THE PROBLEM OF THE PUBLIC UTILITY RATE BASE

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INTRODUCTION

The rate base, upon which the income of a public utility is based, is of primary importance to both the company and to its patrons. If this base is established at too low a value the utility company will be deprived in part of its just and reasonable income. On the other hand, if the rate base is established at too high a value, the customers will be forced to pay an excessive rate for the services rendered them, and the utility company will make more than a fair return on its investment. If the rate base is fixed at its proper value, the financial status of the company will be such that, in addition to profits, sufficient reserves will be established to take care of extensions to service, and to renew or replace elements of the property that may wear out or become obsolete. In fact, if this rate base is too low the utility property will actually depreciate because insufficient funds will be available for its upkeep. Thus it becomes evident that an insufficient return on a public utility property is not only detrimental to the company, but the benefits to be derived by the public from the services rendered by company will be reduced because of the inability of the company to furnish modern first class service. On the other hand, a rate base which is so high as to cause an unreasonable rate to be charged for the services rendered by the company will act to the disadvantage of both patrons and company. The public will refuse to use the service furnished by the company to its fullest extent if high rates prevail, and thus both the public and the company will be deprived of the mutual benefits which they should enjoy.

It is evident, therefore, that for any public utility company there is a definite value of the rate base that should be established for it. This rate base should be such that it will justify a rate for the services rendered by the company which will be of mutual advantage to both the company and its patrons.

Much writing has been done on this subject by many able writers and

students of public utility ecomomics. However, much of this writing has been of a technical or legal nature, and it has been complicated by the addition of other problems in public utility economics. It is the purpose of this paper to present the problem of the rate base in as clear and logical manner as possible without complicating the matter by the introduction of kindred problems.

It is believed that if the general public had a clearer understanding of the problems of public utility economics there would be less controversy over the matter of rates for public utility services, resulting in benefits to all parties concerned. It is to be hoped that papers of this nature will serve toward that end.

CHAPTER I

HISTORY AND GENERAL ASPECTS OF THE RATE BASE PROBLEM

There are three important groups of public utility companies in existance today that will be discussed in this paper. These are (1) the Electric Light and Power Systems, (2) the Gas Companies, and (3) the Electric Railways. The very nature of these public utility companies is such as the names implies, that their structures must pass either above, upon, or under public property. This condition is especially true in cities. Hence, there has been from the first the necessity that the utility company obtain a permit or franchise from the proper governmental authorities before proceeding with the construction of its property. Many of the early franchises were granted without any stipulations as to rates, while many more of them stated only what the maximum rate should be. The former type of franchise left the utility company free to establish its rates as high as the public would pay for the services rendered. In the latter case while the maximum rate was fixed the company had the alternative possibility of reducing its rates and thus increasing its volume of business and profit. This method of fixing rates gained rapidly in favor with the public, but in many cases the opponents of privately owned utilities contended that the rates were still excessive.

The nature of many of the early franchises were such that the company applying for the franchise was given exclusive right to operate in the territory which they proposed to serve. This, public utility companies have in general been left without the competition which exists between other types of business enterprises. Because of the factors just reviewed and other kindred problems which arise from time to time it became evident near the end of the nineteenth century that some form of regulation would have to be instituted by the various states.

The regulation of public utilities by the state has but one object, namely, adequate service at reasonable rates. Three methods of regulations

have been employedup to the present time: (1) Franchise stipulations, fixing the character of service and rates to be charged, as has already been discussed; (2) Legislative acts or Ordinances passed from time to time with similar intent; (3) Regulation by state or local authorities. It is not within the scope of this paper to go into a discussion of the various means of regulation. It will be sufficient here to say that the first two methods named obove have for various reasons proven unsatisfactory. The third method, regulation by state or local authorities has proven the most satisfactory, although this method is not without defects.

The method of regulation by state or local authorities is by legislative acts, and is a delegation of legislative authority to a subordinate body. That is, legislation is passed creating regulatory bodies and giving them the authority of the legislative body to regulate utilities. The regulatory commissions in the various states vary from one to seven members. The commissioners are either appointed by the governor and confirmed by the upper branch of the legislature, or they are elected by the people. The former method is the one most widely employed in the various states.

The first state regulatory body was organized in Massachusetts in 1885 and had jurisdiction only over gas companies. Two years later it was given authority over electric light companies. Its powers were limited at first, but its scope was extended in 1894 to practically the full range of present day regulation. This commission served as a pioneer in the field of state regulation, and its example was followed in the establishment of regulatory commissioners in other states. Modern regulatory methods had their beginning in 1907, when Wisconsin and New York established commissioners having very broad jurisdiction and authority over all forms of public utilities and interstate transportation.

The necessity for the establishing regulatory commissions and the early history of these commissions has now been discussed. It will be in order now to examine briefly the duties of these commissions. As has been stated the sole function of these bodies is to see that the various public utility companies

furnish adequate service at reasonable rates. The problem of determining what adequate service should be is not so difficult. It involves such factors as continuity of service, extensions of service, and the replacement of worn or obsolete elements of the utility property. The problem of reasonable rates is much more involved and centers largely upon establishing a reasonable value of the rate base, from which value the gross income of the company is computed by applying a fair return percentage to the rate base.

The general procedure of the commission in rate cases is as follows: when a complaint of excessive rates is made to the commission, the commission at once notifies all interested parties and sets a date for a hearing. In the meantime, the utility company, the petitioners, or the commission, or possibly all three, may prepare appraisals of the property in question. When the formal hearing is held, evidence is presented as to the valuation of the property based upon the appraisals that have been made, or upon the accounting records of the investment of the company in its property. The records of the company are presented, showing the current operating expenses, taxes, and other charges incurred by the company in conducting its business. Testimony is usually offered as to a fair rate of return upon the value of the property, or "rate base." After the hearing is over the parties are given opportunity to prepare briefs summarizing the evidence and citing authorities in their favor. The commission then considers the case and renders its decision as to the need of changes in rates.

