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2018 WHOLESALE RATE CHANGE

Draft Environmental Assessment

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Proposed Decision and Need:

The Tennessee Valley Authority (TVA) is working in collaboration with local power companies that distribute TVA power (LPCs) to change the rates LPCs pay for wholesale power. TVA proposes to refine the structure of its wholesale electric power rates better align wholesale rates with underlying costs. In addition, TVA proposes several administrative changes associated with its rate structure, including simplifying the rate schedule language and improving processes for approving and publishing rates.

The actions under consideration encompass changes to pricing structures and rates for electricity and to certain administrative practices. Changes to pricing structures and rates are proposed for two broad groups: wholesale Standard Service, which consists of residential and small commercial and industrial customers served by LPCs, and large commercial and manufacturing customers with power demands over 5,000 kW, which include customers served by LPCs and customers directly served by TVA.

The electric utility industry is facing competitive and technological changes that will impact the traditional electric utility business model through distributed generation, energy efficiency, technological advances, shifts in customer behavior, and regulatory requirements. This complex interplay of factors creates a need for self-funded electric utilities such as TVA to adjust their pricing structures and their management of generation and transmission assets. Identifying and appropriately apportioning costs of providing electric service is an important factor in equitably addressing this ongoing need.

In 2015, TVA, the Tennessee Valley Public Power Association (TVPPA), and the Tennessee Valley Industrial Committee (TVIC) agreed on a direction to incrementally improve pricing signals and fixed cost recovery, as well as to encourage technology investment. The rate change TVA implemented in 2015 focused on better aligning pricing with underlying cost drivers. TVA is discussing next steps with LPCs and directly served customers,. proposing a rate change to be implemented beginning in 2018.

The primary objectives of this proposed rate change are to continue to improve the alignment of wholesale rates with their underlying costs to serve and to facilitate measured, managed changes in LPCs' retail rate structures. The proposed changes will reduce upward rate pressure by mitigating the effects of uneconomic DER development and lessen weather-based fluctuations in bills. The intent is to implement changes concurrently at wholesale and retail and to reduce the risk for both TVA and LPCs by diminishing cost shifting among consumers and among LPCs. The proposed changes will ensure that rates remain as low as feasible for all consumers, consistent with TVA's mission to serve and to improve the quality of life in the Valley.

TVA's current energy prices over-incentivize consumer installation of DER, leading to uneconomic results for the people of the Valley as a whole. Over the next decade, forecasted load is expected to be flat or declining, resulting in little need for new energy sources. At the same time, consumer interest in renewable energy continues to rise. The imbalance created by uneconomic DER investment means that costs are shifted to consumers throughout the Valley who do not invest in DER.

Description of Alternatives

In the EA, TVA considers four alternatives; Alternative C represents the rate change TVA proposed to LPCs in its August 2017 rate change letter.

Alternative A: No Action Alternative
Alternative B: Energy rate reduction and grid access charge (0.25¢/kWh)
Alternative C: Energy rate reduction and grid access charge (1¢/kWh)
Alternative D: Energy rate reduction and grid access charge (2.5¢/kWh)

Each of the rate change alternatives under review in the EA would not change the amount of revenue TVA collects. TVA proposes to make several other changes in rates, including:

1. Incorporating the environmental adjustment and other adjustments currently on the adjustment addendum into the base rates;
2. Moving all hydro allocation adjustments (credits to residential customers, debits to non-residential customers) from base rates to the appropriate adjustment addendum;
3. Decreasing Large General Service rates to move them closer to what it costs to serve those customers. Rates for Standard Service and Large Manufacturing Service will be increased slightly so that this change is revenue neutral.;
4. Updating the power cost recovery components of LPCs' resale rates to account for changed Standard Service wholesale rates and changed hydro allocation adjustments;
5. Changing the fuel cost adjustment mechanism to administer the resource cost allocation to three rate classes instead of two rate classes;
6. Providing LPCs flexibility in their administration of the hydro allocation credits distributed to residential consumers;
7. Implementing a series of rate administration simplification initiatives to simplify business conducted through the rate schedules, including:
   - Modifying Part B of the Outdoor Lighting rate schedule to replace the list of available fixtures with a cost-based formula,
   - Consolidating the B, C and D rate schedules into one manufacturing schedule and one general service schedule, maintaining structured and rates for each class, and
   - Phasing out or eliminating mid-month billing; and
8. Updating ESS (Electricity Sales Statistics) reporting requirements.

