Performance Benchmarking: An Overview

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Benchmarking enables “apples to apples” performance comparisons relative to a given sample. The accuracy of the benchmarking exercise is dependent upon data availability and the benchmarking technique employed in the analysis. Two approaches are popular in utility benchmarking: peer group and econometric. This paper provides an overview of benchmarking by contrasting the two approaches to benchmarking, lists utility performance measures open to benchmarking, and discusses how benchmarking is a valuable evaluation tool to utility management and regulators.

What is benchmarking?

Performance benchmarking offers a comparison to be constructed relating a utility’s actual data to a customized expectation of this data. In the case of cost benchmarking, performance is judged to be above average if the studied utility’s actual costs are below the expected costs, or vice versa. Similar to scoring in golf, a lower score indicates better performance. For example, a score of 0.80 would indicate actual costs are 20% below what we would expect spending levels to be, conversely a score of 1.20 would signify costs are 20% above those of a hypothetical average performing utility with the exact operating circumstances of the measured utility.

\[ \text{Performance} = \frac{\text{Costs}_{\text{Actual}}}{\text{Costs}_{\text{Expected}}} \]  

Equation 1 shows performance to be a function of two terms. Actual costs are reported directly from the utility, whereas expected (benchmark) costs must be estimated. The research challenge is to calculate expected costs in a fair and accurate way accounting for the specific advantages and disadvantages inherent in the operating circumstances of each utility.

This illuminates the entire reason for benchmarking research. Each utility faces unique operating conditions. If every service territory were identical, benchmarking would be reduced to a simple exercise of comparing the utility’s data with industry averages. However, this is not
the case. Utilities significantly differ in numerous ways. An incomplete list comprising the varying conditions of power distributors, for example, might include:

1. Number of customers
2. Volume per customer
3. Peak demand
4. Amount of forestation
5. Customers per line mile
6. Amount of underground line miles relative to total line miles
7. Area labor price levels
8. Customer mix
9. System age
10. Specific geographical characteristics (e.g., mountains)
11. Weather

Power System Engineering, Inc. (“PSE”) is currently working with the Ontario Energy Board in benchmarking the O&M costs of the eighty power distributors operating in Ontario. One power distributor, Northern Ontario Wires, is a relatively small, rural utility. The first bar shows Northern Ontario Wires O&M costs per customer relative to the Ontario average. The second bar shows the Ontario average of 1.0. The third bar shows the costs of Northern Ontario Wires after econometric benchmarking adjustments have been made.

**O&M Performance of Northern Ontario Wires using Different Benchmarking Methods**

![O&M Performance Chart](chart.png)
The above graph illustrates the importance of adjusting for external characteristics. If Northern Ontario Wires performance is solely based on cost per customer it would appear that its costs are over 20% above what they should be. However, after accounting for the fact that Northern Ontario Wires is a rural, small utility the performance score is vastly improved. With these adjustments made, Northern Ontario Wires is actually one of the best cost performing utilities in Ontario.

Determining how each particular variable impacts utility data and making adjustments for these impacts is the challenge for the benchmarking practitioner. The development of an equitable “apples to apples” evaluation requires careful adjustments for each significant difference in external operating conditions. For example, if power distribution reliability is to be benchmarked, reliability data such as SAIDI or SAIFI need to be adjusted for such operating conditions as customers per line mile, forestation, percent underground lines, etc. Absent these adjustments the evaluation does not reliably reveal a utility’s performance in this area.

How Can Benchmarking Be Used?

The following areas of utility (or power plant) performance can be benchmarked:

- Total O&M expenses or specific O&M cost subcategories
- Reliability/Service quality
- Capital expenditures
- Total cost of utility operations
- System efficiency (e.g., line losses)
- DSM expenditures and programming
- Customer satisfaction
- Employee counts
- Employee salary levels
- System age

Proper benchmarking reveals the performance of the utility in managing the studied area. This information can be used in a number of ways. For instance, regulators can use this information in performing their due diligence in the evaluation of utility cost and service levels. Likewise utility management is able to leverage benchmarking research into a number of strategic applications. These include:

1. Determining if current operating strategy is producing results or is in need of modification.
2. Pinpoint operational areas where potential improvements show the most promise.
3. Set challenging yet achievable goals for management and staff.
4. Identification of best practices within the industry.
5. Estimation of potential benefits/costs from contemplated or installed investments.
6. Setting of employee bonuses tied to specific utility performance targets.
8. Communication to customers and Board of Directors regarding performance levels.
9. In evaluating appropriate terms and agent performance in outsourcing contracts.

