National Association of Regulatory Utility Commissioners Regulatory Partnership Program

The Energy Regulation Board of Zambia (ERB) and the Pennsylvania Public Utility Commission (PUC) Second Activity

Cost of Service

"The establishment of a rate for a regulated industry often includes two steps of different character, one of which may appropriately precede the other. The first is the adjustment of a general revenue level to the demands of a fair return. The second is the adjustment of a rate schedule conforming to that level, so as to eliminate discrimination and unfairness from its details."

Chief Justice Stone, Federal Power Commission vs. Natural Gas Pipeline Company - - 315 U.S. 575, 584 (1941).

Criteria Of A Desirable Rate Structure

- Simplicity, understandability, public acceptability, feasibility of application;
- Freedom from controversies as to proper interpretation;
- Effectiveness in yielding total revenue requirements under the fair return standard;
- 4. Revenue stability from year to year;
- 5. Stability of rates;
- Fairness in specific rates in the apportionment of total costs;
- 7. Avoidance of undue discrimination;
- Efficiency of rate classes and rate structure in discouraging wasteful use and promoting all justified use with respect to total amount and type of service.



Ratemaking Equation

- Revenues Expenses = Net Income
- Net Income / Rate Base = Rate of Return
- (R-E)/Rate Base = Rate of Return
- Revenue Requirement = E+ROR(RB)



Cost Accounting Is Allocation Of Responsibility For Revenue Requirement

Operation and Maintenance Expense

Fuel and Purchased Power Costs

Depreciation Expense

Return on Rate Base

Income Taxes

Property Taxes and Insurance

Administrative and General Expenses

Revenue Taxes

Working Capital Requirements

Cost of Service Study

- Once the revenue requirements are determined, then the proper allocation of the rate increase between the customer classes becomes an issue
- Many factors are considered in determining the revenue allocation and rate design
- Cost of service outweighs all the other factors
- Other factors include value of service, gradualism and social welfare considerations
- Apply all these factors with considerable judgement

Cost of Service

- Note Cost of service is only a ratemaking guide or tool
- Other factors can be taken into consideration when designing rates and allocating revenues





Determining Rate Classes

- How many classes are needed?
- How should customers be grouped?

Factors To Be Considered

- Homogeneous loads
- Size
- Location
- Diversity
- Value of service



Typical Customer Groups

Residential, Domestic

- Individual meter
- Master meter

Small Light and Power, Commercial

Medium Light and Power

Large Light and Power Customers

Agriculture and Pumping

Street Lighting

Cost of Service – Customer Demand

- Customer demand has major impact of the cost of service
- Affected by many factors including: Population density, price, weather, usage patterns, age and utilization of equipment

Cost of Service – Load Factor

- Cost of Service study attempts to identify the cost per unit to serve each particular customer class
- This concept is known as load factor
- Generally, residential and small commercial customers, who tend to consume utility service during peak periods, place a greater per unit cost on the system than large industrial customers, who operate around the clock at a stable level of demand

Cost of Service – Load Factor

- A residential and small commercial customer will have a low load factor
- Large industrial customers generally have high load factors
- Load Factor determination is a science all to its self
- Demand Studies are performed to determine peak usage

Cost of Service - Pennsylvania PUC Requirements

- Increase in annual revenues in excess of \$1 million must file a cost of service study with their rate filing
- Commission has also advocated that any utility with revenues exceeding \$1 million file a cost of service study (water filings)
- Many small utilities with revenue approximating \$100,000 will also file cost of service study

Cost of Service Study

Fully allocated class cost of service study allocates each and every item of cost and assigns these costs to the various customer classes based upon engineering, operating, economic, and legal principles Cost of Service Study – Three Basic Steps

- Functionalization
- Classification
- Allocation







Functionalization Of Costs Electric

| Production | Transmission | Distribution | General | |
|------------------|-----------------------|---------------------------|-------------|--|
| | | - | | |
| Generating Plant | High Voltage | Distribution Lines | Plant | |
| | | | investment | |
| Generation O&M | Transmission Lines | Distribution Substations | or expenses | |
| | | | not | |
| Fuel Cost | Transmission O&M | Line Transformer | related | |
| | | | directly | |
| Purchased Power | Transmission Stations | Meters | to other | |
| | | | functions | |
| | | Service | | |
| | | | | |



Functionalization Of Costs Gas Systems

| Production | Storage | Transmission | Distribution | General |
|-------------------------------|------------------------|--------------------------|------------------------------------|------------------------------------|
| Pipeline demand charges | Underground storage | High pressure long | Transporting gas to ultimate | Plant investment or expenses |
| Peaking facilities | Local storage | distance gas | customers | not related |
| SNG or LNG plant | | transportation | | directly to other functions |
| | | | | |







Cost of Service -Functionalization

- What is the cost function?
- Functionalization identifies the costs attributable to the provision of service, excluding non-utility or other utility service items
- Groups costs according to the particular function i.e.

