THE TREATMENT OF CWIP

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Electric utilities will be required to make substantial investments in new generating plants, transmission lines, and distribution plants in the coming years. Construction periods are long--it is not at all unusual for a nuclear plant to be under construction for ten or more years, and coal-fired plants may be under construction for five years. These long construction periods, combined with inflated construction costs, mean that huge sums of capital must be tied up in construction projects for many years.

An idea of the importance of construction work in progress (CWIP) and the manner in which it varies from year to year is given in Table 1. Here we see, for three Florida companies, that the percentage of total invested capital tied up in plant under construction has varied, during the past six years, from over 46% to under 4%. Typically, the CWIP percentage is quite high just before a major new plant is completed and put on line; then it drops and is low until a new construction cycle begins to build up.

Table 1

THE RELATIONSHIP OF CWIP TO NET PLANT IN SERVICE

	Florida Power & Light			Florida Power Corporation			Tampa Electric Company		
Year	CWIP	Net Electric Plant in Service	% CWIP to Net Plant in Service	CWIP	Net Electric Plant in Service	% CWIP to Net Plant in Service	CWIP	Net Electric Plant in Service	% CWIP to Net Plant in Service
1975	$ 994	$2,130	46.7%	$ 411	$ 958	42.9%	$ 153	$ 539	28.4%
1976	602	2,868	21.0	454	1,001	45.4	22	706	3.1
1977	575	3,080	18.7	113	1,377	8.2	26	718	3.6
1978	806	3,156	25.5	65	1,467	4.4	26	729	3.6
1979	1,120	3,234	34.6	116	1,513	7.7	30	738	4.1
1980	1,009	3,831	26.3	246	1,604	15.3	56	745	7.5

Note: The ratios of AFUDC to net income available to common stockholders in 1980 were 48% for FP&L, 17% for FPC, and 5% for TECO.

The capital used to construct plants must be obtained from investors--stockholders and bondholders. These investors must be compensated for the use of their capital by the payment of interest and dividends, and the money used to pay interest and dividends must, in turn, be obtained, sooner or later, from the company's customers. If all plant and equipment were acquired in ready-to-use condition, and if it started producing electricity immediately upon acquisition, there would be no problem. The company would sell securities (stock and bonds), use the proceeds to acquire plant, get revenues from the sale of power produced by the plant, and use part of these revenues to "pay the rent" on the capital used to acquire the plant. However, as noted above, utilities do not spend money and obtain immediately usable plant--rather, they have large amounts of money invested over long periods in CWIP. In the case of FP&L in 1980, over $1 billion of CWIP existed, and the Company had to pay interest and dividends on the billion dollars of stocks and bonds used to finance this CWIP. Yet, since the billion dollars of CWIP was not producing electricity, it produced no direct revenues, hence no cash which could be used for the payment of interest and dividends.

If CWIP is small relative to plant in service, and if a company is earning a reasonable rate of return on its plant in service, then it can use some of the cash produced by its operating assets to pay the carrying charges on the capital invested in CWIP. However, if CWIP is large relative to total investment, and if the rate of return earned on operating assets is relatively low, then it will not be feasible for the company to service capital invested in CWIP out of returns on operating assets. In this case, it will be necessary either (1) for the company to sell new stock and/or bonds and use the proceeds to pay interest and dividends or (2) for customers to pay all or part of the financing costs associated with new plants. The latter treatment is analogous to a down payment on a house, car, or major appliance. If one expects to use a house over a thirty year period, then it seems reasonable to buy the house and to make equal payments over thirty years. However, lenders balk at making thirty year loans with no down payments--they insist that the home purchaser put up 20 to 30 percent. Home purchasers can sometimes obtain virtually 100 percent financing, but when they do they are forced to use second mortgages and other irregular types of credit, and they pay for it in the form of substantially higher interest rates. This same situation exists for the utilities.

PURC has been studying the question of CWIP and its financing for several years. We have done two studies under grants from the Florida PSC, and two doctoral dissertations plus several shorter papers have resulted. The purpose of this paper is to summarize this work and to present our findings as to the effects of alternative CWIP policies on utility investors and customers.

THEORETICAL CONSIDERATIONS

Under the Hope doctrine, utilities are supposed to be allowed the opportunity to earn a rate of return on their invested capital, and this return should be

> "....commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and enable it to attract capital."

It is well recognized that the dollars invested in CWIP, as well as those invested in operating assets, must earn a return. The return on CWIP can be earned immediately, or it can be delayed until after the project has been completed.

The traditional view in public utility economics, and a view which has carried over to regulatory theory, is that, since CWIP is not currently "used and useful," it should not be included in rate base for purposes of determining current service rates. Rather, the traditional view has been that CWIP should be held as a separate account, and a return called the "allowance for funds used during construction" (AFUDC) should be calculated, reported as income, and then added to CWIP, or capitalized. Then, when the plant is placed in service, the full plant cost, including capitalized AFUDC, should be added to the rate base and allowed to earn a cash return. A return on accumulated AFUDC would then be earned during the operating life of the plant, and the AFUDC itself would be recovered from customers by increasing the depreciation charge built into rates. The result of this treatment is that the customers who actually use the output of the plant would pay the full cost of the plant, including financing costs during the construction period.[1] In the remainder of this paper, this procedure is called the "AFUDC method."

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[1]Certain important details need to be handled properly to insure that costs are allocated properly. For example, the tax savings from interest charges during the construction period must not be flowed through to current customers, but, rather, they must be reserved and then allocated (normalized) to customers over the life of the plant.

An alternative to the AFUDC method is to put CWIP directly into the rate base and to allow the utility a cash return on this investment--this is called the "rate base method." Under the rate base method, if a utility spent $2 million on construction projects, financed by the sale of $1 million of stock and $1 million of bonds, the $2 million of CWIP would be added to operating assets to develop the rate base, the company would be allowed to earn a rate of return on this rate base, and thus the CWIP itself would generate cash income which would then be used to pay the interest and dividends on the capital invested in CWIP.

Total reported profits, averaged over time, would be approximately the same under both the AFUDC and the rate base methods, but some important differences should be noted:[1]

1. Under the AFUDC method, revenue requirements are calculated as follows:

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[1]Many technical details are omitted from the discussion in this paper. For an in-depth discussion of the technical aspects of CWIP treatment, see Gordon D. Quick, "A Computer Simulation Analysis of Alternative Methods of Accounting for Utilities' Construction Work in Progress," Ph.D. Dissertation, University of Florida, 1974, and Geraldine Westmoreland, "Electric Utilities' Accounting for Construction Work in Progress: The Effects of Alternative Methods on the Financial Statements, Utility Rates, and Market to Book Ratios," Ph.D. Dissertation, University of Florida, 1979. Many of the analytical conclusions reported in this paper were developed in Quick's dissertation, while many of the empirical conclusions were obtained from Westmoreland's dissertation.

$$\begin{pmatrix}\text{Operating}\\ \text{plant}\end{pmatrix}\begin{pmatrix}\text{Allowed rate}\\ \text{of return}\end{pmatrix} + \begin{pmatrix}\text{CWIP}\end{pmatrix}\begin{pmatrix}\text{Allowed rate}\\ \text{of return}\end{pmatrix}$$

$$= \text{Income from operations} + \text{AFUDC income}$$

$$= \text{Cash income} + \text{Non-cash income}$$

$$= \text{Return component of revenue requirements}$$

If no regulatory lag exists, then revenue requirements will equal reported income. Income from operations is cash income, paid in cash by ratepayers, and it is available to pay interest or dividends, or for reinvestment. AFUDC income is not cash. It is simply a bookkeeping entry, and it cannot be used to meet interest or dividend payments. Since AFUDC income cannot be paid out, it must therefore be retained and, thus, it may be regarded as a type of forced savings.

2. Under the rate base method, revenue requirements are calculated as follows:

$$\begin{pmatrix}\text{Operating}\\ \text{plant} + \text{CWIP}\end{pmatrix}\begin{pmatrix}\text{Allowed}\\ \text{rate of return}\end{pmatrix} = \begin{matrix}\text{Return component of}\\ \text{revenue requirements}\end{matrix}$$

Here the return component of revenue requirements is all cash, so the total reported income is available for payments of interest and dividends.[1]

Simple logic suggests that investors should prefer the rate

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[1]It is, of course, possible to put CWIP in the rate base but also to compute AFUDC and to use it as an offset to help meet revenue requirements. If the same rate is used to calculate AFUDC as is allowed on operating assets, the effect is the same as if CWIP were not put into the rate base. Sometimes a lower AFUDC rate is used, which results in some cash income on CWIP.

base method to the AFUDC method, and that they should impose a higher cost of capital on an AFUDC utility than on a rate base company. Our empirical work demonstrates that this is indeed the case, and, as a result, in the long run customers must pay higher rates if the AFUDC method is used.

However, in spite of the higher costs inherent in the AFUDC method, AFUDC has been used traditionally in most utility ratemaking procedures, and it is the dominant method employed today. The reason for this dominance seems to stem from a faulty application of an otherwise sound economic principle, the principle that those who receive the benefits of a particular plant should pay all costs associated with the plant. This principle has led to the "used and useful" rule under which plant is not allowed in the rate base unless it is actually being used to provide service.[1] The supposed advantage of applying the used and useful rule to CWIP is that it keeps current customers from having to pay the financing costs associated with building plant for use by future customers. According

[1]The used and useful rule is actually bent in virtually all jurisdictions, with the most significant deviations from the rule being the practice of allowing in the rate base (1) plants held on a standby basis for peak usage and/or to provide a reserve margin for generating capacity and (2) plant, especially land, held for future use. Also, many commissions have long followed the practice of including in the rate base plants scheduled for completion within a fairly short period, such as six months. Thus, the "used and useful" rule has never been rigorously upheld.

to this line of reasoning, it would be inequitable to the current generation of customers if CWIP were put into the rate base. Therefore, use of the AFUDC method is said to be more equitable than is use of the CWIP method.

