Where Does Your Utility Stand? A Regulator's Guide to Defining and Measuring Performance

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NRRI

August 2010

10–12

Acknowledgments

The author wishes to thank Howard Stone, Ken Costello, Scott Hempling, Adam Pollock, and Sherry Lichtenberg for their help in the preparation of this paper.

Online Access

This report can be accessed online at http://www.nrri.org/pubs/multiutility/NRRI_performance_measures_aug10-12.pdf.

Executive Summary

Are utilities in your state performing at the highest possible level consistent with reasonable costs? The answer depends on how a regulator defines performance. If we define performance in terms of cost alone, a utility might appear to be a superior performer, for now, but its cost savings could come at the expense of future performance in areas such as reliability and safety. Performance is a multidimensional issue, covering not only cost but customer satisfaction, financial health, plant performance, innovation activity, and management practices.

For each of these dimensions, there exist numerous ways to measure performance. Selecting appropriate measures requires knowledge of the specific industry, plus the disciplines of economics, finance, accounting, engineering, and management. Finding the relevant information from various sources in different areas can be a burdensome task.

This paper provides a one-stop reference for regulators who decide to measure the performance of their utilities. **Part I** covers a number of important dimensions of performance and their definitions, measures, and data sources. Given the limited resources available to a regulator, it will not always be possible to evaluate performance from all perspectives. When deciding what to focus on, a regulator should take various factors (such as data availability, ease of measurement, and relations between different performance parameters) into consideration. **Part II** of the report discusses the factors that should be taken into account.

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Introduction

The purpose of regulation is to induce high-quality performance in regulated utilities. In developing a commission policy on utility performance, the first step is to define the dimensions of performance important to the commission; the next is to determine appropriate measurements. As technology advances and the political sector imposes new expectations, new performance dimensions will arise, and the relative value of existing dimensions will change. These changes underscore the need for commissions to develop processes for evaluating their utilities over an extended period of time.

The challenge is that there is no comprehensive, generally accepted source of reference for the dimensions of utility performance and their measurements. Those commissions that address performance explicitly focus on different performance dimensions and apply different measures. If commissions have access to a common vocabulary about performance dimensions, as well as a common set of measurements, they can more easily make utility-by-utility comparisons, thus supporting each others' efforts.

This paper provides a reference for those commissions wishing to create a comprehensive performance policy. It addresses dimensions that are traditionally evaluated (such as costs and reliability), and dimensions that policymakers have started to focus on in recent years (such as innovation activity). It also discusses alternative ways to investigate performance (*e.g.*, processes, in addition to outputs). While some measures of performance are the same across different industries (for example, most financial measures), other measures are industry-specific (*e.g.*, measures of reliability). The list of measures provided in this paper primarily covers the measures specific to the electric industry, but includes measures specific to other utility industries as well.

A comprehensive source of reference has the following benefits:

First, the reference will provide regulators with a starting point for integrating utility performance measures into their policies, such as decisions on rate levels, facilities certificates, integrated resource planning, approvals of new products and services, and corporate restructuring.

Second, the reference will encourage consistent attention over time to a comprehensive set of dimensions that will be more likely to induce overall performance improvement. Contrast this goal with a set of shifting priorities and temporary focuses on distinct performance dimensions, such as fuel purchases, power plant performance, and outage duration—approaches that can send mixed signals and distort decisionmaking by causing unmentioned dimensions to receive insufficient management attention.

Third, the use of the same source of reference by commissions will lead to the application of a consistent definition of performance across states. This consistency will facilitate the process of comparing utility performance within and across states, and over time.

In an ideal world, a regulator would measure utilities across all the dimensions. In reality, given limitations on human resources, funds, time, and data, a regulator often must select a certain number of dimensions to evaluate. The second part of the paper provides advice on what factors to take into account when selecting performance measures.

Part I of the paper covers a number of important dimensions of utility performance. **Part II** discusses the selection criteria.

This paper is part of an NRRI series of papers on performance. The second paper in the series, *Utility Performance: Evaluating It Using Indexing, Econometrics, and Data Envelopment Analysis* (Report # 10-05), provides guidance on the types of performance evaluation techniques available and discusses their advantages and limitations, application examples, and data requirements. The third paper in the series, *How Performance Measures Can Improve Performance* (Report #10-09), discusses how commissions can employ evaluation results in their regulatory practices to induce excellence in utility performance.