Electric – Generation, Transmission, Distribution

Gas – Production, Gathering, Transmission, Distribution

Cost of Service -Functionalization

- Uniform System of Accounts classifies most cost items
- Other items such as income taxes, cost of capital, and administrative costs must be allocated within these functions

Cost of Service - Classification

Functionalized costs are classified as being either Fixed or Variable Costs

Fixed and Variable Cost

Fixed costs relate to providing installed capacity. Generally fixed costs have been allocated based on a demand measure rather than an energy or commodity measure. This is, however, not exclusively true. Examples of deviations are:

- 1. Electric Average and Excess Allocation
- 2. Electric System Planning Allocation BIP Equivalent Peaker
- 3. Gas Pipeline Atlantic Seaboard 50% Demand/50% Commodity
- 4. Gas Pipeline United 25% Demand/75% Commodity
- 5. Recent Gas Pipeline Policy Minimize Commodity Charge



Cost of Service – Cost Classification

- Three types of Classified Costs
- Demand/Capacity Costs
- Commodity/Energy Costs
- Customer Costs

Cost of Service – Cost Classification

Demand/Capacity Costs are those costs which include capital and operating expenses incurred to provide sufficient capacity to meet peak demand. These costs are not affected by the number of customers or annual usage, but rather are put in place to service customers at the time of maximum usage

Cost of Service - Cost Classification – Demand Costs

An example of demand cost classification would be transmission plant constructed to provide service to meet the peak demand...all capital and operating expenses associated with the construction and maintenance of this facility would be considered demand costs

Cost of Service – Cost Classification – Commodity Costs

- Commodity/Energy Costs are those costs that vary in direct proportion to the volume of service consumed. These costs are not related to capacity or customer costs
- An example of Commodity costs are the purchased natural gas volumes transported through interstate pipelines utilizing fixed demand (capacity costs)

Cost of Service – Cost Classification – Customer Costs

- Customer Costs are those costs that are affected directly by the number of customers served regardless of usage.
 Such costs include meters, meter reading, billing, and some portion of the distribution system
- Normally, the customer charge recovers customer related costs

Determination of Customer Related Costs

Plant

Meters

Service Extension

Minimum Grid

Zero Intercept

Expenses

Meter Reading

Customer Accounting

Customer Service





Classification



Cost of Service – Cost Classification

- Traditionally, one of the most contentious issues concerning cost of service is the classification of costs between capacity, energy, and customer costs
- No right or wrong judgment must be used to resolve these disputes

Cost of Service – Cost Classification

Example

In the gas industry, distribution mains comprise the largest single capital investment of the utility. There are elements of all three classifications in this cost category. Distribution mains carry energy and should be classified as an energy cost. However, the size of the distribution mains installed is determined by the peak design day. Therefore they are demand related. Finally, the number of customers also determines how extensive the distribution main system extends. Thus, they are also customer related. The key question then becomes: What portion of the distribution mains account should be classified as demand, energy, and customer related?

Cost of Service - Cost Classification

- Classification of costs is largely a matter of judgment
- Parties litigating rate cases have proposed distribution mains as 50% energy related and 50% customer related –
- This type of classification reduces the distribution mains allocation to industrial customers
- OCA normally supports 50% demand related and 50% energy related
- This type of classification places more burden on the industrial customers and shifts costs away from residential customers