Thus, there is an apparent conflict between the twin goals of (1) holding down the cost of capital and thus benefitting all customers and (2) promoting intergenerational equity: Putting CWIP in the rate base lowers the cost of capital, but it creates some degree of intergenerational inequity. <u>However, the conflict is not as serious as many people think, because the intergenerational equity problem is based on a false premise and is greatly overstated.</u>

The false premise is that the new plant which is being built to meet forecasted load growth is primarily for the benefit of new customers, not existing customers.[1] This view is false because it assumes a type of marginalism in utility operations that simply does not exist. It assumes, implicitly, that the new plant being built will be dedicated to the new customers who gave rise to the new plant.

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[1] In the past, residential and commercial customer usage has tended to increase over time (that is, a given customer tended to use more kwh as air conditioners, appliances, and so forth, were added). Today, because of more energy-efficient appliances, stepped up insulation, and general conservation brought on by high electricity prices, we can anticipate a much slower growth rate in usage. Of course, there may be in the future major coversions from gas and/or oil to electricity for home heating; in this event, usage of electricity per customer could rise sharply.

However, this is not the case at all. All customers, new and old alike, are treated equally. All are hooked up to the <u>system</u>, and all buy power at the <u>system's average cost</u>. If the new plant were not built, then new customers would still, under most existing franchise agreements, be able to hook up and to draw power, and the result would be shortages that would be borne by all customers, new and old alike. Therefore, in a very real sense, new plant is being built, not to meet the specific needs of new customers, but to avoid shortages which would have to be shared by all customers.

It should also be noted that generating plant expenditures occur for several purposes: (1) pollution control, (2) conversions of existing plants from oil and gas to coal or nuclear in order to conserve oil and gas, (3) building new plants to replace worn out older plant, (4) building new plants to replace older plants that are still serviceable but that are economically obsolete because of technological improvements which have occurred and/or because the older plants use a higher cost fuel (generally oil) than the newer plants (this refers to new plants as distinguished from conversions of existing plants), (5) building new plants which are needed to meet the forecasted increased demands of existing customers, and (6) building new plants designed to meet the forecasted demands of future customers who are not now on the system. The primary beneficiaries of the first five categories are clearly the existing customers, as all of these types of expenditures are related to plants used to service them. Therefore, the question of inter-generational equity logically comes up mainly in connection with the sixth plant category.

Of course, any given new plant is likely to contain elements of several categories, or even of all six. For example, a large new coal plant might be used to replace worn out and obsolete existing oil-fired plants, and still have capacity left over to meet forecasted load growth both from new customers and from expanded demands of existing customers. Note also that Category 6, demands of new customers, could be thought of in a micro sense and related to a specific utility or in a macro sense and related to customers in the aggregate. Since both people and firms tend to move, and to change service areas, a given utility will have, in any specific period, more new customers than its share of nationwide aggregate growth. Thus, Category 6 should be broken into two segments, gross new customers and net new customers, and assuming optimal regulation nationwide, only net new customer demands should be included in Category 6.

It would be useful to quantify the percentage of total construction expenditures that falls into each category, and especially to isolate the net increase portion of Category 6.

Dr. Westmoreland, in her Ph.D. dissertation, attempted to do this through a questionnaire.[1] However, utility company records are not set up in a manner that makes this breakdown feasible, so all one can do is make an educated guess. In our judgment, the net component of Category 6 is relatively small. Our studies suggest that the growth rate in customers in the 1980's is generally forecasted in the range of 1 to 1 1/2 percent per year. Total energy sales are generally forecasted to grow at a rate of 3 to 4 percent per year, which implies that the growth in demand by current customers will represent well over half of the total growth.

Utilities also expend funds for distribution and transmission facilities. Distribution expenditures are primarily related to current customers, hence should be expensed or put into rate base as a matter of course. Transmission expenditures are less clear cut. Some transmission lines are built to bring distant power into the service area and are, really, built in lieu of new generating stations; such expenditures could presumably be allocated between current and future customers in the same manner as generating plants. Other transmission systems are for purposes of increasing generating efficiency and/or reliability within a large area, and as such they would seem to benefit primarily, but not exclusively, the current customers.

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[1]Geraldine Westmoreland, op. cit.

The breakdown of construction expenditures between pollution control, conversions, replacements of economically obsolete and/or physically deteriorated plant, new demand, transmission, and distribution is, as noted above, conceptually, but not actually, feasible. Hence, at this time, one can only make an educated guess as to the division. In our judgment, the following is a reasonable allocation on a nationwide basis:

	Percentage of construction which will benefit	
	Current customers	Future customers
Low end	60%	40%
Most likely	70	30
High end	80	20

We cannot stress too strongly that these numbers are based on judgments, not solid accounting data, but they are certainly indicative of the correct order of magnitude of the benefits of allocation, and if one were forced to defend a benefit range, the one indicated would seem to be easier to defend than any other. In any event, it should be clear that a major part of any company's construction program is for its current customers. Therefore, putting CWIP in the rate base is not totally unfair to current customers. On the other hand, if all CWIP were put into the rate base, then it would appear that current customers would to some extent be subsidizing future customers. Thus, on equity considerations alone, it would appear that a large part, but not all, of CWIP could be included in the rate base.

One can also ask this question: If the AFUDC method were used exclusively, would this be completely fair to all customers, current and future alike? As we see it, the answer is no. As we shall show later in the paper, the AFUDC method raises the cost of capital to utilities and thus causes all customers, current and future alike, to pay higher rates. A customer who stays on the system will, if AFUDC is capitalized, pay more for electricity than if CWIP were put into the rate base. Further, for most customers, this higher cost will occur not only in total dollars but also on a present value basis. Therefore, since most current customers will also be future customers, and since capitalizing AFUDC will cause these customers' costs to be higher, it would seem that putting zero CWIP in the rate base is no more "fair" than putting all CWIP in the rate base.

Long Run Versus Short Run Effects

If a given utility is currently using the rate base method, converting to AFUDC will lead to an immediate decline in service rates; they will rise later on, but the short-run effect is a rate decrease. Similarly, if a company is using the AFUDC method, then converting to the rate base method will lead to an immediate increase in service rates, followed in the future by rate decreases. Thus, if one focuses on the short run, the AFUDC method always looks better from the standpoint of its effects on rates. However, this is very deceptive, for in the long run, under today's economic conditions, the rate base method has a substantially lower cost.

In subsequent sections, we first describe in some detail how cash flows and service rates vary over time under the alternative methods. Second, we look at the effects of the alternative methods on the cost of capital. Third, we describe several case histories of companies that used different CWIP methods and discuss how these methods affected the companies' operations. Finally, we give our own conclusions as to how CWIP should be treated for regulatory purposes.

COMPUTER SIMULATION

As noted above, the treatment of CWIP has short-run and long-run effects on both consumers and investors. Further, these effects vary depending on a number of different factors, including (1) the length of the construction cycle, (2) whether the new plant is fully utilized when the plant goes on line versus increasing the reserve margin until demand catches up with capacity, (3) the rate of inflation, which affects the relative cost of new plants versus the embedded cost of old plant in service, (4) the rate of growth in demand, (5) the effect of CWIP treatment on the cost of capital, (6) the fuel efficiency and other operating characteristics of new versus existing plant, (7) the extent of regulatory lag, and so on.

G. D. Quick, working under a PURC grant, developed a computer simulation model designed to show how cash flows and customer service rates are affected, under different economic conditions, by the AFUDC and rate base methods.[1] Quick's model assumes that two firms have been operating for some years under the AFUDC method, and then one firm switches to the rate base method.[2] The companies' results beyond the year of the switch are then compared. The

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[1]Quick, op. cit.

[2]The model can also be set up to show the effects of a switch from the rate base to the AFUDC method, but this would simply produce a mirror image of the results shown here.

model assumes that the tax effects of liberalized depreciation, and also the tax shelter from interest on debt used to support construction, are normalized. The model was run with construction periods of different lengths, but in this paper we assume a 5-year average construction period.

<u>The Size of the Rate Base</u>. If a utility puts CWIP in the rate base, this obviously increases its rate base. However, if it capitalizes AFUDC, then ultimately its rate base will be larger by the amount of capitalized AFUDC. Figure 1 shows, in general terms, how the rate base varies over time under the rate base and AFUDC methods. By definition, the two companies start in Year 1 with identical rate bases. The rate base company's rate base increases steadily from year to year as construction expenditures go directly into the rate base. The AFUDC company's rate base declines initially because annual depreciation charges are deducted from the rate base.[1] However, at Year 6, a 5-year construction period ends, a new plant goes into commercial operation, and the CWIP associated with that plant (including capitalized AFUDC) is added to the rate base.

The result, as shown in Figure 1, is a continuously increasing rate base for the rate base company and a saw-toothed rate base for the AFUDC company. The AFUDC company generally has a lower rate base in the early years, but later on, as accrued AFUDC accumulates, the

