Electricity Prices in the Tennessee Valley

Are customers being treated fairly?

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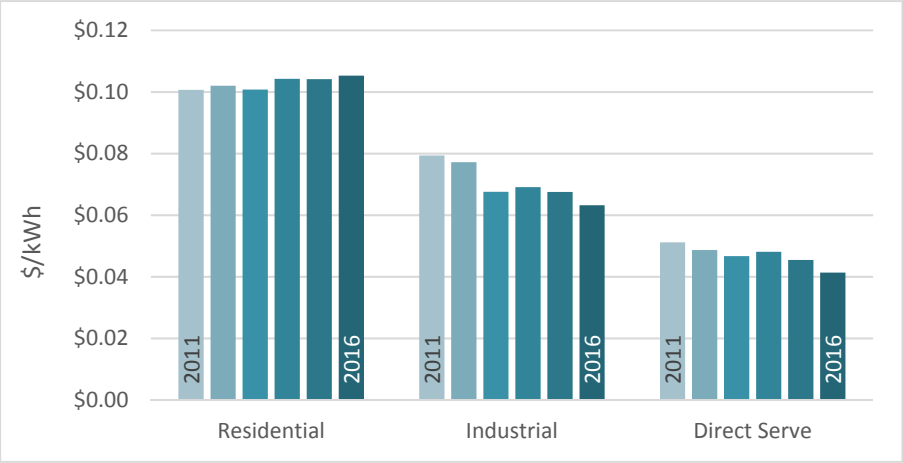
Introduction

Since 2011, the Tennessee Valley Authority's industrial and direct serve customers have benefitted from a nearly 20% cut in the price of energy, while residential customers have experienced steady rate increases.[1] As illustrated in Figure 1, the average price of electricity for residential customers has increased above 10 cents per kilowatt-hour for residential customers, but industrial customers directly served by TVA have seen prices drop to approximately 4 cents per kilowatt-hour.[2]

Figure 1. TVA Average Revenue per Kilowatt-Hour 2011-2016



Electricity rates can be expected to change as costs rise, but they can also change if TVA modifies the underlying method used to set rates for each customer class is modified. The divergence in electricity costs for residential and industrial customers raises several questions:

- What is the reason for residential customers shouldering rising rates while and large industrial customer rates decline?
- Has TVA modified the methodology by which costs are allocated to customer classes?
- Are the rates charged to customers fair?

This white paper reviews trends in the prices paid by industrial and residential customers in the Tennessee Valley to determine whether

TVA is the nation's largest public power provider, supplying electricity to millions of customers in Tennessee, as well as portions of Alabama, Mississippi, Kentucky, Georgia, North Carolina, and Virginia. TVA's customers include approximately 60 large "direct serve" industrial customers, as well as 154 individual local power companies (LPCs) who resell the electricity to retail customers.

TVA recovers the costs of providing electricity through contracts with its direct serve customers, as well as through wholesale electricity rates that it charges distributors. Despite primarily being an electricity wholesaler, TVA also has broad authority over the retail rates that the LPCs charge their residential, commercial, and industrial retail customers. Thus, the manner in which TVA develops and sets rates has broad implications for TVA's direct-serve industrial customers and the more than six million retail customers of served by LPCs.

[1] The rate increases for non-direct-serve customers reflect the total bundled rate (supply and distribution), rather than just the wholesale supply cost. These bundled rates are collected by Local Power Companies, but are under TVA's regulation.

[2] Calculated using U.S. Energy Information Administration Form 861 data, 2011-2016.

costs are being fairly allocated across customer classes. Due to limited information regarding TVA's ratemaking methodologies, many questions remain unanswered and point to a need for greater transparency in TVA's ratemaking.