I. What are the Dimensions of Utility Performance, and How are They Measured?

This section discusses the different dimensions of utility performance, the definitions of these dimensions, the measures that regulators can use to evaluate performance in these dimensions, and data sources. The dimensions are: reliability, safety, customer satisfaction, financial health, costs, plant performance, innovation, and asset management.

Given that there exist an indefinite number of ways to measure performance, the task of this section is to cover the most often used measures of performance in different dimensions. While some measures are the same across different industries, other measures are industry-specific. This section primarily uses measures specific to the electric industry, but does refer to examples from other utility industries.

Table 1, found on the next page, provides a summary of the dimensions of performance: their definitions, measures, and data sources. Each performance dimension is discussed in more detail in the text that follows the summary table.

Table 1. Summary of Information on Performance Dimensions

Performance Dimension	Definition	Measures	Data Sources
Reliability	Reliability is a system's ability to consistently perform as intended without degradation or failure.	Outage indices Power quality indices	Utilities NERC
Safety	Safety is a state of being certain that the utility's operations will not harm the public, employees, or the environment.	Public safety measures Employee safety measures	Utilities OSHA
Customer Satisfaction	Customer satisfaction indicates how content customers are with their utilities' services.	Customer complaints Call center performance Appointments Metering and billing accuracy Emergency response Results of customer surveys	Utilities J.D. Power and Associates' surveys
Financial Health	The state of the utility's financial health indicates whether a utility's financial position is adequate for it to fulfill its public service obligation.	Liquidity Equity Leverage Variable-rate debt Return and valuation Credit ratings	SEC Form 10-K FERC Form 1 RUS Form 12 RUS Form 7
Costs	Costs are the value of resources (including labor, capital, and materials) that go into the production of the utility's services.	Utility total costs Different categories of costs	FERC Form 1 EIA Form 923 RUS Form 12 RUS Form 7
Plant Performance	Plant performance indicates how efficiently a utility operates its plants.	Equivalent forced outage rate on demand Equivalent forced outage rate on peak Heat rate Outage rates Availability factor Capacity factor Economic efficiency	NERC EIA Form 860 EIA Form 923
Innovation	Introduction of new processes or technologies that make a utility operate more efficiently.	R&D spending R&D effectiveness index Number of patent applications	FERC Form 1
Asset Management	The evaluation of a utility's asset management practices indicates how efficiently a utility manages its assets.	Evaluation of the whole asset management process Evaluation of specific aspects of asset management	Utilities

A. Reliability

1. Definition. Reliability is the ability of an electric system to consistently perform as intended without degradation or failure.

2. Measures

Table 2. Measures of Reliability

Industry	Group of Measures	Measures
Electric	**Outage Indexes**	**1. System Average Interruption Duration Index (SAIDI).**[1] The average duration of sustained interruptions[2] per consumer during the year. SAIDI is measured in units of time (minutes or hours). SAIDI = Total duration of sustained interruptions in a year / Total number of consumers **2. System Average Interruption Frequency Index (SAIFI).** The average number of sustained interruptions per consumer during the year. SAIFI = Total number of sustained interruptions in a year / Total number of consumers **3. Customer Average Interruption Duration Index (CAIDI).** The average duration of an interruption. CAIDI = Total duration of sustained interruptions in a year / Total number of interruptions CAIDI = SAIDI/SAIFI **4. Momentary Average Interruption Frequency Index (MAIFI**). The average number of momentary interruptions[3] per consumer during the year. MAIFI = Total number of momentary interruptions in a year / Total number of consumers

[1] The definitions for outage indices follow Institute of Electrical and Electronics Engineers (IEEE) Standard 1366.

[2] Utilities usually define a "sustained interruption" as an interruption that lasts more than one or five minutes.

[3] Utilities usually define a "momentary interruption" as an interruption that lasts less than one or five minutes.