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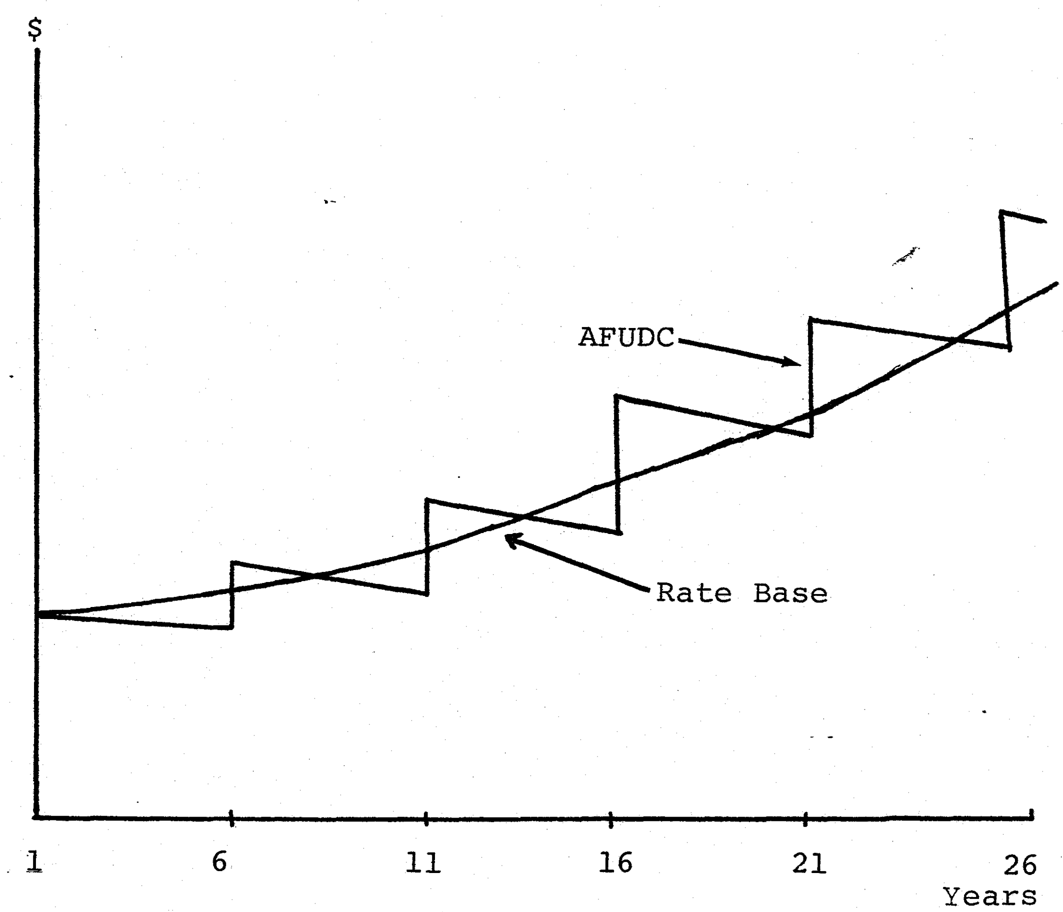
[1]Realistically, the investment in distribution and transmission facilities would offset depreciation and cause the rate base, between major plant additions, to rise slowly rather than to decline as shown in Figure 1.

Figure 1

REGULATORY RATE BASES
UNDER ALTERNATIVE CWIP METHODS



AFUDC company's rate base is generally larger than that of the rate base firm.

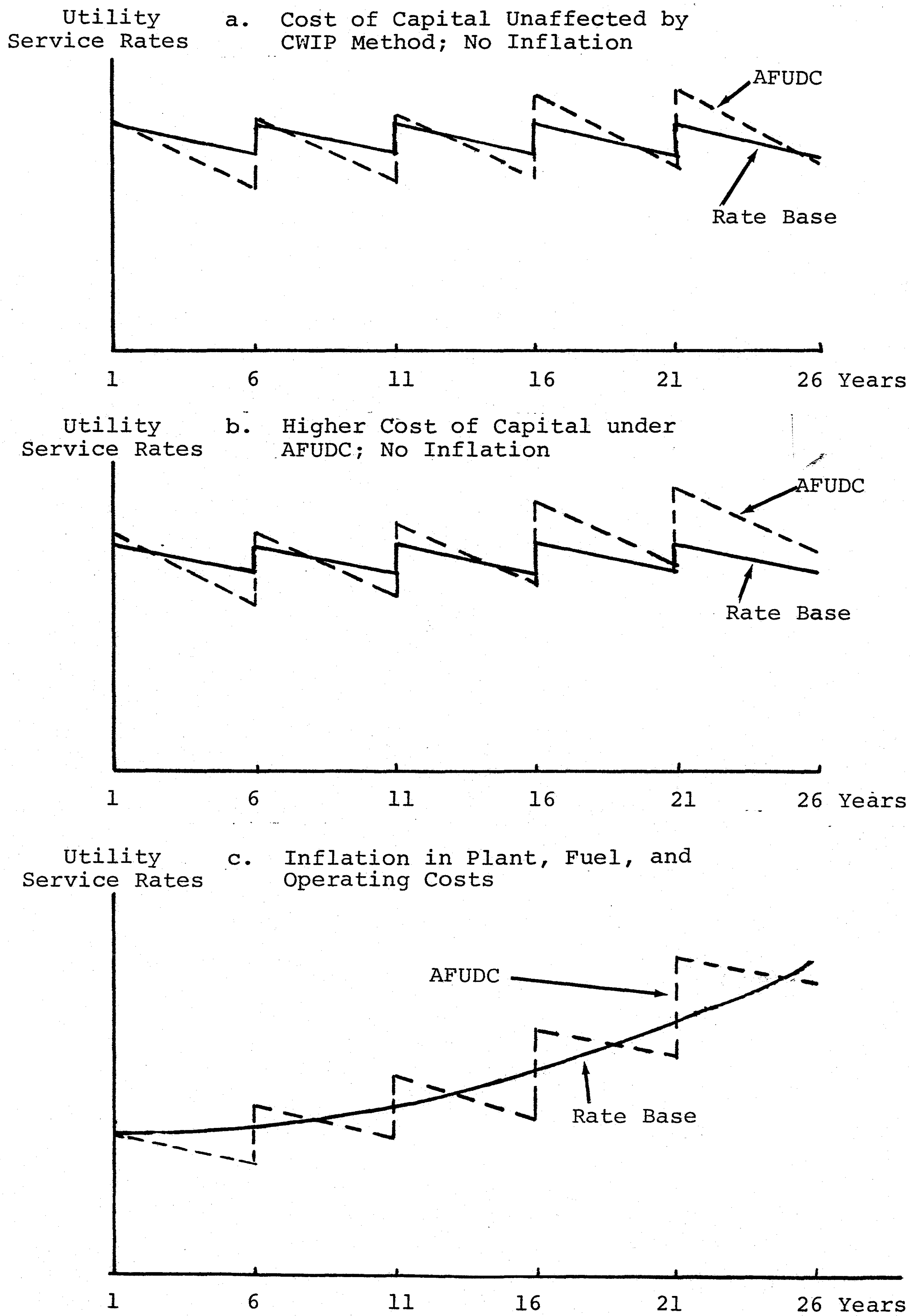
Utility Service Rates. Figure 2 shows how utility service rates vary over time under the alternative CWIP methods.[1] The rate base method produces a relatively stable pattern of service rates, with the slight fluctuations resulting from the model's assumption that a certain amount of excess capacity will exist when a new plant is placed in service. As system demand increases, the excess capacity is absorbed, capital costs are spread over more kwh of sales, and the cost per kwh declines.

The AFUDC company's rates are much less stable. Absent inflation, they decline initially (1) because of the absorption of excess capacity and (2) because depreciation lowers the rate base, hence revenue requirements. Then, when the new plant goes into service and its CWIP is added to the rate base, rates jump (1) because AFUDC must be replaced with operating income and (2) because depreciation must be taken on the new plant. The rate base company also has some fluctuation in its

[1]The simulation model assumed that new plant has the same operating cost as old plant. Some new plants are actually more efficient than old ones--this is especially true if the old plant is oil-fired and the new plant is coal or nuclear. However, pollution control equipment required on new plants often offsets any efficiencies that might otherwise have existed. Also, the simulation results reported here assume that demand increases steadily over time, and, as a result, excess capacity which the utility must "grow into" exists at the time each new plant is added.

Figure 2

UTILITY SERVICE RATES UNDER ALTERNATIVE CWIP METHODS



rates because of the capacity situation and depreciation charges. Rates are highest right after the new plant goes on line, and then they decline as the plant becomes more fully utilized.

The general level of service rates for the rate base company is stable--far more stable than that of the AFUDC company. The AFUDC company's level goes up over time even in the absence of inflation because of an increasing amount of capitalized AFUDC in the rate base. Where we assume (realistically) both inflation and a higher cost of capital for the AFUDC company, the difference in stability is especially notable. But even here, the average level of rates in the early years is lower for the AFUDC company, although eventually the rate base company has significantly lower rates because the absence of capitalized AFUDC causes it to have a much smaller rate base.

One should not place too much emphasis on the exact scale of the diagrams. The results are quite sensitive to the assumptions built into the model regarding the inflation rate, the rate of growth in demand, the percentage of total cost represented by fuel and O&M versus capital costs, the length of the construction period, whether demand increases steadily or in spurts, and the extent of the cost of capital differential between the rate base and AFUDC companies. Still, the general tendencies shown in the graphs certainly do hold, and these conclusions may be reached:

