice versa. For example, ACFAC will not estimate the rate of return for a set product price, but PRP is not as flexible in its treatments of capital investments. ACFAC has been used to calculate the example problem in the PRP report. The result is within 0.2% of that obtained with the PRP code. The difference results because ACFAC treats property tax as a deductible expense for state income tax purposes; it is not deducted in PRP.

A FORTRAN listing of ACFAC is given as Appendix B to this report. ACFAC, programmed in FORTRAN IV, is designed to run on IBM 360 series computers. The program uses 120 K bytes of core during execution, and the running time for a typical case is about 0.4 s.

2. METHODOLOGY

2.1 Discounted Cash Flow Method

The objective of the calculations performed by this code is to obtain an average unit product price such that the revenue received from the sale of a product throughout the life of the project will pay all expenses, taxes, and return on outstanding investment and will pay off the investment by the end of the project life. The method used to estimate the product price is a form of the discounted cash flow method.

Simply stated, in the discounted cash flow method, the sum of all cash payments and receipts discounted at the average cost of money to some common point in time (usually the beginning of the project) is equal to zero, or

$$\sum_n \frac{(\text{cash flow})_n}{(1 + d)^n} = 0 . \quad (1)$$

(See Appendix A for a description of nomenclature.)

The cash flow consists of the difference between the money received for the sale of product (I_n) and all payments for capital investment (Z_n) and operating expenses (O_n). Another way of stating this equation is that the discounted cash receipts equal the discounted cash payments, or

$$\sum_n \frac{I_n}{(1 + d)^n} = \sum_n \frac{Z_n + O_n}{(1 + d)^n} . \quad (2)$$

The revenue (or income) is equal to the price times the production rate, or

$$I_n = S_n(P_n) . \quad (3)$$

If the product price P is constant, then

$$P = \frac{\sum_n \frac{Z_n + O_n}{(1+d)^n}}{\sum_n \frac{S_n}{(1+d)^n}} \quad (4)$$

The average cost of money or discount rate d is the weighted-average cost of debt and equity capital based on the capital structure of the enterprise; thus,

$$d = F_b i_b + F_e i_e \quad (5)$$

Use of this method assumes that the cost of money does not vary over the life of the project and that capital is retired or paid back in proportion to the original capitalization.

If the product price is to reflect all costs of production, all expenses must be included, including income taxes.

Income taxes complicate the direct computation of product price using Eq. (4). Income taxes depend on earnings, which, in turn, depend on the difference between income $[P(S_n)]$ and the deductible expenses during a tax period. These taxes are not easily estimated. Vondy³ and others⁴ have shown that an analytic equation exists which yields identical results to the standard cash flow equation but removes the direct calculation of income taxes from the expression. This equation is

$$P = \frac{\left(\frac{1}{1-r}\right) \sum_n \frac{Z_n}{(1+X)^n} + \sum_n \frac{O'_n}{(1+X)^n} + \left(\frac{r}{1-r}\right) \sum_n \frac{D_n^T}{(1+X)^n}}{\sum_n \frac{S_n}{(1+X)^n}} \quad (6)$$

In this expression, O'_n is the operating costs excluding income taxes, r is the income tax rate, D_n^T is the tax-deductible depreciation during period n , and X is the tax-adjusted discount rate. This discount rate embodies the fact that interest on debt is deductible for income tax

purposes; that is,

$$X = (1 - r) F_{b1b} + F_{e1e} . \quad (7)$$

The product price calculated using Eq. (6) will satisfy the requirements stated in the first paragraph of this section and produce a unit price identical with that obtained from Eq. (4) in most cases. There is an implicit assumption in this method that tax losses (negative income taxes) are used to offset other corporate income taxes and are not carried forward or lost altogether.

In the computer code, the product price is obtained by an iterative solution. The first estimate of the price is obtained by applying Eq. (6). In the case where there are no tax losses, this price will stand as the final result. If tax losses are carried forward, the cash flow table will show a capital balance at the end of project life. The product price is adjusted, and the period-by-period computation is repeated until a negligible balance remains at end of life.

In a final summary table in the computer output, the product price is broken down as to source. A cost is calculated for each cost component m as

$$P_m = \frac{\sum_n \frac{C_{m,n}}{(1 + d)^n}}{\sum_{ii} \frac{S_n}{(1 + d)^n}} . \quad (8)$$

Here C_m is an individual cost component such as capital investment, income taxes, or materials costs.

In the accounting procedures used in ACFAC, capital investments may be made either at the beginning or end of the accounting period (year). Income from sales and the expenses are assumed to be paid at the end of the accounting period.

2.2 Special Considerations

The following is a discussion of code features and treatment of various items and options.

2.2.1 Capital expenditures

Up to ten separate depreciable capital investments or capital investment groups may be made. Individual capital items may have different construction cash payment schedules, depreciation lifetimes, and investment tax credit treatments. A capital item can be put into operation at any time during the facility life so that replacement of large blocks of equipment may be simulated. The actual lifetime of the facility or equipment might differ from the tax life.

The cost of money used during construction either may be expensed as the expenditure occurs or capitalized. The money used for construction can be from the capital structure (and cost of debt and equity) of the operation or in the form of a construction loan. In the latter case, the interest rate is specified as input.

2.2.2 Preoperational costs

These are costs such as manpower training and expenses that occur prior to actual production. The costs are specified for each year prior to operation and will be capitalized or expensed, depending on whether construction money is capitalized or expensed.

2.2.3 Tax depreciation

The cost of capital assets cannot be expensed for tax purposes when payment is made but must be depreciated over some period of time. This period need not be the same as the actual life of the item. Depreciation may be taken on the initial cost of the item less its salvage value. In the following discussion, this net value is referred to as V . The code contains provision for four methods of computing the depreciation allowance for income tax purposes. These deductions are computed for each capital item and then summed to obtain the total deduction during a period n .

- Pro rata depreciation with sales — The total product sales over the plant lifetime is estimated, and depreciation is taken in proportion to the sales in each period.

$$D_n^T = \frac{S_n}{\sum_n S_n} (V) . \quad (9)$$

- Straight-line depreciation — Depreciation in any year is equal to the reciprocal of the tax life of the asset.

$$D_n^T = \frac{V}{N_T} . \quad (10)$$

- Sum-of-year's-digits method — The annual depreciation rate is defined as a fraction, the numerator of which is the remaining years of life; the denominator is the "sum of the year's digits." For a nine-year tax life, the first year's deduction is

$$D_1^T = \frac{9V}{1 + 2 + 3 + \dots + 9} = \frac{9V}{45} ;$$

the second year's deduction is

$$D_2^T = \frac{8V}{45} ;$$

the ninth year's deduction is

$$D_9^T = \frac{V}{45} .$$

- Double-declining balance followed by straight-line depreciation — In the double-declining-balance method, the remaining undepriciated balance is depreciated at a rate double the original straight-line depreciation rate. For the nine-year tax life example,

$$D_1^T = \frac{2}{9} V = 0.222 V ;$$

the undepriciated balance is equal to 0.778 V; thus,

$$D_2^T = (0.222)(0.778)V = 0.1728 V ,$$

etc.

The Internal Revenue Service allows the change from the declining-balance method to the straight-line method. When this change is made, the unrecovered cost is spread over the remaining life at the time of change. In our example, the straight-line method produces greater depreciation than the double-declining-balance method in the sixth year.

$$D_6^T = 0.0633 V \text{ (double-declining-balance method).}$$

$$D_6^T = 0.0712 V \text{ (straight-line method).}$$

The ACFAC program will switch to straight-line depreciation in the sixth year in this example.

2.2.4 Investment tax credits

Currently, industry is allowed to deduct a portion of their capital investment cost directly from their federal income taxes. This credit is not applicable to all investments. The computer program allows the user to specify both the fraction of the capital investment on which the credit is applicable and the tax credit rate for each capital item. If the interest during construction and the preoperational costs are expensed, the direct investments are used to compute the tax credit. If these costs are capitalized, the credit is based on the capitalized costs.

For tax liabilities greater than \$25,000, the 1979 federal tax law⁵ allows the investment tax credit to offset up to a maximum of 60% of tax liability in a given year. Unused credits may be carried forward. The program user can specify this fraction (which may be other than 60%); the \$25,000 minimum is ignored. This maximum tax offset fraction is applied only if the project is a stand-alone venture and not part of a larger corporation with additional tax liabilities.

2.2.5 Income taxes

Both federal and state income taxes are considered. State taxes are deductible for federal tax purposes but not vice versa. Credits for negative state income taxes are not allowed in ACFAC, and there is no tax carry forward for state income taxes. The federal law allows for both carry forward and carry back on income taxes and investment credits.

These unused tax credits and tax losses can be carried forward a maximum number of years specified by the code user. Tax loss carry back is not available in ACFAC.

2.2.6 Decommissioning expense

The cost of decommissioning the facility may be provided for in two ways in this code. With the first method, a lump-sum payment at the end of the facility life is specified. The product price is increased by that amount, which will produce a final capital balance equal to the specified decommissioning cost.

In the second decommissioning option, a set percentage of sales income is set aside in a trust fund, and the accumulated amount with interest is available for decommissioning at the end of the facility life.

2.2.7 Working capital

In addition to the capital investment in plant and equipment, money needed for the day-to-day operation of the plant must be considered. This capital is referred to as working capital and is not tax deductible because it is assumed to be recovered at the end of plant life. The program user specifies this investment to be paid in at the beginning of the first year of operation and withdrawn at the end of project life.

2.2.8 Property taxes and insurance

The code user may specify property tax and insurance rates and the capital base on which they apply. These tax and insurance payments are made during each year of plant operation and are not diminished by depreciation.

2.2.9 Interim equipment replacement

In addition to the major equipment purchases (which are treated as capital investments), the year-to-year upkeep and spare parts requirements of production equipment must be included. The program user specifies the capital base for equipment replacement and the fraction replaced in each year. This cost is expensed as incurred.

2.2.10 Operating costs

The program user specifies a full production rate operating cost. This cost is divided into fixed and variable portions. The fixed portion remains the same regardless of the plant operating rate (capacity factor). The variable operating cost is proportional to capacity factor in any given year. In addition to this operating cost, the user may specify up to six sets of year-by-year costs.

3. INPUT INSTRUCTIONS

This section contains a card-by-card description and explanation of the input data required by the ACFAC program.

Card 1. (Format = 20A4). A title card containing general alphanumeric information.

Card 2. (Format = 20A4). A second general alphanumeric information card.

Card 3. (Format = 20A4). A third general alphanumeric information card.

Card 4. (Format = 13I5). Control information.

NLIFE: Number of years plant is to be in operation.