The problem of fixing the rate base requires a consideration of several of the following: (1) original cost of the property, (2) cost of reproducing the property, (3) depreciation, (4) earning capacity of the property, and (5) other factors of less importance depending upon the particular case. The first three factors are of such importance that each will be treated separately in the following chapters. The first two factors have to do with the physical value of the property itself, while the third affects the physical value, and also creates the necessity of permitting the company to accumulates reserves to offset depreciation. The fourth requires a study of existing financial con-

ditions in order to fix a fair rate of return to the investors in the company's stocks. The fifth requires a study of local conditions. It may be impossible for one company due to its physical location to earn a fair return on the same rate base upon which an exactly similar company, but more favorably located, could earn a liberal return.

The above outline of the history and purpose of state control of public utilities gives some idea of the complexity of the problem of establishing a rate base that is fair to all parties concerned. In the final determination of this base no fixed rules can be followed. Rather it is a problem for men of broad experience in the field of economics to give each of the various factors the proper right in th final valuation. The subject is summarizedby the following quotation from the opinion written by Mr. Justice Hughes in the Minnesota rate cases:

> "The ascertainment of that value is not controlled by artificial rules. It is not a matter of formulas, but there must be a reasonable judgment having its basis in a proper consideration of all relevant facts" ([1]230 U.S. 352, 434).

However, some systematic method must be employed in obtaining the approximate values of the factors entering into the rate base. These factors, which have already been stated, will now be taken up separately and discussed in detail.

CHAPTER II

INVESTMENT OR ORIGINAL COST

Accounting Records. - The first basis of valuation is the investment in, or the original cost of the property. The value of the property on this basis is generally obtained from the accounting records of the company. If the property is new, such a determination of value may be made with accuracy, due to standardized accounting methods. However, most companies were organized before accounting methods were standardized, and in may cases the early records have been destroyed or are unavailable. This complicates considerably the problem of determining accurately the original cost. In such cases it is often necessary to make estimates of the cost of the original property based upon market prices which prevailed at the time the property was constructed. If some of the records are available, accountants experienced in such work can often construct remarkably accurate statements of the cost of construction. If some of the records are available, accountants experienced in such work can often construct remarkably accurate statements of the cost of construction, by the use of interpolation and other methods.

Historical and present value. - On this basis of valuation there is the question of what is meant by investment or original cost. The owner ship of the property may have changed from the company who constructed it originally to an entirely different company by reorganizing or by outright purchase. Thus, the cost to the present owner may be greater or less than the original cost. There is no authoritative answer as to whether the cost of the original elements of the property or the purchase price of the property should be considered in establishing the rate base. However, it is logical that the present owners should be interested in protecting their investment in the company whether they are the original builders or whether they have acquired the company by purchase. Investment may be defined as including the direct proceeds from the sale of outstanding securities, the earned surplus which has been left in the business, reserves (which belong to the owners), and under certain conditions, the cost of pro-

perty retired but not removed from fixed capital account.

Land . - Unlike the cost of the elements of property, which are based on accounting records, land owned by the company is usually assigned present value. The present value of the land is easier to fix than the present value of the other elements of property because it has a definite value based upon the value of adjoining or comparable parcels.

Legal Basis. - The legal basis for this method of valuation is found in many commission and court decisions. The following quotation from an openion of the Massachusetts Commission is typical.

> Accordingly, we rule that under Massachusetts law capital honestly and prudently invested must, under normal conditions, be taken as controlling factor in fixing the basis for computing fair and reasonable rates; that if there is mismanagement causing loss, such loss must be charged against the stockholders legally responsible for the mismanagement; that reproduction cost either with or without depreciation, while it may be considered, is not under our law, to be taken as the determining basis for reckoning rates. (Re Middlesex & Boston Street Railway Co.(Mass) 2 M.P.S.C.R. 99, 111.).

The advantage claimed for this method is that the value may be determined at any time by simply taking from the records the value of the additions that have been made since the last appraisal and adding this value to the total value of the last appraisal.

Chapter III

COST OF REPRODUCTION

The second basis of valuation cost of reproduction requires the determination of the cost of duplicating the property used and useful in the service rendered by the public utility. Although occasionally the cost of an equivalent substitute new plant has been used as the basis of valuation, such a procedure has found little favor. The former method, in which the cost of reproducing the original plant is determined, is the basis of valuation which has been most used by the public utility commissions and by the courts.

The first difficulty which arises is whether the assumed reproduction of the plant is to be made under present conditions, or under the conditions prevailing at the time the property was originally constructed. The difference in value under the two conditions is considerable. For example, under present conditions such factors as paving over underground constructions or between tracks would be included in the cost, while such difficulties as grading, removing buildings, and other obstacles would have disappeared. Thus, if present conditions are assumed, the cost might be either more or less than under original conditions, depending upon which factors prove to be the most expensive.

The method which has been most favored is to assume reconstruction under the physical conditions existing at the time of the original construction of the property, but using the prevailing present prices for material and labor. In general, the "present" prices used are the average prices over a period of years that represents a reasonable cycle in fluctuation of prices. The increase in prices which followed the world war have modified this practice somewhat. It is now the common practice to apply pre-war prices to property constructed previous to the war, and post-war prices to property constructed subsequent to the war. "Trend" prices are sometimes used. By trend prices is meant the prices that would prevail now if the war had not occurred. The dif-

ficulty with this method is the unreliability of the methods used in establishing the trend prices, and because of this uncertainty is not widely used.

Thr problem of the determination of the cost of reproduction is a complex one. Many details are involved, some of which are the subject of controversy, and will require discussion.In general, a cost of reproduction appraisal the preperation of an inventory of all the items of use and useful property of the public utility, the application of suitable unit prices, and the addition to the value of physical property, thus, determined of certain physical and non-physical over heads. It has been found advisable not to go into too great detail in the preperation of the inventory, such detail causes controversy regarding the matters at issue and adds little to the accuracy of the work. The factors which enter into the determination of the cost of reproduction will now be taken up in detail.

Physical Items. - Omissions and Contingencies. - Omissions and Contingencies are labor and material items which have disappeared, concealed, or for other reasons cannot be listed on the inventory. They include such items as waste, shortage, leakage, inspection, freight, storage, commissionary, temporary structures, such as offices and storage sheds, losses due to storms, strikes and delays in materials. These items should be included in the physical inventory so that unit prices may be applied to them, instead of including them in the overhead expenses.