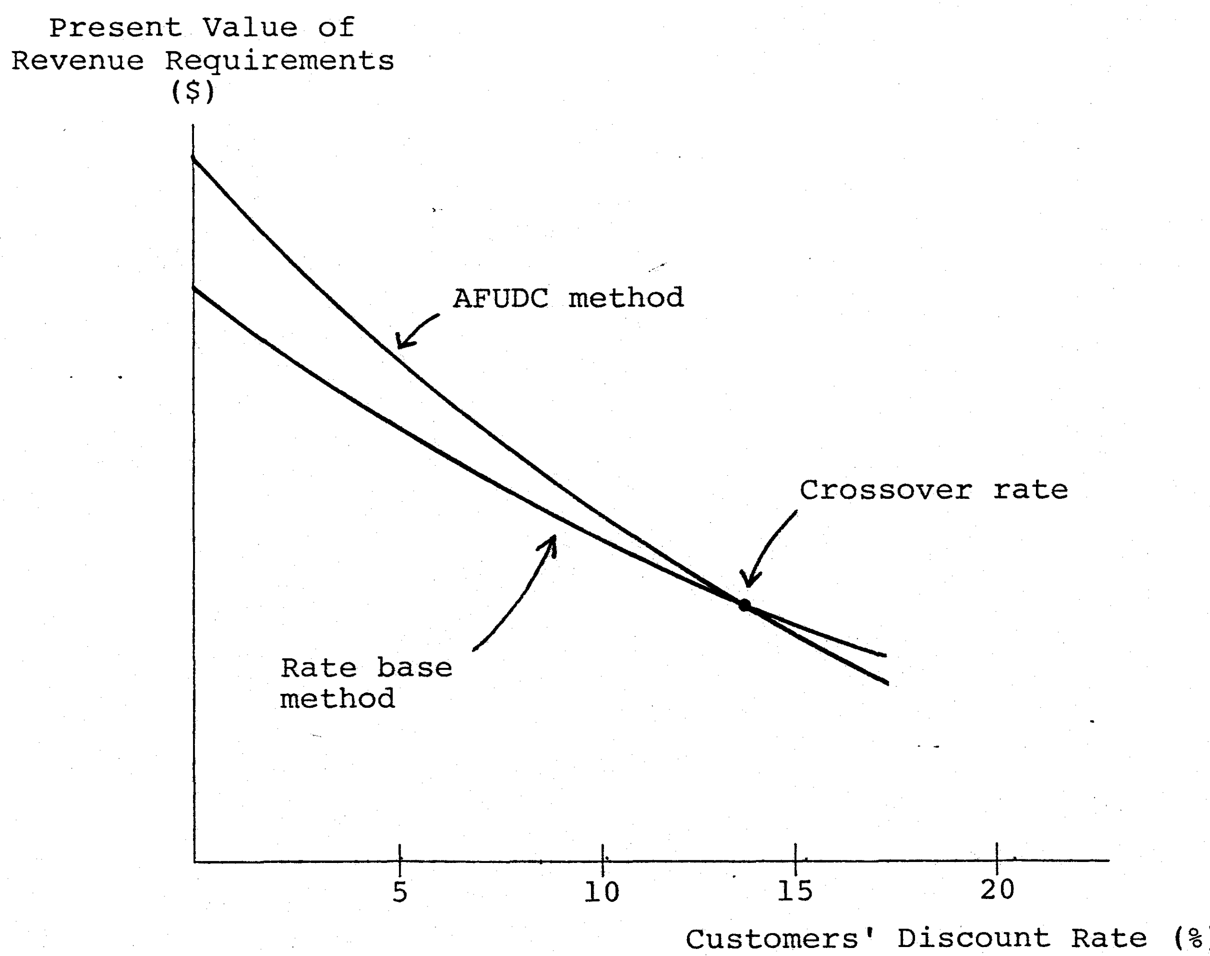
1. Utility service rates will be more stable under the rate base method than under AFUDC. This is especially true if strong inflation is present.

2. The short-run effects of a switch from AFUDC to rate base will always increase rates, while a switch from rate base to AFUDC will lower rates. In the long run, however, rates will be lower under the rate base method.

We also found the present values of future rates under the two methods--Figure 3 shows the general results. If a low discount rate is used, then the rate base method is superior to the AFUDC method, while at high discount rates the reverse is true. There exists a "crossover rate" at which the present value of future revenue requirements, hence costs to all customers in the aggregate, is equal under either the rate base or the AFUDC methods. Under realistic assumptions in today's economy, the crossover rate is in the 13-14 percent range.

Figure 3

PRESENT VALUE PROFILES OF FUTURE REVENUE REQUIREMENTS, RATE BASE VERSUS AFUDC



The appropriate discount rate should be found in accordance with the opportunity cost principle. Since it is customers who must meet the company's revenue requirements, it is the customers' opportunity cost discount rate which should be used in the present value analysis. Further, the revenue requirements associated with plant construction are known with virtual certainty and are long-term, so a discount rate associated with a low risk, long-term cash flow stream should be used. Finally, consumers pay utility bills with after-tax dollars, so the discount rate should be on an after-tax basis.

Different consumers are in different situations, and they have different opportunity costs. Some individuals have money invested in bank and savings & loan passbook accounts which pay only 5 to 5 1/4 percent, and the after-tax returns are lower yet. Others have very good investment opportunities for cash flows, including paying off credit card loans at 18-20 percent; rates may be even higher for some borrowers, but the tax deductibility of interest charges would reduce the effective charges for most consumers.

Customers who can invest and obtain after-tax returns greater than 14 percent should prefer the AFUDC treatment.[1]

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[1] A married couple with a taxable income of $25,000 in 1980 would be paying a marginal tax rate of 32%. Thus, the pre-tax rate of return necessary to obtain a 14% after-tax return would be 20.6%. Returns on low risk, long-term bonds such as Bell System bonds have yielded as much as 17% during 1981, but the average yield in recent years has been much lower.

Similarly, customers who are borrowing at close to 20%, and whose marginal income tax rates are less than 30% (which implies a taxable income for married couples filing joint returns in 1980 of $24,600 or more), should prefer AFUDC. But consumers whose after-tax returns on investments and/or costs of borrowings are less than about 14 percent should prefer the rate base method.

Robert R. Trout has studied the discount rate issue and has published a paper on the subject.[1] He concluded that the proper discount rate was 5.7%, and he further concluded that the present value of future revenue requirements was some 20 to 50 percent lower for rate base than for AFUDC treatment.[2] Our analysis indicates a lower, but still positive advantage for the rate base method.

It is important to recognize that both our conclusions and Trout's are based on simulations <u>in which no extreme changes occur</u>. As we note later on, dislocations such as occurred following the oil embargo in the mid 1970's could seriously change the situation. If such disruptions occur, then the rate base company is almost certainly going to be in a better position, and this can have a beneficial effect on its customers that is not reflected in the simulated output.

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[1] R. R. Trout, "A Rationale for Preferring CWIP in the Rate Base," <u>Public Utilities Fortnightly</u>, May 10, 1979.

[2] Interest rates were lower when Trout conducted his study, but since a utility's cost of capital and customer discount rates move in the same direction, there is no reason to think that the rise in interest rates would lower his PV advantage of the rate base method. The 5.7% customer discount rate would, however, increase.

Cash flows. Figure 4 shows how our simulated firms' cash flows after dividends vary over time, while Figure 5 shows how interest coverages vary. Since the rate base company receives a cash return on its CWIP, its net cash flows never decrease. The AFUDC company, on the other hand, receives varying net cash flows, depending on how much CWIP, hence AFUDC, it has at any given time. These cash flow patterns are reflected in the coverage ratios shown in Figure 5. With the assumed capital structure (40% equity, 60% debt) and cost of capital, the rate base company generally has a coverage ratio of about 3.0, which is the average ratio of the Aa/A electric utilities. The AFUDC company has a lower coverage, but, even more importantly, one which varies greatly over time and which falls to almost 1.0 toward the end of its construction cycle. These differences occur because we excluded AFUDC from the numerator of the coverage ratio. If all AFUDC had been included in the coverage ratios, they would have been similar for the two firms. However, bond indentures normally exclude amounts of AFUDC over specified levels, and security analysts and rating agencies today calculate cash coverages such as those shown here and give them as much or more weight as coverages which include AFUDC.

Figure 4
CASH FLOWS AFTER INTEREST AND DIVIDENDS

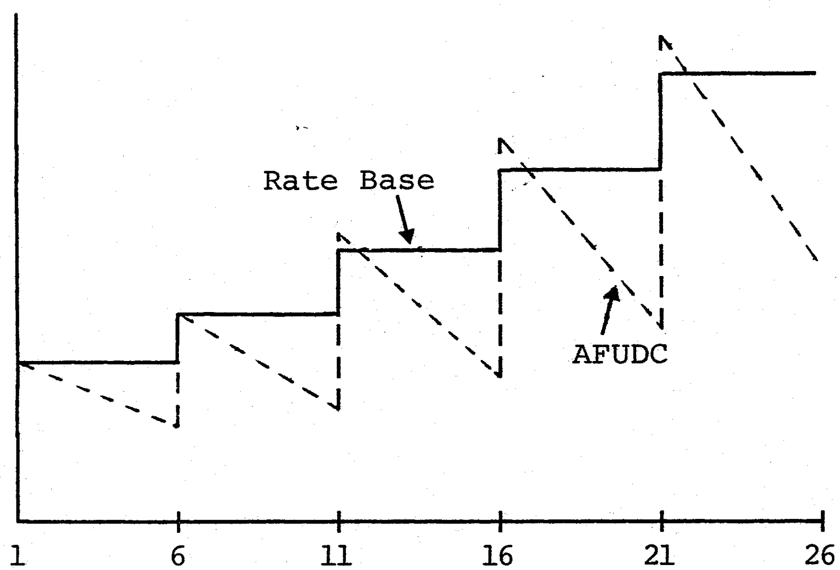
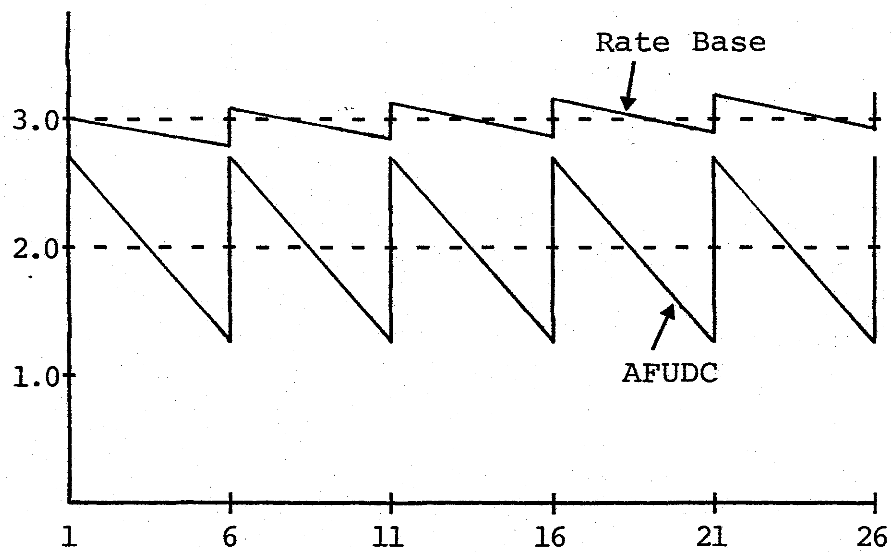


Figure 5
INTEREST COVERAGE (CASH)



It is again important to note that the simulation model assumes that the companies always earn their allowed rates of return, and that no regulatory lag whatever exists. This is not realistic, and the introduction of regulatory lag would have a major impact on the coverage ratios shown here. For example, if a spurt of inflation occurred in Year 5, depressing operating income, this would cause the reported coverage ratios to decline. Obviously, a decline would be especially serious for the AFUDC company, because its coverage ratio is precariously low already. A similar problem would occur if the plant's in-service date were delayed--the coverage would remain low until the plant was completed and placed in service.

