



1. Benchmarking

This chapter presents benchmarking evidence on PREPA's relative cost performance. This analysis sheds light on how PREPA compares to a number of "peer" utilities on several benchmark metrics. Evidence on PREPA's relative cost performance may, in turn, be relevant for assessing whether PREPA's internal cost management is contributing to the Company's financial difficulties.

Navigant's benchmarking analysis was relatively high level. We compared PREPA on seven metrics against electric utilities from the US mainland and island utilities in the Caribbean and Pacific. The seven performance metrics were:

- Operating revenue per customer served;
- Operating revenue per kWh sold;
- Operating revenue excluding fuel and purchased power costs per customer served;
- Operating revenue excluding fuel and purchased power costs per kWh sold;
- Operating expenses (excluding fuel and purchased power costs) per customer served;
- Operating expenses (excluding fuel and purchased power costs) per kWh sold; and
- Annual wages and salaries per employee.

On the first six metrics above, Navigant compared PREPA against the following sets of peers:

- A broad group of 76 vertically-integrated electric utilities in the mainland United States;
- A more narrowly-tailored peer group of ten vertically-integrated electric utilities in the mainland United States;
- One U.S. island utility operating in the Pacific: Hawaiian Electric Industries ("HEI"); and
- Three Caribbean island utilities: The Bermuda Electric Light Company ("BELCO"); the Virgin Islands Water and Power Authority ("VIWAPA"); and Jamaica Public Service Company ("JPS").

On the wage and salaries metric, Navigant compared PREPA to two measures of wages and salaries for the U.S. electric utility industry. The first was wages and salaries as measured biannually by the Occupational Employment Survey (OES). The second was annual earnings as measured by the Quarterly Census on Employment and Wages (QCEW). Navigant examined both of these wage measures for the broad "Utilities" sector (with the two-digit NAICS¹ of 22) and the "Electricity generation, transmission and distribution" industry segment within the utilities sector (with the four-digit NAICS 2211). All of these industry wage estimates are developed by the U.S. Bureau of Labor Statistics (BLS) within the U.S. Department of Labor. However, the QCEW definition of "wages and salaries" is far more expansive, and contains more types of compensation, than the more narrowly-defined OES definition of wages and salaries.

In the next section, Navigant considers the benchmarking evidence from the two sets of U.S. electric utilities (the broad group of 76 utilities and the more narrowly-tailored peer group of ten utilities). Section 4.2

¹ North American Industry Classification System (NAICS).



benchmarks PREPA against the Caribbean and Pacific island utilities. Section 4.3 benchmarks PREPA wage and salary data against wage measures for the US electric utility industry.

1.1 Comparing PREPA to Mainland U.S. Electric Utilities

Navigant compared PREPA to mainland U.S. vertically-integrated electric utilities. A utility was deemed to be vertically-integrated if it reported electricity generation assets in each year from 2008 through 2014. Navigant identified a group of 76 mainland U.S. utilities that satisfied this criterion and which reported all the other variables necessary to construct the six performance metrics (excluding the salaries and wages metric) in each year from 2008 through 2014. Appendix F provides a listing of these utilities.

From within this broad group of 76 utilities, Navigant also selected a peer group of U.S. utilities which were more similar to PREPA in terms of the “drivers” of electric utility cost. Navigant considered three different cost drivers when selecting peers for PREPA.

The first was the size of the utility, as measured by the total number of customers served. Overall utility size (and hence utility output) impacts utility cost since electric utility technologies exhibit economies of scale (*i.e.*, the unit cost of production declines as the scale of production increases, at least up to a certain output level). Other than fuel, most costs for vertically-integrated electric utilities depend more on the numbers of customers a utility serves rather than the total kWh delivered to those customers. The reasons are that, for a given generation capacity and infrastructure needed to deliver energy to customers, the incremental cost associated with generating an additional kWh tends to be very small (again, excluding fuel costs). Since most electric utility costs depend more strongly on customers served rather than kWh sold, Navigant focused on customer numbers rather than kWh sales as the more relevant indicator of scale economies.

PREPA served an average of 1,468,329 customers over the 2008-2014 time period. There were ten utilities in the broad US utility group that served between one million and 1.7 million customers. The average number of customers served by these ten US utilities was 1,444,218 over the 2008-2014 time period, which is virtually indistinguishable from the number of PREPA customers. These ten utilities are therefore collectively an appropriate peer group for PREPA in terms of the scale of output and the degree of economies of scale realized. These ten U.S. mainland utilities are:

- Alabama Power;
- Consumers Energy;
- Duke Energy – Florida;
- Duke Energy – Progress;
- Northern States Minnesota;
- PacifiCorp;
- Public Service of Colorado;
- Puget Energy;
- San Diego Gas and Electric; and
- Wisconsin Electric Power Company.

