Service Quality Regulation and Performance Monitoring in Ohio

Measuring Commercial Quality Between Distribution and Supply

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ACCRA, GHANA

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Commercial Quality Distribution: (1) What is to be measured? (2) What are the indicators?

- MEASUREMENT = the reliability of each distribution system
- INDICATORS = Service reliability indices to be matched against performance targets.

"Reliability" is defined by

1. **Adequacy**

   The ability of an electric system to supply the aggregate electrical demand and energy requirements of the customers at all times.

2. **Security**

   The ability of the electric system to withstand sudden disturbances such as electric disruptions or unanticipated loss of system elements

In the USA, three measurements are used to determine how well a distribution system is performing

1. **CAIDI** (customer interruptions)
2. **SAIDI** (system interruptions) and
3. **SAIFI** (the frequency of system interruptions)

The measurement of how well a system is performing provides an indicator of “reliability.”

CAIDI

- CAIDI (measurement) - The customer average interruption duration index, represents the average interruption duration or average time to restore service per interrupted customer.

- CAIDI (percentage indicator) is expressed by:

  Sum of customer interruption durations ÷ number of interruptions

SAIDI

- "SAIDI" (measurement) is the system average interruption duration index, represents the average time each customer is interrupted.

- SAIDI (percentage indicator) is expressed by:

  Sum of customer interruption durations ÷ number of customers

SAIFI

- "SAIFI" (measurement) is the system average interruption frequency index, represents the average number of interruptions per customer.

- SAIFI (percentage indicator) is expressed by:

  Sum of customer interruptions ÷ number of customers

Momentary outages can act as precursors to larger reliability problems

- "MAIFI" (measurement) represents the average number of momentary interruptions per customer
- For example, if a recloser or circuit breaker operates, the operation shall be considered one momentary interruption.

Momentary outages (cont'd)

MAIFI (percentage indicator) is expressed by:
customer momentary interruptions ÷ number of customers

Including the following details in a report will prove helpful in correcting the onset of greater problems:

1. Each circuit lockout that occurred during the reporting period should be noted with an explanation of the cause and duration
2. The total number of outages experienced during the reporting period with an explanation of the cause
3. Total out-of-service minutes for the reporting period by outage cause
4. Identification of any major factors or events that specifically caused the circuit to be reported

How To Use Measurements and Indicators

- Each distribution system operator should determine system performance targets to create the basis for a service reliability indicator
- Performance targets (starting with the next succeeding calendar year) can be revised as patterns of performance of the system become more recognizable
- Performance targets should reflect historical system performance, system design, service area geography, and other relevant factors

Recognition of system performance aids in targeting maintenance and system improvements

- Annual performance levels for each service reliability indicator during a major weather event such as a storm should be recorded and reported for future use
- Performance data during a “major storm”, or other uncontrollable interruption of service can be used by the operator to develop an emergency plan
- If the annual performance level is worse than the target for any indicator, the operator can develop an action plan to improve performance to a level that meets or exceeds the target level for each missed reliability indicator

Measurements for performance of generators

- Generator performance is also important to maintaining adequate and reliable capacity resources.
- Generator performance, particularly for deregulated capacity resources in a competitive market can assure reliability and optimized return on investment in these assets.
- The generator that avoids unexpected (“forced”) outages of equipment will find that regular maintenance and repairs pay off in the long run
- Outages to accommodate regular maintenance schedules are not considered “forced” outages and therefore do not contribute to the calculation of a forced outage rate.

Two Types of "forced outage rates" have been used in the USA

- **Equivalent forced outage rate or EFOR** = Equivalent Forced Outage Hours / (Period Hours – Equivalent Scheduled Outage Hours)
- **Equivalent Demand Forced Outage Rate or EFORd** = approximations to estimate when a resource is needed and the EFORd equation includes additional information on each unit such as average forced outage duration. This more accurate equation, based on actual availability of generating units, is favored by RTOs/ISOs for the deregulated wholesale markets in the USA .

Variations on the use of these indicators

- ***EFOR*** - Defined by the NERC GADS Data Reporting Instructions Appendix F. This value may be calculated on any basis including hourly, daily, weekly, monthly, quarterly, and annually as well as time periods based on these periods such as 12-month rolling averages, last 5 years, etc. In addition, the EFOR may be calculated for peak periods.