The Importance of AFUDC

As noted earlier, the importance of CWIP treatment depends on the size of the CWIP account vis-a-vis operating assets. Further, CWIP depends mainly on (1) the level of inflation, (2) the length of the construction period, (3) the rate of growth in demand, and (4) the rate used to capitalize AFUDC. The importance of AFUDC depends on (1) the size of the AFUDC account relative to operating assets, (2) the rate of return allowed on CWIP, and (3) the rate of return actually earned on operating assets, which in turn depends on the authorized rate of return and the extent of regulatory lag.

Table 1 showed, for three Florida companies, that CWIP as a percentage of plant in service has varied, over the last six years, from a high of 46.7% to a low of 3.1%. The Florida companies have been permitted to put part of their CWIP into their rate bases, while AFUDC is accrued on the remainder of their CWIP. The percentage of CWIP in the rate base, combined with other variables, has led to a changing percentage of AFUDC included in net income. Table 2 shows the extent to which earnings have consisted of AFUDC over the twenty-one year period 1959 to 1979 for FP&L, FPC, TECO, and the electric utility industry average. For both the Florida companies and the industry, AFUDC was only a small part of net income during the 1950's and 1960's. However, as we moved into the 1970's, inflation, longer construction periods, and larger and more capital intensive plants, caused the CWIP account to rise relatively rapidly. At the same time, higher inflation rates pushed up the cost of capital and the rate used to determine AFUDC. With more CWIP and a higher AFUDC rate, the dollar amount of AFUDC ballooned. Simultaneously, for most companies, inflation and regulatory lag combined to keep the rate of return earned on operating assets below authorized levels. The net result has been an increase in the industry average ratio of AFUDC income to total income.

TABLE 2

PERCENT AFUDC TO EARNINGS AVAILABLE FOR COMMON, 1959-1979

Year	Florida Power & Light	Florida Power Corp.	Tampa Electric Co.	Industry Average
1959	6.21%	4.31%	7.49%	7.46%
1960	6.13	4.70	14.40	6.56
1961	5.71	7.64	1.48	5.25
1962	0.00	7.88	4.20	5.01
1963	0.00	8.28	12.04	4.06
1964	0.00	3.98	3.11	4.05
1965	0.00	9.70	9.34	4.09
1966	0.00	9.95	4.47	5.16
1967	0.00	3.12	12.96	7.17
1968	0.00	8.23	8.34	10.23
1969	0.00	14.85	18.43	14.17
1970	0.00	11.48	27.35	19.73
1971	23.33	34.45	12.48	25.13
1972	34.52	37.25	17.59	29.39
1973	25.45	70.20	20.41	32.06
1974	42.54	122.05	37.78	39.31
1975	38.74	57.05	25.08	34.98
1976	69.33	46.28	6.85	33.60
1977	18.92	7.37	1.19	36.86
1978	18.91	1.39	4.19	40.93
1979	34.42	2.12	5.01	N.A.

Source: Compustat

Note: Industry average figures are based on aggregate data; hence they constitute weighted averages.

The situation for the Florida companies has been somewhat different. First, any single company will, in general, have a less stable AFUDC ratio than the industry average. Thus, FPC's AFUDC/net income ratio rose dramatically in 1974 because of its large construction program and low (negative) operating income in that year. After 1976, when a major nuclear plant was completed, CWIP dropped, and AFUDC dropped with it. TECO went through a similar, but far less dramatic, cycle. Both TECO and FPC had relatively small construction programs during the period 1977-1979, and they were allowed to put some CWIP into their rate bases, so AFUDC was small. However, during the 1980's both companies' construction programs will be quite large, and CWIP will again represent a major part of their total assets. For example, TECO's ratio of CWIP to net operating plant is scheduled to rise to about 50 percent. If the AFUDC method were used, this would mean that TECO's percentage of AFUDC to net income would rise similarly.

EFFECTS OF CWIP TREATMENT ON THE COST OF CAPITAL

CWIP treatment affects the cost of both debt and equity capital to a utility. These effects are discussed in this section.

The Cost of Equity

An econometric model developed at PURC was used to estimate the effects of CWIP treatment on the cost of equity.[1] In essence, the model employs cross sectional regression analysis, using the market/book ratio as the dependent variable and such explanatory variables as the company's dividend book yield, earnings growth rate, whether flow through or normalized accounting is used, and CWIP method as measured by the ratio of AFUDC to net income. Other variables examined include the interest coverage ratio, the debt ratio, and the ranking of a utility's state regulatory climate.

Our study, like all other studies designed to measure the cost of capital statistically and to specify how different explanatory variables affect the cost of capital, has several basic problems. (1) All relevant variables in the models are the values which investors expect, on average, in the future, yet we have available as data only the historic values of these variables. To the extent that future values are expected to vary from past levels, the model will not correctly measure the cost of capital or explain how a variable such as AFUDC affects this cost. Since AFUDC varies over time depending on the stage of the construction program, measurement errors are obviously a problem.

(2) To the extent that the explanatory variables are not

[1] Westmoreland, op. cit.

independent of one another, then we have the problem of multicollinearity, and in this case the effects of one variable may be absorbed by another one. For example, we know that Value Line, Salomon Brothers, Duff and Phelps, and others who rank state regulators consider CWIP treatment in their rankings, along with other factors. Therefore, if both the AFUDC/net income ratio and regulatory rank are used in the same regression equation, the effect of AFUDC may be absorbed in the regulatory rank variable and therefore appear less important than it actually is.

(3) Tied in to point (2) above is the fact that rate cases are often determined on the basis of total dollars awarded as much as on the merits of the individual issues in the case. According to well informed people, commissions often seem to decide, toward the end of a rate case, that a company which has requested say $100 million of rate relief can "live with" say $60 million, that a $60 million award will be "within the range of reasonableness," and that a $60 million increase won't cause a revolt among ratepayers. Having reached such a decision, the commission would then direct its staff to write an order which is as reasonable as possible yet which produces additional revenues of approximately $60 million. Tradeoffs will then be made among such variables as cost and rate base disallowances, rate of return, flow

through versus normalization, changes in the fuel adjustment clause, projected cost data, weather adjustments, and the inclusion of CWIP in the rate base. If such a procedure is followed, then it is possible that a commission could with one hand permit some CWIP in the rate base, which should have a favorable effect on stock prices and bond ratings, but with the other hand take away these benefits through disallowances or other actions, and leave the company's stock price and cost of capital unchanged. Stated another way, what we are seeking to learn is how a change in CWIP treatment would affect the cost of debt and equity, other things held constant, but in reality other things simply are not held constant.

The solution to the problem raised as point (3) should be some type of multivariate regression analysis, but the multicollinearity problem raised as point (2) makes this a less than perfect solution. In fact, there is no completely satisfactory way to solve the statistical problems and, therefore, it is impossible to obtain an exact measure of how CWIP and AFUDC affect the cost of capital. Accordingly, the results shown in this section must be viewed with caution, and our final conclusions are based partly on the statistical analysis and partly on judgment.

The basic regression equation, and the statistical parameters, are shown in Table 3. Here P/B is the price/book (or market/book) ratio. BKYLD is the book yield of dividends,

TABLE 3

CROSS-SECTIONAL ESTIMATES OF THE PARAMETERS FOR 1970-1977
100 ELECTRIC UTILITIES

Model: $P/B = \alpha_0 + \alpha_1 BKYLD + \alpha_2 GROBR + \alpha_3 AFD + \alpha_4 FT$

Year	α_0	α_1	α_2	α_3	α_4	Corr. R^2 (S.E.E.)	F(4.95)
1970	-0.3947	13.470	17.259	-0.08491	-0.068499	0.6562	48.235
	(-2.410)	(8.789)	(9.922)	(-0.466)	(-1.349)	(0.2209)	
1971	-0.2802	13.981	14.158	-0.15538	-0.041061	0.6599	48.802
	(-1.693)	(9.209)	(9.161)	(-1.131)	(-0.870)	(0.200)	
1972	-0.1912	13.144	11.938	-0.23069**	-0.044425	0.6428	45.531
	(-1.165)	(8.740)	(0.058)	(-2.031)	(-0.996)	(0.1883)	
1973	-0.1166	11.385	6.6214	-0.03259	0.02696	0.7044	59.978
	(-1.243)	(12.662)	(8.480)	(-0.590)	(-0.639)	(0.1157)	
1974	-0.1057	9.3763	4.7072	-0.081150**	-00.060684	0.7361	70.028
	(-1.551)	(13.795)	(8.776)	(-2.764)	(-3.033)	(0.08778)	
1975	-0.1987	11.242	5.1486	-0.14114**	-0.079586	0.7536	76.894
	(-2.832)	(15.809)	(8.748)	(-3.144)	(-3.916)	(0.09031)	
1976	-0.1138	11.129	5.2641	-0.071714*	-0.052235	0.7064	60.546
	(-1.477)	(14.615)	(7.701)	(-1.462)	(-2.494)	(0.09275)	
1977	0.01427	10.998	2.3815	-0.073054**	-0.052369	0.7845	91.121
	(0.255)	(18.533)	(5.455)	(-2.457)	(-3.623)	(0.06467)	

The t-ratio for the coefficient is shown in parenthesis below the coefficient. The standard error of the estimate is in parenthesis below the R^2.

