RATE OF RETURN REGULATION

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October 2005

For the *Encyclopedia of Energy Engineering and Technology* (forthcoming).

Keywords: rate of return, asset, rate base, earnings, cost, revenue, prudent, used and useful

I. INTRODUCTION

This article describes rate of return regulation, which regulators often use to determine fair and reasonable prices for electricity sold by utility companies. Prices under rate of return regulation are considered fair and reasonable because they give the company an opportunity to recover the costs it has appropriately incurred in providing electricity service, and customers are protected from paying prices that would provide the company with monopoly profits (1). Rate of return regulation is sometimes criticized for not providing companies incentives to operate efficiently.

In performing this form of regulation, the regulator determines the appropriate amount for the company's rate base, cost of capital, operating expenses, and depreciation.[1] Based on these amounts, the regulator determines the amount of revenue the company needs to cover its operating expenses, depreciation, and cost of capital.

The emphasis on cost recovery in rate of return regulation is the source of the concern that companies may not operate efficiently (2). For example, if the regulator allows a rate of return that is higher than what the company actually needs to ensure that shareholders continue to provide capital for investment, the company could increase its returns to shareholders by making unnecessary investments (if the regulator does not catch the company doing so). This is called the Averch-Johnson effect (3). However, rate of return regulation is also generally viewed as having the advantage of restricting opportunities for regulators to arbitrarily lower companies' prices.

[1] Rate base is the gross value of the company's assets, minus accumulated depreciation. Cost of capital is also called the allowed rate of return and is the interest that the company pays on its debt plus the return it must provide to shareholders to ensure they continue to invest in the company.

II. BASICS FOR ASSESSING RATE OF RETURN

Assessing the company's rate of return involves evaluating the effects of price levels on earnings so that investors have an opportunity to receive a fair rate of return on their investments. There are five traditional criteria for determining whether a rate of return is appropriate (1). The first is whether the rate of return is adequate to attract capital. One of the primary goals of utility regulation is to ensure that a sufficient level of service is available for customers. Service cannot be provided on an ongoing basis without continual reinvestment, therefore capital attraction is a primary criterion for evaluating the rate of return. A second criterion is the implementation of efficient management practices. The third criterion measures efficient consumer-rationing of services. To encourage efficient consumption of services, prices should reflect marginal costs. In some situations efficient prices may be different than those that attract capital, so there will be a need to balance these two criteria. A fourth criterion is rate stability and predictability, which assists customers who value being able to plan their utility expenses. The last criterion is fairness to investors. This may sound redundant with the capital-attraction criterion, but it is different. Consider, for example, a situation in which asset prices have been declining. A regulator may be tempted to adopt prices that are sufficient to attract investment for the new lower-priced assets, but that are insufficient to recover the past costs of the historical assets. Such a decision would not satisfy the fairness criterion.

III. HOW RATE OF RETURN REGULATION WORKS

Rate of Return Regulation Basic Formula

Rate of return regulation combines a company's costs and allowed rate of return to develop a

revenue requirement. This revenue requirement then becomes the target revenue for setting prices. The basic formula for determining a revenue requirement is:

$$R \equiv B \bullet r + E + d + T$$

where:

R = revenue requirement,

B = rate base, which is the amount of capital or assets the utility dedicates to providing its regulated services,

r = allowed rate of return, which is the cost the utility incurs to finance its rate base, including both debt and equity,

E = operating expenses, which are the costs of items such as supplies, labor (not used for plant construction), and items for resale that are consumed by the business in a short period of time (less than one year),

d = annual depreciation expense, which is the annual accounting charge for wear, tear, and obsolescence of plant, and

T = all taxes not counted as operating expenses and not directly charged to customers.

For example, assume that the regulator determines that the company has a net asset base of $30,000,000, an after-tax cost of capital of 12 percent, a tax rate of 25 percent, operating expenses of $1,000,000, and depreciation expenses of $150,000. Further assume that the cost of capital is comprised of 50 percent debt and 50 percent equity, the cost of debt is 10 percent, and the cost of equity is 14 percent.[2] To calculate the revenue requirement, we first need to determine the

[2] See the section below on estimating the cost of capital.

after-tax profit that the company would be allowed to receive once the new prices are in place.