General Contractor's Services. - It is the general practice to employ a general contractor in the construction of public utility property in order to save money. This is accomplished through the experience and equipment of the contractor which enables him to e xecute the work at a lower cost, including profits, than would be possible by the owners of the property with their own facilities. In determining the cost of the work involved the the unit prices which the contractor would pay should be used, because the contractors command of labor and material will make these prices lower than those that would be available to the utility.

When the total cost of the work involved has been determined as accurately as possible by applying the contractor's unit prices to the inventory, it is customary to add from 2 to 10 per cent for omissions and contingencies which have been unavoidably omitted from the inventory. Then from the total actual cost so obtained, the cost of the contractors services is usually computed by taking 10 percent of the actual cost, (Re Cripple Creek Water Co.(Cole) P.U.R. 1916c,788). Thus, the total cost of actual physical construction will be the actual cost plus 10 percent for the contractors profit.

Land Factors. - Another of the physical units of a public utility property is the land which it must acquire in order to proceed with the construction of its system. For lots and large tracts of land, a suitable basis of valuation is found in recent transfers of adjacent or comparable tracts. However, when the land owners become aware of the fact that the utility company is attempting to acquire land in a certain vicinity there is a tendency on the part of the landownersto raise prices since the utility must usually obtain its property in this given locality and does not have the privilege of bargaining for land located in different localties. This factor assumes even greater importance in the acquisition of right-of-way because of the severance damages and also a hold-up factor. The increase in the land valuation due to these conditions will depend largely upon the public attitude toward the project. The more unfavorable this attitude the greater will be the increase in valuation over the normal value of the land. In the case of railroads the value per unit area is sometimes three times as great as the value of adjacent lands. In valuing such lands acquired by the utility it must be kept in mind that the utility company is willing to pay prices that will secure satisfactory present and future public relations.

Overhead Charges. - The costs of reproduction covered up to this point are collectively known as the "Structual Cost". To this cost must be added several overhead charges which would be necessary in reproducing the property. These charges may be classified as physical and non-physical as fol-

lows:

Physical:

Administration and legal

Engineering and supervision

Insurance and damages

Taxes

Interest

Financing

Non-Physical:

Promotion

Organization

Working capital

Riparian rights

Franchise value

Going value

Some of the items listed as physical might be classified as non-physical, but they are here listed with the physical items because of their close relation to structural costs. The various commissions and courts are not consistent in their classifications of overhead charges, or of the allowances which should be made for them. The following discussions will, therefore, be general, and the allowances stated will be those commonly made.

Administration and Legal. - This item includes the salaries of the administrative, clerical, and legal staff during the period prior to operation of the utility, together with the expenses incurred by them in this period. Such a staff is necessary for general supervision of construction, preparation of contracts, accounting for construction costs and other activities. The allowance for these costs is between 1 and 2 per cent of the cost of the work involved or structural cost. (Re Duluth Street Railway Co. (Minn) P.U.R. 1927 A.41).

Engineering and Supervision. - Detailed surveys of the property, plans

for building, designs and specifications for apparatus, supervision of construction and final tests of apparatus are included in this item. These matters are handled in different ways by different utility companies, so that the allowances for them varies between 2 and 10 percent, with 5 percent being common (Re Worcester Electric Light Co.(Fed.Master) P.U.R. 1929B,1,51.).

Insurance and Damages. - This item covers the cost of insurance policies which protect the owners from loss due to personal injuries or damages to property by accident, fire, or other unavoidable causes. One-half of one percent ordinarily covers the cost (Re Union Electric Co. (Maut* P.U.R. 1928E, 396,402).

Taxes.- Taxes on the property prior to its completion depend upon length of the construction period, and the practices of local tax authorities with regard to projects under construction. The land, however, is subject to taxation as soonas it is acquired. Because of widely different conditions in different localities, the allowance for taxes vary from less than one percent to 3 percent (Re Elmira Water, Light & Railway Co.(N.Y.) P.U.R. (927B,400,437).

Interest. - In construction a new utility property, as a cost of reproduction appraisal assumes, it is generally necessary to assemble all construction funds before work is begun. As long as these funds are available they may be placed in a bank subject to moderate interest. But as the funds are expended in construction the property, they are no longer subject to interest and the interest so lost becomes a part of the construction cost to the company. For large properties, it is sometimes urged that interest should not be allowed during the entire construction period since some of the units may be, or should be placed in operation before the entire project is completed. It does not necessarily follow, however, that the units so placed in operation will earn sufficient revenue to pay their carrying charges. In fact, the whole property may be unable to earn a return on the investment until somtime subsequent to its completion. In such cases it has been proposed that the allowance for interest on the investment until the company is in successful operation. How-

ever, such a condition is generally provided for under "Going Value" which will be discussed later.

The common practice is to assume a rate of interest some what lower than the fair return rate for a going property, and to apply such interest on the entire investment for a period equal to one-half the construction period. Such a procedure will result in an allowance in the vicinity of 5 percent the structural cost for interest (Re Cumberland & Allegheny Bas Co. (W.Va. P.U.R. 1928B, 20,56).

Financing .- In order to secure capital, it is customary for a newly organized utility company to issue bonds to be sold to investors. Since the utility company is not familiar with the prospective purchasers of their bonds, it is common practice to sell the entire issues to bankers at a discount from face value. In this way the utility receives its entire capital from its bankers and at the same time confers upon them the task of selling its bonds to investors. The discount on the bonds, however, constitutes a real cost to the company because it must assume obligations equal to the face value of the bonds. In order to cover this cost of financing in the appraisal, it is customary to make an allowance of not less than 5 percent of the structural cost.

Promotion. - We come now to the discussion of the non-physical over heads, the first of which is promotion. No large project begins of itself. Some person must be responsible for its inauguration. This person is the promoter. The promoter dicovers some field ripe for development. Under his direction engineers make an extensive study of its revenue possibilities and of the cost necessary to produce the revenue. Attorneys are employed to study the legal situation, such as franchise terms, regulartory practices, political conditions, and unfavorable general restrictions. The general business condtions of the territory are also studied by the promotor.

Finally, if the project appears to be practical and gives induction of becoming a profitable investment, a prospectus of the situation is

perpared and submitted to an investment banking house. If the bank finds prospects sufficiently favorable to interest investors, it agrees to finance the project. Thus, the promoter has created a new business enterprise.