	Power quality indexes (elements of power delivery that do not include outages, but do influence the power actually delivered)	**1. Transient**. A sudden momentary (a few seconds') change in voltage. Also called a spike.[4] **2. Sag.** A short-term decrease in voltage lasting anywhere from milliseconds up to a few seconds. Sags starve a machine of the electricity it needs to function, causing computer crashes or equipment lock-ups. **3. Surge.** A short-term increase in voltage, lasting up to a few seconds. Surges are due either to customer equipment operation, such as air conditioners or motors switching on and off, or to utility activities, such as capacitor switching. **4. Undervoltage.** A decrease in voltage lasting longer than a few seconds. **5. Harmonic distortion.** Continuous or sporadic distortions of the 60-hertz (Hz) voltage sine waveform, usually caused by microprocessor-based loads in the building such as computer power supplies, lighting ballasts, and electronic adjustable speed drive. Harmonics can also be transmitted from an energy user down the block. **6. Noise.** Sporadic voltage changes consisting of frequencies higher than the normal 60-Hz power frequency due to any number of causes, including arc welders, loose wiring, and nearby radio and TV transmitters. **7. Voltage stability**. A power system's ability to remain in a state of equilibrium at normal operating conditions and to restore an acceptable state of equilibrium after a disturbance. **8. Flicker.** A voltage fluctuation that causes an annoying visibly perceptible effect.
Water		**1. Water distribution system integrity.** The number of breaks and leaks requiring repair per a certain number of miles (*e.g.*, 100) of distribution piping.[5] **2. Disruptions of water supply.** The number of customers experiencing service disruptions per a certain number (*e.g.*, 1,000) of active customer accounts.

[4] The definitions of the power quality indices (except for the last two) come from http://www.we-energies.com/powerquality/voltagesags.pdf. The sources of the last two definitions are *Voltage Stability of Electric Power Systems* by Van Custem, T. and Vournas, C.; and *Sampling Frequency and Time Window Influence on Flicker Measurements Significance: A Case Study* by Oliveira, F., Madureira, A., and Donsion, M.P.

[5] The definitions of reliability measures in water and wastewater industries come from the American Water Works Association (AWWA), www.awwa.org.

Wastewater		**1. Sewer overflow rate.** The number of overflows per a certain number of miles (*e.g.*, 100) of collection piping. **2. Collection system integrity.** The number of collection system failures per a certain number of miles (*e.g.*, 100) of piping.

3. Sources of data

Most utilities collect data on SAIDI and SAIFI. Commissions differ in their practices of requiring utilities to report this information. Transmission system outage and performance data are collected by the North American Electric Reliability Corporation (NERC) and are available through the Transmission Availability Data System (TADS). TADS data are partly reported in Section 7 of the Energy Information Administration (EAI) Form 411.

B. Safety

1. Definition. Safety is the state of being certain that a utility's operations will not harm the public, employees, or the environment.

2. Measures. See Table 3 on the next page.

Table 3. Measures of Safety

Industry	Group of Measures	Measures
Electric	**Public Safety**	**The number of public-safety incidents** incurred by a utility annually
	Employee Safety	**1. Injury and illness rate among workers**. The rate can be computed according to the following formula of the Occupational Safety and Health Administration (OSHA). Injury and Illness Rate = Number of Injuries and Illnesses X 200,000[6] / Number of Hours Worked **2. Lost time rate.** The rate can be calculated according to the following OSHA formula. Lost Time Rate = Number of Lost Time Accidents X 200,000[4] / Number of Hours Worked, where a lost time accident is any occupational injury or illness that results in an employee being unable to work a full assigned work shift.
Gas	**Public Safety**	**1. Time required to respond to calls about gas odors.** **2. Number of fires or evacuations** resulting from leaks on the utility side of the pipeline.
Water	**Public Safety**	**Drinking water compliance rate.**[7] The percentage of days in the reporting year during which a utility was in full compliance with the maximum contaminant levels and treatment techniques mandated by the U.S. National Drinking Water Regulations.

3. Sources of data

Most utilities keep a record of their safety accidents. The Occupational Safety and Health Administration (OSHA) only collects data from a small portion of all U.S. private companies (80,000 out of 7.5 million).

[6] The 200,000 hours in the formula represents the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and provides the standard base for the incidence rates.

[7] The definition is from the American Water Works Association (AWWA), www.awwa.org.

In the water industry, the United States Environmental Protection Agency (EPA) has a national regulatory compliance database for the drinking water program (SDWIS/FED). It includes information on 160,000 U.S. public water systems and violations of drinking water regulations.