NCAP: Number of capital cost items to be read in as input. Maximum number = 10.

NDTYP: Tax depreciation option to be used.

0 = capital investment written off pro rata with unit sales;

1 = straight-line depreciation;

2 = sum-of-year's-digits depreciation;

3 = double-declining-balance depreciation method followed by straight-line depreciation when it produces the maximum allowable depreciation.

IDCC: 0 = Money used during construction obtained from same sources as during operation. Preoperational costs and interest paid on debt are expensed as they occur.

1 = Capitalize all construction costs including interest and preoperation costs. Cost of construction loan given as input (see AINC on card 6).

2 = Same as 1, only interest rate on construction money is equal to the average cost of money during operation.

-1 = Money used during construction obtained from construction loan. Interest rate = AINC (see card 6). Expense interest and preoperation costs as they occur.

-2 = Same as -1 except interest and preoperation costs are accumulated and expensed at start-up for tax purposes.

INIT: Preoperation period included in cash flow analysis (years).

This number must be equal to or greater than the initial construction and design period.

IEND: Postoperation period included in cash analysis (years).

ITC: 0 = investment tax credit not included.

1 = investment tax credits are to be included in the cash flow analysis.

NTAX: 0 = Tax losses cannot be written off against other undefined earnings.

1 = Negative federal income tax allowed; tax losses can be written off against other earnings. (If NTAX = 0, tax losses are carried forward to a maximum of NCRY or NITCF years.)

NDEC: Decommissioning expense option.

0 = Decommissioning not considered.

1 = A lump-sum payment at end of plant life is specified.

2 = Decommissioning money is accumulated in a trust fund.

Payments into fund, as a percentage of sales and interest rate on the funds, are to be specified on card 7.

NCRY: Number of years a tax loss may be carried forward.

NITCF: Number of years an investment tax credit can be carried forward if it is not used when available.

IOUT: 0 = Cash flow printout for final iteration only.

1 = Cash flow printout for every iteration.

NPAY: 0 = Capital investment payments at beginning of year.

1 = Capital investment payments at end of year.

Card 5. (Format = 8E10.3). Economic factors.

EINT: Return on equity investment (fraction per year).

BINT: Interest rate on borrowed money (fraction per year).

BFRAC: Fraction of capitalization from debt.

FTRAT: Federal income tax rate (fraction per year).

STRAT: State income tax rate (fraction per year).

TREF: Year's dollars in which costs are specified.

FITR: Maximum fraction of income tax liability which investment tax credit can offset in a given year.

CONV: Convergence criteria, convergence tolerance for cash flow analysis (millions of dollars).

Card 6. (Format 7E10.3).

WORK: Working capital ($\$10^6$). This quantity of money is paid in at the beginning of the first year of operation and withdrawn at the end of the operation life.

AINC: Interest rate during construction (fraction). This rate is used during construction period if IDCC on card 4 = 1, -1, or -2.

CPRT: Property tax rate (fraction per year).

CINS: Property insurance rate (fraction per year).

YRCST: Interim equipment replacement rate (fraction per year).

CRPL: Original equipment cost to which YRCST applies ($\$10^6$).

CAPV: Capital base for insurance and property tax purposes ($\$10^6$).

Card 7. (Format 7E10.3).

PWU: Full production rate (units per year).

TO: Year production is to begin.

CSTM: Annual cost of materials at full production ($\$10^6$ /year).

CSTO: Annual operating cost (excluding materials) at full production ($\$10^6$ /year).

AOPER: Fraction of operating cost that is independent of production rate.

BOPER: Fraction of operating cost that is proportional to annual production.

DECOM: If NDEC = 1 (card 4), lump-sum decommissioning cost at end of plant life ($\$10^6$).
If NDEC = 2 (card 4), payment rate into decommissioning annuity (fraction of total sales income).

ANINT: Interest rate paid on decommissioning annuity (fraction per year).

Card 8. (Format 8E10.3). There are NLIFE + 1 of these cards, which contain information on the plant capacity factor and additional cash payments not covered by the balance of the input. Each card contains the following:

RELT: Time relative to beginning of plant operation. Begin numbering at 0.0 and end at NLIFE on NLIFE + 1 card.

PWF: Plant capacity factor during preceding period ending at RELT.

OTH CST: Maximum of six of these items. Cost expended at time RELT ($\$10^6$).

Cards 9 and 10 are taken as a set. There is one set of these cards for each of NCAP (see card 4) capital cost items. A maximum of ten capital cost items is allowed.

Card 9. (Format 4I5, 4E10.2).

NONL: Year (relative to plant start-up) that capital cost item is put on line.

LDEP: Depreciation lifetime (years).

NYSL: Actual life of capital item (years).

NBLD: Construction period, years prior to year item is put in service.

VCAP: Capital cost, excluding interest during construction ($\$10^6$).

VSAL: Salvage value at end of life ($\$10^6$).

FITC: Fraction of capital cost applicable for investment tax credit ($\$10^6$).

RITC: Investment tax credit rate (fraction).

Card 10. (Format 8E10.3). Cash payment schedule for capital items during construction (BLDS). There are NBLD (see card 9) entries on this card (or series of cards). The first field contains the fraction of the total capital cost (VCAP) paid during the first year of construction. Subsequent fields contain cost fraction for subsequent years. The total of all fields = 1.0.

Repeat cards 9 and 10 for each of NCAP capital cost items.

Card 11. (Format 8E10.3). Preoperational cost payment schedule (PROP) ($\$10^6$ /period). There are INIT (see card 4) entries on this card (or series of cards). Payments in each period are entered in subsequent fields beginning with the first year of the preoperational period and ending with the year before start-up. If the preoperational costs are capitalized, the computer code will include and depreciate these costs with the first capital item from card 10.

Card 12. (Format I5). Option to stack cases.

NCLUE: 0 = Last case in series.

1 = Another case follows.

4. EXAMPLE PROBLEM

The example problem is to estimate the cost of manufacturing low-enriched uranium fuel for a pressurized-water reactor. The ground rules used for this problem are similar to but not exactly the same as those used to calculate product price in Ref. 1. The hypothetical fuel fabrication plant has an annual throughput of 520,000 kg/year of fuel heavy metal content at full operating capacity.

The input data for the problem are shown in Fig. 1. The operation is assumed to be a stand-alone venture; therefore, negative income taxes are not allowed. The corporate capitalization is 65% equity and 35% debt. The cost of bonded debt is 8.3%, and the needed return on equity capital is 14%.

Of the operating costs, 10% are fixed and 90% are variable; 1% of sales income is set aside each year for decommissioning the plant and is accumulated at 8% interest.

There are different cash payment schedules for the buildings (facility) and for the initial equipment. These cash payments are assumed to be made at the beginning of the year. The equipment is assumed to be replaced en masse during the eleventh year of operation. This is in addition to a 1% interim replacement rate. The plant capacity is 33% the first year, 67% the second year, and full (100%) capacity thereafter. The interest during construction and preoperational costs were capitalized; construction money interest is 10.5%.

An investment tax credit rate of 10% is used. Half of the facility and all of the equipment are applicable for the credit in this example problem. The output from the example problem is given in Appendix C. Input data are listed in the first four pages of output, along with explanatory notes. A list of period-by-period expenses is given on the fifth page of output. The capacity factor is that applicable during the operating year given. Expenses are those charged at the time point. For example, there is a 0.33 capacity factor during the first year of operation, and the material cost of \$7.6 million is expensed as if it occurred at the end of year one (time point = 1.0). Also given on this page are discount rates and total production and total discounted production.

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SAMPLE PROBLEM FOR ACFAC REPORT									
PMR FUEL FABRICATION PLANT									
SYD DEPRECIATION WITH INVESTMENT TAX CREDITS									
21	3	2	1	8	1	1	0	2	5
0.14	0.083	0.35	0.46	0.04	1978.	0.5			
9.112	0.105	0.025	0.005	0.01	34.2	66.2			
520000.	1990.	23.041	13.383	0.1	0.9	0.01	0.08		
0.0	0.0	5.0	2.0						
1.0	0.33	3.0	1.0						
2.0	0.67	1.0	0.0						
3.0	1.0	0.0							
4.0	1.0								
5.0	1.0								
6.0	1.0								
7.0	1.0								
8.0	1.0								
9.0	1.0								
10.0	1.0								
11.0	1.0								
12.0	1.0								
13.0	1.0								
14.0	1.0								
15.0	1.0								
16.0	1.0								
17.0	1.0								
18.0	1.0								
19.0	1.0								
20.0	1.0								
21.0	1.0								
0	20	21	8	32.0	0.0	0.5	0.10		
0.045	0.072	0.115	0.172	0.208	0.162	0.144	0.082		
0	10	10	6	34.2	0.0	1.0	0.10		
0.025	0.065	0.182	0.442	0.271	0.015				
11	10	10	1	34.2	0.0	1.0	0.10		
1.0									
0.0	0.0	0.669	1.338	2.677	4.015	5.353	5.353		
0									

Fig. 1. Sample problem input data.

The sixth page of output contains the cash flows for capital investment and the tax deductions for depreciation purposes. Time here is the actual year (assuming 1990 start-up) as given in the input data (T0 on card 7). The year given is again the time point for cash flow. In the example problem, capital investments are assumed to be paid in at the beginning of the time period (NPAY on card 4); thus, the \$1.44 million capital investment made during 1982 is treated as a cash flow occurring at 1982.0. If the option to pay for capital investments at the end of the period had been selected, the \$1.44 million would have been treated as a cash flow occurring at 1983.0 and would have shown up on the 1983 line in this table.

Taxes are assumed to be paid at the end of the period in which the taxable income is generated. The tax depreciation is an expense for tax calculation purposes and is used to reduce taxes, which, in turn, are treated as a cash flow at the end of the period. For example in the sample problem, the deduction for depreciation during the first year of operation (beginning 1990) is \$15.58 million and is applied at the end of the year so that it shows up as a credit at time 1991.0.

The next page of output is a summary table of cash flow from the final code iteration. Time does not represent time points in this table but the year in which the transactions occur. Therefore, the direct capital investment should be thought of as occurring at the start of the year, and income, expenses, taxes, and return on and of capital should be thought of as occurring at the end of the year in question. Because negative taxes were not allowed in the example problem, multiple iterations occurred to arrive at the cash flow on this summary table. If a cash flow printout is desired for each iteration, set IOU = 1 on input card 4.

This cash flow summary table shows that the income from sales at a product price of \$130.71/kg pays the required return each year on start-of-year (outstanding) capital and reduces the outstanding capital to zero at the end of project life.