Rate base (B)	$30,000,000
Cost of equity	x 14%
	$4,200,000
Percent of B financed by equity	x 50%
After-tax profit	$2,100,000

The company would pay a 25 percent tax on this profit, namely

After-tax profit	$2,100,000
1-Income tax rate	÷ 75%
Pre-tax profit	$2,800,000
After-tax profit	- $2,100,000
Income taxes (T)	$700,000

We can now calculate the revenue requirement as

Rate base (B)	$30,000,000
Allowed rate of return (r)	x 12%
Allowed after tax return (B x r)	$3,600,000
Expenses (E)	1,000,000
Depreciation expenses (d)	1,500,000
Taxes (T)	700,000
Revenue Requirement (R)	$6,800,000

Advantages and Disadvantages of Rate of Return Regulation

There are several advantages to using rate of return regulation. The first is that it is sustainable if there is no competition because prices can be adjusted to the company's changing conditions. It can also provide comfort to investors because rate of return regulation constrains the regulator's discretion in setting prices. This lowers investor risk, which lowers the cost of capital. Furthermore, company profits can be kept within acceptable levels from the perspectives of both investors and customers. Unless the regulator chronically underestimates the cost of capital (and courts do not reverse the regulator in this regard), investors can be confident they have a fair opportunity to receive the profits they expect and thus are willing to make investments. Customers can observe that the regulator is limiting company profits to the cost of capital.

There are also several disadvantages to using rate of return regulation. First, it provides only weak incentives for companies to operate efficiently (2). This weakness takes two forms. The first form is the Averch-Johnson effect. The second is that managers have less incentive to operate efficiently because regulators are unable to perfectly observe managers' efforts toward efficiency or the managers' innate abilities to be efficient. Another disadvantage is that rate cases have to occur frequently during times of high inflation (in the absence of a periodic adjustment for inflation between rate cases), and rate cases may be costly to perform. Lastly, rate of return regulation provides a mechanism for companies to shift costs from competitive markets to non-competitive markets.

IV. REVENUE IMPUTATION

In some situations the company may receive revenues that should be attributed to the regulated operations but are recorded in its non-regulated operations accounts. In such cases regulators can impute these revenues to the regulated operations. For example, in the U.K. an electric distribution company receiving financial benefits from the government because the company used hydro power did not reflect this benefit in its regulated accounting books. Consequently, the regulator adjusted the revenue requirement to reflect this revenue.

The calculation for revenue imputation is fairly simple. The regulator first calculates the revenue requirement. The regulator then subtracts from the revenue requirement the revenue imputation amount. The adjusted revenue requirement is the amount of revenue the company is allowed to recover through prices charged for regulated services. For example, consider our previous example in which the revenue requirement was $5,275,000. If the regulator determined that there should be $200,000 in imputed revenue, the company would be required to charge prices designed to provide $5,075,000 in revenue.

V. HOW RATE BASE IS DETERMINED

The Objective

When determining rate base the objective is to identify the amount of capital the company uses and needs to use to provide regulated services. This capital includes the plant or facilities in service that the regulator determines to be prudent, and the working capital. The basic decisions include determining how to value the plant that is in service, for what time period the rate base is measured,

and what plant is included. Each of these decisions is discussed below.

Methods for Valuing Plant in Service

There are three basic methods for valuing the plant that the company uses to provide its services (1,4). The first of these is called fair value or economic valuation. There are two methods for determining fair value. The first is a non-market approach that bases fair value on the company's financial data, such as the discounted value of its cash flow. The second method uses the market valuation of the company. The fair value approach can be problematic because it involves circular reasoning, namely, that the profitability of the company affects the asset value, which in turn affects profitability.

The most common method for valuing utility plant in the United States is the original cost approach, or historical approach. In this approach, assets are valued at what the company originally paid to place it in service. For example, if an electric company spent $500,000 for distribution wire and poles in 1999 and spent an additional $150,000 to construct the distribution facilities, that portion of the distribution network would be valued at $650,000, less depreciation, until it was retired from service.