*Level of significance = .10

**Level of significance = .05

Source: Westmoreland, op. cit.

which can be measured as the product of the payout rate and return on equity. Thus,

$$\text{BKYLD} = \frac{\text{Dividend}}{\text{Book value}} = \left(\frac{\text{Dividend}}{\text{Earnings}}\right)\left(\frac{\text{Earnings}}{\text{Book value}}\right)$$

$$= \text{Payout rate X Return on Equity.}$$

GROBR is the growth rate in dividends attributable to the reinvestment of earnings and is measured as the product of retention rate and return on equity. AFD is the ratio of AFUDC to net income available to common, and FT is a dummy variable set equal to 1.0 if a company uses flow through and to 0 if it normalizes. The book yield variable shows the amount of dividends the company is able to pay per dollar of book value. Thus, it captures both the dividend level and the rate of return on equity, which allows dividends to be paid. The higher the book yield, the higher the price/book ratio. Similarly the higher the growth rate in earnings and dividends, the higher the price/book ratio. The flow through dummy variable indicates that, since 1973, companies which use flow through accounting have price/book ratios which are about 0.06 below the level of an otherwise identical normalizing company. In other words, if a normalizing company had a M/B ratio of 1.00, and then switched to flow through, then if everything else were held constant, its M/B ratio would fall to about 0.94. Assuming that regulators wanted to keep its M/B ratio at 1.00, then its allowed rate of return on common equity would have to be raised by about 75 basis points.

The effect of AFUDC on the cost of equity depends on (1) the size of the regression coefficient α_3 in Table 3 and (2) the level of AFUDC a particular company has during a given year. We can illustrate this effect using the 1977 regression data. First, assume that a commission decides to allow a company to earn a return on equity that is designed to cause its market/book ratio to equal 1.10. Further, assume that the company uses normalized accounting, and that its expected payout ratio is 0.70, or 70%. Further, assume that it puts CWIP into the rate base, hence has no AFUDC. We can insert these values for the explanatory variables into the regression equation for 1977 from Table 3 and derive the company's estimated required rate of return on equity:

$$M/B = 0.01427 + 10.998(BKYLD) + 2.3815(GROBR) - 0.073054(0) - 0.052369(0)$$

$$1.10 = 0.01427 + 10.998(\text{Payout X ROE}) + 2.3815(\text{Retention X ROE}) - 0.0 - 0.0$$

$$= 0.01427 + 10.998(0.7 \text{ X ROE}) + 2.3815(0.3 \text{ X ROE})$$

$$1.0857 = 8.4131(ROE)$$

$$ROE = 0.1290 = 12.90\%.$$

Thus, if this company, in 1977, earned enough on equity to provide investors with a book yield of 0.7 X 12.90 = 9.03%, while still retaining enough to obtain a growth rate of 0.3 X 12.90 = 3.87%, then its stock would sell for 1.1 times its book value. Had we solved the equation for a market/book ratio of 1.0, we would have obtained an ROE of 11.72%; this is the market value or "bare bones" cost of equity to the company.[1]

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[1]In 1977, the average U.S. utility had an 11.23% ROE and sold at 95% of book value. These figures are reasonably consistent with our cost of capital estimates. Note also that the cost of equity figures given here are for a company which normalizes and has no AFUDC. As noted above, the use of flow through would raise the cost of equity, and, as we shall show, the use of AFUDC also increases the cost of capital.

Now assume that the company begins to use the AFUDC method and has 50% of its net to common represented by AFUDC. In this case, its required ROE for M/B = 1.10 is 13.34%, calculated as follows:

$$1.10 = 0.01427 + 10.998(0.7 \times ROE) + 2.3815(0.3 \times ROE) - 0.073054(0.50)$$

$$1.1222 = 8.4131(ROE)$$

$$ROE = 13.34\%.$$

For M/B = 1.0, ROE = 12.15%.

We can now determine the effect of AFUDC on the cost of equity:

<u>M/B = 1.10</u>

	ROE with AFUDC	13.34%
	ROE without AFUDC	12.90
Difference:	Effect of AFUDC	0.44%

<u>M/B = 1.0</u>

	ROE with AFUDC	12.15%
	ROE without AFUDC	11.72
Difference:	Effect of AFUDC	0.43%

The AFUDC effect has varied over the years--see the column headed "α_3" in Table 3. For example, the parameter was almost twice as high in 1975 as in 1977 (-0.14114 versus -0.073054), indicating much more investor sensitivity to AFUDC in 1975 than in 1977. Further, since the percentage of AFUDC for the average company was larger in 1975 than in 1977, the total effect of AFUDC on the cost of capital in 1975 was far greater than in 1977.[1]

We have not calculated the regression parameters with data more recent than 1977, but chances are good that if we did, the AFUDC effect would be higher than it was in 1977. Industry average M/B ratios today are down to about 0.80 versus about 0.95 in

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[1]Trout, op. cit., reached cost of capital effects conclusions that were similar to but stronger than ours. He concluded that, in 1976, the effect on the cost of equity was about 60 basis points. Our results for that year would, for an average utility, be closer to 40 basis points.

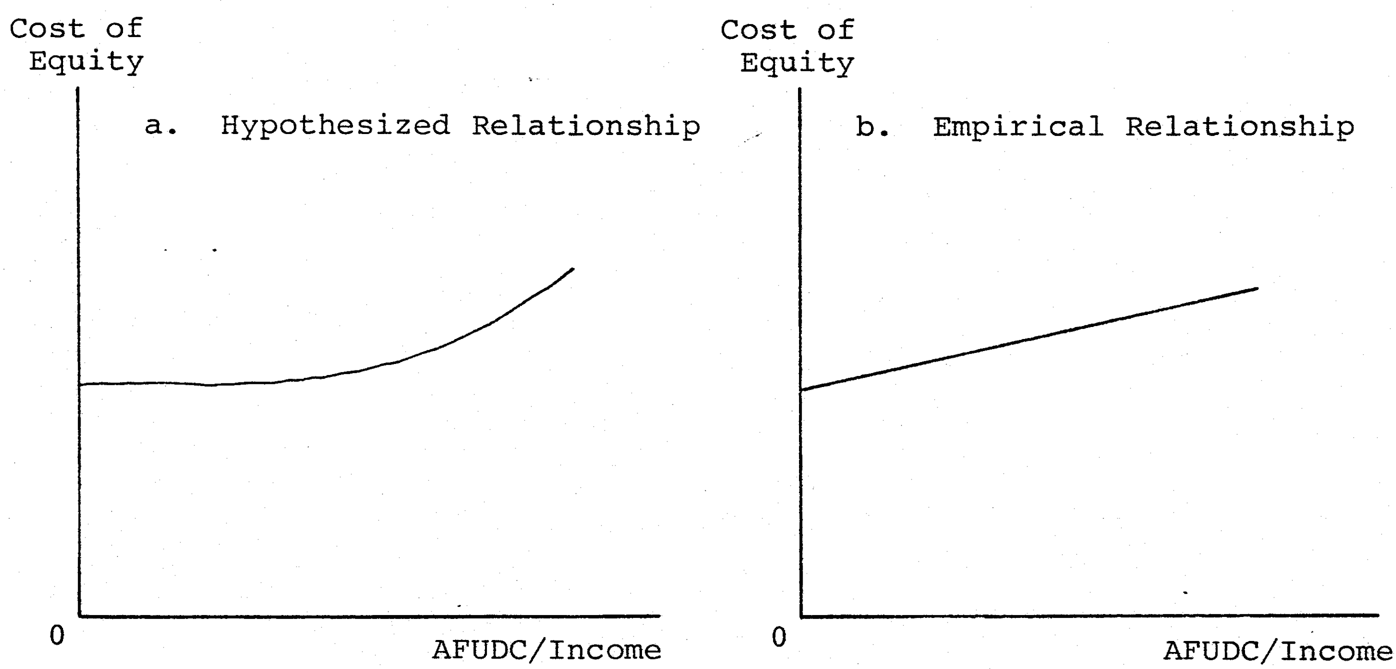
1977, and AFUDC as a percentage of income is up to about 45% versus 30.5% in 1977. This suggests a higher AFUDC effect.

Nonlinear Effects

The regression analysis assumes a linear relationship between AFUDC and the cost of equity. We tested for nonlinearities, but significant ones were not found. In other words, the model indicates that the first 10% of AFUDC as a percent of net income would have the same effect as the seventh 10% increase; that is, going from zero AFUDC to 10% AFUDC would have the same effect as going from 60% to 70%. Intuitively, this does not seem reasonable. A company ought to be able to carry a certain amount of AFUDC without running into cash flow and coverage problems, but above some threshold level, AFUDC should have an increasingly adverse effect on operations and the cost of capital. In graph form, we expected the relationship to be like that shown in the left panel of Figure 6, but the statistical analysis suggests that the right panel is the correct one.

It is likely that our hypothesized relationship is really the correct one, and that the statistical measurement problems discussed earlier caused the observed linear relationship. The statistical problems would be exacerbated if investors anticipate that companies with high AFUDC ratios will soon complete their construction programs and replace AFUDC with cash operating income, while those with low AFUDC ratios will soon begin new construction programs which will raise their ratios. It is possible that further research will enable us either to confirm the linear relationship or else to identify a specific nonlinear relationship.

Figure 6


Cost of Equity
a. Hypothesized Relationship
0
AFUDC/Income
Cost of Equity
b. Empirical Relationship
0
AFUDC/Income

Effects of the Cost of Debt

A number of researchers have attempted to determine how such factors as AFUDC affect bond ratings, hence the cost of debt capital.[1] These studies have met with only limited success, in part, according to representatives of the rating agencies, because bond ratings are based on more factors than the quantitative data that are used in regression studies, but also because of the statistical problems discussed in connection with the cost of equity.

We have not attempted to do a definitive study of our own to determine the effect of CWIP treatment on bond ratings and the cost of debt. However, based on discussions with investment bankers and rating agency analysts, as well as on observations of the amount of AFUDC reported by utilities in different bond rating categories, it is obvious that the method used to account for CWIP does have a material bearing on debt costs. As an approximation, for a company with an earned ROE of about 12 percent and a debt ratio of about 37 percent, a 10 percent change in the expected long-run average AFUDC percentage would cause a change of about one rating in a company's bonds, and consequently the following change in

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[1]For example, see G. E. Pinches and K. A. Mingo, "A Multivariant Analysis of Industrial Bond Ratings," Journal of Finance, March 1973, and S. B. Bhandari, R. M. Soldofsky, and W. J. Boe, "Bond Quality Rating Changes for Electric Utilities," Financial Management, Spring 1979.

its cost of new debt:

		1979 Averages	
AFUDC/Net Income	Bond Rating	Interest Rate	Premium over Aaa/AAA
0-10%	Aaa/AAA	9.64%	-0-
10-20%	Aa/AA	9.97	0.33%
20-30%	A/A	10.17	0.53
30-40%	Baa/BBB	10.69	1.05
over 40%	Bad/BAD	varies	varies

These are, obviously, only rough approximations, and they assume that many other factors are held constant. Also, it should be noted that the risk premiums on differently rated bonds vary somewhat from year to year, but that these premiums have been increasing in recent years and are higher in 1981 than they were in 1979.