C. Customer satisfaction

1. Definition. Customer satisfaction indicates how content customers are with their utilities' services.

2. Measures

Table 4. Measures of Customer Satisfaction

Industry	Group of Measures	Measures
Applicable to All Utility Industries	**Customer complaints**	**Number of customer complaints** to utility or commission
	Call center performance	**Percentage (or number) of customer calls answered** within a certain period of time (*e.g.*, 30 or 60 seconds)
	Appointments (repairs, installation services, testing)	**1. Average time between placing an order and meeting this order** **2. Percentage of appointments met**
	Metering and billing accuracy	**1. Percentage of meters that are read** each billing period **2. Percentage of prepared bills that must be adjusted** for errors
	Emergency response	**Time it takes a utility to respond** to an emergency situation
	Results of customer surveys	Survey questions

3. Sources of data

Utilities often collect information on customer satisfaction. Some states require their utilities to provide this information to the commission and to the public. J.D. Power and Associates conducts customer satisfaction surveys and rankings for a number of industries including electric utilities, gas utilities, and telecommunication services. The surveys are conducted through telephone interviews with the customers of the largest utilities. J.D. Power and Associates conducts two studies on electric utilities: the Electric Utility Residential Customer Satisfaction Study (quarterly) and the Electric Utility Business Customer Satisfaction Study (biannual). Both studies measure customer satisfaction in six key areas: power quality and reliability, price, billing and payment, corporate citizenship, communications, and customer service. Utilities are ranked in four geographical regions (East, South, Midwest, and West) as well as in a category of medium-size utilities. For gas utilities, J.D. Power and Associates also conducts two studies: the Gas Utility Residential Customer Satisfaction Study (quarterly) and the Gas Utility Business Customer Satisfaction Study (biannual). Customer satisfaction with gas utility companies is evaluated in the following key areas: price, billing and payment, corporate citizenship, communications, customer service, and field service.

D. Financial health

1. Definition

The state of a utility's financial health indicates whether a utility's financial position is adequate for it to fulfill its public-service obligation. Regulators should look at both short-term measures of liquidity and longer-term measures of creditworthiness and ability to access capital.

2. Measures

Table 5. Measures of Financial Health[8]

Industry	Group of Measures	Measures
Applicable to All Industries	**Liquidity**. Indicates how much cash a utility has relative to its operating expenditures.	**1. Days cash on hand** = (Unrestricted Cash[9] and investments / Operating Expenses less Depreciation) * 365 **2. Days of liquidity on hand** = (Unrestricted Cash + Available Lines of Credit + Commercial Paper Capacity / Operating Expenses less Depreciation) * 365
	Equity. Indicates how much equity a utility has relative to its asset base.	**Equity to capitalization** = Total Equity / Capitalization[10]
	Leverage. Indicates a utility's debt burden relative to its operating cash flow.	**1. Debt / Funds Available for Debt Service** (FADS)[11] **2. Debt / Equity** **3. Debt-service coverage** = FADS / Total Annual Debt Service

[8] The information on financial measures comes from Fitch Ratings, U.S. Public Power, Peer Study.

[9] Unrestricted cash is cash that is available for immediate liquidity needs, with flexible or no limitations on use.

[10] Capitalization = Total Debt + Total Equity

[11] FADS = Operating Income + Depreciation and Amortization + Interest Income

		4. Debt per customer = Total Debt / Total Customers
	Variable-rate debt. Indicates how much interest rate risk is carried by a utility.	**Variable-rate exposure to total capitalization** = Variable Rate Exposure[12] / Capitalization
	Return and valuation. Indicates how much an investor gets on his/her investment.	1. Earning per share 2. Dividends per share 3. Dividend payout ratio 4. Book value per share 5. Market price per share 6. Return on average assets 7. Return on average equity
	Credit ratings	Utility ratings from agencies such as Standard and Poor's, Fitch, and Moody's.

3. Sources of data

Form 10-K of U.S. Securities and Exchange Commission (SEC); FERC Form 1 (for electric utilities) and FERC Form 2 (for gas utilities); RUS (Rural Utilities Service) Form 12 (for generation and transmission cooperatives) and RUS Form 7 (for distribution cooperatives).