These efforts of the promoter involves expenditures for the services of the promotor himself and of his engineering and legal assistants, and also some margin for possible losses of the promoter in case the project is not accepted by the bankers. This items, cost of promotion is excluded by some commissions, but a common allowance for it is 5 percent of structural cost. (Re United Railways Co. of St. Louis, (Mo) P.U.R. 1931B, 448,461; 345W.(2nd)507).

Organization. - After the promotion of the public utility project as described in the preceeding paragraph, it is necessary to organize a company to take over the rights which the promotor has secured, and start the actual construction of the project. Such organizing procedure will require further services of an attorney, fees for incorporation, and other incedentals, including the acquiring of the fanchise from the promoter acquisition of the franchise is sometimes combined with promotion, but when it is considered separately are allowance of one percent of structural cost is ordinarily made for it. The allowance for organization services is often combined with the adminstration and legal item for convenience, and an allowance of 2 to 3 percent is made for combination (Re Brooklyn Borough Gas Company, 16 Red. (2nd) 615, P.U.R. 1927A, 200,239,242).

Working Capital. - Electric and gas utilities do not collect their revenues in advance, and hece it is necessary to provide working capital to carry on operations and maintain credit from one collection date to the next. Even railways which collect in advance, may find it necessary to carry substantial working capital in order to provide for contingencies such as damage claims. The allowance for this item usually consists of a percentage of the value of fixed assets, varying from 4 to 6 (Re Iroguois Gas Corp. (N.Y.) P.U.R. 1930 D,30-45), or an allowance based on revenues, the allowance usually being 1 or 2 months actual requirements (Re Vincennes Water Supply Co., 32 Fed (2d) 14;

1929E, 339,346).

Reparian Rights. - In the development of Hydroelectric sites the value of the rights of the water must be considered as distinct from the physical value of the property. Such rights will be seen to exist when it is remembered that because of them it is possible to furnish electric service to customers within a reasonable radius at a lower cost than would be possible with steam or other sources of power. Thus, the water rights have a distinct value to the utility which should be considered in the cost of reproduction. The common method of determining the value of these rights is to determine the cost of delivering hydroelectric service from the water power in question, exclusive of the value of its reparian rights, and the similar cost of delivering an equal amount of service from the most economical alternative source. The difference in the two costs represents the value of the riparian rights (Re Big Springs Electric Co.(Utah), P. U. R. 1927A, 655,668).

Franchise Value. - The franchise under which a public utility operated is no longer of great importance. In the past, when there was no limit to the profit which might be made when operating under a franchise, the value of the franchise was a paramount issue. At the present time, however, with the utilities under regulation which limits their profits to those obtainable from other businesses, the franchise value disappears.

Because of this fact, the commissions and courts of the various states have in valuation proceedings consistantly excluded any value assigned to the franchise in excess of its actual cost. Usually these costs consist of costs for administrative and legal services, since the actual franchise is usually granted to the utility without cost. Occasionally outright payments for the franchise or annual payments of some nature are demanded. In such cases, these costs must be considered in determining the cost of reproduction of the utility property in question.

Going Value. - We come finally to the consideration of the last item of non-physical overheads, going value. This item has been less clearly defined

by the various commissions and courts, and has been the subject of more controversities, than any other overhead entering into public utility valuations. There is unquestionably a difference in value between any new business enterprise which has before it such tasks as obtaining customers and establishing satisfactory public relations or "good will", and a long established company which has built up a large cliental and which enjoyes the confidence of the public. Although there are several other elements which must be considered in going value, going value may, from the above statement, be defined as the difference in value existing between a plant in successful operation and a similar plant assembled but not yet operating successfully. The legal authority for such definition is to be found in many court decisions, of which the following is typical.

> That there is an element of value in an assembled and established plant, doing business and earning money, over one not thus advanced, is selfevident. This element of value is a property right, and should be considered in determining the value of the property, upon which the owner has a right to make a fair return when the same is privately owned although dedicated to public use. (Des Moines Gas Co.vs.City of Des Moines,238 U.S. 153; P.U.R.1915D, 577,584)Omaha Water Works vs. Omaha, 218 U.S. 180).

Commissions hold the same views in their decisions, as the following quotation reveals:

> Alabama. - It is obvious to the commission and we believe that the courts have held, that a going concern has a value over and above that of its inventory value. Eliminating, however, any decision on the subject by the courts, and looking at the matter purely as a business proposition, it is perfectly clear that anyone who desired to purchase a telephone plant would give more for a plant that was a going concern with an attached business, and developed earning power, and an efficient organization, than he would give

for the mere physical property without a subscriber, without an organization, and without any earning of money. It is worth more. (Re Southern Bell Telephone & Telegraph Co., P.U.R.1919B, 791, 794.)

Many state laws require that going value be recognized in valuation proceedings (Pa. State 1913, No. 854, Art.5 Sec.20A; Ind. Pub. Utl. Low Sec. 9).

Elements of going Value. - Two groups of items must be considered in establishing going value, namely, (1) Costs of assembling an operating organization and acquiring business, and (2) deficits incurred during early operation.

Cost of Establishing Business. - When a property has been assembled and is ready for operation, it cannot be expected to operate satisfactorily from the first. An operating organization must be assembled and each member must be tranied in his duties. The property cannot be depended upon to deliver satisfactory service until each memeber of the operating staff has become thoroughly acquainted with his own particular task in the operation of the complicated machinery which makes up the property. Not only must the operators be trained for routine duty, but they must be able in emergencies to protect the expensive apparatus and maintain continuous service. In order to so train the operating staff, the plant must be operated under trial conditions for a considerable period. Even after the plant is in service, high efficiency is not obtained in certain units, such as boiler plants, until the operating staff has had extended experience. In addition to the service employees, supervisory officials must be employed during the period of establishing business.

The office force must also be assembled before revenue operations are began. This group must be tranied in accounting methods, billing methods, meter reading, etc.

A new business department is very essential to the establishing of the property. It is the duty of this department to obtain business through the mediums of advertising, correspondence, solicitation, demonstrations, services of power engineers, and other activities which will serve to inform the public of the advantages of the service offered.

The total cost of establishing business has been found to lie between 5 and 12 percent of the investment in physical property (Re Utah Gas & Coke Co., (Utah) P.U.R. 1919D, 645,655).