The original cost approach has the advantages of being objective because the values are tied to the financial records of the company and provide a continual matching between the money the shareholders provide for investment and the cash flow that is provided back to investors. Disadvantages include difficulty of implementation where accounting and property records are

poor, understating the economic value of assets during times of inflation, and providing misleading economic signals to markets as to the real economic costs of the electricity service.

The final approach to valuing assets is the replacement cost approach, also called current cost accounting, in which assets are valued based on what it would cost to replace them today. Under one version of this approach the physical facilities in place are re-priced at today's cost. For example, if prices for wires, poles, and labor for the electric company in the previous example were increasing at a rate of 10 percent per year, the assets would be valued at $786,500, less depreciation, after two years. Replacement costs are generally determined by applying an inflation factor. They may also be valued by finding replacement prices in the marketplace. However, because finding such prices are difficult, the inflation method is the most commonly used approach. Under an alternative version, sometimes called the virtual company approach, the system is redesigned on paper to incorporate new technology not available when the original investment was made, and the components of this new system are valued at current prices.

Replacement cost valuation has the advantages of being able to overcome some deficiencies of poor accounting records, although previous values are needed for applying the inflation approach. It also values assets near their economic value, which sends efficient price signals to customers and suppliers. The disadvantages include its subjectivity because of the difficulty obtaining objective prices or inflation indices for old equipment, requiring exact inventories if current prices are used to estimate replacement costs, and returning to investors an amount of cash that is different than what they provided to the company. It is important to note that if rate base is defined in

terms of current value, the cost of capital used to compute the revenue requirement should be adjusted to exclude inflation.]

Some regulators use a combination of the historical and current cost approaches. These regulators use historical costs for determining the total amount of revenue that the company is allowed to collect and current costs for designing prices. This combination gives the best of both worlds: investors receive back from customers exactly the cash they provided to the company, plus a return on their investment, and prices can send efficient economic signals to customers and managers.

Choosing a Test Period

A test period, which can be either a historical period or a future period, is the period of time chosen for quantifying the amount of plant that is being used to provide the utility service, expenses that are being incurred, and billing units that are being used to develop prices that will produce the allowed revenue requirement (4). It is normally at least one year and may be several years. In choosing a test period, regulators generally attempt to choose a period that is representative of the time over which the prices will actually be charged. They also seek a period sufficiently long that it represents normal operations. In cases where the test period contains some unusual activities or events, such as an extraordinary amount of maintenance, regulators will generally normalize the costs or revenue they believe may have been affected.

With historical periods, the plant in service is measured for a recent period of time that is believed to be representative of the company's typical operations, for which the necessary accounting

records are available, and for which all major adjustments to the accounting records have been concluded. This has an advantage of being objective and transparent, but the period for estimating plant in service is different than the period for which prices will actually be in effect.

When using a future period for the test period, the plant in service is estimated based on projected changes. This has the advantage of being able to match the period for which plant in service is estimated with the period for which prices will actually be in effect. However, it has the disadvantages of being subjective and may provide a greater incentive for companies to operate to meet the regulator's expectation rather than to be efficient. Or alternatively, the company may project major additions to plant, then fail to make the investment and in effect receive a return and depreciation element on non-existent plant.

Determining the Amount of Plant in Service During the Test Period

Once the test period is chosen, the amount of plant in service may be valued in one of three ways: (1) average monthly balances, (2) end-of-period balance, or (3) average beginning-of-year and end-of-year balances. Average monthly balance simply estimates the arithmetic average of the plant in service at the end (or beginning) of each month. End-of-period balance uses the plant in service at the end of the year. Average beginning-of-year and end-of-year balances simply estimate the arithmetic average of the first month's and last month's plant in service.

Prudence Concept and Used and Useful Concept

In some jurisdictions, a utility plant must be considered both prudent and used and useful before

being allowed into the rate base (1,4). Prudent means the investment is reasonable based on cost-minimizing criteria. There are two perspectives. In one view, the investment is considered prudent if it was prudent at the time the decision was made. This requires accurately assessing what information management had available and used to make its decision. In the second perspective, the investment is prudent if management acted to minimize costs by fully considering changing conditions that would affect the investment. This requires assessing what management should have known and should have considered in making its decision.