Although provided for under the current wholesale rate schedule and not a change to the wholesale rate schedule, TVA also proposes to rebalance the hydro allocation credits distributed to residential consumers with the hydro allocation debits collected from nonresidential consumers to reflect recent declines in commercial and industrial sales.

The proposed rate change would not affect the total revenue collected by TVA, but the allocation of revenues across customer classes and among LPCs would change slightly. If approved by the TVA Board of Directors, the rate change would be effective October 1, 2018.

What is the difference between a 'rate change' and a 'rate adjustment'?

A "rate change" is the process by which TVA changes the structure of the rates or the allocation of costs. Rate changes are designed to be revenue neutral to TVA.

A "rate adjustment" is the process by which TVA increases or decreases rates across the board to match revenue needs. A rate adjustment is not intended to be revenue neutral.

Public Involvement

TVA initiated the rate change process by sending letters to all LPCs on August 9, 2017. This notification was made in accordance with the rate change provisions of the wholesale power contracts. TVA is currently meeting with LPCs to endeavor to reach agreement on the proposal. These meetings have aided in scoping issues and alternatives considered for this EA, and they provide important stakeholder input to the process. In March 2018, TVA issued the draft EA for public review and comment. TVA will consider the public's input when completing the final EA and will respond to substantive comments.

Resources

Consistent with past environmental reviews conducted by TVA on rate changes, the following resources and issues as potentially affected by the proposal:

- Socioeconomics,
- Energy production and use,
- Air resources,
- Water resources,
- Land use, and
- Solid and hazardous waste

The assessment of potential impacts on the physical environment is speculative because the effects of the rate change on the physical environment depend on decisions made by entities and consumers outside TVA's direct control.

Summary of Environmental Impacts

Because of the limited magnitude of the direct and cumulative effect of the alternative rate structures, TVA expects that any induced environmental impacts would be indirect, limited, and essentially indiscernible, for either the No Action or the three Action Alternatives. See Table 1 below.

TVA expects some minor socioeconomics impacts to result from all alternatives. Under Alternative A, cost shifting from DER participants to nonparticipants would continue and likely worsen over time. Higher retail energy rates would likely stimulate minor additional investment in DER compared to the current conditions, if all else is equal. However, this would increase the amount of cost shifting to nonparticipant consumers compared to current conditions. In contrast, Alternatives B, C, and D would avoid or lessen potential cost shifting while maintaining revenue neutrality. Under Alternative B, no change in the trend of DER adoption is expected, while under Alternatives C and D, it is expected that the penetration of DER may be slowed marginally. For existing DER investments where rates are specified by contract, the time for those investments to break even would not be affected.

TVA expects that under Alternative B (reduction in Standard Service energy rate by 0.25¢ per kWh and adding a corresponding grid access charge), most LPCs would not change retail Standard Service rates. Therefore, there would be no to very limited effects on energy use or monthly bills at the retail level for Standard Service customers. Alternatives C and D would have minor effects on energy use and monthly bills to Standard Service customers, with negative effects to some customers and positive effects to some customers. The proposed implementing guidelines set by TVA under Alternatives C and D, however, would limit negative economic impacts to customers, lessen potential cost shifting, and would limit any changes in energy use.

Across the alternatives, there would be a mix of minor negative and minor positive effects on households for all alternatives. Each alternative has the potential to slightly increase the monthly bill for a majority of residential customers. Under Alternative C and D, for instance, high-usage households would likely see a decrease of more than 1.5 percent in their average monthly bills while low-usage households would likely see a small increase in their

average monthly bills. Low-usage households' monthly bills would increase more than other households as a proportion of household income.