Development Cost. - A study of the history of the development of any large business enterprise reveals the fact that the revenues during the first few years of operation are not sufficient to pay a reasonable return on the investment in the business public utility developments are not exceptions to this statement. In fact, a study of public utility records reveals a surprisingly low rate of return during the first few years of operation. The following example will illustrate the conditions existing during the early years of operation. The figures are taken from the actual records of a combined railway, electric, and gas system operating in a small city. The distributable income was as follows:

First Year	.....	1.2 percent
Second "	.....	3.9 "
Third "	.....	4.6 "
Fourth "	.....	5.5 "
Fifth "(Business Depression)	.....	5.2 "
Sixth " " "	.....	4.9 "
Seventh "	.....	7.4 "
Eighth "	.....	8.5 "

During the same period the normal rate of return to investors was approximately 8-0%. On this basis the cumulative losses to the investors in

the utility was 24.3% (Wash. L. R., "The Economics of Public Utilities," R170, McGrow-Hill Book Company 1931).

Because of the early losses suffered by investors in public utility property, it is necessary to assure investors that these early losses will be conmpensated for in some way in later years. This can be done in one of two ways. The first is by amortizing the losses, including interest thereon, by establishing a sinking fund from the profits of later years. However, this process will require the allowance of a supplementory return in later years in additon to the return necessary for current requirements, and will result in higher rates than would be necessary withoutamortization. Such high rates in the early years of development of the utility would seriously retard its growth, and hence the amortizing process cannot be begun until the utility has become firmly established and is paying a normal return to investors.

The second method is by including in the rate base an allowance for the development cost as going value. The advantage of this method is that the burden of compensating investors for their early losses is distributed over an indefinite period, resulting in low current rates, which stimulates the growth of the utility. Furthermore, it is only reasonable, from an economic standpoint, that the utility be reinbursed for its early losses by all its customers during a long period of time, rather than by a relatively few customers in the few years subsequent to the unprofitable years. This view of going value has been long recognized by various commissions and courts. The following decision by the Oklahoma Supreme Court in 1911, states clearly the argument in favor of capitalization of early losses.

> Few industires, if any, involving an investment of $90,000 or more, can bemade self-sustaining form the first day of their operation. The uncontradicted evindence in this case discloses that appellant's plant, for the years preceding the first hearing, failed to produce revenue sufficient for operating expenses, current repair, and to lay aside an

amount for depreciation. During the time of development there is a loss of money actually expanded and of dividends upon the property invested. How shall this be taken care of? Must it be borne by the owner of the plant? Or by the initial customers? Or shall it be treated as part of the investment or value of the plant, constituting the basis upon which charges shall be made, to all customers who receive the benefits from the increased service-rendering power of the plant by reason of these expenditures? It seems that the last solution is the logical, just, and correct one. If rates were to be charged from the beginning, so as to cover these expenditures, and earn a dividend from the time a plant is first operated, the rate to the first customer would be in may instances, if not in all, so exorbitant as to be prohibitive, and would be so at the time when the plant could be of least service to them. On the other hand, the public cannot expect as a business proposition, or demand as a legal right, that this loss shall be borne by him who furnishes the service; for investors in public service property make such investments for the return they will yield; and, if the law required that a portion of the investments shall never yield any return, but shall be a total loss to the investor, capital would unwillingly be placed into such class of investments; but the law, in our opinion, does not so require. Private property can no more be teken in this method for public use without compensation, than by any other method. When the use of the property and the expenditures made during the non-expense-paying and non-dividend-paying period of the plant are treated as an element of the value of the property upon which fair returns shall

be allowed, then the burden is distributed among those who receive the benefits of the expenditures and the use of the property in its enhanced value. (Pioneer Telephone & Telegraph Co. Vs Westenhave, 29 Okla. 429; 118 Pac.354,360).

Allowances for goingvalue. - Due to the fact that going value has never been clearly defined, the allowances in the valuation for this item have varied considerably. The allowance usually lies between 5 and 20 percent, and in a few exceptional cases have been as high as 30 percent. The most frequent allowance, however, for this item is 10 percent of the value of the physical property (Re Indianapolis Water Co., 272 U.S.400; P.U.R. 1927A, 15,28). In some few cases the commissions have approved an allowance for going value covering the cost of acquiring business, but making no allowance for inadequacy of returns for such business after it was acquired. Such allowances have been unit allowances, that is, a fixed sum is allowed for each customer in electric, gas, and telephone utilities. No suitable method has been found for making unit allowances in railway utilities. Such allowances have ranged from $5.00 to $13.25 per telephone, and from $15.00 to $30.00 per customer in electric and gas utilities (Re Albemade Telegraph Co. (Va) P.U.R. 1922A,756), (Re Utah Gas & Coke Co. (Utah) P.U.R. 1919 D,645)

Summary. - This concludes the discussion of the method of making cost of reproduction appraisals. All the items which make up both the physical and non-physical elements of the property have been taken up and discussed in detail, and the customary allowances made for each item have been stated. There is no definite method which is employed by all commission. The appraisal may include all of the items as discussed, or some of the items may be omitted entirely. Again, two or more of the closely related items any be combined into on item. However, the above discussion has been general enough to include all the elements of value in a public utility property.

Legal Basis for cost of reproduction valuations. - The courts have

consistently held that the constitutional protection of property extends to its present value, or cost of reproduction, and not its actual cost.

The following quotations from the decisions in a few leading cases illustrate these holdings:

> And we concur with the court below in holding that the value of the property is to be determined as of the time when the inquiry is made regarding the rates. If the property, which legally enters into the consideration of the question of rates, has increased in value since it was acquired, the company is entitled to the benefit of such increase. (Willcox vs. Consolidated Gas Co.,212 U.S.19.)

> In the solution of that problem (valuation), many considerations may enter; among them, the amount of money actually invested. But that is by no means, of itself, controlling, even where the property was at the time fairly worth what it cost. If it has since enhanced in value, those who invested their money in it, like others who invest their money in any other kind of property are justly entitled to the benefit of the increased value. If, on the other hand, the property has decreased in value, it is but right that those who invested their money in it, and took the chances of an increase in value, should bear the burden of the decrease. (SanDiego Land & Town Co.Vs National City,74 Fed.79.)

> The property is held in private ownership and it is that property and not the original cost of it, of which the owner may not be deprived without due process of law. (Minnesota Rate Cases-Simpson vs. Shepard, 230 U.S.352.).