We note that the analysis presented here relies primarily on cost of service studies as an indicator of whether rate changes are justified. This approach is consistent with the standards typically applied to assessing rates at investor-owned utilities. However, the TVA Act (48 Stat. 65, 16 U.S.C. sec 831) imposes additional considerations on TVA. For example, Section 831 states, in part, that the TVA projects "shall be considered primarily as for the benefit of the people of the section as a whole and particularly the domestic and rural consumers to whom the power can economically be made available, and accordingly that sale to and use by industry shall be a secondary purpose…." Although not specifically addressed here, it is worth investigating whether TVA's actions have been consistent with the Act.

Allocating Costs among Customer Classes

Numerous investments are required to provide electricity to customers. Energy must be generated at power plants, transmitted over high-voltage lines, and then distributed over a low-voltage network of wires to customer premises. Fairness requires that these costs should be apportioned among customers according to who bears responsibility for causing the cost. Of course, many costs are incurred to serve all customers, which makes fair apportionment of costs difficult. A baseload power plant, for example, serves residential, commercial, and industrial customers alike. However, some costs are caused more by certain types of customers and the particular characteristics of how they use the electricity system, such as the degree to which customer load causes spikes in system peak demand.

A cost of service study is the primary mechanism by which determinations are made regarding how costs should be allocated among the various customer classes. Such studies consider key factors such as the number of customers, class peak demand, and annual energy consumption in allocating costs.

However, there are numerous competing methodologies for performing cost of service studies and a variety of assumptions that an analyst must make regarding cost drivers and allocation methods. The methodology and assumptions selected can have substantial implications for the share of costs allocated to each class.

Over time, TVA has adjusted its cost of service methodology and rate designs. For example, in 2010, TVA implemented time-of-use pricing at the wholesale level, which was not expected to substantially alter the revenues collected from each class.[3] Then, in 2015, TVA changed the method that it uses to allocate fuel costs – one of the largest components of TVA's rates. Prior to 2015, TVA allocated fuel costs on an average cost basis, whereby all types of customers paid the same price for fuel costs, regardless of when they used the energy. In 2015, TVA adopted the resource cost allocation (RCA) methodology, which

[3] Tennessee Valley Authority, "Final Environmental Assessment: Elimination of End-Use Wholesale Rate Structure and Introduction of Time-of-Use Pricing for Electricity at the Wholesale Level," July 2010, 25.

allocates total fuel costs among large and small customers in proportion to when each class uses electricity and the incremental cost of the electricity.[4]

This change did not impact customers equally; rather, it was expected to increase rates paid by small, standard service customers and reduce rates for large commercial and industrial customers.[5] According to TVA's 2015 assessment, the new rate structure was expected to be revenue neutral overall, but increase residential rates by about 0.4% while reducing rates for large commercial and industrial customers by between 1.7% and 3.6%. However, the actual changes appear to have been approximately three times larger. From 2015 to 2016, residential rates increased 1.1%, while industrial rates fell by 6.4% and direct serve rates dropped by 9.0%.[6] The apparent discrepancy between what TVA anticipated would happen as a result of its 2011 and 2015 rate reforms, and what actually occurred, does not prove that TVA intended to cause such a disparate impact, but it highlights how small changes can result in large impacts on customers.[7]

Because such changes can significantly impact customer rates, the underlying assumptions and methodologies should be carefully reviewed to ensure that each class is treated fairly. A cost of service study provides important information regarding:

1) The method by which costs are classified,

2) The allocation factors used, and

3) Whether current rates would under- or over-recover a class's share of costs.

Without access to TVA's cost of service study, we are only able to evaluate the fairness of TVA's rates indirectly. Below we describe these indirect factors and what they may signify regarding TVA's cost allocation methodologies.

Trends in TVA Electricity Rates

Customers in the Tennessee Valley are billed for electricity through a combination of charges. Residential customers are primarily billed based on the total kilowatt-hours (kWh) consumed per month, but large commercial and industrial customers are also billed based on the peak amount energy consumed during a billing cycle (measured in kW). Thus, to compare electricity rates across classes,

[4] Tennessee Valley Authority, "Refining the Wholesale Pricing Structure, Products, Incentives and Adjustments for Providing Electricity to TVA Customers: Final Environmental Assessment" (Knoxville, TN, July 2015).