A breakdown of the product price by cost component is contained on the final page of output. This cost breakdown was obtained by applying Eq. (8) (discussed earlier in this report). In the example, the preoperation cost component is set equal to zero because this cost is capitalized

and included with capital recovery. If the money used during construction were not capitalized (IDCC negative on card 4), the interest paid during construction would have been included under preoperation costs in this breakdown.

The final value of the fund to decommission the plant is also shown on this page. The value of \$31.2 million is about one-half of the initial facility plus equipment cost.

REFERENCES

1. R. R. Judkins and A. R. Olsen, *Estimation of Costs for Fabrication of Pressurized-Water Reactor Fuel*, ORNL/TM-6501 (January 1979).
2. Royes Salmon, *PRP — A Discounted Cash Flow Program for Calculating the Production Cost (Product Price) of the Product from a Process Plant*, ORNL-5251 (March 1977).
3. M. W. Rosenthal et al., *A Comparative Evaluation of Advanced Converters*, ORNL-3686 (January 1965), pp. 243-48.
4. *Guide for Economic Evaluation of Nuclear Reactor Plant Designs*, NUS-531 (January 1969), Appendix E.
5. Department of the Treasury, Internal Revenue Service, *Tax Guide for Small Business*, 1979 Edition, Publication 334 (revised November 1978), p. 143.

Appendix A

NOMENCLATURE

$C_{m,n}$	Cash flow associated with cost component m during time period n
D_n^T	Tax-deductible depreciation during period n
d	Discount rate based on weighted-average cost of money
F_b	Fraction of capitalization from debt
F_e	Fraction of capitalization from equity
I_n	Income during period n
i_b	Interest rate on debt
i_e	Return on equity
m	Index associated with a cost item
N_T	Tax lifetime
n	Index associated with time period
O_n	Total operating costs during period n
O_n'	Total operating costs (excluding income taxes) during period n
P	Levelized average price of product
P_m	Levelized average price produced by cost component m
P_n	Price charged for product during period n
r	Effective income tax rate
S_n	Sales of product during period n
V	Net depreciable cost (cost — salvage)
X	Tax-adjusted discount rate
Z_n	Investment in depreciable capital in period n

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Appendix B
FORTRAN LISTING

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C      CASH FLOW ANALYSIS CODE TO OBTAIN PRODUCT PRICE
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /COM1/ TITLE(20), EXPL(20), TCASE(20)
      COMMON /COM2/ RELT(150), OTHCST(150,6), TOTR(150), FITC(10), RITC(10)
      COMMON /COM3/ VALCT(150), CRF(150), TIME(150)
      COMMON /COM4/ CONV
      COMMON /COM5/ TAXL, TOTAL, ACOM, VALAN, DECOM, PVP,
1      STRAT, TFACT, WORK, ADPRE, DISCAP, DISWK
      COMMON /COM6/ EINT, BFRAC, EINT, STAX, PTRAT, ANINT, AINC, TO, FITR
      COMMON /COM7/ NLIFE, NLOAD, IEND, NTAX, IDCC, NDEC, IIC
      COMMON /COM8/ NCRY, NITCF, IOUT
      COMMON /TAX1/ NONL(10), LDEP(10), NCAP, NCALC, NDTYP, INIT
      COMMON /TAX2/ TXCAP(10), PFW(150), TCAP, PWRP, PWRD, PRAT, DEPR(150)
      COMMON /ZEROS/ ELDS(10,15), CAPI(10,150), CAPT(150), CAPA(150),
2      ITDC(150), PREOP(150), VALMAT(150), VALOPR(150), VALPTX(150),
3      VALINS(150), VALRPL(150), VALPOP(150), VITC(150), DIS(150),
4      FD(150), FDPL(150), VALOTR(150), XMAT(150), OPER(150),
5      PWF(150), PRTAX(150), PRINS(150), REPL(150)
      COMMON /ZERO2/ DISCT, DIOPR, DISOPR, DIRMAT, DISMAT,
6      DIRINS, DISINS, DIRPTX, DISPTX, DIRRPL, DISRPL, DIRPOP, DISPOP,
7      DISDPR, XITC, PWRPV, PWROR, DIOTR, DISOTR,
8      DRSMAT, DR SOPR, DR SPTX, DR SINS, DR SRPL, DR SOTR
      DIMENSION NBLD(10), NYSL(10), XIDC(10,150), VCAP(10), VSAL(10)

C      READ IN 3 CARDS FOR CASE DESCRIPTION
C
C
3      READ(5,100) TITLE
      READ(5,100) EXPL
      READ(5,100) TCASE
      WRITE(6,105) TITLE
      WRITE(6,100) EXPL, TCASE

C      READ GENERAL INPUT DATA
C
C
      READ(5,102) NLIFE, NCAP, NDTYP, IDCC, INIT, IEND, IIC, NTAX, NDEC
1      , NCRY, NITCF, IOUT, NPAY
      NLOAD = NLIFE + 1
      START = INIT
      NCALC = NLIFE + 1 + INIT + IEND
      PWRD = 0.0
      READ(5,101) EINT, BINT, BFRAC, PTRAT, STRAT, TREF, FITR, CONV
      READ(5,101) WORK, AINC, CPRT, CINS, YRCST, CRPL, CAPV
      READ(5,101) PWU, TO, CSTM, CSTO, AOPER, BOPER, DECOM, ANINT
      WRITE(6,103)
      WRITE(6,111) NLIFE, NCAP, NDTYP, IDCC, IEND,
2      IEND, IIC, NTAX, NDEC, NCRY, NITCF, IOUT, NPAY
      WRITE(6,112) EINT, BINT, BFRAC, PTRAT, STRAT, TREF, FITR, CONV
      WRITE(6,113) WCRK, AINC, CPRT, CINS, YRCST, CRPL, CAPV, PWU, TO,
3      , CSTM, CSTO, AOPER, BOPER
      PWU = PWU*1.E-6

C      DECOMMISSIONING EXPENSE OPTION NDEC
C
C
      IF(NDEC-1) 6,7,8
7      WRITE(6,115) DECOM
      GO TO 6
8      WRITE(6,117) DECOM, ANINT
6      CONTINUE

C      ZERO VARIABLES IN SUBROUTINE ZERO
C
C
      CALL ZERO
C

```



```

C      READ RELATIVE TIME, CAPACITY FACTOR, AND MISC. COST DATA
C      PWF---PLANT FACTOR DURING TIME PERIOD ENDING AT RELT
C      RELT--TIME RELATIVE TO STARTUP, YEARS
C
C      WRITE (6,125)
C      DO 31 I = 1,NLOAD
C      READ(5,101) (RELT(I), PWF(I), (OTHCST(I,J),J=1,6))
C      WRITE(6,108) (RELT(I), PWF(I), (OTHCST(I,J),J=1,6))
C      IF (I.EQ.1) GO TO 35
C
C      CALCULATE YEARLY COST FOR MATERIAL, OPERATION, PROPERTY TAX,
C      PROPERTY INSURANCE, AND REPLACEMENT BASED ON PREVIOUS INPUT DATA
C
C      XMAT(I) = CSTM*PWF(I)
C      OPER(I) = (AOPER + BOPER*PWF(I))*CSTO
C      PRTAX(I) = CAPV*CPRT
C      PRINS(I) = CAPV*CINS
C      REPL(I) = YRCSI*PWF(I)*CRPL
35  CONTINUE
C      TOTR(I) = 0.0
C      DO 34 J = 1,6
C      TOTR(I) = TOTR(I) + OTHCST(I,J)
34  CONTINUE
31  CONTINUE
C
C      READ CAPITAL COST DATA
C
C      TCAP = 0.0
C      TSAL = 0.0
C      WRITE (6,119)
C      DO 19 I = 1,NCAP
C      READ(5,126) NONL(I), LDEP(I), NYSL(I), NBLD(I), VCAP(I), VSAL(I),
C      1 FITC(I), RITC(I)
C      WRITE(6,120) (I, NONL(I), LDEP(I), NYSL(I), NBLD(I), VCAP(I), VSAL(I),
C      1 FITC(I), RITC(I))
C      LMIT = NBLD(I)
C      READ(5,101) (BLDS(I,J),J=1,LMIT)
C
C      NONL---YEAR CAPITAL ITEM PUT ON LINE, RELATIVE TO STARTUP
C      LDEP---DEPRECIATION LIFETIME, YEARS
C      NYSL---ACTUAL LIFE OF CAPITAL ITEM, YEARS
C      NBLD---CONSTRUCTION PERIOD, YEARS PRIOR TO USE
C      VCAP---CAPITAL COST, MILLION $
C      VSAL---SALVAGE VALUE, MILLION $
C      FITC---FRACTION OF CAPITAL COST APPLICABLE FOR INVESTMENT
C      TAX CREDIT, MILLION $
C      RITC---INVESTMENT TAX CREDIT RATE
C      BLDS---PAYMENT SCHEDULE DURING CONSTRUCTION
C      PROP---PRE-OPERATION COST SCHEDULE
C
C      DO 23 J = 1,LMIT
C      M = NONL(I) - LMIT + INIT + J + NPAY
C      CAPI(I,M) = VCAP(I)*BLDS(I,J)
C      CAPT(M) = CAPT(M) + CAPI(I,M)
C      CAPA(M) = CAPT(M)
23  CONTINUE
C      TXCAP(I) = VCAP(I) - VSAL(I)
C      M = 1 + INIT + NONL(I) + NYSL(I)
C      CAPT(M) = CAPT(M) - VSAL(I)
C      CAPA(M) = CAPT(M)
C      TSAL = TSAL + VSAL(I)
C      TCAP = TCAP + VCAP(I)
C      TCAP = TCAP - TSAL

```

```

19 CONTINUE
  WRITE(6,124)
  WRITE(6,121)
  DO 20 I = 1,NCAP
    LMIT = NBLD(I)
    WRITE(6,122) (I, (BLDS(I,J), J=1,LMIT))

```

```

20 CONTINUE
  WRITE(6,123)
  READ(5,101) (PREOP(J), J = 1,INIT)
  WRITE(6,130) (PREOP(J), J=1,INIT)

```

C
C
C

TAX FRACTION AND DISCOUNT RATES

```

TFACT = (1. - FTRAT)*(1. - STRAT)
DISC = BFRAC*TFACT*BINT + (1. - BFRAC)*EINT
TFACT = 1. - TFACT
DRR = BFRAC*BINT + (1. - BFRAC)*EINT
IF(IDCC.LE.0) GO TO 2

```

C
C
C
C

CAPITALIZE INTEREST DURING CONSTRUCTION AND PRE-OP EXPENSES
IF IDCC.GE.1

CINT = DRR

C
C
C
C
C

IF IDCC.EQ.1, CONSTRUCTION PERIOD INTEREST RATE IS GIVEN AS
INPUT (AINC). IF, IDCC.GE.2, THEN CONSTRUCTION PERIOD INTEREST
RATE IS EQUAL TO THE AVERAGE COST OF MONEY(DRR).