CHAPTER IV

THE RELATIONS BETWEEN INVESTMENT AND COST OF REPRODUCTION

It is now in order to discuss the relations which exist between the two methods of determining the value of the rate base of a public utility, which have been discussed in the preceeding chapters. Valuations by the two methods may check closely or they may vary greatly. The amount of variation depends largly upon the difference in conditions existing at the time the property was originally constructed and the conditions exisiting at the time of the appraisal made for rate case purposes.

Historical Relations. - The general price levels on all commodities have been decreasing for the past ten years. During and immediately following the world war, the price level reached its peak, and although since that time it has been declining prices are still above normal. Price levels are expressed by index numbers. It is customary to take the prices prevailing in 1913 as 100. Then the price level of a commodity at a given time following 1913 is expressed by a number which is either greater or less than 100 depending on whether the price of the particular commodity is greater or less than it was in 1913. The difference between the index number of a commodity and the base of 100 shows the relative increase or decrease in the price of that commodity as compared with the 1913 price. The method of computing these index numbers is quite complicated, and it is not necessary to discuss this method for present purposes. It will be sufficient to say that index numbers do represent commodity prices at a given time with reasonable accuracy.

Professor Albert S. Richey of Worcester Polytechnic Institute has compiled a series of index numbers for the relative costs of public utility construction, taking 1913 as the base year(Nash, L. R., Economics of Public Utilities, page 183, McGrow-Hill Book Co.,Inc. 1931). A part of his figures are reproduced in the following table:

Year	Electric Railway Index Numbers	Electric Light & Power Index Numbers
1913	100	100
1914	97	92
1915	100	99
1917	163	163
1919	205	182
1921	201	182
1923	200	179
1925	202	176
1927	201	174
1929	202	181

An examination of this table reveals the fact for example that an electric railway property constructed in 1919 would have cost $\frac{205}{100}$, or 2.05, times as much as a similar property constructed in 1913. Similarly, an electric light and power property constructed in 1919 would have cost $\frac{182}{100}$, or 1.82, times as much as a similar property constructed in 1913. From these examples it becomes evident that the value of the investment, or original cost of a utility property constructed in 1913, will not check with the value obtained from a cost of reproduction appraisal made in 1919, using, as its customary 1919 prices.

On the other hand, if the cost of reproduction appraisal had been made in 1914, the price level would have been less than the actual investment in the property. As has been stated, the price trend at present is downward and a study of past price trends shows that such a decline in prices may be expected to continue for a certain fairly definite period which will end around 1945. Therefore, it is not difficult to foresee a time in the near future when any cost of reproduction appraisal will be less than the actual investment in the property. Particularly is this time if substancial additions or extensions have been made to the property during the period peak prices.

Because of the difference in valuation obtained by the two methods at different times, the various parties concerned in valuation proceeding have not been consistent in their views as to which method should be adopeted. In general, the utility urges that the method which gives the largest valuation, and hence, higher rates should be used, while the complaining customers urge that method which gives the smallest valuation and lower rates. Neither have

the commissions adopted any definite method or procedure to be followed.

Court Decisions. - As a matter of fact, the utility companies prefer investment or actual cost, as basis of valuation. It is contended by them that such a value is established by facts, and is not a matter of guess work , based on estimates, theories, and speculations. But because of the attitude of the courts the utilities fear to adhere to this basis. The courts have consistently excluded so many items of the valuation on this basis that the rate base has been reduced to a value which makes the resulting income insufficient to meet current expenses, and at the same time to pay a reasonable rate of return to the investors in the company. In fact, there are numerous cases on record in which the rate base has been established at such a low value that the resulting rates were actually confiscatory. Although such a proceeding is prohibited by the fifth amendment to the Federal Constitution, it is often difficult to make the courts see the injustice which is brought about by establishing the rate base too low, and the utilities must take the loss.

Because of this attitude on the part of the courts it has become customary on the part of the utilities in recent hearings to present evidence both as to the investment in their property and the cost of reproducing it. It is then a problem for the courts to decide what relative weights shall be given to the two methods of valuations. Up to the present the courts have made no definite rulings on this matter. However, certain Supreme Court decisions may be interpreted as giving a weight of about 60 per cent to cost of reproduction and 40 per cent to original cost.

CHAPTER V

D E P R E C I A T I O N

The last factor to be considered in establishing the value of a fair rate base for a public utility is depreciation. Undoubtedly most of the physical elements of a utility property depreciate with the passing of time. Some authorities contend that at the time an appraisal is made a deduction should be made for the accrued depreciation, and that a depreciation reserve should be established from the income which at all times will just equal the amount of the accrued depreciation. In order to establish such a reserve it is necessary to allow an additional return on the remaining value of the property over and above the return necessary for current operation.

Another group of authorities contedn that since a public utility has an unlimited life, no deduction in its value should be made so long as there is no reduction in the value of its service. In this case the rate base will not be decreased because of depreciation, and thus, the return will be large enough to take care of depreciation under operating expenses without allowing an additional return for depreciation.

Court-Decisions. - In the first cases in which depreciation was an issue, the courts generally upheld the practice of reduction of value on account of depreciation. The "Knoxville" decision in 1909 states the issue clearly.

> Before coming to the question of profit at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property invested is kept unimpaired, so that at the end of any given term of years the original investment re-

> mains as it was at the beginning. It is not only the right of the company to make such a provision, but it is its duty to its bond and and stockholders, and, in the case of public service corporation at least, its plain duty to the public . . . If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities or of omission to exact proper prices for the output, the fault is its own. When, therefore a public regulation of its prices comes under question, the true value of the property then employed for the purpose of earning a return cannot be enhanced by a consideration of the errors in management which have been committed in the past (212 U.S. 1, 13).

In the decision it is evident that the court had in mand an increase in rate of return in order to establish a depreciation reserve.

In a later decision, the "Minnesota" rate cases, the court still held the same view.

> It must be remembered that we are concerned with a charge of confiscation of property by the denial of a fair return for its use; and to determine the truth of the charge there is sought to be ascertained the present value of the property . . . And when particular physical items are estimated as worth so much new, if in fact they be depreciated, this amount should be found and allowed for. If this is not done, the physical valuation is manifestly incomplete (230 U. S. 352).