[5] Chris Mitchell, "Potential Impacts from Oct 2015 Rate Change," May 14, 2015; Tennessee Valley Authority, "Refining the Wholesale Pricing Structure, Products, Incentives and Adjustments for Providing Electricity to TVA Customers: Final Environmental Assessment," 19.

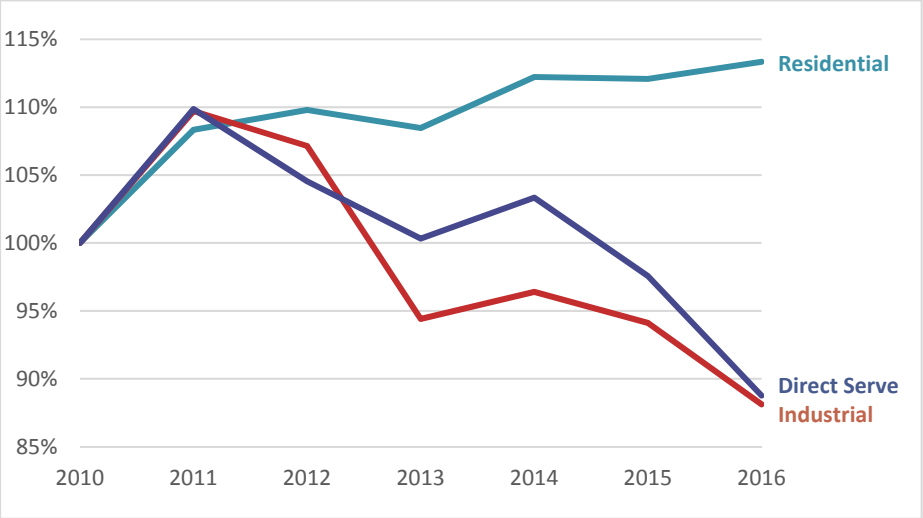
[6] As measured in terms of average revenue per kilowatt-hour, EIA 861 data.

[7] We also note that the rate impacts for non-direct-serve customers include any changes at the distribution level, which may have compounded the impacts TVA made at the wholesale supply level.

rates must be converted to a common metric, such as the average revenue the utility receives per kilowatt-hour ($/kWh).[8]

Sales, revenue, and customer data for this analysis were obtained from the U.S. Energy Information Administration Form 861 for TVA and the LPCs served by TVA. Using this data, we calculated the average revenue per kilowatt-hour by dividing total revenues by sales and normalized the data to the year 2010. The graph below depicts trends in average revenue per kilowatt-hour for residential customers (light blue) compared to industrial customers (red) and TVA's direct serve customers (dark blue) for 2010 through 2016.[9]

Figure 2. Average Revenue per Kilowatt-Hour at TVA and LPCs



As shown in the graph, from 2010 to 2011, the average revenue per kilowatt-hour increased for all classes of TVA's customers, including those served by local power companies as well as direct serve customers. However, from 2011 to 2016, rate trends diverge.

From 2011 to 2016, average revenue per kilowatt-hour for the residential class rose steadily, while the industrial and direct serve average revenue fell per kilowatt-hour. By 2016, average revenue per kilowatt-hour for residential customers was more than 5% higher than in 2011, while average revenue for industrial and direct serve customers had fallen by 20% and 19%, respectively.

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[8] The average revenue per kilowatt-hour metric is a close approximation of actual energy rates paid by residential customers, as residential customers are primarily billed on an energy consumption (kWh) basis. Residential customers also pay a mandatory monthly fee for service, which varies widely among TVA's local power companies. For industrial and direct serve customers, however, the average revenue per kilowatt-hour metric differs from the actual energy rate, since these customers are also billed on the basis of the customer's maximum demand during the month. Thus, the average revenue per kilowatt-hour collected can vary due to changes in the ratio of customer demand (kW) to energy consumption (kWh), even though the actual electricity rates may not have not changed. Still, the average revenue per kilowatt-hour metric is useful for identifying general trends, and is one of the key metrics reported by TVA in its annual performance reports to Congress. In its FY 2017 performance report, TVA refers to this metric as "Retail Rates (cents/kWh)," defined as the "average of the previous twelve months' LPC reported retail power revenue and directly served power revenue divided by LPC reported retail power sales and directly served power sales." *See:* Tennessee Valley Authority, "Budget Proposal and Management Agenda (Performance Report) for the Fiscal Year Ending September 30, 2017," February 2016, 24.