```

IF(IDCC.EQ.1) CINT = AINC
DO 43 M = 1,NCALC
  CAPA(M) = 0.0

```

```

43 CONTINUE
  DO 41 I = 1,NCAP
    VCAP(I) = 0.0
    LMIT = NBLD(I) + 1
    DO 42 J = 1,LMIT
      M = NONL(I) - NBLD(I) + INIT + J
      XIDC(I,M) = VCAP(I)*CINT
      VCAP(I) = VCAP(I) + XIDC(I,M) + CAPI(I,M)
      TIDC(M) = TIDC(M) + XIDC(I,M)
      IF(J.LT.LMIT) GO TO 42
      IF(NPAY.EQ.1) VCAP(I) = VCAP(I) + CAPI(J,M+1)
      CAPA(M) = VCAP(I) + CAPA(M)

```

```

42 CONTINUE
  TXCAP(I) = VCAP(I) - VSAL(I)
  M = 1 + INIT + NONL(I) + NYSL(I)
  CAPA(M) = CAPA(M) - VSAL(I)

```

```

41 CONTINUE
  PRE = 0.0
  LMIT = INIT + 1
  DO 44 J = 1,LMIT
    PIDC = PRE*CINT
    PRE = PRE + PIDC + PREOP(J)
    TIDC(J) = TIDC(J) + PIDC
    IF(J.EQ.LMIT) CAPA(J) = PRE + CAPA(J)

```

```

44 CONTINUE

```

C
C
C
C

PRE-OPERATIONAL COSTS ARE INCLUDED WITH FACILITY COSTS (I=1)
FOR CAPITALIZATION PURPOSES

TXCAP(1) = TXCAP(1) + PRE

```

2 CONTINUE
  WRITE(6,109)

```

```

WRITE(6,108) (RELT(I), PWF(I), XMAT(I),
1 OPER(I), PRTAX(I), PRINS(I), REPL(I), TOTR(I), I=1,NLOAD)
IF(IIC.NE.1) GO TO 4

```

INVESTMENT TAX CREDIT CALCULATION

```

DO 5 I = 1,NCAF
CRF(I) =VCAP(I)* FITC(I)*RITC(I)
MM = NONL(I) + INIT + 2
VITC(MM) = VITC(MM) + CRF(I)
5 CONTINUE
4 CONTINUE
WRITE(6,110) DISC, DRR

```

FIND YEAR AND RELATIVE OPERATING CAPACITY FOR EACH PERIOD

```

PFW(1) = 0.0
PFW(NCALC + 1) = 0.0
TIME(1) = T0 = START
DO 33 I = 2,NCALC
PFW(I) = 0.0
TIME(I) = TIME(I-1) + 1.0
DO 32 J = 1,NLCAD
TCK = RELT(J) + T0
IF(TCK.LT.TIME(I)) GO TO 32
PFW(I) = PWF(J)
GO TO 33
32 CONTINUE
33 CONTINUE

```

DISCOUNT FACTORS FOR EACH INTERVAL

```

DISF = 1./(1. + DISC)
DISRF = 1./(1. + DRR)
DPRE = 1./(1. + AINC)
AJPRE = AINC*(1. - TFACT)
DJPRE = 1./(1. + AJPRE)
PVF = 1./(1. - TFACT)
PWRP = PWF
DO 10 I = 1,NCALC
IF(IDCC.GE.0.OR.TIME(I).GE.T0) GO TO 11
DIS(I) = DJPRE**(TIME(I) - T0)
PD(I) = DPRE**(TIME(I) - T0)
GO TO 12
11 CONTINUE
DIS(I) = DISF**(TIME(I) - T0)
PD(I) = DISRF**(TIME(I) - T0)
12 CONTINUE
PWRI = PWRP*PFW(I)
PWRD = PWRD + PWRI
PWRPV = PWRPV + PWRI*DIS(I)
PWROR = PWROR + PWRI*PD(I)
10 CONTINUE

```

PRINT OUT DIRECT AND DISCOUNTED TOTAL PRODUCTION

```

WRITE(6,107) PWRD,PWRPV, PWROR

```

CALL SUBROUTINE TO CALCULATE ANNUAL TAX DEPRECIATION

```

CALL TXDEPR

```

PRINT OUT DIRECT CAPITAL INVESTMENT CASH FLOW AND TAX DEPRECIATION

```

C      WRITE(6,127)
      DO 28 I = 1,NCALC
      WRITE(6,128) (TIME(I), (CAPI(J,I), J=1,8), CAPT(I), DEPR(I))
28 CONTINUE

C      SUBROUTINE 'SOLVE' CALCULATES UNIT PRODUCT PRICE USING
C      THE THEORETICAL SOLUTION
C
C      CALL SOLVE

C      SUBROUTINE 'CASH' LAYS OUT THE YEAR BY YEAR CASH FLOW AND
C      RECALCULATES PRODUCT PRICE IF AN ITERATIVE SOLUTION IS REQUIRED
C
C      CALL CASH

C      PRINT OUT ITEMIZED UNIT COST
C
C      WRITE(6,105) TITLE
C      WRITE(6,100) TCASE
C      WRITE(6,100) EXPL
C      WRITE(6,104) DISCAP,DRSMAT,DRSOPR,DRSPTX,DRSINS,DRSRPL,DRSOTR,
1 ADPRE, DISWK, TAXL
C      IF(NDEC.NE.0) WRITE(6,116) ACOM
C      WRITE(6,114) TOTAL
C      IF(NDEC.EQ.2) WRITE(6,118) VALAN
C      READ(5,102) NCLUE

C      STACK CASES IF NCLUE.GE.1
C
C      IF(NCLUE.GE.1) GO TO 3
C      WRITE(6,129)
100 FORMAT(20A4)
101 FORMAT(8E10.3)
102 FORMAT(16I5)
103 FORMAT(1H0,'CARD 4, GENERAL INPUT INFORMATION, (0 = NO, 1 = YES)'
1,/,/)
104 FORMAT(1H0,/,/,15X,' PRICE BREAKDOWN BY COST COMPONENT',/,/,
A 11X,' LEVELIZED COSTS, DOLLARS/UNIT',/,/,
1' CAPITAL RECOVERY ',F8.2,/,/, ' MATERIAL ',F8.2,/,/,
2' OPERATING ',F8.2,/,/, ' PROPERTY TAX ',F8.2,/,/,
3' PROPERTY INSURANCE ',F8.2,/,/, ' REPLACEMENT ',F8.2,/,/,
4' OTHER OPERATING ',F8.2,/,/, ' PRE-OPERATION ',F8.2,/,/,
5' WORKING CAPITAL ',F8.2,/,/, ' INCOME TAX ',F8.2)
105 FORMAT(1H1,20A4)
107 FORMAT(1H0,'LIFETIME PRODUCTION, MILLIONS OF UNITS',15X,F12.4,/,/,
1' DISCOUNTED LIFETIME PRODUCTION',/,/,10X,'AT TAX ADJUSTED DISCOUNT
2 RATE',14X,F12.4,/,/,10X,'AT DISCOUNTED CASH FLOW RATE OF RETURN',5
3X,F12.4)
108 FORMAT(F7.2,7F12.2)
109 FORMAT(1H1,' SCHEDULE OF EXPENSES, MILLIONS OF DOLLARS',/,/,
1 ' YEAR CAPACITY MATERIAL OPERATION PROP. TAX PROP.
2INS REPLACEMENT OTHER EXPENSES')
110 FORMAT(1H0,'TAX ADJUSTED DISCOUNT RATE ',31X,F8.5,/,/, ' DISCOUNTED
1 CASH FLOW RATE OF RETURN',23X,F8.5)
111 FORMAT(' NUMBER OF OPERATION YEARS',31X,I5,/,/,
1' NUMBER OF CAPITAL ITEMS TO BE READ ',I5,/,/,
2' TAX DEPRECIATION OPTION ',I5,/,/,
3' INTEREST DURING CONSTRUCTION OPTION ',I5,/,/,
4' PRE-OPERATION PERIOD INCLUDED IN CASH ANALYSIS, YEARS ',I5,/,/,
5' POST-OPERATION PERIOD INCLUDED IN CASH ANALYSIS, YEARS ',I5,/,/,
6' IS INVESTMENT TAX CREDIT TO BE CONSIDERED? ',I5,/,/,
7' CAN TAX LOSSES BE WRITTEN OFF AGAINST OTHER EARNINGS? ',I5,/,/,
8' DECOMMISSION EXPENSE OPTION TO BE USED ',I5,/,/,
9' NUMBER OF YEARS TAX LOSS MAY BE CARRIED FORWARD ',I5,/,/,

```