**What are the Approaches to Benchmarking?**

The degree to which management will be willing to place benchmarking into their toolkit is linked to the accuracy of the results. There is a trade-off between simplicity and accuracy. Most decision-makers are familiar with the **peer group benchmarking approach**. This method calculates metrics such as O&M cost per customer or the duration of outages per customer and then compares these statistics to neighboring utilities. This method is only valid if there are numerous almost identical neighboring utilities. However, as discussed above, this is typically not the case.

Even utilities in close proximity can have vastly different operating conditions. When varying conditions persist, the accuracy of the peer group approach to benchmarking is greatly diminished. Results cannot be trusted and conclusions of best practices and implementation of focused improvement plans will not be forthcoming.

The **econometric approach to benchmarking** allows the researcher to fashion an appropriate target (or benchmark) for an examined metric. Econometric benchmarking calculates a prediction of cost customized for the specific operating conditions encountered by each utility. This model prediction is interpreted as the expected costs of a utility with identical characteristics and “average” performance. This benchmark can be compared to the target company’s actual costs to determine performance.

\[
Performance = \frac{A \& G \ Cost^{Actual}}{A \& G \ Cost^{Model \ Prediction}} \tag{2}
\]

The model prediction of the appropriate cost level is attained by choosing a functional form, based on economic theory, and using regression analysis to estimate the parameters embedded within this functional form. This approach not only allows for multiple, simultaneous
consideration of variables, it permits statistical testing of these variables and an estimate of the appropriate “weights” in the estimation of predicted cost. An extremely simplified functional form is offered below in Equation 3.

\[
\text{Predicted } O \& M \text{ Cost} = a + b \times \text{No. of Customers} + c \times \text{Percent undergrounding} \quad [3]
\]

If the researcher postulates that power distribution O&M costs are only linearly influenced by the number of customers and the percent of lines underground, Equation 3 would be the functional form.\(^1\) The coefficient “\(a\)” is the intercept term; its interpretation is that it costs money to be in business even if output is zero. The coefficient “\(b\)” signifies the marginal cost of adding a customer, and the coefficient “\(c\)” shows the marginal cost of increasing the proportion of undergrounding.\(^2\)

The researcher would then collect a data sample and use regression analysis to estimate these parameter values. The signs of the estimates would need to conform to theory and hypothesis testing would be conducted to assure the researcher that these variables are indeed statistically significant cost drivers. The values of \(a\), \(b\), and \(c\) serve as weights to determine the magnitude of the impact of each variable on cost.

Equation 3, although simplified, shows the supremacy of the econometric benchmarking approach. It permits the consideration of multiple explanatory variables. Rather than ignoring a significant cost driver as the peer group approach typically would, such as undergrounding, the researcher tests the significance of this variable and is able to incorporate it into the analysis.

The graph below illustrates the impact of undergrounding on O&M cost. The x-axis is a measure of the amount of undergrounding; the y-axis is distribution O&M cost per customer. This figure reveals the relationship between undergrounding and distribution O&M. As undergrounding increases, cost per customer declines. The econometric method is able to capture this tendency and incorporate it in the expected cost value of each company.

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1 This is not actually the case. There are numerous variables which influence power distribution O&M cost and the relationships are not always linear.

2 Underground lines will typically lower O&M cost, yet raise total costs (O&M plus capital costs). Additionally, they will typically increase the reliability level (e.g., SAIDI, SAIFI, CAIDI) of the power system and the aesthetic appearance of neighborhoods. A proper cost benefit analysis of the impacts of underground lines can assist utility management in determining if an underground investment is worthwhile.
Econometric benchmarking is further enhanced by the inclusion of additional variables. In the case of power distribution O&M costs additional variables may include line miles, volume per customer, labor price levels, customer mix, forestation, etc.

After the appropriate variables are chosen, industry data are collected. The econometric approach enables a large sample since utilities with vastly differing operating conditions can be included. Contrary to the peer group approach, since the econometric method adjusts for numerous conditions, a sample with varied operating conditions actually enhances the evaluation.