[9] Direct serve customers are primarily industrial customers. However, beginning in 2015, it appears that some direct serve customers were reclassified as commercial customers.

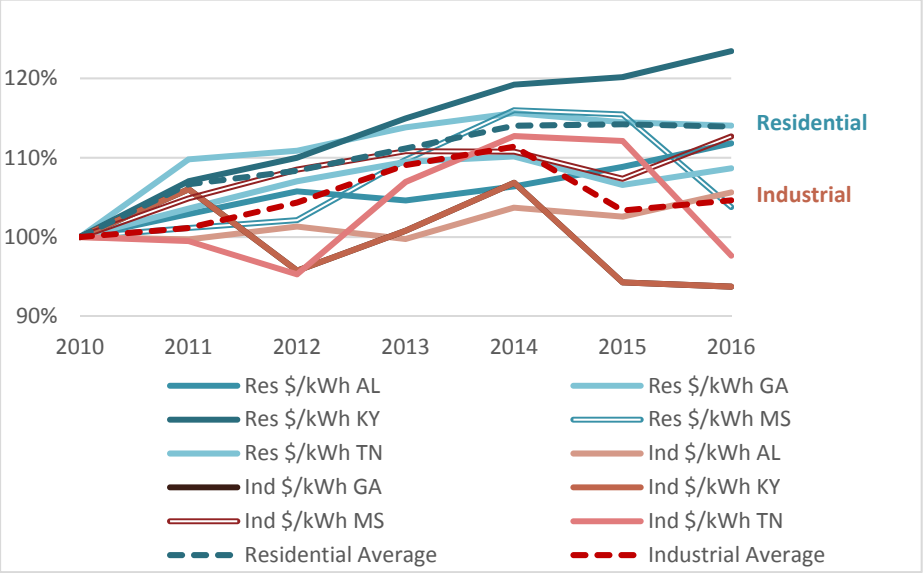
For simplicity, we have focused on the residential and industrial classes. However, it is important to note that commercial customers have also seen rising rates, but at a slightly slower pace relative to the residential class.

Comparison to Other Utilities

To determine whether the trends in average revenue per kilowatt-hour could be explained by regional trends (such as macroeconomic factors), we also analyzed average revenue per kilowatt-hour for non-TVA utilities in the region (Alabama, Georgia, Kentucky, Mississippi, and Tennessee). The figure below shows average revenue per kilowatt-hour for non-TVA utilities in each state.

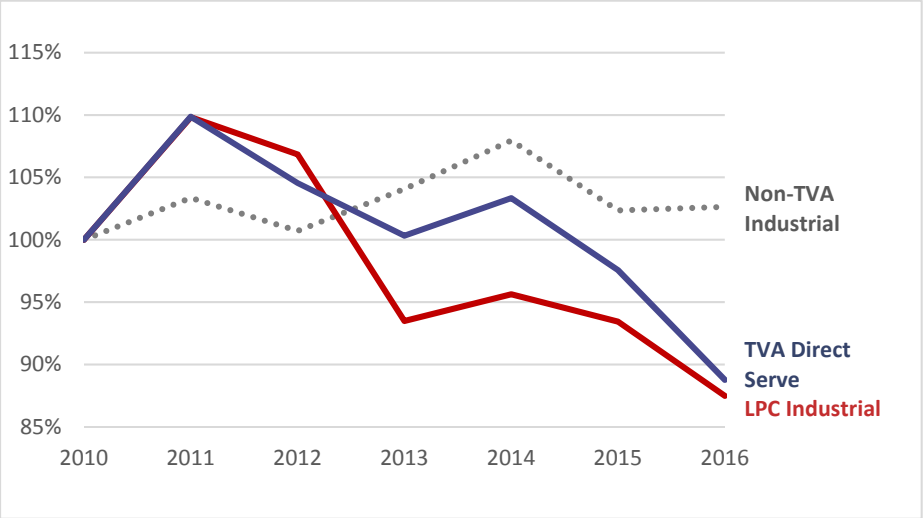
The residential data (shown in blue) indicate that average revenue for residential customers of non-TVA utilities has generally increased at a pace similar to that at TVA distributors. However, the trends for industrial and direct serve customers of TVA distributors do not closely mirror trends at non-TVA utilities.