```

A' NUMBER OF YEARS INVESTMENT CREDIT MAY BE CARRIED FORWARD',I5,///,
B' CASH FLOW PRINTOUT FOR EACH ITERATION',I5,///,
C' CAPITAL INVESTMENT PAYMENT OPTION',I5)
112 FORMAT(1H1,' INPUT INFORMATION ON CARD 5',///,
1' RETURN ON EQUITY INVESTMENT, FRACTION',F10.3,///,
2' INTEREST RATE ON CAPITALIZED DEBT, FRACTION',F10.3,///,
3' FRACTION OF CAPITALIZATION FROM DEBT',F10.3,///,
4' FEDERAL INCOME TAX RATE, FRACTION',F10.3,///,
5' STATE INCOME TAX RATE, FRACTION',F10.3,///,
6' COSTS ARE IN DOLLARS OF THIS YEAR',F10.3,///,
7' MAXIMUM FRACTION OF TAXES WHICH TAX CREDIT CAN OFFSET',F10.3,///,
8' CASH FLOW CONVERGENCE TOLERANCE, MILLION $',F10.3)
113 FORMAT(1H0,' INPUT INFORMATION ON CARDS 6 AND 7',///,
1' WORKING CAPITAL, MILLION $',F10.3,///,
2' INTEREST DURING CONSTRUCTION',F10.3,///,
3' PROPERTY TAX RATE',F10.3,///,
4' INSURANCE RATE',F10.3,///,
5' INTERIM REPLACEMENT RATE',F10.3,///,
6' CAPITAL VALUE FOR INTERIM REPL. PURPOSES, MILLION $',F10.3,///,
7' CAPITAL BASE FOR INS. AND PROP. TAX, MILLION $',F10.3,///,
8' FULL PRODUCTION RATE, UNITS/YEAR',F10.0,///,
9' YEAR PRODUCTION IS TO BEGIN',F10.0,///,
A' MATERIAL COST AT FULL PRODUCTION, MILLION $/YEAR',F10.3,///,
B' OPERATION COST AT FULL PRODUCTION, MILLION $/YEAR',F10.3,///,
C' FIXED COST FRACTION OF OPERATION COST',F10.3,///,
D' OPERATING COST FRACTION PROPORTIONAL TO PRODUCTION',F10.3,/)
114 FORMAT(20X,'-----',///,' TOTAL',14X,F8.2)
115 FORMAT(' LUMP SUM DECOMMISSIONING COST, MILLION $',14X,F10.3)
116 FORMAT(1H0,' DECOMMISSIONING',F8.2)
117 FORMAT(' DECOMMISSIONING EXPENSE AS FRACTION OF SALES',10X,F9.3,///,
1' INTEREST PAID ON DECOMMISSIONING EXPENSE ANNUITY',F9.3)
118 FORMAT(1H0,' FINAL VALUE OF ANNUITY TO DECOMMISSION PLANT = ',
1 F9.3,' MILLION DOLLARS')
119 FORMAT(1H1,'CARD 9, CAPITAL COST DATA',///,' INFORMATION FOR [NCAP|
1CAPITAL ITEMS',///,' ITEM NONL LDEP NYSL NBLD VCAP VSAL
2 FITC RITC',/)
120 FORMAT(5I5,4F10.3)
121 FORMAT(1H0,'CARD 10, CAPITAL PAYMENT SCHEDULE DURING CONSTRUCTION
1, FRACTION OF TOTAL',///,' ITEM CONSTRUCTION PAYMENT IN EACH YE
2AR OF CONSTRUCTION PERIOD[NBLD]',/)
122 FORMAT(14,12F9.3)
123 FORMAT(1H0,'CARD 11, PRE-OPERATION EXPENSE SCHEDULE',///,
1' MILLIONS OF DOLLARS PAYED IN EACH OF [INIT| YEARS PRIOR TO OPERA
2TION')
124 FORMAT(1H0,6X,'NONL---YEAR, RELATIVE TO STARTUP, THAT CAPITAL ITEM
1 COMES ON LINE',///,7X,'LDEP---DEPRECIATION PERIOD, YEARS',///,7X,
2'NYSL---LIFE OF CAPITAL ITEM, YEARS',///,7X,'NBLD---CONSTRUCTION PE
3RIOD, YEARS',///,7X,'VCAP---COST OF CAPITAL ITEM, MILLION $',///,7X,
4'VSAL---SALVAGE VALUE AT END OF LIFE, MILLION $',///,7X,'FITC---CAP
5ITAL COST APPLICABLE FOR INVESTMENT TAX CREDIT, MILLION $',///,7X,
6'RITC---INVESTMENT TAX CREDIT RATE, FRACTION')
125 FORMAT(1H1,'CARD 8, CAPACITY FACTORS AND MISCELLANEOUS EXPENSES'
1,///,' YEAR CAPACITY',26X,' OTHER COST ITEMS')
126 FORMAT(4I5,4E10.2)
127 FORMAT(1H1,' CAPITAL INVESTMENT CASH FLOW, MILLION $',///,' TIM
1E',28X,' MAXIMUM OF EIGHT CAPITAL ITEMS',28X,' TOTAL TAX DEPR')
128 FORMAT(11F10.2)
129 FORMAT(1H1,'END OF JOB')
130 FORMAT(12F9.3)
STOP
END

```

```

SUBROUTINE SOLVE
IMPLICIT REAL*8(A-H,O-Z)
SUBROUTINE SOLVE CALCULATES THE UNIT COSTS USING THE
THEORETICAL SOLUTION
COMMON/COM2/RELT(150),OTHGST(150,6),TOTR(150),PITC(10),RITC(10)
COMMON/COM3/VALCT(150),CRF(150),TIME(150)
COMMON/COM5/TAXL,TOTAL,ACOM,VALAN,DECOM,PVF,
1 STRAT,TFACT,WORK,ADPRE,DISCAP,DISWK
COMMON/COM7/NLIFE,NLOAD,IEND,NTAX,IDCC,NDEC,IIC
COMMON/TAX1/NONL(10),LDEP(10),NCAP,NCALC,NDTYP,INIT
COMMON/TAX2/VCAP(10),PFW(150),TCAP,PWRP,PWRD,PRAT,DEPR(150)
COMMON/ZEROS/FLDS(10,15),CAPI(10,150),CAPT(150),CAPA(150),
1TIDC(150),PREOP(150),VALMAT(150),VALOPR(150),VALPTX(150),
2 VALINS(150),VALRPL(150),VALPOP(150),VITC(150),DIS(150),
3 PD(150),PDFL(150),VALOTR(150),XMAT(150),OPER(150),
4 PWF(150),PRTAX(150),PRINS(150),REPL(150)
COMMON/ZERO2/DISCT,DIROPR,DISOPR,DIRMAT,DISMAT,
1DIRINS,DISINS,DIRPTX,DISPTX,DIRRPL,DISRPL,DIRPOP,DISPOP,
2 DISDPR,XITC,PWRPV,PWROR,DIROTR,DISOTR,
3 DRSMAT,DRSOPR,DRSPTX,DRSINS,DRSRPL,DRSOTR
DO 11 I = 1,NLCAD

      ADJUST INDEXING

      J = I + INIT
      VALMAT(J) = XMAT(I)
      VALOPR(J) = OPER(I)
      VALINS(J) = PRINS(I)
      VALPTX(J) = PRTAX(I)
      VALRPL(J) = REPL(I)
      VALOTR(J) = TOTR(I)

      IF IDCC.GE.1, THE INTEREST DURING CONSTRUCTION IS CAPITALIZED
      IF IDCC.LE.0, PREOPERATIONAL COSTS ARE EXPENSED

      IF (IDCC.GE.1) GO TO 11
      VALPOP(I+1) = PREOP(I)
11 CONTINUE
      TWORK = WORK

      ACCUMULATE DIRECT AND DISCOUNTED COSTS THROUGH STATEMENT 36

      DO 15 I = 1,NCALC
      VALCT(I) = CAPT(I)
      IF (IDCC.GE.1) VALCT(I) = CAPA(I)
      DISDPR = DISDPR + DEPR(I)*DIS(I)
      DIRMAT = DIRMAT + VALMAT(I)
      DIROPR = DIROPR + VALOPR(I)
      DIRPTX = DIRPTX + VALPTX(I)
      DIRINS = DIRINS + VALINS(I)
      DIRRPL = DIRRPL + VALRPL(I)
      DIRPOP = DIRPOP + VALPOP(I)
      DIROTR = DIROTR + VALOTR(I)
      DISOTR = DISOTR + VALOTR(I)*DIS(I)
      DISCT = DISCT + VALCT(I)*DIS(I)
      DISMAT = DISMAT + VALMAT(I)*DIS(I)
      DISOPR = DISOPR + VALOPR(I)*DIS(I)
      DISPTX = DISPTX + VALPTX(I)*DIS(I)
      DISINS = DISINS + VALINS(I)*DIS(I)
      DISRPL = DISRPL + VALRPL(I)*DIS(I)
      DISPOP = DISPOP + VALPOP(I)*DIS(I)
      XITC = XITC + VITC(I)*DIS(I)

```

C
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C

ACCUMULATE OPERATING COSTS DISCOUNTED AT AVERAGE COST OF MONEY

```

DRSMAT = DRSMAT + VALMAT(I)*PD(I)
DRSOPR = DRSOPR + VALOPR(I)*PD(I)
DRSPTX = DRSPTX + VALPTX(I)*PD(I)
DRSINS = DRSINS + VALINS(I)*PD(I)
DRSRPL = DRSRPL + VALRPL(I)*PD(I)
DRSOTR = DRSOTR + VALOTR(I)*PD(I)
15 CONTINUE
NEND = NCALC - IEND
TWORK = TWORK - WORK*DIS(NEND)
DIRDCM = 0.0
DISDCM = 0.0
IF(NDEC.NE.1) GO TO 36
DISDCM = DECOM*DIS(NEND)/PWRPV
DIRDCM = DECOM/PWRD
36 CONTINUE

```

C
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C

NEXT CALCULATE AVERAGE DIRECT COSTS PER UNIT OF PRODUCTION

```

DIRMAT = DIRMAT/PWRD
DIROPR = DIROPR/PWRD
DIRPTX = DIRPTX/PWRD
DIRINS = DIRINS/PWRD
DIRRPL = DIRRPL/PWRD
DIRPOP = DIRPOP/PWRD
DIROTR = DIROTR/PWRD

```

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NEXT CALCULATE RATIOS OF TOTAL DISCOUNTED COSTS TO DISCOUNTED PRODUCTION, ALL USING THE TAX ADJUSTED DISCOUNT RATE

```

DISCT = DISCT/PWRPV
DISMAT = DISMAT/PWRPV
DISOPR = DISOPR/PWRPV
DISPTX = DISPTX/PWRPV
DISINS = DISINS/PWRPV
DISRPL = DISRPL/PWRPV
DISPOP = DISPOP/PWRPV
DISOTR = DISOTR/PWRPV
XITC = XITC/(PWRPV*(1. - TFACT))
TWORK = TWORK/PWRPV
DISDPR = (TFACT/(1.-TFACT))*DISDPR/PWRPV

```

C
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C

NEXT CALCULATE DISCOUNTED AVERAGE OF OPERATING COST COMPONENTS

```

DRSMAT = DRSMAT/PWROR
DRSOPR = DRSOPR/PWROR
DRSPTX = DRSPTX/PWROR
DRSINS = DRSINS/PWROR
DRSRPL = DRSRPL/PWROR
DRSOTR = DRSOTR/PWROR

```

C
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C

SOLVE FOR UNIT PRODUCT PRICE 'TOTAL' BASED ON THEORETICAL FORMULATION