Navigant also considered two other cost drivers when selecting peers. The first was energy usage (sometimes also called “energy density”), or kWh sold per customer. Because many electric utility costs do not vary with



kWh sold, utilities serving a customer base with relatively higher energy usage tend to enjoy relatively lower unit costs. The second cost driver was customer density, or the number of customers per mile of transmission and distribution line. All else equal, more customers along a given mile of line indicates a more densely populated service territory. Utility cost generally increases as service territories become more spatially dispersed *i.e.* as customer density declines. Energy usage and customer density are therefore relevant cost drivers that can be used to select peer utilities in benchmarking studies.

In the current analysis, however, utilizing these cost drivers proved problematic. The miles of transmission lines and distribution data was spotty and incomplete for many U.S. utilities, as well as for PREPA. This made it difficult to examine differences in customer density between PREPA and the broader U.S. electric utility sample.

Energy usage levels were also almost uniformly greater for U.S. utilities than for PREPA. PREPA's annual energy usage per customer averaged 12.5 MWh between 2008 and 2014. Over the same period, energy usage for the broad 76 U.S. utility group averaged 25.15 MWh per customer, and energy usage for the ten utility peer group averaged 24.19 MWh per customer. It is perhaps not surprising that U.S. customers' energy usage is almost double the energy usage for Puerto Rico customers given the differences in income in the U.S. and Puerto Rico, but the almost uniformly higher energy use in the U.S. makes it difficult to select peers based on this criterion.

Because of the practical difficulties in using energy usage or customer density to select peers, Navigant selected the ten peers entirely on the basis of number of customers served. It should be noted, however, that one utility within the selected peer group stands out and is especially comparable to PREPA. San Diego Gas and Electric (SDG&E) has customer densities and, more importantly, energy usage levels that are quite similar to PREPA's. For example, in 2014 SDG&E customers consumed 11.7 MWh per customer, compared with a comparable value of 11.9 MWh for PREPA. Energy consumption for SDG&E and other California utilities tends to be lower than most other U.S. utilities because of the extent of California's demand side management and conservation programs. Combined with the fact that SDG&E and PREPA serve a comparable number of customers, the similarities in energy usage and customer density make SDG&E the single best "peer" utility for PREPA within the U.S. sample. Navigant will therefore highlight the SDG&E benchmarking results while also presenting benchmarking metrics for the broad U.S. utility sample and the ten utility peer group.



Table 1. Comparison of PREPA and Mainland Electric Utilities

Item	U.S. Peer Group	76 Utility Sample	PREPA
MWh/Customer	24.011	25.516	12,496
Bundled Total Sales MWh	34,941,470	22,762,030	18,433,994
Bundled Total Customers	1,444,218	892,060	1,468,329
Operating Rev per Customer	\$2,734.53	\$2,931.71	\$3,082.15
Operating Rev per kWh	\$0.12273	\$ 0.10911	\$0.24720
Net Oper Rev per Customer	\$1,631.45	\$ 1,705.97	\$1,001.71
Net Oper Rev per kWh	\$0.07300	\$0.06440	\$0.08027
O & M Excl Fuel and PP per cust	\$709.43	\$762.76	\$515.23
O & M Excl Fuel and PP per kWh	\$0.03307	\$0.02916	\$0.04121

Data Source: PREPA data and FERC (Federal Energy Regulatory Commission) Form 1

Table 10 presents data on all the performance metrics other than salaries and wages for PREPA, the broad 76 US utility aggregate, and the 10-company U.S. utility peer group. Data are presented for the average values of each metric over the 2008-2014 time period. All data used to construct the U.S. metrics were drawn from utilities' annual FERC Form One filings.

Beginning with the operating revenue metrics, it can be seen that PREPA has slightly higher values of operating revenues per customer and per kWh than the U.S. utility groups. PREPA's operating revenues per customer averaged \$3082 between 2008 and 2014, compared with comparable values of \$2932 for the broad U.S. utility aggregate and \$2735 for the peer group. The discrepancies are somewhat higher when examining operating revenues per kWh. These values are \$0.2472 for PREPA compared with \$0.1091 for the broad U.S. industry aggregate and \$0.1209 for the peer group.

Two points should be kept in mind regarding these comparisons.