Table IV-A Classification Between Energy and Demand Related Costs

Classification of Rate Base

FPC Uniform System of

| System of | | Demand | Energy | Customer |
|--------------|--------------------------------------|---------|---------|----------|
| Account Nos. | Description | Related | Related | Related |
| | Production Plant | | | |
| 301-303 | Intangible Plant | Č. | • | • |
| 310-316 | Steam Production | č | | - |
| 320-325 | Nuclear Production | Č | 5 | |
| 330-336 | Hydraulic Production | Š | X | |
| 340-346 | Other Production | x | * | • |
| | Transmission Plant | | | |
| 350-359 | All Transmission Accounts | x | - | • |
| | Distribution Plant | | | |
| 360 | Land & Land Rights | X | • | X |
| 361 | Structures & Improvements | x | - | x |
| 362 | Station Equipment | x | - | • |
| 363 | Storage Battery Equipment | x | • | - |
| 364 | Poles, Towers & Fixtures | x | • | X |
| 365 | Overhead Conductors & Devices | x | • | x |
| 366 | Underground Conduit | x | • | x |
| 367 | Underground Conductors & Devices | x | - | X |
| 368 | Line Transformers | x | - | X |
| 369 | Services | • | | X |
| 370 | Meters | 1.00 | | x |
| 371 | Installations on Customer Premises | - | • | x |
| 372 | Leased Property on Customer Premises | | | x |
| 373 | Street Lighting & Signal Systems | | • | • |
| | General Plant | 2 | | |
| 389-399 | All General Plant Accounts | x | (**) | x |
| | Material & Supplies | ~ | | |
| 151 | Fuel | 0 | - | : |
| 152-174 | Other | * | 1996 | x |

 Direct assignment or "exclusive use" costs are assigned directly to the customer class or group which exclusively uses such facilities. The remaining costs are then classified to the respective cost components.

2. In some instances, a portion of hydro rate base may be classified as energy-related.

Excerpted from NARUC. Electric Utility Cost Allocation Manual, 1973.

Cost of Service – Cost Classification

- PA PUC does not have a definitive classification method
- Remember that a cost of service study is only a ratemaking guide or tool

- Once the costs are functionalized and classified, the final step is to allocate the costs among the various customer classes
- Direct Allocation known costs that are incurred on behalf of one customer or class of customers should be directly assigned to that customers or class
- For example Uncollectible Expenses are normally incurred by residential customers

 For costs that cannot be directly assigned, then customer class ratios are developed to allocate the remaining costs

Example of class ratios

| Class | #Customers | Ratio to Total | | |
|-------|------------|----------------|--|--|
| | | | | |
| R | 75 | .75 | | |
| С | 15 | .15 | | |
| I | 10 | .10 | | |
| Total | 100 | 1.00 | | |

In this example, if the costs were classified as customer related costs, then the residential customer class would be allocated 75% of all customer identified and classified costs that are not directly assigned



Time of Day

Cost Allocation Guidelines



Cost causation

Why was plant installed?

Why was expense incurred?

What measure of system usage best captures cost causation?

Allocating Costs to Customer Classes

(Commonly Used Allocation Methods)

Demand Costs

Coincident Peak Method

Twelve Month Coincident Peak

Average and Excess

Class Coincident Peak Method

Maximum Non-Coincident Demand

Energy Costs

Energy Usage

Time Differentiated Energy Usage

Customer Costs

Customers

Weighted Customers



Frequently Contested And Unresolved Allocation Issues

- Allocation of Fixed Cost of Base Load Generation
- Determination of Customer Related Costs
- · Allocation of Take or Pay Costs
- Appropriate Measure for Demand Allocation
- · How to Apply Results
- Normalization

Summary



Essential Steps in Cost Allocation

- Define Classes
- Detail Investment and Expenses
- Decide on Appropriate Allocator for Each Investment or Expense
- Determine Allocator from Load Research Data
- Perform Calculations

Jurisdictional Allocation



Objective is to fairly and fully allocate overall revenue requirements to jurisdictions.

Examples are:

Utilities providing service to an regulated by commissions in more than one state.

Utilities providing wholesale service which is regulated by the FERC and retail service which is regulated by states.

Rate cases are at different times.

Cost allocation is primary method of allocating revenue requirements.

Direct assignment may be appropriate.

Revenue offset used in some cases.