Figure 3. Average Revenue per Kilowatt-Hour at Non-TVA Utilities



The difference in average revenue per kilowatt-hour for industrial customers of TVA utilities and non-TVA utilities can be seen more clearly in the Figure 4 below. For customers of TVA utilities, average revenue per kilowatt-hour for both industrial customers and direct serve customers has declined substantially since 2011. In contrast, non-TVA utilities' average revenue per kilowatt-hour (dotted line) exhibits no clear trend upward or downward relative to 2011.

Figure 4. Industrial and Direct Serve Average Revenues for TVA and Non-TVA Utilities



Magnitude of Rate Impacts

As shown above, since 2010 the average revenue per kilowatt-hour has increased by more than 13% for residential customers served by TVA's local power companies. In contrast, TVA direct serve customers paid 11% less per kilowatt-hour in 2016 than in 2010, and industrial customers paid 13% less. The magnitude of these trends is clearly visible when translated into dollars. If each rate class had experienced the same percentage increase in rates each year from 2011 to 2016, then revenues collected from each class would have changed as follows:[10]

Table 1. Class Revenue Increase or Decrease Under Uniform Percentage Rate Changes (2011-2016)

	Residential Revenue Change	Commercial Revenue Change	Industrial Revenue Change	Direct Serve Revenue Change
2011	-$9 million	$69 million	-$37 million	-$24 million
2012	-$105 million	$35 million	$22 million	$48 million
2013	-$245 million	$26 million	$178 million	$42 million
2014	-$262 million	$7 million	$217 million	$39 million
2015	-$327 million	-$23 million	$230 million	$120 million
2016	-$442 million	-$78 million	$321 million	$198 million
Cumulative	**-$1,390 million**	**$36 million**	**$930 million**	**$423 million**

In other words, had rate increases for 2011 through 2016 been allocated equally across the classes, residential customers would have paid $442 million less in 2016. On a cumulative basis, $1.4 billion less would have been collected from residential customers in the Tennessee Valley from 2011 through 2016.

[10] Note that these revenues reflect total (supply and distribution) revenues, not only wholesale supply revenues.

The 2015 Environmental Assessment and Changes to Utility Tariffs

Electricity rates are generally developed based on cost of service studies, as well as other considerations, such as customer equity, simplicity and understandability, and efficient price signals.[11] In 2015, TVA filed its Environmental Assessment for its proposed rate change, which provides a high-level overview of the proposed changes to electric tariffs and the rationale for such changes.

In the Environmental Assessment, TVA outlined the objectives associated with its rate proposal, including improving price signals and enhancing the competitiveness of industrial rates.[12] TVA explained that the proposed 2015 rates reflected a reallocation of costs among customer classes, as well as revisions to credit programs, such as a $22 million increase in the credits provided to general manufacturing customers.[13]

However, TVA provided little data to justify its proposals, and only vague descriptions of how it intended to reallocate costs across classes. We are aware of a change in TVA's fuel cost allocation methodology in 2015 (discussed above), but other changes may also have been made. A change in the underlying cost of service methodology, such as a change in how demand-related costs are allocated or defined, would lead to a change in the total costs allocated to each class, which could have significant impacts on the rates of certain classes.