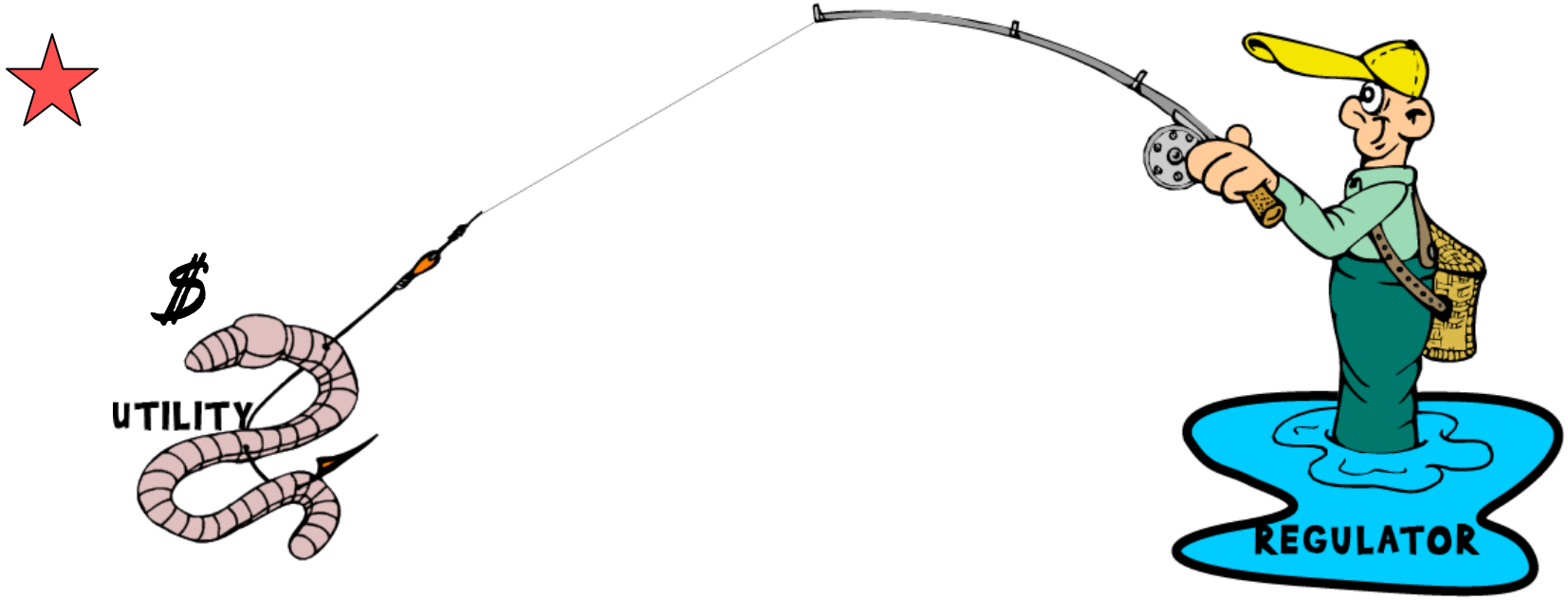
- ***EFORd (PJM)*** - Defined by the PJM Interconnection. As required by the PJM Interconnection, the EFORd can be calculated on a monthly, quarterly and annual basis as well as time periods based on these periods such as 12-month rolling averages, last 5 years, etc. Also utilized by New York ISO and ISO-New England. And under development by MISO.

- The value of these individual performance indicators for distribution and generation is the improvement that can result in the overall performance and reliability of any electrical system.
- If “points” were awarded to the best performing distribution systems and individual generators as they meet customer requirements, the customers, the asset owners and the system operators would indeed, all be

“WINNERS!”

INCENTIVE REGULATION

Use of penalties and rewards to induce utilities to achieve desired goals



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"All regulation is incentive regulation."

INCENTIVE REGULATION

- Recognizes the fact that the utility has better information than the rest of us, and uses it for profit maximization

- Used when the utility has some discretion in actually achieving the goals

"Regulation is an art, not a science."

MOTIVATION

"The Puritan hated bear-baiting, not because it gave pain to the bear, but because it gave pleasure to the spectators." *Thomas Babington Macaulay, History of England*

"I'm not a vegetarian because I love animals; I'm a vegetarian because I hate plants." *A. Whitney Brown*

"Today I will drink until I see double, not because I am addicted to alcohol, but because I want to recycle two bottles." *B. Lagowski and R. Mumma, Daily Negations*

SOME KEY INGREDIENTS

- Performance targets must be achievable
- Utilities AND Stakeholders set goals
- Utility discretion in how to get there
- Observable and verifiable
- The measures actually reflect utility performance and efforts

EXAMPLE MEASURES

- Number of service interruptions
- Duration of service interruptions
- Call center response
- Cost thresholds

IMPLEMENTATION ISSUES

Start too high=>no room for improvement or only at extremely high costs

Start too low=>easy improvements, high reward with little or no effort

Look for ***needed*** improvements

RATE OR RETURN REGULATION

- Prices set to generate allowed rate of return
- Used and useful plant
- Reasonable earnings
- Earnings stability
- Prices and revenues tied to cost of production/delivery
- Consumers bear risk
- Limited incentives for exceptional performance

RATE OF RETURN

- Regulator sets rate of return on capital investment
- Regulator decides what capital investment earns a return
- Regulator performs prudency test
- Utility allowed to recover expenses, depreciation, taxes

REVENUE REQUIREMENT

- Allowed rate of return (r)
- Rate base (B)
- Expenses (E)
- Depreciation (d)
- Taxes (T)
- Assumed quantity of sales or consumer demand (Q)
- Price (P)

REVENUE REQUIREMENT

Revenue Requirement

equals

E *plus* d *plus* T *plus* (B *times* r)

equals

P *times* Q

- Prices are set to generate a rate of return
- Utility allowed reasonable earnings
- Prices are linked to costs
- Departure from earnings trigger regulatory reviews
- Pass-through mechanisms used for variable expenses, such as fuel

TEST PERIOD

- Typically the 12 month period beginning six months prior to the date of the application is filed and ending six months subsequent to that date.
- In no event shall the test period end more than nine months subsequent to the date the application is filed
- Revenue and expenses of the utility shall be determined during the test year.