PSE recently submitted econometric benchmarking testimony to the Illinois Commerce Commission. This testimony evaluated the electric distribution O&M expenses of three investor-owned utilities operating in Illinois in the context of a rate case proceeding. In this work PSE gathered data for 115 U.S. investor-owned utilities. An econometric model was estimated to adjust for the varying operating conditions faced by each sampled utility. Below is a ranking of the utilities.
The graph above shows that ABC Utility is in the top quartile of the industry after the econometric adjustments for operating conditions have been made. Likewise, XYZ Utility is in the bottom quartile of electric distribution O&M expenses. These results might lead to ABC Utility having more confidence in its current operating strategy, whereas XYZ Utility might be urged to re-examine its strategy.

Certain processes or investments might be identified that ABC Utility is engaging in (or is not engaging in) that XYZ Utility is not (or is). Both rankings allow utility management to set goals for the future. Perhaps in ABC’s case the goal will be to maintain its top quartile ranking, whereas XYZ might set a goal to move up into the third quartile within the next couple of years. To accomplish this goal, XYZ might benefit from more detailed benchmarking research to pinpoint the specific areas of its weak performance in the pursuit of identifying the causes and finding solutions to rectify this result. Both utilities might be interested in tying specific benchmarking results to employee compensation. This can be done on the basis of the utilities overall performance score, or based on the specific categories where certain managers/employees have a responsibility.

What are the Potential Benefits of this Research to PSE Clients?

Utility system planning has typically taken a “bottom up” approach in determining appropriate investments, strategy, and processes. This approach depends heavily on the decisions of experts. Benchmarking research offers a different perspective, a “top down” approach, which examines the available historic data to evaluate the investments, strategy, and processes chosen by utility management. This “top down” approach offers utility experts a different perspective based on statistical analysis when making important management decisions.
The situation is somewhat analogous to a Major League Baseball Manager. The Manager is an expert in the fundamentals of baseball, has intimate knowledge of his team, and oftentimes will manage based on this knowledge and instinct. However, most Managers in baseball supplement this expert knowledge with statistical data on performance. For example, how a certain pitcher fares against a batter will assist in the decision of going to a relief pitcher. Econometric benchmarking can be used in the same fashion.

The overall performance score offers information on if past strategic choices are moving the utility in the right direction. If they are, then the status quo option should be given more consideration. If utility performance is moving downwards, then a modification in the strategic plan may be warranted.

### Performance Score of a Hypothetical Utility

![Graph showing performance score from 2005 to 2009](image)

In the above illustration, the utility is improving relative to the industry in each year. Even though it’s overall performance is above 1.0 (indicating below average performance), this performance appears to be improving over the past 5 years. Further study might be conducted to pinpoint those areas causing the overall poor performance; however, it appears the strategic plan of the past 5 years is moving the utility in the right direction.

Goals can be set based on the benchmark scores that would serve to measure future progress. This additional motivation could be coupled with employee bonuses if such goals are reached. A common management precept is that you must have a measure of your objective if you want to effectively manage your organization towards it. Improving performance is an important objective!

Another important way benchmarking can allow for more informed decisions is by using it to estimate benefits from certain investments. For example, underground lines. It is generally believed that underground lines will save on O&M expenses, but by how much? What is the expected reliability impact of these investments?

A typical “bottom up” approach when comparing annual expenses between overhead and underground lines would be to quantify such factors as the costs associated with vegetation management, outage restoration, equipment maintenance, locating, inspection, maintenance and
installation equipment, failure rates, etc... To quantify all of these variables is quite a challenging task for utility staff, sometimes resulting in avoiding it all together. The “top down” approach of econometric benchmarking can provide estimates of the differences in annual expenditures of underground versus overhead lines to provide management with more information regarding the benefits versus the investment costs of installing an underground line.³

Along the same lines, industry best practices can be identified through the use of accurate benchmarking. The strategies, processes, and investments made by top performers can be examined to help determine why they are top performers. Such research can help other utilities decide if these items would be beneficial.

Conclusion

Benchmarking offers a fresh perspective on utility operations. It can be used in a number of ways to improve the overall performance of a utility. However, benchmarking accuracy is of paramount importance. If results are inaccurate they can misinform and mislead management into non-optimal decisions. The econometric benchmarking method offers the most accurate benchmarking results available. Additionally, this method offers important ancillary products, such as the above mentioned cost saving estimates of installing underground lines.

PSE believes performance benchmarking is an important tool for effective utility management. Our benchmarking program aims to provide utility decision-makers with quality information, allowing for more effective and efficient utilities.

³ Any major investment can be analyzed in a similar way, assuming it has previously been installed by a number of utilities and that reliable data are available.