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Busting myths: Investor-owned distribution utility performance can be credibly benchmarked

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ABSTRACT

This article examines the use of publicly-available financial and operating data to benchmark distribution performance of U.S. IOUs. The authors describe a methodology addressing characteristics beyond IOU control commonly held to impact performance. Econometric analyses refute many commonly-held beliefs about the influence of various characteristics on various performance measures, and support other beliefs only weakly. The authors then apply appropriate adjustments quantified through regression analyses to create a distribution business performance ranking of U.S. IOUs.

1. Introduction

Despite a lack of growth in peak demand and energy use, investor-owned utilities (IOUs) from coast to coast are proposing record levels of investment in distribution grids and businesses (see Fig. 1). With generation investment opportunities few, transmission investments requiring a 10-year lead time, and the difference between the cost of capital and authorized rates of return at an all-time high,[1] IOU interest in grid investment is stronger now than it has ever been.

Regulators and consumer advocates are facing enormous distribution investment proposals with increasing frequency, presenting regulators and advocates with significant challenges. Regulators and consumer advocates are ill equipped to question IOUs' technical arguments for new distribution capabilities and capital, as well as IOUs' estimates regarding associated customer or grid benefits. How can a regulator at a significant information, resource, and experience disadvantage possibly distinguish between the investments an IOU proposes to make, and the minimum investments an IOU requires to reliably accommodate growth in PV solar or electric vehicles, to name just two examples?

Faced with this dilemma, more regulators are questioning reliance on cost-based ratemaking, in which rates are determined solely by resource inputs. Many are considering compensation based in part on performance (outputs), though measurement challenges loom large. Benchmarking is one approach to performance measurement with several attractive features. First, an IOU is unable to "game" the performance reports of other IOUs to which it can be compared. Second, benchmarking adds an element of competition to a monopoly environment.

IOUs have historically dismissed benchmarking as not credible. Every IOU believes a combination of climate, system load shape, customer attributes, utility business characteristics and size, regulatory characteristics, and other variables make its own situation unique, rendering benchmarking meaningless. But is this belief accurate? With sufficient industry-wide data, couldn't econometric analyses be employed to quantify the relationship between various characteristics, such as peak demand per customer or customer density per distribution line mile, and performance measures such as distribution rate base per customer? (Distribution rate base per customer is a capital efficiency performance measure, with lower values indicating relatively better capital efficiency and lower rates from a customer's perspective.)

If the size and direction of the relationship between various characteristics (independent variables) and various performance measures (dependent variables) could be quantified through econometric analyses of industry-wide data over several years, it would seem a

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[1] Hyman, Leonard S. Presentation to the Society of Utility Regulatory Financial Analysts. New Orleans, April 21, 2017. Slide 6.

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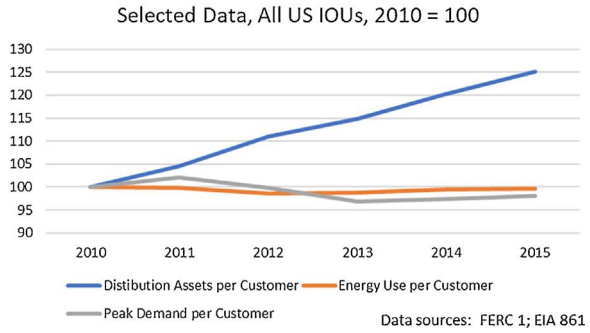

Fig. 1. Growth in distribution assets per customer relative to load and peak demand, U.S. IOUs, 2010–2015.

relatively simple matter to apply appropriate adjustments to any individual IOU's performance measures based on its characteristics. Such an approach could make IOU performance benchmarking both credible and relevant.

This article describes our use of publicly available data on IOU performance and characteristics to enable credible benchmarking. Routine econometric analyses are employed to identify factors beyond utility control which impact performance, and to quantify the size and direction of any influence to enable appropriate adjustments to reported performance. We describe our methodology and present our findings. Several findings challenge conventional wisdom about the impact of various characteristics on various performance measures, which we label "busted myths."

Building on our efforts, we calculate a "Customer Value Ranking™" of U.S. electric distribution IOUs, comparing IOU inputs (capital and O & M spending) to customer outputs (reliability and customer satisfaction) as an indicator of IOU value creation. We conclude with a discussion on the potential uses of benchmarking for IOU performance evaluation, compensation, and management purposes.

2. The methodology

First, with the help of information technology partners, we combined a variety of publicly available data sources on IOU distribution business performance into a single dataset. These included the FERC's Form 1, the EIA's Form 861, JD Powers and Associates' annual customer satisfaction surveys, and SEC and state regulatory filings. (While some may question IOU accounting consistency regarding FERC's Uniform System of Accounts, our analyses were conducted at an aggregation level high enough to mitigate this concern.)

We then developed over 30 performance measures of interest, addressing key performance indicators such as reliability, capital spending, operations & maintenance (O & M) spending, customer engagement, demand-side management effectiveness, and others. In addition to SAIDI without Major Event Days, these performance indicators included distribution O & M spending per customer and per line mile; distribution rate base per customer and per line mile; overall residential customer satisfaction; and many more.