Of course, the full effect of any change in CWIP policy on service rates would occur over time, as the changed cost of new debt produced changes in the embedded cost of debt. Thus, if a company were to change from the AFUDC method to the rate base method, and if it thereby lowered its AFUDC ratio from 40% to 0%, its bond rating would improve over time, its cost of new debt would decline from what it otherwise would have been, and its embedded cost of debt would likewise decline. However, whereas the beneficial effects of such a change on the cost of equity could be reflected in service rates relatively rapidly, the debt-related benefits would come more slowly.

SURVEY OF INDUSTRY AND REGULATORY PRACTICES

PURC also conducted surveys of (1) Edison Electric Institute member companies and (2) state regulatory commissions in order to obtain further information on both attitudes toward CWIP treatment and actual practices.[1] These surveys yielded some interesting information.

First, regulators and company officials alike indicated that CWIP treatment should consider these three factors:

1. Financial Soundness and Integrity. Everyone seems to agree that CWIP treatment can affect a utility's financial integrity, and that there are conditions under which it is essential to allow some cash return on CWIP.
2. Proper Price Signals. Most respondents agreed that it would be desirable for the CWIP method used to contribute to the giving out of proper price signals.
3. Intergenerational Equity. The respondents also agreed that CWIP treatment should be as fair as possible to different generations of customers.

These seem to be the three major goals or considerations that people believe should be examined when CWIP policy is set. Different people do, of course, assign different weights to each of the three factors.

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[1] The details of these surveys are contained in Westmoreland, op. cit.

The issue of financial soundness was addressed earlier in this paper in connection with the simulation results. Clearly, the larger the construction program, the greater the possibility that a decline in operating income will render a company's financial situation unsound and prevent it from raising capital. Equally clearly, a company using the AFUDC method will be more vulnerable to this problem than will an otherwise similar rate base company.

The price signal issue was also addressed earlier, and as was noted then, the rate base method has a clear advantage over the AFUDC method on this count. Some of the survey respondents also mentioned a related item--the national energy conservation goal. Since the rate base method typically causes short run bills to customers to be higher, this encourages energy conservation, whereas the AFUDC method encourages energy use.

The matter of intergenerational equity is more complex, and there is no unambiguous conclusion as to which method scores highest on this count. This point was discussed earlier at some length.

Some respondents also mentioned the possible effects of CWIP treatment on a utility's construction program. If the AFUDC method is used, utilities can anticipate cash flow problems that they would not have if the rate base method were used. This anticipation --or in several cases actual fact--may cause management to cut back on expansion plans and/or to use less capital intensive, less fuel-efficient plants. This may be a very logical, rational, decision, but if the construction program as originally conceived was the most economically efficient one, and if it could have been financed on reasonable terms, then such a cutback is socially undesirable.

Questionnaire respondents also addressed the question of risk. If CWIP is put into the rate base, then the customers will have paid part of the cost of the new plant when it goes on line. This is like a down payment on a home purchase or other purchases financed in part with debt. On the other hand, if the AFUDC method is used, customers will have paid nothing on the plant. There is always a risk, when a major construction project is undertaken, that something will go wrong. The Three Mile Island nuclear plant is the best example, but other less dramatic ones could be found. Had the GPU subsidiaries been putting CWIP in the rate base, then the investment in the TMI units would have been smaller and GPU's investors would have been exposed to less risk. Of course, the customers would have been exposed to more risk.

On a less dramatic scale, many utilities in 1981 find themselves completing plants that were committed back before energy costs soared, and before the growth in demand slowed down. These companies' reserve margins are high by historic standards, and certain parties have suggested that the new plants represent excess capacity and should not be allowed to earn a rate of return. In some cases, plants have been cancelled, and sunk costs have had to be absorbed by stockholders rather than by ratepayers. Such treatment seems completely unfair, assuming that construction began on the basis of a rational decision based on economic facts as they existed at the time. Yet in a highly politicized atmosphere there is always some chance that new plants will be deemed to be excess capacity and allowed no return, or that stockholders will have to absorb all the costs of cancelled plants. As with the TMI units, had CWIP been put into the rate base, the investors' exposure would have been reduced somewhat.

For a nuclear plant which is under construction for a long time, and when interest rates have been quite high during the construction period, AFUDC might amount to 30 percent or more of the total cost when the plant goes into service. For a coal plant, AFUDC would be smaller, in the neighborhood of 25 percent. Thus, investors would be bearing about 70 percent of the risks of new construction, consumers 20-25 percent, if the rate base method were used, versus 100% for investors under the AFUDC method.

People have argued that investors should bear all of these risks, customers none, on the grounds that investors are better able to bear risks and, indeed, that they are in the business of bearing risks. This argument has some appeal on the surface, but it does have flaws. First, utility investors tend to be either pension funds and insurance companies (which buy most of the bonds and preferred stock) or small individual investors, frequently retirees, who buy the common stock for dividend income and modest growth as a hedge against inflation. Investors who are really able to assume substantial amounts of risk tend to avoid the utilities, concentrating instead on growth stocks. A utility's customers, on the other hand, include the full spectrum of the business and industrial population, so whatever risks customers bear are spread over a large group and, further, are borne in proportion to their usage of electricity.

Another risk-related issue that should be addressed has to do with the installation of new technology. Suppose a utility is considering three alternatives for expanding generating capacity. One method is nuclear, where the total investment would be \$3 billion, but the total projected cost per kwh would be 4 cents. The second method is a new coal process, where the investment would be \$1.5 billion and the expected cost per kwh is 5 cents. The third alternative is a proven coal technology, with an investment of \$1 billion and an expected cost per kwh of 6 cents. If the company goes nuclear, and things work out well, the customers will benefit greatly, but investors will only earn a normal return. On the other hand, if something goes wrong and the plant is not licensed, investors may lose heavily, but under certain regulatory treatment customers may not be any worse off. With such a "heads I win, tails you lose" prospect, investors may well refuse to supply capital to utilities for the construction of anything other than proven-technology plant, or would do so only at a very high cost of capital. Allowing the utility to put CWIP into the rate base would help greatly to offset this problem, while using the AFUDC method is likely to compound it.

SOME CASE EXAMPLES OF CWIP TREATMENT

We have recently estimated the cost of equity in connection with several rate cases, including those of Louisville Gas & Electric, Texas Power & Light, and Portland General Electric. These studies were done at different times during 1979, 1980, and 1981, and with the volatile capital markets we have been experiencing, the cost of capital has been changing too rapidly to permit direct comparisons among the companies. Nevertheless, on the basis of the detailed studies done for each company, it is very clear that CWIP treatment does have a material bearing on the companies' financial situations, and on their debt and equity costs.

Louisville Gas & Electric. LG&E has throughout its history put all CWIP in the rate base and capitalized zero AFUDC. This company, along with the Texas Utilities subsidiaries, was until 1981 the only Aaa electric utility in the country (LG&E was downgraded to Aa in 1981). LG&E has a debt ratio which is about equal to the industry average, and its coverages have not been as high as those of the typical Aa company since 1977. The Kentucky regulatory climate is regarded as being about average by most analysts, and LG&E's ROE has been at or below the industry average in most recent years and was only 8.46% in 1978, 9.67% in 1979, and 12.09% in 1981. The company uses coal as its primary fuel, but it has a relatively high current and projected reserve margin. Based on all this, and on comparisons with other companies, LG&E would appear to be only an average utility. Its financial position would appear to be similar to mid-range electrics. However, LG&E carried an Aaa rating until June of 1981, it is now a strong Aa company, and its estimated cost of equity is at least 50 basis points below what it would have been if LG&E had capitalized AFUDC. Incidentally--but not unimportantly--LG&E's treatment of CWIP has been upheld by the Kentucky courts. This is an important consideration because, in several states, the CWIP method has been successfully attacked. In Kentucky it seems safe.

Since it has never capitalized AFUDC, LG&E's rate base is much lower than it otherwise would be. Also, its embedded debt cost is very low. These two factors help to allow LG&E to have one of the lowest costs per kwh in the nation.

Texas Power & Light. TP&L and its sister Texas Utilities (TU) companies are the only remaining Aaa electrics in the nation. The Texas Commission is favorably regarded by investors; regulatory lag in Texas is short; TP&L's capital structure is better than average; its authorized and earned ROE's are relatively high; and it has a good supply of lignite for fuel. On the other hand, it has a large construction program, both to meet load growth and to convert from gas-fired generation. The Texas Commission permits TP&L to put a portion of its CWIP in the rate base, with the amount of allowed CWIP being based (apparently) on a desire to keep AFUDC as a percentage of income below 20 percent. This seems to be a reasonable policy, and one that holds down the company's total costs and thus benefits the customers, while still minimizing problems of intergenerational equity among customers.

It should also be noted that TU's historically strong financial position enabled it to buy extensive lignite reserves in the 1950's and to hold them until the 1970's, when they were developed as shortages and rising costs made oil and gas generation no longer feasible. This is an excellent example of how a strong financial position can contribute to good long-run operating performance.