Date Certain

Shall fall within the test period, but be no later that the date of the application.

Valuation of the “used and useful” property of the public utility shall be determined as of the date certain.

COST OF SERVICE

Detailed cost accounting and allocation

Approximate costs incurred by a utility in providing the service and identifies the causes of the costs.

Assign costs to various customer classes relative to their respective cost imposition.

THREE STEPS

1. Functionalization

- Production
- Transmission
- Distribution

2. Classification

- Customer
- Demand
- Energy

3. Allocation

- Residential
- Commercial
- Industrial

This Step utilizes:

- ❑ Direct Assignment
- ❑ Number of Customers
- ❑ Class Energy Usage
- ❑ Class Demands

POSTIVE ATTRIBUTES OF RATE OF RETURN

- Prices are reflective of costs
- Utility provided revenue stability
- Prevents against excessive over- and under-earnings
- Customer provided rate certainty
- Potential for cost containment with regulatory timing “lag”

SOME PROBLEMS

- Information intensive
- Subjective
- Contentious and costly proceedings
- They may also be frequent
- Cross subsidies can occur

AND POTENTIAL DISADVANTAGES

- If rate of return is not equal to the actual cost of capital, can lead to over- or under- investment
- When pass-through mechanisms are utilized for operating costs, price risk hedging is not needed or used
- Nor are there rewards for cost containment
- Consumer bears the risk
- No incentives for good performance

- Investment decisions may be perverted
- Long run cost reductions minimal
- Short-run costs reductions favorable to utility, a ‘”reward” due to regulatory “lag”

PRICE CAP REGULATION

Theoretically

price set arbitrarily

utility performance “determines” cost

PRICE CAP REGULATION

In practice, however

- price cap is set under some semblance of rate of return regulation
- rate of return regulation timing “lag” is used for performance gains
- reviews are not contingent on earnings

PRICE CAP REGULAT

- Set fixed price and let utility att to beat the price
- Increase in profits through good performance
- Reviews are not contingent on earnings
- In fact, next regulatory review time should be specified in advance

PRICE CAPS

- Specify for long period of time (3-5 years)

➢ Based on estimated costs, and
➢ Fair rate of return enabled
➢ Price increase with inflation rate
➢ Costs change based on gains in efficiency

What is supposed to Happen

- Utility cost reductions
- Technology innovation
- Consumer protection against risk
- Not as information intensive
- Decrease in regulatory costs

POTENTIAL DOWNFALLS

- Earnings instability may occur
- There will likely be a “cap” on even better performance
- Cost reductions may result in decrease in service quality
- No mechanism for social programs

THINGS TO WATCH FOR

- While cost containment might be done under the cap, the utility will likely “make up” for that as the next review period nears.
- Incentive disappears as that time nears
- Utility will increase spending to reflect higher cost for next price cap setting

Unintended Consequences

The utility might also earn higher profits when the estimated demand is less than actual demand EVEN WITHOUT good performance.

REVENUE CAP REGULATION

- Revenue earnings set
  - ➢ Fair return
  - ➢ Cost
  - ➢ Output

- Long period of time

- May or may not fluctuate with inflation

What is supposed to Happen

- As consumer demand changes, so does the price
  - ➢ Increase in demand, decrease in price
  - ➢ Decrease in demand, increase in price

- Price
  - ➢ Per unit (per kwh)
  - ➢ Flat (demand)

REVENUE CAP REGULATION

- Allowed revenues may or may not fluctuate with inflation rate

- Revenues can fluctuate with efficiency gains

BENCHMARKING

- Must find “comparable” utility or, alternatively, “create” a hypothetically efficient entity

- Performance measured in comparison to this entity

BENCHMARKING

- Compensation based on relative performance
- Incentive to cut costs
- Can pick and choose operations or measure performance on the entire utility operations

BENCHMARKING PROBLEMS

- Starting point difficult
- ➢ Categories for benchmarking contentious
- ➢ Resources needed cumbersome
- ➢ Methodologies and assumptions are contentious.

HYBRID APPROACH

- Revenue/price caps
- Profit/revenue/cost sharing
- Targeted incentives
- Benchmarking

WHEN TO DO WHAT

Rate of return regulation might be desired

- When expected costs are difficult to predict
- When stable utility earnings ar desirable
- When current utility operations are efficient

WHEN TO DO WHAT

On the other hand, rate cap regulation is preferred

- When stable and certain prices are desired
- When utility earnings are not problematic
- When regulatory proceedings are costly
- When utility operations are not efficient

SHARED MECHANISMS

- Political balancing act
- Utility can share profits with ratepayers and shoulder some of the risk (under rate of return regulation)
- Provide some incentive for cost containment and shared earnings in excess of allowed earnings
- “Shares” can change as costs/earnings deviate further from target