- First, the operating revenues metrics include the recovery of fuel costs. PREPA's fuel costs will almost certainly be relatively greater than those of the U.S. utilities since PREPA (unlike almost no mainland U.S. electric utility) relies heavily on oil-fired generation, which has especially high fuel costs. PREPA can do relatively little to mitigate these costs until infrastructure is developed that facilitates greater fuel diversity in electricity generation. PREPA's fuel costs are therefore largely beyond its control. Accordingly, Navigant believes the more relevant measures of PREPA's underlying cost performance are operating *expenses* and revenues net of fuel and purchased power costs.
- Second, this table illustrates the impact that lower energy usage tends to have on a utility's measured performance. As discussed, other than fuel, there are few incremental costs associated with generating and delivering an additional kWh using the utility's existing power generation and delivery infrastructure. All else equal, utilities with greater energy usage therefore tend to look better on performance metrics expressed on a per kWh basis, simply because selling more kWh directly reduces the denominator of a cost or revenue per kWh metric but has little impact on the numerator.



The fact that the US utilities have energy usage levels that are approximately double those of PREPA's is therefore translated into lower operating revenue per kWh measures for most US utilities than for PREPA.

However, this finding does not apply to SDG&E, which is the single best peer U.S. utility for PREPA. In 2014, SDG&E's operating revenues per customer were \$3263 compared to \$3168 for PREPA. SDG&E also had 2014 operating revenues of \$0.2792 per kWh compared with \$0.2664 for PREPA. Thus, even though PREPA's operating revenues included the recovery of relatively larger fuel costs per customer and kWh than SDG&E, PREPA has displayed lower operating revenues per customer and per kWh than did its closest U.S. utility peer.

Table 2. Operating Revenue per Customer

Year	San Diego Gas & Electric Co.	PREPA
2014	\$3,263.48	\$3,168.26
2013	\$3,190.91	\$3,246.37
2012	\$2,694.07	\$3,414.86
2011	\$2,449.91	\$2,986.97
2010	\$1,928.58	\$2,827.11
2009	\$1,830.07	\$2,732.81
2008	\$1,918.04	\$3,001.99

Table 3. Net Operating Revenue per Customer

Year	San Diego Gas & Electric Co.	PREPA
2014	\$1,780.42	\$750.13
2013	\$1,856.79	\$750.13
2012	\$1,625.87	\$732.84
2011	\$1,520.34	\$736.90
2010	\$1,329.07	\$762.78
2009	\$1,272.77	\$734.91
2008	\$1,215.06	\$780.79



Table 12 presents data on operating revenues net of fuel and purchased power costs and operating expenses. It can be seen that PREPA's relative performance is more favorable on these metrics, which exclude fuel costs that are largely beyond the Company's control. When fuel and purchased power costs are excluded, the 76 utility U.S. aggregate had average net operating revenues of \$1706 per customer and \$0.0644 per kWh over the 2008-2014 period. The analogous measures for PREPA's U.S. utility peer group were \$1631 per customer and \$0.0717 per kWh. PREPA's operating revenues net of fuel and purchased power costs were \$1002 per customer and \$0.0803 per kWh. The Company's "net" operating revenue per customer was therefore about 40% below analogous operating revenue measures for the U.S. groups, although it remained somewhat higher on a per kWh basis because of lower energy usage levels in Puerto Rico.

The pattern is similar for operating expenses. The broad U.S. utility aggregate has operating expenses (excluding fuel and purchased power costs) of \$762.76 per customer and \$0.0292 per kWh. The U.S. utility peer group has operating expense of \$716.70 per customer and \$0.0328 per kWh. PREPA's operating expenses of \$515.23 per customer are about 30% below those of the US utility groups, although lower energy usage in Puerto Rico leads to somewhat higher operating of \$0.0412 per kWh.

Comparing PREPA directly with SDG&E further illuminates these points. Recall that SDG&E has energy usage similar to, and slightly below, PREPA. SDG&E's average net operating revenue is \$1514 per customer and \$0.1507 per kWh over the 2008-2014 period. PREPA's values on these metrics are 34% and 47% below SDG&E's, respectively. On operating expenses, SDGE registered average values of \$742.50 per customer and \$0.0740 per kWh; PREPA's performance is 31% and 44% below these respective metrics.

Navigant believes US-PREPA benchmarking can be distorted by differences in fuel costs and energy usage between PREPA and U.S. electric utilities. PREPA's measured performance will be negatively impacted by higher fuel costs and lower energy usage relative to the U.S. industry. Both factors are almost entirely beyond PREPA's control and thus not indicative of management's ability to manage or control costs.