To determine the impact of TVA's rate changes, we analyzed tariffs from an LPC (Johnson City Power Board, now BrightRidge) for both residential and industrial customers. Utility tariffs contain all of the rate components (energy charge, demand charge, customer charge) that customers see on their bills. Tariffs were available for the residential class for each month from January 2015 to November 2017. For the industrial class, tariffs were available annually for 2013 through 2017. To most consistently compare industrial tariffs across years, we focused on the rate structure for large manufacturing customers (MSB).

The MSB tariff consists of several fixed charges, on-peak and off-peak demand charges, and on-peak and off-peak energy charges combined with declining block rates. Since 2013, the MSB tariff has shifted more revenue recovery into the energy charge, with a reduced emphasis on the demand charge and steeper declining block rates. Specifically, in 2015 most demand charges for MSB customers were reduced by approximately 45%, while winter on-peak energy charges were increased by 53% and the first block of energy charges were increased. Subsequent blocks of energy were priced lower, however, further emphasizing the declining block rate structure. Since 2015, the energy charge for MSB customers has remained relatively constant, with modest increases of 5% to the first blocks of energy, and 4% decreases to the tail block.

An analysis of the residential tariffs reveals that in 2015, the residential fixed charge was increased by 27%, while the energy rate did not change. In 2017, the fixed charge was again increased by 13%, while

[11] These principles are discussed extensively in James Bonbright's 1961 book, Principles of Public Utility Rates. In addition, as discussed above, the TVA Act specifies additional guidance for rate setting.

[12] Tennessee Valley Authority, "Refining the Wholesale Pricing Structure, Products, Incentives and Adjustments for Providing Electricity to TVA Customers: Final Environmental Assessment," 2.

[13] Tennessee Valley Authority, 11.

energy rates increased by 7%. This change is not yet reflected in the EIA data used in the graphs above, but points to a continued rise in residential rates.

These changes to the industrial and residential customer rates help explain how rates were modified to result in higher average revenue per kilowatt-hour for residential customers and lower average revenue for industrial customers. However, neither the tariffs nor TVA's 2015 Environmental Assessment adequately explain why the relationship between various rate elements were modified so significantly, or what changes were made to cost of service methodologies that may have prompted these changes. Without such support, it is not possible to determine whether such changes were truly justified, or whether the changes result from a bias toward large industrial customers who may exercise considerable leverage in rate negotiations.

Summary

Our analysis reveals that significant changes have been made to TVA rates in recent years. These changes have not only altered the proportion of costs borne by each class, but have also changed *how* costs are collected. Specifically:

1) Since 2011, average revenue per kilowatt-hour (a proxy for electricity rates) for TVA direct serve and industrial customers has decreased substantially relative to residential customers. This trend contrasts with non-TVA utilities in the region, where industrial average revenue per kilowatt-hour has slightly increased.

2) Considerable modifications have been made to the rate designs by which revenues are collected. For industrial customers served on the MSB rate, this means lower demand charges and steeper declining block rates. For residential customers, fixed charges have increased much more rapidly than energy rates, leading to a higher proportion of customers' bills which are fixed, and reduced customer control over their bills.

Because we have not been able to review TVA's cost of service studies over the past decade, we do not know the extent to which these changes are justified. Without this information, numerous questions and concerns remain unaddressed. In particular:

1) Why does the average revenue per kilowatt-hour for direct serve and industrial customers at TVA utilities decline more than at other regional utilities? Have costs been unfairly shifted away from TVA direct serve and industrial customers onto other classes?

2) What was the rationale for the change in the proportion of revenues collected through the MSB demand charges and energy charges in 2015? Is this reflective of a change in the cost of service methodology?

3) Why have residential fixed charges at certain TVA utilities increased dramatically over the past decade? Are these increases driven by changes in TVA's cost of service methodology? Does TVA recognize that increased fixed charges represent less efficient price signals to customers and reduce customer control over their bills?