Under Alternatives B and C, the average consumer would experience a $1 increase to their monthly electricity bill; the maximum increase in a consumer's monthly bill would be small, generally no more than $2. Alternatives C and D would likely have the beneficial effect of lowering households' bills in months of high usage (i.e., summer and winter), therefore helping to stabilize bills from fluctuations due to seasonal variation in weather. This would be more beneficial for low-income households, for whom variations in bills due to season or weather are more likely to cause a problem than for other households. While the exact changes in Standard Service customers' monthly bills would vary by LPC, TVA projects that the changes would likely be similar across the entire TVA service area. Therefore, no particular minority or other socioeconomic group would bear a disproportionate share of negative effects. None of the alternatives would create environmental justice issues requiring mitigation, as no meaningful environmental or health effects would occur.

TVA expects minor positive effects to large commercial customers and minor negative effects to Standard Service and large manufacturing customers under Alternatives B, C, and D. Alternatives B, C, and D would lower rates for large commercial customers and make the rates more competitive. Rates for Standard Service and large manufacturing customers would increase, however, but remain competitive (see Appendix B for recent state, regional and national rate comparisons). Combined, these changes are expected to have negligible to minor economic effects on the TVA service area, including negligible changes in revenue and employment for existing firms.

Although economic impacts may vary slightly among the alternatives, there would generally be no variation in impacts to the environment among the alternatives. TVA found that none of the alternative rate changes is substantive enough to result in market responses and customer behavior changes that would require TVA to modify its power generation operations or to alter its power generation and transmission systems. Thus, there would be no discernible impacts to air resources, water resources, land use, or waste production resulting from implementing the alternative rate changes. Because of the absence or limited magnitude of the direct and cumulative effects of the alternative rate structures, TVA expects that any induced environmental impacts would be indirect and essentially indiscernible for any of the alternatives. The comprehensive environmental regulatory programs that exist throughout all of the Valley states would further ensure that any resulting environmental impacts are minor. The potential for derivative secondary impacts to resources such as cultural resources, floodplains, biological resources, endangered species, or wetlands would accordingly be highly unlikely.

Other than implementing guidelines that would be applied under Alternatives C and D, TVA has not identified any additional mitigation measures necessary to offset or reduce the level of impacts of the alternatives.

Table ES-1. Comparison of Potential Environmental Impacts

Environmental Impacts	Alternative			
	A	B	C	D
Socio-Economics	No change; potential effect to TVA and LPCs	Minor bill impacts, although less likely than under Alternatives C and D	Minor bill impacts = typical consumer would experience $1/month bill increase; stabilization of seasonal bill variation	Minor bill impacts = typical consumer would experience $1/month bill increase; stabilization of seasonal bill variation
Energy Production and Use	No change	No impacts on rates or customer behavior expected; thus, no need for changes in generation or operations	Negligible; price elasticity analysis shows potential decrease of energy sales (kWh) of 0.01%, which would not change TVA generation or operations	Negligible; price elasticity analysis shows potential decrease of energy sales (kWh) of 0.01%, which would not change TVA generation or operations
Air Resources	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to result in any identifiable impacts to air resources or GHG releases	Negligible change in energy sales, not substantial enough to result in any identifiable impacts to air resources or GHG releases
Water Resources	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to water resources	Negligible change in energy sales, not substantial enough to discern impacts to water resources
Land Use	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to land use	Negligible change in energy sales, not substantial enough to discern impacts to land use
Waste	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to waste generation	Negligible change in energy sales, not substantial enough to discern impacts to waste generation

CHAPTER 1 - PURPOSE OF AND NEED FOR ACTION

1.1 The Proposed Decision and Need

The Tennessee Valley Authority (TVA) is working in collaboration with local power companies that distribute TVA power (LPCs) to change the rates LPCs pay for wholesale power. TVA proposes to refine the structure of its wholesale electric power rates through pricing that better aligns wholesale rates with underlying costs.

In addition, TVA proposes several administrative changes associated with its rate structure, including simplifying the rate schedule language and improving processes for approving and publishing rates and rate-related documents (e.g. revising the Electric Sales Statistics (ESS) reporting requirements, revising the Outdoor Lighting rate schedule, and consolidating rate schedules for large customer classes).

The actions under consideration encompass changes to general pricing structures and rates for electricity and to certain administrative practices. Changes to pricing structures and rates are proposed for two broad groups: (1) wholesale Standard Service, which consists of residential and small commercial and industrial customers served by LPCs; and (2) large commercial and manufacturing customers with power demands over 5,000 kW, which include customers served by LPCs under Non-Standard Service provisions and customers directly served by TVA.