Navigant therefore finds that the most relevant metrics for US-PREPA benchmarking are operating expenses per customer and operating revenues net of fuel and purchased power per customer. On the operating expense metric, PREPA's cost is about 30% below those of the U.S. utility groups (and SDG&E). On the net revenue metric, PREPA's cost is about 40% below those of the U.S. utility groups (and 34% below SDG&E). Based on these metrics, Navigant believes PREPA is at least an average cost performer, and perhaps a good cost performer, relative to comparable US electric utilities.

1.2 Comparing PREPA to Caribbean and Pacific Island Electric Utilities

In general, there will be fewer operational differences between PREPA and other island utilities. Island utilities typically utilize oil-fired generation and therefore have similar fuel costs. Energy usage levels can still vary across islands depending on income and other factors, but island economies are generally more comparable to Puerto Rico than the U.S. economy.



While island utilities are more natural comparators for PREPA, far less data are available for island utilities than in the U.S. However, Navigant was able to supplement its U.S. dataset with data from four relatively prominent island utilities. Three of these utilities are based in the Caribbean: the Virgin Islands Water and Power Authority (VIWPA); the Bermuda Electric Light Company (BELCO); and Jamaica Public Service (JPS). Data for all three companies were drawn from the firms’ financial reports. Navigant also added Hawaiian Electric Industries (HEI), a U.S. electric utility operating on several islands in the Pacific Ocean. HEI data were drawn from reports filed with its state Public Service Commission.

Table 4. PREPA v Other Island Utilities

Utility Name	Virgin Islands Water and Power Authority (U.S.)	Bermuda Electric Light Company	Jamaica Public Service	Hawaii	PREPA
MWh/Customer	13.215	16.521	5.395	21.840	12.496
Bundled Total Sales MWh	721,017	633,020	3,165,015	8,245,224	18,433,994
Bundled Total Customers	54,560	38,940	587,060	377,601	1,468,329
Operating Rev per Customer	\$ 5,405	\$ 6,392	\$ 1,736	\$ 4,494	\$ 3,082.15
Operating Rev per kWh	\$ 0.41251	\$ 0.38952	\$ 0.32255	\$ 0.27975	\$ 0.24720
Net Oper Rev per Customer	\$ 1,534	\$ 2,635	\$ 610	\$ 1,586	\$ 1,001.71
Net Oper Rev per kWh	\$ 0.11704	\$ 0.15847	\$ 0.11307	\$ 0.07282	\$ 0.08027
O & M Excl Fuel and PP per Cust	\$ 1,165	N/A	\$ 259	\$ 1,010	\$ 515.23
O & M Excl Fuel and PP per kWh	\$ 0.08912	N/A	\$ 0.04792	\$ 0.04633	\$ 0.04121

Data Source: PREPA data, self-published annual utility financial reports

Table 13 compares PREPA with these four island utilities. It can be seen that VIWPA and BELCO each have energy usage a bit higher than PREPA’s, although JPS’s energy usage is much lower. Energy usage for HEI is greater than for any of the other island utilities but somewhat below the U.S. average.

Table 13 also shows PREPA’s operating revenues are well below those of most of the island utilities. VIWPA’s operating revenues per customer are \$5405, which is about 80% above PREPA’s. BELCO’s operating revenues per customer are more than 100% above PREPA’s, while HEI’s are almost 50% higher. On the other hand, JPS has operating revenues per customer that are lower than PREPA’s.

However, all four island utilities have higher operating revenue per kWh than PREPA. PREPA’s operating revenue per kWh of \$0.2472 compares with analogous values of \$0.2798 for HEI, \$0.3225 for JPS, \$0.3895 for BELCO, and \$0.4125 for VIWPA. The comparisons with HEI, BELCO, and VIWPA are especially relevant, since all three utilities enjoy higher energy usage per customer which, as discussed, will tend to make those utilities look better on this metric compared with PREPA.



A similar but somewhat less pronounced pattern is found for the “net” operating revenue metrics. Again, PREPA displays better performance on the operating revenues per customer measure for all utilities except JPS. PREPA also exhibits lower net revenues per kWh than VIWPA, BELCO and JPS, although HEI’s measured net operating revenues per kWh is a bit lower than PREPA’s. Operating expense data are not available for BELCO, but PREPA’s operations expenditures (opex) per customer is about half the analogous measures for HEI and VIWPA, although well above JPS. On a per kWh basis, though, PREPA again displays better performance than all other island utilities.

Overall, the results of benchmarking PREPA against island utilities support Navigant’s conclusions from the U.S. benchmarking analysis. PREPA shows better performance on all six metrics than all, or nearly all, of the island utilities. The one exception is JPS, where costs may be lower partly because wages in Jamaica are generally below market wages in Puerto Rico (or the Virgin Islands, Bermuda, or Hawaii). Time constraints did not allow Navigant to investigate this issue, although we did consider the relationship between PREPA wages and those paid by the U.S. electric utility industry.² We turn next to this issue.