```

TDIR = DIRMAT + DIROPR + DIRPTX + DIRINS + DIRRPL + DIRPOP
1 + DIROTR + DIRDCM
DISEXP = DISMAT + DISOPR + DISPTX + DISINS + DISRPL + DISPOP
1 + DISOTR + DISDCM
TOTAL = PVF*(DISCT + TWORK) + DISEXP - DISDPR
IF(IIC.NE.1) GO TO 18

```

C

C ADJUST FOR INVESTMENT TAX CREDIT

C

TOTAL = TOTAL - XITC
18 CONTINUE
TDIR = TDIR - DIRDCH
IF(NDEC.NE.2) GO TO 38

C

C

C

ADJUST FOR DECOMMISSIONING EXPENSE IF IT IS A % OF SALES

TOTAL = TOTAL/(1. - DECOM)
38 CONTINUE
RETURN
END

SUBROUTINE CASH
IMPLICIT REAL*8(A-H,O-Z)

C

C

C

C

THIS SUBROUTINE LAYS OUT THE YEAR BY YEAR CASH FLOW AND
RECALCULATES THE UNIT COST IF AN ITERATIVE SOLUTION IS NEEDED

COMMON /COM1/ TITLE(20), EXPL(20), TCASE(20)
COMMON /COM3/ VALCT(150), CRF(150), TIME(150)
COMMON/COM4/ CCNV
COMMON /COM5/ TAXL, TOTAL, ACOM, VALAN, DECOM, PVP,
1 STRAT, TFACT, WORK, ADPRE, DISCAP, DISWK
COMMON /COM6/ EINT, BFRAC, EINT, STAX, FTRAT, ANINT, AINC, TO, FITR
COMMON /COM7/ NLIFE, NLOAD, IEND, NTAX, IDCC, NDEC, IIC
COMMON /COM8/ NCRY, NITCF, IOUT
COMMON /TAX1/ NONL(10), LDEP(10), NCAP, NCALC, NDTYP, INIT
COMMON /TAX2/ VCAP(10), PFW(150), TCAP, PWRP, PWRD, PRAT, DEPR(150)
COMMON/ZEROS/ ELDS(10,15), CAPI(10,150), CAPT(150), CAPA(150),
1TIDC(150), PRECP(150), VALMAT(150), VALOPR(150), VALPTX(150),
2 VALINS(150), VALRPL(150), VALPOP(150), VITC(150), DIS(150),
3 PD(150), FDPL(150), VALOTR(150), XMAT(150), OPER(150),
4 PWF(150), PRTAX(150), PRINS(150), REPL(150)
COMMON/ZERO2/ DISCT, DIROPR, DISOPR, DIRMAT, DISMAT,
1DIRINS, DISINS, DIRPTX, DISPTX, DIRRPL, DISRPL, DIRPOP, DISPOP,
2 DISDPR, XITC, PWRPV, PWROR, DIROTR, DISOTR,
3 DRSMAT, DR SOPR, DRSPTX, DRSINS, DRSRPL, DRSOTR
DIMENSION ATAX(150), AITC(150)
NSTR = 1 + INIT
NRPAY = NLIFE + 1 + INIT
NLAST = NLIFE + INIT

C

C

C

MAXIMUM OF 20 ITERATIONS ALLOWED ON PRODUCT PRICE

1 CONTINUE
DO 25 L = 1,20

C

C

INITIALIZATION


```

C
SPRE = 0.0
ACIDC = 0.0
BCAP = 0.0
ACAP = 0.0
AWRK = 0.0
AOPR = 0.0
WCAP = 0.0
DTAX = 0.0
ECAP = 0.0
ACOM = 0.0
VALAN = 0.0
ADPRE = 0.0
PWRs = TOTAL*PWRf
DO 18 I = 1, NCALC
  ATAX(I) = 0.0
  ALT(I) = VITC(I)
18 CONTINUE
  IF(IOUT.EQ.0) GO TO 19
  WRITE(6,105) TITLE
  WRITE(6,115) TCTAL
  WRITE(6,111) WCRK
  WRITE(6,112)
19 CONTINUE

C
C
C      SET UP CASH FLOW FOR EACH OF NCALC TIME PERIODS
C
DO 17 I = 1, NCALC
  CDEC = 0.0

C
C
C      SUBSCRIPT = (I) FOR START OF INTERVAL PAYMENTS
C      SUBSCRIPT = (N) FOR END OF INTERVAL PAYMENTS
C
N = I + 1

C
C
C      ADJUST CAPITAL INVESTMENT TO ACCOUNT FOR WORKING CAPITAL CHANGES
C
CORK = 0.0
IF(I.EQ.WSTR) CORK = WORK
IF(I.EQ.NRPAY) CORK = - WORK
IF(I.EQ.NLAST.AND.NDEC.EQ.1) CDEC = DECOM
CAPINV = CAPT(I) + CORK
CCAP = VALCT(I)
VALCAP = VALCT(I) + CORK
WCAP = WCAP + CAPA(I) + CORK

C
C
C      PWSAL---INCOME FROM SALES
C
PWSAL = PFW(N)*PWRs
IF(NDEC.NE.2.OR.I.GE.NRPAY) GO TO 7

C
C
C      DECOMMISSIONING EXPENSE ACCUMULATED IN AN ANNUITY IF NDEC = 2
C
CDEC = PWSAL*DECOM
VALAN = VALAN*ANINT + CDEC + VALAN
7 CONTINUE

C
C
C      EXPN---OPERATING EXPENSES
C      BOND---INTEREST ON DEBT
C      PRAN---TAXABLE INCOME
C      STAX---STATE INCOME TAX
C      FTAX---FEDERAL INCOME TAX
C      REQ---INCOME TO EQUITY
C      TAX---TOTAL INCOME TAX

```

```

C      EXPN = VALMAT(N) + VALOPR(N) + VALINS(N) +
1 VALPTX(N) + VALRPL(N) + VALOTR(N) + CDEC
  REQ = WCAP*EINT*(1. - BFRAC)
  BOND = WCAP*BINT*BFRAC
  AIDC = 0.0
  XIDC = 0.0
  XPRE = VALPOP(N)
  IF (IDCC.GE.0.OR.TIME(I).GT.T0) GO TO 3
  IF (TIME(I).LT.T0) GO TO 4
  CCAP = CCAP + ECAP
  BCAP = 0.0
  GO TO 3
4 CONTINUE

C      FOR OPTIONS IDCC.LT.0, THE IDC RATE IS GIVEN AS INPUT. THE
C      INTEREST DURING CONSTRUCTION IS BROKENOUT SEPARATELY IN THE
C      OUTPUT AND IS THE RETURN ON INVESTED CAPITAL IN THIS CASE.
C      THE ACCUMULATED INTEREST DURING CONSTRUCTION + CAPITAL INVESTMENT
C      IS THE FUTURE VALUE OF THE DIRECT CAPITAL INVESTMENT, THEREFORE
C      THE DISCOUNT RATE DURING CONSTRUCTION (FD) IS SET = 1.0.
C
  FD(N) = 1.0
  REQ = 0.0
  BOND = 0.0
  AIDC = WCAP*AINC
  TIDC(N) = AIDC
  BCAP = BCAP + CCAP
  CCAP = 0.0
  IF (IDCC.LE.-2) GO TO 5

C      IF IDCC IS EQUAL TO -1, EXPENSE PRE-OPERATION COST AS INCURRED
C
  XPRE = VALPOP(N)
  XIDC = AIDC
  GO TO 3
5 CONTINUE

C      IF IDCC IS EQUAL TO -2, EXPENSE PRE-OPERATIONAL COSTS AT STARTUP
C
  ACIDC = ACIDC + AIDC
  XPRE = 0.0
  SPRE = SPRE + VALPOP(N)
  IF (TIME(N).LT.T0) GO TO 3
  XIDC = ACIDC
  XPRE = SPRE
3 CONTINUE

C      PRAN = TAXABLE INCOME DURING PERIOD
C
  PRAN = PWSAL - BOND - DEPR(N) - EXPN - XPRE - XIDC
  STAX = PRAN*STRAT

C      NEGATIVE STATE INCOME TAX IS NOT ALLOWED. ASSUME THAT
C      ALL OTHER CORPORATE ENTERPRISE IS OUT OF STATE
C
  IF (STAX.LT.0.0) STAX = 0.0
  PRAN = PRAN - STAX
  FTAX = PRAN*FTRAT
  TAX = STAX + FTAX - VITC(N)
  IF (NTAX.GE.1.OR.N.GE.NCALC) GO TO 27

C      IF INCOME TAX LOSS CAN NOT BE WRITTEN OFF AGAINST OTHER INCOME,
C      IT MAY BE CARRIED FORWARD AGAINST FUTURE INCOME TAX LIABILITY

```

```

C      TAX LOSS CARRY FORWARD CALCULATION THROUGH STATEMENT 27
C
TAX = PTAX
IF (TAX.GE.0.0) GO TO 20
ATAX(N) = -TAX
TAX = 0.0
GO TO 26
20 CONTINUE
DO 21 K = 1, NCRY
M = N - NCRY + K - 1
IF (M.LE.0) GO TO 21
BTAX = DMIN1(ATAX(M), TAX)
TAX = TAX - BTAX
ATAX(M) = ATAX(M) - BTAX
IF (TAX.LE.0.0) GO TO 26
21 CONTINUE
IF (IIC.EQ.0) GO TO 26
NLM = NITCF + 1
DO 22 K = 1, NLM
M = N - NITCF + K - 1
IF (M.LE.0) GO TO 22
XTX = FITR*TAX
BTAX = DMIN1(AITC(M), XTX)
TAX = TAX - BTAX
AITC(M) = AITC(M) - BTAX
IF (TAX.LE.0.0) GO TO 26
22 CONTINUE
26 CONTINUE

C      STATE INCOME TAX LOSS NOT CARRIED FORWARD
C
C      TAX = STAX + TAX
27 CONTINUE

C      CFLOW, PFLOW--- CASH FLOW DURING PERIOD
C      RCAP, PCAP---MONEY LEFT OVER, USED TO REDUCE OUTSTANDING CAPITAL
C      COUT, WCAP---OUTSTANDING CAPITAL
C      TIDC---INTEREST DURING CONSTRUCTION
C      PREOP---CAPITALIZED PRE-OPERATION COSTS
C      VALPOP---EXPENSED PRE-OPERATION COSTS
C      ECAP---END OF PERIOD OUTSTANDING CAPITAL
C
CFLOW = PWSAL - EXPN - TAX - VALCAP - VALPOP(N) - AIDC
RCAP = CFLOW - BOND - REQ
COUT = WCAP
PFLOW = CFLOW
PCAP = RCAP
IF (IDCC.LE.0) GO TO 14

C      IF IDCC.GE.1, IDC AND PRE-OP COSTS ARE CAPITALIZED AND
C      WILL BE INCLUDED WITH CAPITAL RECOVERY IN ITEMIZATION.
C
COUT = CAPINV + ECAP
CONST = CAPINV + TIDC(N) + PREOP(I)
PFLOW = CFLOW - CONST + VALCAP
PCAP = RCAP - CONST + VALCAP
14 CONTINUE
DTAX = DTAX + PD(N)*TAX