[12] Variable Rate Exposure = Total Variable-rate Debt + Outstanding Commercial Papers + Fixed-to-Variable-Rate Swaps - Variable to Fixed-Rate Swaps

E. Costs

1. Definition

Costs are the value of resources (including labor, capital, and materials) that go into production of utility's services. Examination of different categories of costs shows how a utility allocates its resources.

Costs are driven by the number of customers and the amount of services provided. Thus, costs are usually measured (a) per customer or (b) per unit of utility's output (*e.g.,* per kWh).

2. Measures

Table 6. Measures of Utility Costs

Industry	Group of Measures	Measures
Electric Industry	**Utility total costs**	Sum of all of the utility costs
	Different categories of costs	**By area of service:** Distribution Transmission Generation Ancillary services **By function:** Operation and maintenance (O&M) Capital costs Customer service Advertising and other promotional activities Fuel/purchased gas Labor Administrative and general services Material purchases Plant construction Outsourcing

3. Sources of data

FERC Form 1 for electric utilities and FERC Form 2 for interstate natural gas pipelines. EIA Form 923 contains information on cost of fuels. Information on costs of rural utilities can be found in RUS (Rural Utilities Service) Form 12 (generation and transmission cooperatives) and RUS Form 7 (distribution cooperatives).

F. Plant performance

1. Definition. Plant performance indicates how efficiently a utility operates its plants.

2. Measures. See Table 7 on the next page.

Table 7. Measures of Plant Performance[13]

Industry	Measures
Electric industry	**1. Equivalent forced outage rate on demand** ("EFORd") measures the availability of the generating units when dispatched.[14] **2. Equivalent forced outage rate on peak ("EFORp")** measures the availability of the generating units during the system's peak demand periods (when prices are highest and volatility is greatest).[15] **3. Heat rate.** A measure of how efficiently a generator uses heat energy. It is expressed as the amount of heat required to produce a kilowatt-hour of energy. Heat Rate = Heat supplied to the power plant for a period (Btu, kJ) / Energy output from the power plant in the period (kWh) **4. Outage rates.** The proportion of hours in a year for which a unit is unavailable due to outages. Rate can be calculated for forced outages, planned outages, or both. Outage hours = Number of hours a unit was in an outage state / Number of hours a unit was in an outage state + Number of hours a unit was in the in-service state **5. Availability factor.** The proportion of hours over a certain period when a unit is able to produce electricity. Availability factor = Number of hours when a unit is able to produce electricity over a certain period / Number of hours in the same period. **6. Capacity factor.** The ratio of the total energy generated by a unit for a specific period to the energy it could have generated if operated at the full nameplate capacity for the same period. Capacity factor = Average load for the power plant for a period (kW) / Energy that could be generated at the full nameplate capacity (kW) **7. Economic efficiency.** The ratio of production costs (fuel, labor, materials, and services) to energy output from the power plant for a specific period of time. Energy efficiency = Production costs for a period (cents) / Energy output from the power plant in the period (kWh)

[13] The definitions in this section come from the NERC GADS Data Reporting Instructions and http://www.engineeringtoolbox.com.

[14] *See* the NERC GADS Data Reporting Instructions, Appendix F for the equation of EFORd and the details of the calculation process.

[15] *See* PJM Manual 18: PJM Capacity Market, Revision 10 for the equation of EFORp and the details of the calculation process.

3. Sources of data

North American Electric Reliability Corporation (NERC) collects information on the performance of generating units throughout North America in its Generating Availability Data System ("GADS"). EIA Form 860 and Form 923 provide generator level operating data including information on generating capacity, energy generation, and energy sources.

G. Innovation

1. Definition

Introduction of new processes or technologies that make a utility operate more efficiently.

2. Measures

Table 8. Measures of Innovation Activity

Industry	Measures
Applicable to all industries	**1. R&D spending** as a percentage of total costs **2. R&D effectiveness index** R&D effectiveness index = Percent of profits obtained from new products / Percent of revenue spent on R&D **3. Number of patent applications**

3. Sources of data

FERC Form 1 contains data on utility's expenditures on R&D.

H. Asset management

1. Definition. The evaluation of a utility's asset management practices indicates how efficiently the utility manages its assets.