Used and useful means that the plant is actually being used to provide service and that it is contributing to the provision of the service. For example, if a company has excessive numbers of distribution lines carrying electricity to a neighborhood, the regulator might not include some of the investment in the rate base because, even though all of the lines are used, many are not needed so they are not really useful.

Adjustments for Construction

Companies generally construct facilities over time. This means that investments are made prior to the plant actually being used and useful. There are two ways to reflect this in the rate base (1). One method, called construction work in progress (CWIP), includes the investment in the rate base as the investment is made. This is problematic because it violates the used and useful standard and causes current customers to pay for the plant that will be used by future customers. On the other hand, it provides cash flow for the construction project. The second method capitalizes the financing of construction projects and is called allowance for funds used during construction

(AFUDC). AFUDC adds the cost of money used to finance the project during construction to the rate base once the plant is used and useful. The AFUDC is then depreciated along with the plant. AFUDC does not provide cash flow to fund construction. The cash flow comes later and in some instances creates a cash surplus. This cash is either returned to shareholders, held for future use, or invested outside the utility business. AFUDC makes current services more affordable to customers in the short run by capitalizing outlays and deferring returns until construction is complete. However, AFUDC can create "rate shock" when the full cost of the new plant plus accumulated financing costs enter rate based in one year.

Working Capital

Working capital is the average amount of capital, in excess of net plant, that is necessary for business operations (4). Examples include inventories, petty cash, prepayments, minimum bank balances, and cash working capital. Cash working capital is the average amount of money that investors supply to bridge the gap between the time that expenses are incurred and the time that revenues are received. In some cases, customers pre-pay for services. This prepayment can be shown as an offset to cash working capital. When investors have provided working capital, it should be included in the rate base.

Accumulated Depreciation

Rate base excludes accumulated depreciation. In other words, the B in the formula includes the value of the plant less the amount by which it has been depreciated.

VI. COST OF CAPITAL

The return the company is allowed to receive on its rate base is called the allowed rate of return or the cost of capital, and includes both the cost of debt that the company uses to finance its rate base and the cost of equity. The cost of debt is simply the weighted average of the interest rates that the company pays on its long-term corporate bonds. The cost of equity is the returns that shareholders need to ensure they continue to finance the company. Regulators combine the cost of debt and cost of equity to form what is called the weighted average cost of capital (WACC) (1).

There are several ways to estimate the cost of equity but the most popular is the capital asset pricing model, or CAPM. CAPM includes two basic components, the risk-free cost of capital and the risk premium. The risk-free cost of capital is generally considered to be the interest the U.S. government pays on long-term bonds. The repayment of these bonds is generally considered to be secure, so the interest rate reflects only investors' time value of money. The risk premium is the amount of return that investors require because the actual earnings of the company are uncertain. This risk premium for a company is estimated by analyzing the degree to which the variation in the return on the stock follows the variation in the averaged returns on all the stocks in the market. Once the costs of debt and equity are determined, regulators combine them into the WACC, using the company's capital structure as the weights.

VII. OPERATING EXPENSES

Operating expenses (4) include costs of items such as supplies, labor (not used for plant construction), and items for resale that are consumed by the business in a short period of time (e.g.,

less than one year). Standards for accepting expenses include arms-length bargaining, whether the expense is a legitimate expense for providing the utility services, whether the utility company has been inefficient or imprudent in incurring the expenses, and whether the expenses are representative. Arms-length bargaining means that the company management, when deciding whether to incur an operating expense, has looked out for the financial interests of the company as if the company were in a competitive marketplace and had no financial interest in the expense payee, except as a purchaser of the payee's service or product.

Expenses are considered to be representative if they are being incurred at normal levels. Exceptional expenses may be disallowed if they do not represent the normal operations of the company. This applies primarily if the prices based on this revenue requirement will apply to multiple years. If this is the case then including expenses that are rarely incurred would cause these expenses to be recovered several times. Sometimes these expenses are normalized, that is, spread over multiple years. Also, expenses may be adjusted for known changes, such as pending wage increases or imminent decreases in numbers of employees. Expenses included in the revenue requirement are generally referred to as being "above the line." Expenses disallowed by the regulator are generally referred to as being "below the line."