1.3 Comparing PREPA and US Electric Utility Industry Wages

PREPA’s relative cost may also be impacted by the wages it pays. Because it is a U.S. territory, PREPA employees have the right to move to the mainland U.S. in pursuit of better employment opportunities that may exist at U.S. electric utilities. This means PREPA workers essentially compete in the same labor markets as the rest of the U.S. electric utility industry. Appropriately benchmarking PREPA’s salaries and wages therefore means comparing them to salaries and wages paid by US electric utilities.

Navigant compared PREPA wages to those paid in the U.S. electric utility sector. There are several sources of data on U.S. electric utility wages, but two of the most prominent and authoritative measures are the Quarterly Census on Employment and Wages (QCEW) and the Occupational Employment Statistics (OES) Survey, both conducted by the U.S. Bureau of Labor Statistics (BLS), a part of the U.S. federal government’s Department of Labor.

There are significant differences in how “wages” are defined in these two BLS sources. The QCEW measure in most States reports total compensation paid during the calendar year, regardless of when services were performed. Under most State laws, the QCEW measure of “wages” include bonuses, stock options, severance pay, the cash value of meals and lodging, tips and other gratuities, and in some States employer contributions to certain deferred compensation plans, including 401(k) plans. In contrast, the OES wage measure includes only the base rate of pay, tips, cost-of-living allowances, guaranteed, hazardous-duty, and on-call pay. OES wages exclude back pay, overtime, severance, jury duty, bonuses, non-production bonuses, and adjustments for shift differentials. Both wage measures exclude employer contributions for health insurance, old-age, survivors, and disability insurance, unemployment insurance, workers compensation, and private pensions not reported as wages.

² It should also be noted that VIWPA and BELCO are smaller than PREPA, and their relatively small size makes it more difficult for them to achieve scale economies that have been attained by larger utilities like PREPA. This factor may disadvantage VIWPA and BELCO vis-à-vis PREPA, but appropriately controlling for economies of scale in benchmarking studies requires statistical techniques that go well beyond the current analysis.



PREPA provided Navigant with two salary and wage measures for its workforce. One was total salary and wage payments excluding overtime. The second was total salary and wage payments including overtime. Data were provided monthly, and Navigant aggregated these monthly wage and salary data to produce annual measures for each variable. We then divided annual wages by the number of employees in each year to produce two average wage and salary metrics for PREPA employees. Table 14 provides values (in US\$) for both of these wage measures for each year between 2008 and 2014.

Table 5. Annual Salaries and Wages

Year	No Overtime	Including Overtime
2008	\$58,828	\$58,828
2009	\$50,024	\$53,100
2010	\$53,472	\$62,171
2011	\$55,998	\$63,161
2012	\$58,543	\$67,088
2013	\$58,027	\$64,525
2014	\$55,779	\$61,285
Average	\$55,779	\$61,451

For the U.S. electric utility industry, the OES measure of wages excludes overtime, while the QCEW includes it. The two PREPA wage and salary measures also differ regarding the treatment of overtime pay. The PREPA salary and wage measure without overtime is therefore more similar to the OES wage and salary estimate for the U.S. electric utility industry. The PREPA salaries and wage metric that includes overtime pay is more similar to the QCEW estimate, although the QCEW measure also includes elements of compensation (like stock options) that are not reflected in PREPA’s reported wages.

Navigant believes the most “apples to apples” wage comparison between PREPA and the U.S. electric utility industry is obtained by comparing PREPA’s annual wages without overtime to the OES measure of wages and salaries for U.S. electric utilities. For completeness, however, we also report the QCEW estimate of annual wages and salaries for both the electric power industry specifically (NAICS 2211) and more broadly for the “utilities” sector (NAICS 22).

The most recent OES was completed in May 2014. The May 2014 OES reports that the average annual salary for a U.S. electric utility employee is \$72,800. The comparable figure for an average utilities sector employee is \$70,900.

The most recent QCEW has annual data for 2013. The QCEW average wage for a U.S. electric utility employee is \$99,918. The comparable figure for a utilities sector employee is \$95,157.

PREPA’s 2013 wage without overtime of \$58,027 compares with a comparable wage of \$72,800 for the U.S. electric utility industry. PREPA’s wage is about 20% below the U.S. electric utility wage benchmark. Navigant



therefore finds no evidence to conclude that PREPA's expenses (and rates) are being artificially inflated because of excessive wage payments to PREPA employees.

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