2. Measures. See Table 9 on the next page.

Table 9. Measures of Asset Management

Industry	Group of Measures	Measures
Applicable to all industries	**Evaluation of the whole asset management process**	The evaluation covers the whole life of an asset, from asset need identification to design, acquisition, construction, commissioning, utilization or operation, maintenance, renewal, modification, and ultimate disposal. The evaluation helps to clarify whether a utility has an optimal mixture of capital investments, operations, maintenance, resourcing, risks, performance, and sustainability. It helps to identify problems with asset management and develop an action plan to solve these problems. The evaluation of the whole asset management process can be conducted with the help of the following formal frameworks: PAS 55, Total Asset Management Manual, and International Infrastructure Management Manual.[16]
	Evaluation of specific aspects of asset management	Instead of conducting an evaluation of the whole management process, regulators can also focus on specific aspects of the process. One of the measures is the **replacement rate** for different types of assets (distribution, transmission, substations). Replacement rate = Assets replaced during a year / Existing assets

3. Sources of data

Some utilities conduct evaluations of their asset management practices.

[16] Details on these frameworks can be found in "Leveraging Network Utility Asset Management Practices for Regulatory Purposes," KEMA, November 2009, available at http://www.oeb.gov.on.ca/OEB/_Documents/Documents/Report_Asset_Mgmt_Investment_Plans_20091218.pdf.

II. Selecting Measures of Utility Performance

Part I provided an overview of the dimensions of utility performance and their measures. It may not always be feasible for regulators to measure utility performance in every dimension. Often, a regulator must choose what to measure. But how is one to make the selection? Part II.A identifies a number of factors that regulators can take into consideration. Part II.B includes examples of the sets of performance measures that were selected (1) by the American Water Works Association for its members, and (2) by two consulting companies for Canadian regulators.

A. Selection factors

1. The multidimensionality of utility performance

The traditional approach focuses on just a few performance dimensions. Three common examples are a specific cost component (*e.g.*, operations and maintenance costs, fuel purchase costs), outages, and customer satisfaction. Utility performance is, however, a multidimensional issue. We encourage regulators to evaluate performance from as many angles as possible (given the resources available) in order to obtain a complete picture. Covering only a few selected dimensions can lead to "you get what you measure" results. For example, if a regulator concentrates only on utility's price level or costs, then a utility will try to cut its costs, at the expense of current or future reliability or innovation efforts.

2. Relations between performance parameters

Many of a utility's performance dimensions are related. Decisions about which parameters to include in an evaluation require attention to these relationships, which fall into the following categories:

a. *Negative relation:* Improved performance in one dimension leads to worse performance in another dimension (as in the above example of costs and reliability)

b. *Positive relation:* Improved performance in one dimension leads to increased performance in another dimension. For instance, an increase in power plant equivalent availability can reduce a utility's fuel costs.

3. Data availability

Measuring performance requires data. Some data are publicly available and standardized. For example, data on different categories of costs of electric utilities are available from FERC Form 1. Data on other parameters, such as customer satisfaction and innovation, are not easily available and might require additional data collection or sending requests to utilities that collect data for internal purposes. It is important to avoid the temptation to focus only on parameters for which data is readily available.

4. Data credibility

If the sole data source is the utility, the regulator must test its credibility, since regulatory evaluation can affect the utility's bottom line.

5. Ease of measurement

Some performance dimensions are not readily quantifiable, yet they matter to performance. There are, for example, no established or straightforward ways to measure a utility's innovation activity or planning actions. But addressing only quantifiable factors in a performance review can result in over-emphasizing short-term concerns. A review of academic studies and business practices in other industries can provide measurement techniques for evaluating performance in dimensions that are not traditional for utilities (for example, measures of innovation activity can be found in management studies).

6. Outcomes and processes

Traditionally, regulators focus on measuring utility *outcomes*, such as level of costs or number and duration of outages. The other option is to focus on *processes* (*e.g.*, "What actions does the utility take to manage its assets?"). The problem with focusing exclusively on outcomes is that they are, by definition, after the fact. In the case of a multi-billion-dollar power plant, waiting for the outcome limits the actions the regulator can take. Evaluating processes and practices is an additional way to cause utility improvement in outcomes. Information on processes can also find other applications in regulatory practices. For example, information on how a utility manages its assets can serve as evidence of utility's management competence (or incompetence) in the process of approval of new capital investments. However, in general, the evaluation of management processes takes more time and resources. It is therefore advisable to employ some combination of measures of outcomes and measures of underlying management practices.