To address the issue of comparability, we used the same data sources to define 20 specific variables that might impact performance, including every IOU's business, demographic, regulatory, customer, load, and climate characteristics. These variables included NOAA climate region; various definitions of utility size; customer density per line mile; capacity factor; peak demand per customer; and many others.

We analyzed six years' data (2010–2015 inclusive) from 131 electric IOUs for most performance measures, though a few (notably reliability measures) were only available for three years (2013–2015). Given our interest in intercompany performance variation, we avoided panel data and time series econometric techniques that would remove intercompany variation. Instead, we relied on Ordinary Least Squares regression analyses to test the impact of various utility-specific characteristics on various utility specific performance outcomes. Use of a pooled approach with robust standard errors ensured that our coefficient estimates were consistent. (This means that with large numbers of observations, estimates converge to their true values.) Given our 784 observations we consider any bias in the coefficient estimates to be small. The potential for auto-correlation makes it possible that our estimates of coefficient variances are underestimated, which we took into account when making conclusions. Every regression was run in both absolute and logarithmic values, as well as with one-year and two-year lags, though in no case did the lags justify the loss of observations.

3. The findings: much conventional wisdom does not hold and represents 'busted myths'

Some of the findings produced by the econometric analyses refute tenets of conventional wisdom that we label "busted myths." The most interesting of these are described below.

All reliability measures (SAIDI and SAIFI with and without major event days) demonstrate a negative correlation with distribution plant balances per customer. That is, the more capital an IOU has invested in its distribution business, the worse its SAIDI and SAIFI. This effect accounts for only a tiny amount of the variation in the reliability measures, and is only statistically significant for SAIFI. However, the lack of a positive correlation between capital and reliability can clearly be considered a busted myth, and is consistent with the findings of a Lawrence Berkeley National Laboratory study in 2015.[2]

The correlation between NOAA climate regions and reliability are so weak as to be inconclusive. This finding is consistent with the findings of a study by Lawrence Berkeley National Laboratory in 2012.[3] The large size of the NOAA climate regions (nine for the entire U.S.) and the limited number of observations for some regions (four IOUs in the California/Nevada region and three in the Northwest region) were contributing factors. However, the fact that we find no significant correlation between climate and reliability could certainly be considered another busted myth.

Another intriguing finding is that IOUs with higher distribution plant balances per customer also exhibit higher O & M spending, refuting the notion that IOU distribution investments replace labor with capital.

Finally, we observe a negative correlation between Billing and Customer Service Operations & Maintenance (O & M) spending per customer and customer satisfaction. That is, the more an IOU spends on Billing and Customer Service, the lower the IOU's satisfaction score.

4. Other conventional wisdom tenets are confirmed, but correlations are weak

Other statistically significant correlations are in line with industry observers' likely expectations, although the total variation in dependent variables caused by variation in independent variables was surprisingly small in all cases. Notable examples are that higher peak demand per customer is associated with higher distribution plant balances per customer and per distribution line mile. Higher customer density (per line mile) is associated with lower distribution plant balances per customer and lower distribution O & M spending per customer. Higher customer counts are associated with lower distribution O & M spending per customer and lower general and admin spending per customer. Not surprisingly, fewer power outages are associated with higher customer

[2] P. Larsen, KH LaCommare, J Eto, and J. Sweeney. "Assessing Changes in the Reliability of the U.S. Electric Power System." Lawrence Berkeley National Laboratory Study 188741. August 2015. Page xiv.

[3] J. Eto, KH LaCommare, P Larsen, A Todd, and E Fisher. "An examination of Temporal Trends in Electricity Reliability Based on Reports from U.S. Electric Utilities." Lawrence Berkeley National Laboratory Study 5268E. January 2012. Page xiii.

satisfaction.

Another fascinating, though not particularly surprising, finding relates to the difference in distribution investment between IOUs that own generation and those that do not. Regarding the variation from average distribution plant balance per customer of $3265 (Dec. 31, 2015), $410 is explained solely by regulated generation ownership, with IOUs which do *not* own regulated generation exhibiting significantly higher distribution capital spending.

These findings indicate that some of the variables IOUs cite in critiques of performance benchmarking are not supported by the data. The findings also indicate that the impact of other characteristics on performance, though small, are observable and quantifiable, and can be employed to reliably and credibly benchmark utility performance by making adjustments for IOU-specific characteristics (system load shape, customer density, customer counts, etc.).

5. The Customer Value Ranking

We then went one step further. We developed a utility performance ranking that corrected for correlations between characteristics and performance as indicated by the regression analyses. Electric distribution IOUs were ranked by characteristic-adjusted performance in four metrics to create the Customer Value Ranking. The four metrics were (1) capital spending per customer (lower is better); (2) O & M spending (distribution, billing & customer service, and G & A) per customer (lower is better); (3) SAIDI without Major Event Days (lower is better); and (4) Overall residential customer satisfaction as measured by JD Powers & Associates' annual survey (higher is better).