C      IF IDC IS TREATED AS BORROWED MONEY AND NOT CAPITALIZED, IT IS
C      INCLUDED WITH PRE-OPERATION COSTS IN ITEMIZATION
C
ADPRE = ADPRE + (XPRES + XIDC)*PD(N)
ACAP = ACAP + CCAP*PD(I)

```

```

AWRK = AWRK + CORK*PD(I)
AOPR = EXPN*PD(N) + AOPR
ACOM = ACOM + CDEC*PD(N)
ECAP = ECAP - PCAP
WCAP = WCAP - RCAP - VALCAP
IF(IOUT.EQ.0) GO TO 17
WRITE(6,113) TIME(I), CAPINV, COUT, PWSAL, EXPN, TAX, TIDC(N),
1PREOP(I), PFLOW, BOND, REQ, PCAP, ECAP
17 CONTINUE

C
C   IF FINAL OUTSTANDING CAPITAL IS GREATER THAN $1,000 (0.001),
C   ADJUST UNIT PRICE (TOTAL) AND TRY AGAIN (MAXIMUM OF 20 TIMES)
C
TAXL = DTAX/PWROR
IF(DABS(WCAP).IE.CONV) GO TO 24
TOTAL = TOTAL + 1.25*WCAP*PD(NCALC)/(PWROR*(1.-TFACT))
25 CONTINUE
24 CONTINUE
IF(IOUT.EQ.1) GO TO 2

C
C   AFTER FINAL ITERATION, RETURN TO CASH FLOW LOOP FOR CASH FLOW
C   PRINTOUT IF NOT ALREADY PRINTED
C
IOUT = 1
GO TO 1
2 CONTINUE
WRITE(6,125)
ADPRE = ADPRE/FWROR
ACOM = ACOM/PWFOR
DISCAP = ACAP/PWROR
DISWK = AWRK/PWROR
105 FORMAT(1H1,20A4)
111 FORMAT(1H0,' WORKING CAPITAL =',F8.2,' MILLION DOLLARS')
112 FORMAT(1H0,45X,' CASH FLOW, MILLIONS OF DOLLARS'//
1' TIME DIRECT START OF INCOME OPERATING INCOME INTEREST
2 PRE- CASH RETURN ON CAPITAL RETURN END OF',/,
3' YEAR CAPITAL YEAR FROM EXPENSES TAXES DURING
4 OPERATION FLOW ----- OF YEAR',/,
5' INVESTMENT CAPITAL SALES CAPITAL CAPITAL',/)
6 COST DEBT EQUITY CAPITAL CAPITAL',/)
113 FORMAT(F6.0,F8.3,3F10.3,3F9.3,F10.3,2F9.3,2F10.3)
115 FORMAT(1H0,' PRODUCT PRICE = ',F10.2,' DOLLARS/UNIT',/)
125 FORMAT(1H0,10X,'CASH FLOW = INCOME FROM SALES - OPERATING EXPENSES
1 - INCOME TAX',/,22X,'- INTEREST DURING CONSTRUCTION - PRE-OPERATI
2 ON COST',/,22X,'- DIRECT CAPITAL INVESTMENT'
3 ' ,/,10X,'RETURN OF CAPITAL = CASH FLOW - RETURN ON CAPITAL
4 ' ,/,10X,'END OF YEAR CAPITAL(YEAR N) = END OF YEAR CAPITAL(YEAR N
5 -1) - RETURN OF CAPITAL',/,10X,'INCOME TAXES = (INCOME FROM SALES
6 - OPERATIONG EXPENSES - TAX DEPRECIATION - RETURN ON DEBT CAPITAL
7) *TAX RATE',/,25X,'- INVESTMENT TAX CREDIT')
RETURN
END

```

```

SUBROUTINE TXDEPR
IMPLICIT REAL*8(A-H,O-Z)
C THIS SUBROUTINE CALCULATES TAX DEPRECIATION
COMMON /TAX1/ NONL(10), LDEP(10), NCAP, NCALC, NDTYP, INIT
COMMON /TAX2/ VCAP(10), PFW(150), TCAP, PWRP, PWRD, PRAT, DEPR(150)
LIMIT = NCALC + 1
DO 1 I = 1, LIMIT
DEPR(I) = 0.0
1 CONTINUE
IF (NDTYP.EQ.0) GO TO 10
IF (NDTYP - 2) 20,30,40
10 CONTINUE
C CAPITAL WRITTEN OFF PRO-RATA WITH UNIT SALES
PRAT = TCAP*PWRP/PWRD
DO 11 I = 1, NCALC
DEPR(I) = PFW(I)*PRAT
11 CONTINUE
GO TO 100
20 CONTINUE
C STRAIGHT LINE DEPRECIATION
DO 21 I = 1, NCAP
XDEP = LDEP(I)
DPR = VCAP(I)/XDEP
NSTR = NONL(I) + 2 + INIT
NEND = NSTR + IDEP(I) - 1
DO 22 J = NSTR, NEND
DEPR(J) = DEPR(J) + DPR
22 CONTINUE
21 CONTINUE
GO TO 100
30 CONTINUE
C SUM-OF-YEARS-DIGITS (SYD) DEPRECIATION METHOD
DO 31 I = 1, NCAP
XDEP = LDEP(I)
XBOT = XDEP*(XDEP + 1.)/2.
DPR = VCAP(I)/XBOT
NSTR = NONL(I) + 2 + INIT
NEND = NSTR + LDEP(I) - 1
XJ = 0.0
DO 32 J = NSTR, NEND
XJ = XJ + 1.
DEPR(J) = (XDEP + 1. - XJ)*DPR + DEPR(J)
32 CONTINUE
31 CONTINUE
GO TO 100
40 CONTINUE
C DOUBLE DECLINING BALANCE DEPRECIATION METHOD FOLLOWED BY STRAIGHT
C LINE WHEN IT PRODUCES THE MAXIMUM ALLOWABLE TAX DEPRECIATION
DO 41 I = 1, NCAP
XDEP = LDEP(I)
REM = VCAP(I)
NSTR = NONL(I) + 2 + INIT
NEND = NSTR + IDEP(I) - 1
ISL = 0
DO 42 J = NSTR, NEND
IF (ISL.GE.1) GO TO 43
YDEP = LDEP(I) + NSTR - J
DSL = REM/YDEP
DDB = REM*2./XDEP
IF (DSL.GE.DDB) ISL = 1
DPR = DMAX1(DDB, DSL)
REM = REM - DPR
GO TO 44

```

```

43 DPR = DSL
44 CONTINUE
   DEPR(J) = DPR + DEPR(J)
42 CONTINUE
41 CONTINUE
100 CONTINUE
   RETURN
   END

```

SUBROUTINE ZERC

C
C
C

SUBROUTINE ZERO SETS VARIOUS VARIABLES TO ZERO TO INITIALIZE CASE