In recent decisions the courts have modified their views regarding depreciation deductions. The following decision is typical:

> Practical men will prefer to ascertain the cost of a present plant by experience, when they can, rather than by estimate, just as the master here has done. In so arriving at the cost of a present plant of equal capacity, it is clear that the original cost of the plant in question must be abated by depreciation, so far as that is reflected in a loss of capacity. In such a calculation, however, there must figure past renewals as an offset to past depreciation, and if, in fact, the capacity has remained the same, depreciation should not be a function of the "rate base" at all.
>
> ... The plaintiff proved the cost and the necessary repairs to bring the whole plant up to its original condition. It proved that the cost of reporducing fixtures of equal capacity was more than the book cost. That made a case, in my judgment, which was proof against any theory of "straight-line" depreciation. The allowance for repairs might be attached on the ground that the condition of the plants and fixtures in fact required inordinate repairs, but that was not done. In accordance with the principal which I have tried to demonstrate I decline to make any allowance for depreciation. (Consolidated Gas Co. vs. Newton, 267 Fed. 231; P. U. R. 1920 F. 483, 495, 531).

The contention is that depreciation has not affected the capacity of the plant, and hence its value should not be reduced since the additional return obtained without a reduction in value is necessary in order to keep up repairs.

Depreciation Deductions. - Since depreciation deductions are often made in appraisal proceedings, the method of arriving at the amount that should be deducted for depreciation at a given time will now be taken up. It apparently has become the custom of the commissions, in general, not

to make deductions for depreciation when actual investment is taken as the basis of value, but to make such deductions in cost of reproduction appraisals. It is contended by the commissions that since the property is given the benefit of appreciation in value in cost-of-reproduction appraisals, it should logically be subject to offsetting deductions for depreciation. It is not clear why such a distinction should be made when the primary purpose in both methods of valuation is to arrive at present value. Appreciation may result from two causes: (1) community development or removal of hazards, and (2) a rise in general price level. The first cause is not a large factor in the appreciation in value of a utility property. Land is practically the only element of a utility property that will become more valuable with community development, and land is not subject to depreciation. Any student of economics recognizes the fact that an increase in the general price level does not affect the real value of the property. Thus, it appears that a utility property is but little subject to appreciation in value, and that depreciation deductions could logically be omitted.

Causes of Depreciation.-There are four important causes of depreciation. These are, (1) obsolescence, occasioned by new inventions, discoveries, and improvements in engineering methods, (2) inadequacy resulting from business expansion, (3) supersession, arising from changes in public habits, and legislative or other acts, and (4) decrepitude, brought about by use and the action of the elements. All of these factors may affect the value of some of the elements of the utility property, while other elements may be affected by only one or two of them. However, all the elements of the property are in some way affected by depreciation, and the time will come when each element must ultimately be retired. The fundamental problem is to determine the useful life of each element of the property so that the proper deduction for depreciation may be made at the time the appraisal of the value of the property is made. The methods of obtaining useful life data, and the reliability of the data so obtained will now be examined.

Useful Life of Utility Property. - Many authorities on public utility valuations and many associations of public utilities have attempted to compile life tables for the various elements of utility property. One of the most valuable efforts was made in 1913 by the American Electric Railway Accountants Association. This group associated itself with an engineering association, and an attempt was then made to secure useful data from the executives of a large number of railway properties. The data received from these executives was so divergent that the original plan of compiling tables was abandoned. It was the opinion of the Association that tables compiled from these data would not only be useless but might actually be dangerous if the attempts were made to compute depreciation deductions from them. In the course of this investigation, six engineers of wide experience were asked to prepare estimates of useful life in accordance with their experiences. The following table, Table I, has been made up from the reports of these engineers. It is included here to show how widely divergent the opinions of these men were as to the useful life of various elements of public utility property (Nash, L.R., "The Economics of Public Utilities" p. 80, McGraw-Hill Book Co. Inc. 1931):

	Useful Life (years)		
	Minimum	Maximum	Average
Buildings fireproof	60	100	90
Dams (wood, earth)	15	50	31.7
Car bodies	15	20	17
Trolley wire	1	20	17
Poles (wood)	7	20	12.5
Line material	10	50	26.7
Water wheels	20	50	28.8
Turbines	20	25	21
Generators	15	21	21.3

All investigations of any importance regarding useful-life data have ended as the one described on the preceding page. Notwithstanding this fact, however, public utility literature is full of life tables. The value of all such tables is questionable, and if they are of any value, thi value is limited to the specific cases for which the tables were prepared.

Such wide variations in life tables do not occur, primarily, because so many factors enter into the determination of the useful life of an element of property. In the table reproduced on the preceding page, only actual physical depreciation was considered. Had "functional depreciation," which includes, obsolescence, inadequacy, and suppression, entered into the estimates, they undoubtedly would have been even more divergent. Thus, if all the factors which make up depreciation are considered in making estimates of useful life, the problem becomes hopelessly involved, and the results amount to little more than guesswork.

Depreciation Reserves. - It is evident from the above discussion that the amount that should be deducted for depreciation in establishing a fair value for the rate base cannot be computed directly from any available data. Fortunately, however, there is another method which may be employed in arriving at the amount of the deduction to be made which is equitable to all parties concerned. This consists in reducing the physical value of the property by an amount which is equal to the depreciation reserve that has been accumulated by the utility at the time the appraisal is made. It is the general practice for a utility to establish a depreciation reserve as soon after its establishment as its financial status will permit. In accumulating this reserve, an amount is added to it each year which, in the judgment of the executives and engineers of the utility, is equal to the depreciation which occurs during that year. Since these men are usually familiar with local conditions, it may be logically assumed that their estimate is as accurate as any that might be made. Thus, the depreciation reserves become

a measure of the accrued depreciation of the property. When any retirement of property charged to fixed capital is made, the fixed capital account is credited with the value of the property so retired, and the depreciation reserve is charged with an equal amount. Thus the fixed capital remains constant, and the depreciation reserve does not become excessive.

A new company may not be able to establish a depreciation reserve for some years. During this period it is contended that the rate base should not be decreased because of depreciation. The argument is that a return on the entire investment is necessary in order to take care of early losses and otherwise to aid the young company until it is financially able to establish a depreciation reserve.