Cost of Service – Cost Justification

- A company's revenue allocation is cost justified when all of the customer classes are moving towards the average system rate of return
- Gradualism and rate shock are considerations when examining customer class returns



PFG GAS, INC. AND NORTH PENN GAS COMPANY

DEVELOPMENT OF RATE OF RETURN BY SERVICE CLASSIFICATION UNDER PRESENT RATES

| Item | Cost of Service | Residential Service | General Service - Small | General Service - Large | Large Volume Service | Storage Service |
|--|--------------------------|-------------------------|----------------------------|----------------------------|----------------------------|-----------------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Revenues From Sales and Transportation Other Revenues | \$111,768,837 475,000 | \$60,294,113 301,691 | \$33,169,745 71,100 | \$4,062,072 21,397 | \$9,127,295 53,934 | \$5,115,612 26,878 |
| 3. Total Operating Revenues | 112,243,837 | 60,595,804 | 33,240,845 | 4,083,469 | 9,181,229 | 5,142,490 |
| 4. Less: Operating Expenses | 99,361,197 | 59,822,746 | 28,790,872 | 2,167,565 | 5,876,416 | 2,703,598 |
| 5. Return and Income Taxes | 12,882,640 | 773,058 | 4,449,973 | 1,915,904 | 3,304,813 | 2,438,892 |
| 6. Less: Interest Expense | 6,113,253 | 2,721,009 | 1,097,940 | 471,943 | 1,164,575 | 657,786 |
| 7. Taxable Income | 6,769,387 | (1,947,951) | 3,352,033 | 1,443,961 | 2,140,238 | 1,781,106 |
| 8. Less: Income Taxes | 2,982,204 | (858,278) | 1,476,787 | 636,104 | 942,973 | 784,618 |
| 9. Net Return (Ln 5 - Ln 8) | 9,900,436 | 1,631,336 | 2,973,186 | 1,279,800 | 2,361,840 | 1,654,274 |
| 10. Original Cost Measure of Value (Factor 16.) | 163,713,344 | 72,860,975 | 29,410,991 | 12,635,209 | 31,191,679 | 17,614,490 |
| 11. Rate of Return, Percent | 6.05% | 2.24% | 10.11% | 10.13% | 7.57% | 9.39% |
| 12. Relative Rate of Return | 1.00 | 0.37 | 1.67 | 1.67 | 1.25 | 1.55 |

PFG GAS, INC. AND NORTH PENN GAS COMPANY

DEVELOPMENT OF RATE OF RETURN BY SERVICE CLASSIFICATION UNDER PROPOSED RATES

| Item | Cost of Service | Residential Service | General Service - Small | General Service - Large | Large Volume Service | Storage Service |
|--|--------------------------|-------------------------|----------------------------|----------------------------|----------------------------|-----------------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Revenues From Sales and Transportation Other Revenues | \$126,169,599 475,000 | \$70,035,046 293,040 | \$35,202,222 72,773 | \$4,926,184 22,857 | \$10,535,216 56,996 | \$5,470,931 29,334 |
| 3. Total Operating Revenues | 126,644,599 | 70,328,086 | 35,274,995 | 4,949,041 | 10,592,212 | 5,500,265 |
| 4. Less: Operating Expenses | 100,067,788 | 60,091,880 | 28,926,612 | 2,229,762 | 6,027,055 | 2,792,479 |
| 5. Return and Income Taxes | 26,576,811 | 10,236,206 | 6,348,383 | 2,719,279 | 4,565,157 | 2,707,786 |
| 6. Less: Interest Expense | 6,113,253 | 2,721,009 | 1,097,940 | 471,943 | 1,164,575 | 657,786 |
| 7. Taxable Income | 20,463,558 | 7,515,197 | 5,250,443 | 2,247,336 | 3,400,582 | 2,050,000 |
| 8. Less: Income Taxes | 8,664,079 | 3,181,450 | 2,223,203 | 951,316 | 1,439,970 | 868,141 |
| 9. Net Return (Ln 5 - Ln 8) | 17,912,732 | 7,054,756 | 4,125,180 | 1,767,963 | 3,125,187 | 1,839,645 |
| 10. Original Cost Measure of Value (Factor 16.) | 163,713,344 | 72,860,975 | 29,410,991 | 12,635,209 | 31,191,679 | 17,614,490 |
| 11. Rate of Return, Percent | 10.94% | 9.68% | 14.03% | 13.99% | 10.02% | 10.44% |
| 12. Relative Rate of Return | 1.00 | 0.88 | 1.28 | 1.28 | 0.92 | 0.95 |

Cost of Service

Reference Material "Gas Rate Fundamental" 1987 Edition