7. Application of performance measures

Before deciding what performance parameters to evaluate, a regulator should think about how she will use the evaluation results to make regulatory practices more efficient and effective. For example, a regulator can establish an incentive mechanism in regards to service quality that would reward a utility for surpassing a target and penalize it for performing below the target. Determining whether a utility is performing below or above the target will require information on performance in the area of quality of service. NRRI's report *How Performance Measures Can Improve Regulation* discusses different ways in which regulators can use evaluation results in their practices. Planning in advance will help to avoid wasting resources on collecting information that will not find application.

8. Jurisdiction-specific issues

States might have specific policy goals (for example, to increase the production of local renewable energy). A regulator will need to include performance measures that reflect the progress of utilities in these specific areas.

9. Comparability across utilities and over time

A regulator should ensure that all utilities in the jurisdiction use the same definitions of performance measures and interpret them in the same way. A regulator should also ensure that the process of tracking and reporting parameters is as easy as possible and that the end results are transparent and understandable.

10. Dimensions of performance under a utility's control and outside of a utility's control

Performance measures are affected by factors outside a utility's control, but performance measures can anticipate and reduce these effects. For example, the quantity and duration of outages depends on both controllable and uncontrollable factors.[17] To distinguish between these types of factors, the traditional practice is to calculate these statistics without including major weather events (such as storms and hurricanes). The more careful approach requires examining the various sources of outages (such as animal activity, equipment failures, or vandalism). This approach permits the identification of areas for performance improvement.

B. Sets of performance measures: two examples

The American Water Works Association (AWWA) designed a set of performance measures to help its members—water and sewage utilities—identify, track, and measure their performance indicators and compare these indicators against their peers.[18] AWWA takes a multidimensional approach to performance evaluation: The set consists of 22 key performance indicators in five areas of water and wastewater utility operation (Organizational Development, Customer Relations, Business Operations, Water Operations, and Wastewater Operations). Appendix A provides the complete AWWA performance set.

Our second example, from a study conducted for Canadian regulators by two consulting companies,[19] proposes that regulators should focus first on a short list of easily available specific measures. The list includes the following groups of measures: customer service, transportation, distribution, costs, and other (optional). The complete list is provided in Appendix B. The study suggests that in the long run the list can be expanded as more data and more experience are accumulated. The selection criteria included the following:

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[17] For a detailed discussion of outage measurements and the relationship between a utility's actions and outages, see *Regulatory Policies for Electricity Outages: A Systems Approach*, Robert Burns, NRRI, 2007.

[18] The American Water Works Association (AWWA) website's section on benchmarking is located at http://www.awwa.org/Resources/utilitymanage.cfm?ItemNumber=630&navItemNumber=159.

[19] CAMPUT Benchmarking for Regulatory Purposes (CAMPUT study), prepared by First Quartile Consulting, LLC and Elenchus Research Associates, Inc., April 2000.

- The selected set of metrics should be balanced, covering both service and costs.
- It should be a manageable, limited set, focused on outcomes rather than underlying process results.
- Metrics should be measurable by each utility, and should help them in running their business (*i.e.*, they should be tracked and used internally, as well as for regulatory reporting).
- The results should be understandable to everyone (in other words, not a "black box" model creating an index unexplainable to the average observer).
- Appropriate demographics should be included in the data collection to enable the users to recognize and account for differences among utilities in their operating circumstances.[20]

[20] CAMPUT study, p. 42.

Conclusion

The goal of this paper is to help regulators organize their thinking about utility performance—what it is and how to measure it. The first part of the report served as an overview of the important dimensions of performance. The second part of the report addressed various factors that regulators should take into account in the process of setting a strategy for the evaluation of their utilities' performance.

Appendix A

Set of Performance Measures Designed by the American Water Works Association (AWWA)

The following benchmarks were identified and defined by the American Water Works Association.

Organizational Development[21]

1. The **Organizational Best Practices Index** is a self-assessment of the degree to which seven management practices are implemented by a utility:

Strategic Planning
Long-term Financial Planning
Risk Management Planning
Optimized Asset Management
Performance Measurement
Customer Involvement
Continuous Improvement

2. The **Employee Health and Safety Severity Rate** measures lost workdays per employee per year. It is identical to that contained in OSHA Form 300A and already recorded by utilities in the United States.