When such a reserve has been established by the utility, the funds which make up the reserve may be invested elsewhere, or in the property itself, and the return from this investment will compensate for the diminished return due to the reduction of the rate base.

Avoidance of Depreciation Deductions. - Several commissions, including that of Wisconsin, have adopted a method of providing for accrued depreciation in which the rate base is not reduced. The method is stated clearly in the case of the Duluth Street Railroad:

> A second method of giving consideration to accrued depreciation, although the effect of such depreciation is not measured by a deduction from the rate base, is to compute the rate of return upon the rate base before giving effect to accrued depreciation, which means that the utility is permitted to earn a return upon all property, including that built from reinvested reserves, and to provide for a credit of interest to the reserve based upon the reserve balance. This, in effect, constitutes a payment of interest to the reserve for the use of reserve capital exactly comparable to the payment of interest on a funded debt. Therefore, when a rate base is determined without giving effect to accrued depreciation in the base itself, no injustice is

> done to the consuming public as long as the company is required to utilize a proper part of the return which it is allowed to earn upon its total property as a credit to the depreciation or retirement reserve. Such a credit, amounting to the payment of interest for the use of reserve capital, means that the investors in the utility do not actually get a return upon the total property before giving effect to accrued depreciation, but that they get a return after paying interest for the use of reserve capital. In other words, they get a return actually upon a property after giving effect to accrued depreciation and no greater return. (P. U. R. 1923 D, 705, 737).

As stated in the decision, the method is to allow a return upon the full value of the rate base without making depreciation reductions, and from the return so obtained, a certain portion is set aside as interest upon the depreciation reserve which has previously been accumulated. In this way no injustice is done to the customers in permitting a return upon the full value of the rate base, since a proper portion of this return must be applied to the retirement reserve.

The principal advantage of this method is that it simplifies rate proceeding considerably. The value of the entire property is determined by one of the methods described in previous chapters. The amount of retirement appropriations necessary to maintain an adequate reserve is fixed. The value of this reserve usually falls between 10 and 20 per cent of the physical value of the property. Then the total cost of service which would have to be covered by the return on the rate base would include return on the entire investment, operating expenses, taxes, and that portion of the retirement appropriation not covered by earnings of the reserve, whether the reserve is reinvested in the property or in outside interests.

Summary. - We have now examined the two methods of taking care of the accrued depreciation of utility properties. In the first method the rate base is reduced by an amount equal to the accumulated depreciation

reserve. The earning of this reserve tends to compensate for the diminished return caused by decreasing the rate base. In the second method no reduction is made in the rate base because of depreciation. However, a proper part of the earning on the entire value of the property is placed in the depreciation reserve as interest on the reserve already accumulated.

If the rate of return allowed on the rate base is not sufficient to establish a reserve for retirements it will be confiscatory. This is because the rproperty will depreciate in value, and, unless a reserve which is equal to the depreciation is at all times maintained the investors in the property will not be protected.

A more detailed study of the various methods of providing for accrued depreciation reveals the fact that, in the long run, the results obtained by each method are approximately, if not exactly, the same. At the present, however, the method of avoiding deduction in the rate base for depreciation is coming into favor with the various commissions because of its simplicity.

Chapter VI

SUMMARY OF THE RATE BASE PROBLEM

It is in order now to correlate the various factors discussed in the previous chapters which enter into the establishment of a reasonable rate base for a utility property. The fact that different commissions use different methods of valuation makes the procedure confusing. The methods of valuation and items which enter into the value which have been discussed are those generally used by the commissions. The items may be given different names by the different commissions, and some of the items may be combined with others, or additional items may be added. However, the general procedure of all the commissions is practically the same, regardless of disagreement in details, and the final value of the rate base is obtained by one commission would be essentially the same as that obtained by any other.

It was pointed out that there are two methods of determining the present value of a utility property, namely, (1) investment or actual cost, and (2) cost of reproduction. In the first method the value is determined from the accounting records. From these records, the cost of originally constructing the property and placing it in operation, as well as the costs of subsequent additions and extensions can be obtained. The total of these costs is the present value of the company. In the second method an attempt is made to determine the cost of reproducing the property as it is, but under the historical conditions existing when it was originally constructed and by applying present prices to the physical elements of the property. Such a method involves the necessity of assumptions and the use of estimates and theories, and hence the final value obtained will only approximate the true value.

The utilities would prefer valuation on the basis of actual cost if it were not for the fear that the commissions and courts would exclude too many intangible items of value, as has been the experience in the past.

Hence, it is customary in valuation proceedings for the utilities to present evidence of value on both the investment basis and the cost of reproduction basis. It is then the duty of the commission to give appropriate weights to the two values in the final valuation. Although there is no definite court ruling as to the weight which should be given to each value, certain decisions have been interpreted as giving a weight of 40 per cent to original cost and 60 per cent to cost of reproduction.

After the value has been determined by some method, it is necessary, finally, to determine how much that value should be reduced because of depreciation. The result after this deduction will be the rate base to which a fair return percentage is applied in order to compute the gross income of the company. It has recently become the custom of commissions to make depreciations in cost-of-reproduction appraisals, but not to make such deductions if the valuation is based on actual investment. It is contended that this procedure should be followed, because in cost-of-reproduction appraisals the value of the property has been given the benefit of appreciation, which factor does not enter into valuations based on investment. It has been found that life-tables, from which deductions for depreciation were formerly computed, are entirely unreliable and at best are little more than guess work. For this reason, depreciation deductions are now generally made equal to the amount of the retirement reserve of the utility. It is argued that this is reasonable since the retirement reserve represents, in the opinion of the officials of the company, the amount of depreciation which has taken place in the physical elements of the property. It follows that in the appraisal of a young company, which has been unable to establish a retirement reserve, no depreciation deduction will be made.

This completes the discussion of the rate base problem. It is hoped that the reader will have a clearer concept of the problem and of the steps that are being taken toward its ultimate solution than he had before reading this paper.

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APPROVAL

The foregoing thesis is hereby approved as a creditable study of an engineering subject, carried out and presented in a manner sufficiently satisfactory to warrant its acceptance as a prerequisite to the degree for which it has been submitted. It is to be understood that by this approval the undersigned does not necessarily endorse or approve any statement made, opinions expressed, or conclusions drawn therein, but approves the thesis only for the purpose for which it is submitted.

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