Portland General Electric. PGE historically has put CWIP in its rate base but has calculated AFUDC and used it as an offset to required revenues. However, the AFUDC rate was set several percentage points below the allowed rate of return, so CWIP made a contribution to cash flows. PGE has one of the largest construction programs in the country for its size. It was primarily a distributor of federal hydro power until the mid-1960's, at which time it began to lose its rights to this power and had to construct its own generating plants. Faced with the need to build for load growth <u>and</u> to replace hydro power, all during an era of high inflation, PGE had a very large construction program made even larger by a decision to go nuclear to a large extent. Because of the size of its construction program, PGE had (and still has) a lot of CWIP. This became a political issue. The company and the Commissioner wanted to continue with a partial cash return, but opponents succeeded in getting the issue on the ballot in 1978, and a statewide referendum led to a requirement for the complete removal of CWIP from the rate base. This caused a significant increase in the cost of capital. The Commissioner recognized this in a January, 1980, rate order in which the Company was authorized a 15.2% ROE (the authorized ROE was increased still further, to 16.25%, in 1981). Still, PGE has had troubles in recent years meeting indenture coverages; hence it has had difficulty selling bonds, its market/book ratio is about 77 percent, and it has been in generally poor financial health in spite of its relatively high authorized rate of return. This is a case where some CWIP in the rate base clearly would be beneficial both to the Company and to its customers.

SUMMARY AND CONCLUSIONS

The major points revealed by our study may be summarized as follows:

1. CWIP has increased significantly over time due to inflation, to larger and more complex plants, and to longer construction periods. However, for individual companies, the size of the CWIP account varies greatly depending on the phase of the construction cycle.
2. The importance of AFUDC income has risen even faster than that of CWIP. This relative increase has been caused (1) by the rise in CWIP itself, (2) by the effect of inflation on the cost of capital and the AFUDC rate, and (3) by regulatory lag, which has kept companies from earning their authorized rates of return on operating assets.
3. Our analysis suggests that three goals should be considered by companies and commissions when deciding upon CWIP policy: (1) The utility's financial integrity must be maintained, as financial integrity will affect the company's ability to obtain capital, the cost of this capital, and the firm's ability to undertake and complete an optimal construction program. (2) Proper price signals should be given to consumers.

(3) Intergenerational equity should be maintained.

4. Putting CWIP into the rate base clearly improves a utility's financial integrity and lowers its cost of both debt and equity capital. The effects on the cost of capital are impossible to measure exactly, but our statistical analysis did indicate that a rate base company would have a cost of equity that was some 40 to 50 basis points lower than it would be under the AFUDC method, assuming that 50% of net income would be AFUDC income. (At June 30, 1981, the median AFUDC/income ratio was 45%. The range was from a high of 162% to a low of zero.)

5. We did not conduct a full-blown statistical study of the effect of CWIP on the cost of debt. However, we did examine the bond ratings of companies with different financial characteristics, and we did, through our simulation model, examine the effects of CWIP treatment on coverage ratios, the key determinant of bond ratings. Based on our analysis, we concluded that a rate base company would probably have a bond which was rated at least two notches above that of an otherwise similar company, for example, Aa versus Baa. In 1981, this would have reduced the cost of new debt by about one percentage point.

6. Putting CWIP into the rate base definitely provides better price signals to consumers in the sense that

the cost per kwh of power in any year is more likely to reflect what the true cost will be in future years than it would if the AFUDC method were used. Under AFUDC, rates are held down until a plant is completed, at which time they must be increased sharply. This means that consumers will be given incorrect signals all during the construction phase. These incorrect signals may lead to incorrect appliance purchase decisions, to incorrect decisions about the installation of insulation, and, in general, to relatively energy-wasteful lifestyles. Further, the shocks produced by higher rates when new plants go on line can lead to political problems which may jeopardize the very foundations of the utility industry.

7. Putting all CWIP into the rate base would seem to lead to some intergeneration inequities, but being on 100% AFUDC would also create intergenerational inequities. Our admittedly imprecise analysis suggests that between 60 and 80 percent of a typical company's CWIP should be put in the rate base to minimize inequity problems.

8. Putting CWIP into the rate base is beneficial to most customers because it lowers the present value of their future revenue requirements. This result occurs because of the cost of capital effect. It is difficult

to determine the exact size of this benefit because of problems in measuring the effects of CWIP on the cost of debt and equity, and because of difficulties in estimating the proper discount rate to use to determine the present value of future revenue requirements. In addition, if the rate base method enables the company to take on more efficient projects because of improved access to capital markets, then the benefits of the rate base method to customers will be greatly increased.

9. Putting CWIP into the rate base will cause customers to bear a portion (25% to 30%) of whatever risks may be inherent in a construction program. This is similar to the down payment requirement for someone buying a home, which puts greater risks on the homeowner but gives in exchange a lower mortgage interest rate.

Based on these findings, our conclusion is that 60 to 80 percent of a company's CWIP should be put into its rate base.

We have not considered in any detail the best way of converting from 100% AFUDC to 60-80 percent rate base. On both conceptual and pragmatic grounds it would seem most appropriate to put CWIP into the rate base in a manner that would contribute to the leveling out of service rates over time. This would have to be considered on a case-by-case basis, and undoubtedly it would call for the inclusion of different percentages of CWIP for different companies and for a single company at different points in time. Under extreme inflation, it is possible that one might conclude that all CWIP should be included, but under no realistic conditions would it lead to zero CWIP in the rate base.

Our recommended procedure would require companies to file pro forma statements showing utility rate projections going out 10 years or so into the future with different percentages of CWIP in the rate base. Given the computer models that most companies have, this would not be a burdensome task. However, companies might well resist, as they are loathe to make public long run projections that are almost certainly going to be inaccurate on an ex post basis. The companies' fears along these lines are valid, but as a nation we are in serious trouble if companies and commissions refuse to use proper techniques and to make proper decisions because they are afraid of adverse reactions by uninformed parties.

Also, based on conversations with regulators as well as on our questionnaire results, it is clear that most commissions prefer precise rules to subjective, judgmental decisions where it is possible to devise a reasonable set of rules. We agree in principle with having rules whenever it is possible to use them rationally. In the present case, it would seem most appropriate to set an upper limit of approximately 80 percent of CWIP in the rate base, a lower limit of about 60 percent, and then to select the exact percentage allowed in a manner that would provide the smoothest future set of electric rates over time.

Any policy change that calls for a substantial increase in the percentage of CWIP allowed in the rate base could face special transitional problems that might have to be dealt with on a case-by-case basis. For example, if a 100% AFUDC company were approaching the end of a major construction program, it would be inappropriate to suddenly put 60 to 80 percent of its CWIP in the rate base--the revenue effects would simply be too great. In such a case, the CWIP inclusion should be phased in over some period that would have to be decided on an individual basis. On the other hand, the ideal time to start putting CWIP in the rate base is when construction is low and the CWIP account is small. Then, the buildup of CWIP in the rate base, hence its effects on customers' bills, would be gradual.

Our research has not by any means provided answers to all the questions that one could raise about CWIP treatment. Yet the research does make clear, at least in our judgment, that a utility's customers, on balance, would be much better off if a substantial portion of its CWIP were included in rate base and allowed to earn a current return.

SELECTED AFUDC/CWIP BIBLIOGRAPHY

I. ECONOMIC AND REGULATORY BACKGROUND

Bonbright, James C., Principles of Public Utility Rates (New York: Columbia University Press, 1961).

Federal Power Commission, Order No. 561, Federal Register 42, February 15, 1977, pp. 9161-9166.

Federal Power Commission, Order No. 561-A, Federal Register 42, August 5, 1977, pp. 39661-39663.

Pomerantz, Lawrence S., and J.E. Suelflow, Allowance for Funds Used during Construction, MSU Public Utilities Studies (East Lansing: Division of Research, Michigan State University, 1975).

II. ARTICLES

Brandfon, William W., "The Cost Effects of Construction Project Durations," Public Utilities Fortnightly, April 10, 1980, pp. 22-26.

Bunch, C. Robert, "The Tax Effects of AFUDC: Finanical Accounting Aspects," Public Utilities Fortnightly, August 14, 1980, pp. 26-32.

Chandrasekaran, P.R. and W.P. Dukes, "Risk Variables Affecting Rate of Return of Public Utilities," Public Utilities Fortnightly, February 26, 1981, pp. 32-34.

Comtois, Wilfred H., "Construction Work in Progress in the Rate Base: A Benefit to the Consumer," Public Utilities Fortnightly, May 8, 1980, pp. 19-24.

Fitzpatrick, Dennis B., "Capitalizing an Allowance for Funds Used during Construction: The Impact on Earnings Quality," Public Utilities Fortnightly, January 19, 1978, pp. 18-22.

Hyde, W. Truslow, "A Compromise on Construction Work in Progress Would Benefit Consumers and Investors," Public Utilities Fortnightly, August 18, 1977, pp. 15-18.

Johnson, Johnny R., "The Income Quality of Allowance for Funds Used during Construction," Public Utilities Fortnightly, June 9, 1977, pp. 32-36.

Johnson, Johnny R., "Losses on Investments in Construction Work in Progress," Public Utilities Fortnightly, September 14, 1978, pp. 20-24.

Johnson, Johnny R., "Construction Work in Progress: Planning for the Rate Case," Public Utilities Fortnightly, August 2, 1979, pp. 15-21.

Lerner, Eugene M. and William J. Breen, "The Changing Significance of AFUDC for Public Utilities," Public Utilities Fortnightly, January 1, 1981, pp. 17-25.

Nash, Alexander A., "Rate Relief and the Construction Funds Allowance--A Big Dollar Question," Public Utilities Fortnightly, July 6, 1978, pp. 15-18.

Rakes, Ganas K, and William C. Boynton, "AFUDC: An Overlooked Impact on Balance Sheets and Some Broader Implications for Financial Reporting," Public Utilities Fortnightly, June 5, 1980, pp. 19-27.

Trout, Robert R., "A Rationale for Preferring Construction Work in Progress in the Rate Base," Public Utilities Fortnightly, May 10, 1979, pp. 22-26.

III. OTHER STUDIES

Quick, G.A., A Computer Simulation Analysis of Alternative Methods of Accounting for Utility Construction Work in Progress, Unpublished Ph.D. Dissertation, University of Florida, 1974.

Westmoreland, Geraldine, Electric Utilities' Accounting for Construction Work in Progress: The Effects of Alternative Methods on the Financial Statements, Utility Rates and Market to Book Ratios, Unpublished Ph.D. Dissertation, University of Florida, 1979.