3. **Training Hours per Employee** measures a utility's investment in formal training for employees.

4. **Customer Accounts Per Employee, MGD Water Delivered Per Employee, and MGD Wastewater Processed Per Employee** are measures of employee efficiency. They account for contributions completed through contracts.

Customer Relations

5. **Customer Service Complaints** and **Technical Quality Complaints** per 1,000 customer accounts complement one another. The first are service associated; the second quantify complaints of technical quality.

6. **Disruptions of Water Service** quantifies the number of customers experiencing service disruptions as a ratio per 1000 active customer accounts.

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[21] The following is a direct quote from the AWWA's website, www.awwa.org.

7. **Residential Cost of Water and/or Sewer Service** is a suite of six indicators, two of which apply at any water, wastewater, or joint water/wastewater utility.

   Bill amount for monthly residential water service for a customer using 7500 gallons per month.
   Average residential water bill amount for one month of service.
   Bill amount for monthly residential sewer service for a customer using 7500 gallons of water per month.
   Average residential sewer bill amount for one month of service.
   For multiple service utilities that cannot provide individual costs, the total monthly bill amount for residential water and sewer service for a customer using 7500 gallons of water per month.
   For multiple service utilities that cannot provide individual costs, the average residential combined water and sewer bill amount for one month of service.

8. **Customer Service Cost Per Account** measures the cost to a utility of managing a single customer account for one year.

9. **Billing Accuracy** measures the number of error-driven bill adjustments per 10,000 bills issued during the reporting year.

Business Operations

10. **Debt Ratio** is a measure of utility indebtedness.

11. **System Renewal / Replacement Rate** measures the degree to which a utility is renewing or replacing its infrastructure. Rates are provided for water treatment, water distribution, wastewater collection, and wastewater treatment.

12. **Return on Assets** indicates the financial effectiveness of the utility. Investor-owned and enterprise fund utilities may see the greatest value to this indicator.

Water Operations

13. **Drinking Water Compliance Rate** tallies the percentage of days in the reporting year during which a utility was in full compliance with the maximum contaminant levels and treatment techniques mandated by the US National Primary Drinking Water Regulations.

14. **Distribution System Water Loss** measures the percentage of drinking water placed into distribution that does not find its way to customers or other authorized users.

15. **Water Distribution System Integrity** quantifies the condition of the water distribution system with the number of breaks and leaks requiring repair per 100 miles of distribution piping.

16. **Operations and Maintenance Cost Ratios** tally the cost of operations and maintenance and relate them on per account and per millions of gallons produced bases.

17. **Planned Maintenance Ratio** measures how effectively utilities are investing in planned maintenance. Two proposed ratios make comparisons to cost and to hours invested in maintenance activities.

Wastewater Operations

18. **Sewer Overflow Rate** measures the condition of the sewerage collection system and the effectiveness of maintenance activities. It is expressed as the ratio of the number of overflows per 100 miles of collection piping.

19. **Collection System Integrity** measures the frequency of collection system failures per 100 miles of piping.

20. **Wastewater Treatment Effectiveness Rate** quantifies a utility's compliance with the effluent quality standards in effect at each of its wastewater treatment facilities.

21. **Operations and Maintenance Cost Ratios** tally the cost of operations and maintenance and relate them on per account and per millions of gallons of wastewater processed bases.

22. **Planned Maintenance Ratio** measures how effectively utilities are investing in planned maintenance. Two ratios make comparisons to cost and to hours invested in maintenance activities.

Appendix B

Snapshot of Areas for Measurement, from the Report "CAMPUT Benchmarking for Regulatory Purposes"[22]

Customer Care	Reliability	Asset Management	Costs	Optional
- Call Center - Billing - Customer Complaints	- SAIFI - CAIDI - SAIDI	- Asset Replacement Rates (three years), for Distribution, Transmission, and Substation assets	- Customer Care - Bad Debt - O&M (both transmission and distribution) - Corporate Services	- Safety - Line Losses - New Services Conservation

[22] The following is a direct quote from "CAMPUT Benchmarking for Regulatory Purposes," prepared by First Quartile Consulting, LLC and Elenchus Research Associates, Inc., April 2000, p. iv.