```

IMPLICIT REAL*8(A-H,O-Z)
COMMON/ZEROS/ ALL(4800)
COMMON/ZERO2/ EALL(25)
DO 10 I = 1,4800
  ALL(I) = 0.0
10 CONTINUE
DO 20 I = 1,25
  BALL(I) = 0.0
20 CONTINUE
  RETURN
  END

```

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Appendix C
SAMPLE OUTPUT

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SAMPLE PROBLEM FOR ACPAC REPORT
 PWR FUEL FABRICATION PLANT
 SYD DEPRECIATION WITH INVESTMENT TAX CREDIT

CARD 4, GENERAL INPUT INFORMATION, (0 = NO, 1 = YES)

NUMBER OF OPERATION YEARS	21
NUMBER OF CAPITAL ITEMS TO BE READ	3
TAX DEPRECIATION OPTION	2
INTEREST DURING CONSTRUCTION OPTION	1
PRE-OPERATION PERIOD INCLUDED IN CASH ANALYSIS, YEARS	8
POST-OPERATION PERIOD INCLUDED IN CASE ANALYSIS, YEARS	1
IS INVESTMENT TAX CREDIT TO BE CONSIDERED?	1
CAN TAX LOSSES BE WRITTEN OFF AGAINST OTHER EARNINGS?	0
DECOMMISSION EXPENSE OPTION TO BE USED	2
NUMBER OF YEARS TAX LOSS MAY BE CARRIED FORWARD	5
NUMBER OF YEARS INVESTMENT CREDIT MAY BE CARRIED FORWARD	7
CASH FLOW PRINTOUT FOR EACH ITERATION	0
CAPITAL INVESTMENT PAYMENT OPTION	0

INPUT INFORMATION ON CARD 5

RETURN ON EQUITY INVESTMENT, FRACTION	0.140
INTEREST RATE ON CAPITALIZED DEBT, FRACTION	0.083
FRACTION OF CAPITALIZATION FROM DEBT	0.350
FEDERAL INCOME TAX RATE, FRACTION	0.460
STATE INCOME TAX RATE, FRACTION	0.040
COSTS ARE IN DOLLARS OF THIS YEAR	1978.000
MAXIMUM FRACTION OF TAXES WHICH TAX CREDIT CAN OFFSET	0.500
CASH FLOW CONVERGENCE TOLERANCE, MILLION \$	0.010

INPUT INFORMATION ON CARDS 6 AND 7

WORKING CAPITAL, MILLION \$	9.112
INTEREST DURING CONSTRUCTION	0.105
PROPERTY TAX RATE	0.025
INSURANCE RATE	0.005
INTERIM REPLACEMENT RATE	0.010
CAPITAL VALUE FOR INTERIM REPL. PURPOSES, MILLION \$	34.200
CAPITAL BASE FOR INS. AND PROP. TAX, MILLION \$	66.200
FULL PRODUCTION RATE, UNITS/YEAR	520000.
YEAR PRODUCTION IS TO BEGIN	1990.
MATERIAL COST AT FULL PRODUCTION, MILLION \$/YEAR	23.041
OPERATION COST AT FULL PRODUCTION, MILLION \$/YEAR	13.383
FIXED COST FRACTION OF OPERATION COST	0.100
OPERATING COST FRACTION PROPORTIONAL TO PRODUCTION	0.900
DECOMMISSIONING EXPENSE AS FRACTION OF SALES	0.010
INTEREST PAID ON DECOMMISSIONING EXPENSE ANNUITY	0.080

CARD 8, CAPACITY FACTORS AND MISCELLANEOUS EXPENSES

YEAR	CAPACITY			OTHER COST ITEMS			
0.0	0.0	5.00	2.00	0.0	0.0	0.0	0.0
1.00	0.33	3.00	1.00	0.0	0.0	0.0	0.0
2.00	0.67	1.00	0.0	0.0	0.0	0.0	0.0
3.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
4.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
5.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
6.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
7.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
8.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
9.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
10.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
11.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
12.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
13.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
14.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
15.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
16.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
17.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
18.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
19.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
20.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0
21.00	1.00	0.0	0.0	0.0	0.0	0.0	0.0

CARD 9, CAPITAL COST DATA

INFORMATION FOR [NCAP] CAPITAL ITEMS

ITEM	NCNL	LDEP	NYSL	NBLD	VCAP	VSAL	PITC	RITC
1	0	20	21	8	32.000	0.0	0.500	0.100
2	0	10	10	6	34.200	0.0	1.000	0.100
3	11	10	10	1	34.200	0.0	1.000	0.100

NCNL---YEAR, RELATIVE TO STARTUP, THAT CAPITAL ITEM COMES ON LINE

LDEP---DEPRECIATION PERIOD, YEARS

NYSL---LIFE OF CAPITAL ITEM, YEARS

NBLD---CONSTRUCTION PERIOD, YEARS

VCAP---COST OF CAPITAL ITEM, MILLION \$

VSAL---SALVAGE VALUE AT END OF LIFE, MILLION \$

PITC---CAPITAL COST APPLICABLE FOR INVESTMENT TAX CREDIT, MILLION \$

RITC---INVESTMENT TAX CREDIT RATE, FRACTION

CARD 10, CAPITAL PAYMENT SCHEDULE DURING CONSTRUCTION, FRACTION OF TOTAL

ITEM CONSTRUCTION PAYMENT IN EACH YEAR OF CONSTRUCTION PERIOD[NBLD]

1	0.045	0.072	0.115	0.172	0.208	0.162	0.144	0.082
2	0.025	0.065	0.182	0.402	0.271	0.015		
3	1.000							

CARD 11, PRE-OPERATION EXPENSE SCHEDULE

MILLIONS OF DOLLARS PAID IN EACH OF [INIT] YEARS PRIOR TO OPERATION

0.0	0.0	0.669	1.338	2.677	4.015	5.353	5.353
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SCHEDULE OF EXPENSES, MILLIONS OF DOLLARS

YEAR	CAPACITY	MATERIAL	OPERATION	PROP. TAX	PROP. INS	REPLACEMENT	OTHER EXPENSES
0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.00
1.00	0.33	7.60	5.31	1.66	0.33	0.11	4.00
2.00	0.67	15.44	9.41	1.66	0.33	0.23	1.00
3.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
4.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
5.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
6.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
7.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
8.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
9.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
10.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
11.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
12.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
13.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
14.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
15.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
16.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
17.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
18.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
19.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
20.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0
21.00	1.00	23.04	13.38	1.66	0.33	0.34	0.0

TAX ADJUSTED DISCOUNT RATE 0.10606

DISCOUNTED CASH FLOW RATE OF RETURN 0.12005

LIFETIME PRODUCTION, MILLIONS OF UNITS 10.4000

DISCOUNTED LIFETIME PRODUCTION

AT TAX ADJUSTED DISCOUNT RATE 3.8573

AT DISCOUNTED CASH FLOW RATE OF RETURN 3.4831

CAPITAL INVESTMENT CASH FLOW, MILLION \$

TIME	MAXIMUM OF EIGHT CAPITAL ITEMS								TOTAL	TAX DEPR
1982.00	1.44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.44	0.0
1983.00	2.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.30	0.0
1984.00	3.68	0.86	0.0	0.0	0.0	0.0	0.0	0.0	4.54	0.0
1985.00	5.50	2.22	0.0	0.0	0.0	0.0	0.0	0.0	7.73	0.0
1986.00	6.66	6.22	0.0	0.0	0.0	0.0	0.0	0.0	12.88	0.0
1987.00	5.18	15.12	0.0	0.0	0.0	0.0	0.0	0.0	20.30	0.0
1988.00	4.61	9.27	0.0	0.0	0.0	0.0	0.0	0.0	13.88	0.0
1989.00	2.62	0.51	0.0	0.0	0.0	0.0	0.0	0.0	3.14	0.0
1990.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.58
1992.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.38
1993.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.17
1994.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.97
1995.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
1996.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.56
1997.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.36
1998.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.15
1999.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.95
2000.00	0.0	0.0	34.20	0.0	0.0	0.0	0.0	0.0	34.20	4.74
2001.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.54
2002.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.06
2003.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.02
2004.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.97
2005.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.93
2006.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.89
2007.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.85
2008.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.81
2009.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.77
2010.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.73
2011.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.69
2012.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SAMPLE PROBLEM FOR ACPAC REPORT

PRODUCT PRICE = 130.14 DOLLARS/UNIT

WORKING CAPITAL = 9.11 MILLION DOLLARS

CASH FLOW, MILLIONS OF DOLLARS

TIME YEAR	DIRECT CAPITAL INVESTMENT	START OF YEAR CAPITAL	INCOME FROM SALES	OPERATING EXPENSES	INCOME TAXES	INTEREST DURING CONSTRUCT	PRE- OPERATION COST	CASH FLOW	RETURN ON CAPITAL		RETURN OF CAPITAL	END OF YEAR CAPITAL
									DEBT	EQUITY		
1982.	1.440	1.440	0.0	0.0	0.0	0.151	0.0	-1.591	0.0	0.0	-1.591	1.591
1983.	2.304	3.895	0.0	0.0	0.0	0.409	0.0	-2.713	0.0	0.0	-2.713	4.304
1984.	4.535	8.839	0.0	0.0	0.0	0.998	0.669	-6.202	0.0	0.0	-6.202	10.507
1985.	7.727	18.234	0.0	0.0	0.0	2.055	1.338	-11.120	0.0	0.0	-11.120	21.627
1986.	12.880	34.507	0.0	0.0	0.0	3.904	2.677	-19.462	0.0	0.0	-19.462	41.088
1987.	20.300	61.389	0.0	0.0	0.0	6.867	4.015	-31.183	0.0	0.0	-31.183	72.271
1988.	13.876	86.147	0.0	0.0	0.0	9.608	5.353	-28.837	0.0	0.0	-28.837	101.108
1989.	3.137	104.245	0.0	7.000	0.0	11.508	5.353	-26.998	0.0	0.0	-26.998	128.106
1990.	5.112	137.218	22.332	19.239	0.0	0.0	0.0	-6.019	3.986	12.487	-22.492	150.598
1991.	0.0	150.598	45.340	28.514	0.0	0.0	0.0	16.826	4.375	13.704	-1.254	151.851
1992.	0.0	151.851	67.672	39.429	0.426	0.0	0.0	27.817	4.411	13.818	9.587	142.264
1993.	0.0	142.264	67.672	39.429	0.486	0.0	0.0	27.757	4.133	12.946	10.678	131.586
1994.	0.0	131.586	67.672	39.429	2.751	0.0	0.0	25.492	3.823	11.974	9.695	121.891
1995.	0.0	121.891	67.672	39.429	3.949	0.0	0.0	24.294	3.541	11.092	9.661	112.230
1996.	0.0	112.230	67.672	39.429	6.425	0.0	0.0	21.818	3.260	10.213	8.345	103.885
1997.	0.0	103.885	67.672	39.429	8.704	0.0	0.0	19.539	3.018	9.454	7.068	96.817
1998.	0.0	96.817	67.672	39.429	9.383	0.0	0.0	18.860	2.813	8.810	7.237	89.579
1999.	0.0	89.579	67.672	39.429	10.064	0.0	0.0	18.179	2.602	8.152	7.425	82.154
2000.	34.200	116.354	67.672	39.429	10.748	3.591	0.0	-20.296	2.387	7.476	-30.159	112.313
2001.	0.0	112.313	67.672	39.429	3.892	0.0	0.0	24.351	3.263	10.220	10.868	101.445
2002.	0.0	101.445	67.672	39.429	7.357	0.0	0.0	20.886	2.947	9.232	8.708	92.738
2003.	0.0	92.738	67.672	39.429	8.464	0.0	0.0	19.779	2.694	8.439	8.646	84.092
2004.	0.0	84.092	67.672	39.429	9.086	0.0	0.0	19.157	2.443	7.652	9.062	75.030
2005.	0.0	75.030	67.672	39.429	9.714	0.0	0.0	18.529	2.180	6.828	9.521	65.509
2006.	0.0	65.509	67.672	39.429	10.349	0.0	0.0	17.894	1.903	5.961	10.030	55.479
2007.	0.0	55.479	67.672	39.429	10.991	0.0	0.0	17.252	1.612	5.049	10.592	44.887
2008.	0.0	44.887	67.672	39.429	11.640	0.0	0.0	16.603	1.304	4.085	11.214	33.673
2009.	0.0	33.673	67.672	39.429	12.298	0.0	0.0	15.944	0.978	3.064	11.902	21.771
2010.	0.0	21.771	67.672	39.429	12.966	0.0	0.0	15.277	0.632	1.981	12.663	9.108
2011.	-5.112	-0.004	0.0	0.0	0.000	0.0	0.0	9.112	-0.000	-0.000	9.112	-0.004
2012.	0.0	-0.004	0.0	0.0	0.000	0.0	0.0	-0.000	-0.000	-0.000	0.000	-0.004

CASH FLOW = INCOME FROM SALES - OPERATING EXPENSES - INCOME TAX
 - INTEREST DURING CONSTRUCTION - PRE-OPERATION COST
 - DIRECT CAPITAL INVESTMENT

RETURN OF CAPITAL = CASH FLOW - RETURN ON CAPITAL

END OF YEAR CAPITAL (YEAR N) = END OF YEAR CAPITAL (YEAR N-1) - RETURN OF CAPITAL

INCOME TAXES = (INCOME FROM SALES - OPERATING EXPENSES - TAX DEPRECIATION - RETURN ON DEBT CAPITAL) * TAX RATE
 - INVESTMENT TAX CREDIT

SAMPLE IBCBLEM FOR ACPAC REPORT
 SYD DEPRECIATION WITH INVESTMENT TAX CREDIT
 PWR FUEL FABRICATION PLANT

PRICE BREAKDOWN BY COST COMPONENT

LEVELIZED COSTS, DOLLARS/UNIT

CAPITAL RECOVERY	37.89
MATERIAL	44.31
OPERATING	26.07
PROPERTY TAX	3.59
PROPERTY INSURANCE	0.72
REPLACEMENT	0.66
OTHER OPERATING	3.26
PRE-OPERATION	0.0
WORKING CAPITAL	2.37
INCOME TAX	9.97
DECOMMISSIONING	1.30

TOTAL	130.14

FINAL VALUE OF ANNUITY TO DECOMMISSION PLANT - 31.045 MILLION DOLLARS

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