VIII. DEPRECIATION

Depreciation is generally viewed as an annual accounting charge for wear, tear, and obsolescence. In regulation, depreciation is viewed as capital recovery, that is, the spreading of the plant investment over time to be recovered in revenue requirement (4).

The determinants of depreciation are the useful life of the plant, salvage value, and depreciation method (4). The useful life of the plant refers to the number of years over which the assets are depreciated. There are several ways to determine useful life. For many years the physical life of the plant was used, however, this was usually longer than the economic viability of the plant. During times of technical and economic stability, actual experience with the length of time this type of plant is in use is appropriate for determining useful life. In most situations, though, historical experience does not match present or future needs because the stability preconditions are not met. Recently the economic life of the plant, which is the projected length of time in which it will be economical to use the plant, rather than replace it, has come to be favored. This approach has the down side of requiring accurate operating forecasts.

Salvage value refers to the market value of the plant at the time it will be removed from service, minus any removal and decommissioning costs. If this is a positive number, which means that the company can obtain some positive economic value for the asset once it is no longer used or useful, then the salvage value is subtracted from the cost of the asset before depreciation is calculated. For example, assume a building costs $20 million to build and the company can sell it for scrap for $1 million after its useful life. The net cost to the shareholders for providing capital for the building is $19 million ($20 million minus $1 million); this is the amount that is depreciated. If on the other hand the building has contained hazardous waste and it costs $5 million to clean up the site once the building is no longer in use and the materials are worthless, then the amount to be depreciated is $25 million ($20 million plus $5 million).

Several methods are available for spreading the cost of the asset over time, but the most popular method is straight-line depreciation. With straight-line depreciation, the cost of the asset is spread uniformly over its useful life. For example, assume that the building will be used to store hazardous waste and will be used for 25 years. The annual depreciation using the straight-line method would be $1 million per year ($25 million divided by 25 years).

Straight-line depreciation is often criticized for not reflecting the rate at which the plant actually decreases in value. Generally, plant value decreases rapidly its first few years of service, and then more slowly in later years. Because straight-line depreciation assumes a constant rate of decrease, it understates actual depreciation in early years and overstates actual depreciation in later years. Slow depreciation rates create problems for companies whose markets are transitioning to competition or that are experiencing increasing rates of technological change. If the regulatory depreciation rates are slower than economic depreciation, the company's book value of its plant may be greater than the economic value of its plant.

IX. TAXES

Governments generally require utility companies to pay taxes, including income or profit taxes, franchise fees, property taxes, and excise taxes. Some of these taxes are passed directly to customers (it is common to see franchise fees and excise taxes listed on utility bills). Income taxes, however, are not passed on directly to customers so it is necessary to include these taxes in the calculation of the revenue requirement. This is done by tax-effecting the revenue requirement. For

example, consider a situation where a regulator determines that a company's current revenue is $1 million less than the amount of revenue that would be needed to provide an adequate after-tax rate of return. Assume that the income tax rate is 20 percent. This means that the regulator would need to allow the operator prices that would increase before-tax revenue by $1.25 million ($1 million divided by 0.8, which is 1 minus the income tax rate).

The income taxes paid by the company may not match the income taxes that should be included in the rate base. This is because the timing in the accounting methods for tax purposes may be different for those used for regulatory purposes. For example, some countries may allow accelerated depreciation for tax purposes in order to encourage business investment. However, the regulator may prefer to use straight-line depreciation. The effect of using straight-line depreciation is that customers are in effect prepaying taxes and providing capital to the utility.[3] This customer-provided capital typically receives one of two treatments in revenue requirements. Under the first, it is deducted from rate base. Under the second, it is treated as cost-free capital. (5)

X. CONCLUSION

This chapter describes how regulators use rate of return regulation to control power companies' overall rate levels. Setting the overall rate level is just the first step in a two-step process for setting

[3] One regulatory treatment, called "flow-through," eliminates this effect and removes the benefit to the utility of the favorable tax policy.

prices. The second step is rate design, which refers to the price structure or relationship among the individual prices.

In practice regulators combine elements of rate of return regulation with other regulatory tools, such as benchmarking and price or revenue caps. These combinations allow regulators to customize the amounts of certainty and efficiency incentives that they believe are appropriate for their situation.

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