The resulting Customer Value Ranking, which is a simple addition of IOUs' ranks in each of the four metrics, is presented at the end of this article. IOUs missing any one of the four metrics were not included in the ranking. Rankings for the individual metrics are available at http://www.utilityevaluator.com/customer-value-rankings.html. The authors intend to calculate and release the Customer Value Ranking every year in January. Top decile electric distribution IOUs in the inaugural Customer Value Ranking include:

1. Florida Power and Light
2. MidAmerican Energy
3. Toledo Edison (First Energy)
4. NV Energy
5. NSP-Wisconsin (Xcel Energy)
6. Indianapolis Power & Light (AES)
7. Gulf Power (Southern Company)
8. NSP-Minnesota (Xcel Energy)
9. PPL Electric Utilities
10. Central Maine Power (Avangrid/Iberdrola)

6. Conclusions

Can regulators and stakeholders use performance benchmarking to help maximize the value IOUs create for customers per dollar of capital and O & M spending? We believe the answer is yes.

One can envision multiple applications. Benchmarking could be used to conveniently evaluate utility performance claims, such as "Our reliability is comparable to other IOUs in the Midwest." IOUs exhibiting strong performance could use benchmarking to support rate-of-return requests, while stakeholders could use benchmarking to challenge the rate-of-return requests of poor performers. Benchmarking could be employed to identify opportunities for improvement, such as higher than average general and administrative spending per customer relative to other IOUs with similar customer counts. Benchmarking results could also be used to identify top performers for best demonstrated practices research. It is also possible to imagine that benchmarking could play a role in performance-based economic reward and penalty regimes for IOUs.

Consumer advocates in California and New Hampshire have already used performance benchmarking successfully as evidence in rate cases. Can the use of benchmarking for IOU performance measurement and management be far behind? Look for the 2017 Customer Value Ranking in *The Electricity Journal* in early 2018.

2016 Overall Customer Value Ranking

The Overall Customer Value Ranking is determined by individual rankings in capital spending (lower = better), O & M spending (lower = better), reliability (SAIDI without Major Event Days, lower = better), and residential customer satisfaction (JD Power, higher = better). Individual rankings in each of the four categories are available at www.utilityevaluator.com/customer-value-ranking.html.

1	FP & L	35	Georgia Power	69	Emera Maine
2	Mid-American	35	Duke Energy Ohio	70	Indiana-Michigan Power
3	Toledo Edison	37	PECO	71	Ameren Illinois
4	NV Energy	38	Entergy Texas	71	Mississippi Power
5	NSP-Wisconsin	38	APS	73	SCE & G
6	IPL	40	West Penn Power	73	Duke Energy Indiana
7	Gulf Power	40	Potomac Edison	75	Atlantic City Electric
7	NSP-Minnesota	42	Idaho Power	76	Wheeling Power
9	PPL	43	PNM	77	PS New Hampshire
10	Central Maine Power	44	Puget Sound Energy	78	Madison G & E
11	PSE & G	45	Alabama Power	79	Ameren Missouri
12	Kentucky Utilities	46	Interstate P & L	80	Narragansett Electric
13	Otter Tail Power	46	Met-Ed	81	KCP & L Greater Missouri
14	Penn Power	48	Duke Energy Florida	82	SCE
14	Ohio Edison	49	Green Mountain Power	82	Ohio Power
16	PS Colorado	50	NYSEG	84	PG & E
17	WPS	51	SWEPCO	85	SDG & E
17	Wisconsin Electric	52	Appalachian Power	86	Entergy Arkansas
19	Duquesne Light	53	El Paso Electric	86	Niagara Mohawk
20	Portland GE	54	Delmarva	88	PEPCO
21	PS Oklahoma	55	Eversource	89	Vectren
22	PacifiCorp	56	CLECO	90	Westar Energy
22	Louisville G & E	57	Duke Energy Carolinas	91	KCP & L
24	Cleveland Illuminating	57	Duke Energy Progress	92	MonPower
25	WPL	59	Jersey Central P & L	93	Western Mass Electric
26	SPS	60	Penelec	94	Central Hudson G & E
27	Minnesota Power	60	BG & E	95	Pike County L & P
28	Rochester G & E	60	ComEd	96	Empire District Electric
29	Dominion	63	Northwestern Energy	97	Kentucky Power
30	Consumers Energy	64	DTE Energy	98	United Illuminating
31	Dayton Power & Light	64	Massachusetts Electric	98	CL & P
32	Duke Energy Kentucky	64	TECO	100	Entergy New Orleans
33	OG & E	67	ConEd	101	Orange & Rockland
34	Entergy Mississippi	68	Kansas G & E		

Paul Alvarez is President of the Wired Group, a consultancy that helps consumer advocates and regulators maximize the value of grid modernization investments for customers. He is also the author of *Smart Grid Hype & Reality,* a book that identifies common shortcomings in grid modernization designs and implementation plans, as well as the challenges to customer benefit maximization inherent in today's utility compensation models.

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