With rapidly advancing technology and increased consumer choices, the way TVA has priced electricity has also evolved. The current wholesale rate structure recovers costs on a volumetric basis, creating financial risks for consumers of TVA power by allowing costs to shift among LPCs and among end-use consumers.

The electric utility industry is facing competitive and technological changes. Those changes will impact the traditional electric utility business model through distributed generation, energy efficiency, technological advances, shifts in customer behavior, and regulatory requirements. This complex interplay of factors creates a need for self-funded electric utilities such as TVA to adjust their pricing structures and their management of generation and transmission assets. Identifying and appropriately apportioning costs of providing electric service is an important factor in equitably addressing this ongoing need. These costs vary by hour, by season, by customer class, and by customer usage profile.

In 2015, TVA, LPCs, Tennessee Valley Public Power Association (TVPPA), and Tennessee Valley Industrial Committee (TVIC) agreed on a direction based on incremental improvements to pricing signals and fixed cost recovery, as well as encouraging technology investment. The rate change TVA implemented in 2015 focused on better aligning pricing with underlying cost drivers and was the first step in implementing the strategy. TVA is currently discussing next steps with LPCs and directly served customers. A rate change is proposed to be implemented beginning in 2018. The primary objectives of this proposed rate change are to better align wholesale rates with their underlying costs to serve and to facilitate measured, managed change for retail customers.

TVA’s energy prices in the current pricing structure over incentivize consumer installation of distributed energy resources (DER) without a corresponding benefit in reducing TVA’s costs. Over the next decade, forecasted load is expected to be flat or even declining, resulting in little

need for new energy sources. At the same time, consumer interest in DER continues to rise. The imbalance created by uneconomic DER development means that TVA's and LPCs' costs are shifted to consumers throughout the Valley who do not invest in DER.

TVA's proposal to implement such changes is consistent with guidance on rate design for DER issued by the National Association of Regulatory Utility Commissioners (NARUC) in 2016. In their guidance, NARUC recommended that utilities take action to address DER in rate design before DER becomes widespread:

> *Even at low levels of adoption, a jurisdiction should not be content to wait until adoption levels start to increase; planning for the future will enable a jurisdiction to have the tools in place when it is ready to act. Being proactive and maintaining awareness of customer adoption and behaviors will greatly alleviate the strain on a commission, utility, and stakeholders when it does come time to act. (NARUC, 2016; p. 7)*

NARUC also urged utilities to establish appropriate price signals in rate design, stating that: "[I]f those price signals do not appropriately reflect a jurisdiction's policies on cost-causation, the result will likely be an economically and socially inefficient amount of DER." (p. 156) NARUC identified further specific benefits in the minimization of cross subsidies arising from DER:

> *Eliminating, or at least minimizing, the potential intra-class cross subsidies enjoyed by DER-owning customers has both efficiency implications and equity implications. If the cross subsidies are leading to uneconomic bypass (i.e., bypass that while decreasing costs for DER owners increases the overall cost to the general body of ratepayers), elimination of cross subsidies will increase economic efficiency. Reducing intra-class subsidies would minimize lower-income ratepayers from subsidizing higher-income ratepayers. (NARUC, 2016; p. 87)*

The proposed changes are designed to improve pricing by better aligning TVA's wholesale rates with their underlying costs, consistent with TVA's strategic pricing plan. They also reduce upward rate pressure by mitigating the effects of uneconomic DER development, and they lessen weather-based fluctuations in bills. The intent is to implement changes concurrently, at wholesale and retail and to reduce the risk for both TVA and LPCs by diminishing cost shifting among consumers and among LPCs. The proposed changes will ensure that rates remain as low as feasible for all consumers, consistent with TVA's mission to serve and to improve the quality of life in the Valley.

1.2 Background

1.2.1 TVA's Role in the Power Service Area and Current Relationship to Customers

TVA is a self-financed, wholly-owned corporate agency of the United States. TVA is a public power entity, having no shareholders and receiving no tax dollars. Under the TVA Act of 1933, as amended (the TVA Act), Congress tasked TVA with advancing the social and economic welfare of the residents of the Tennessee Valley region. TVA serves a region that consists of parts of seven southeastern states (Figure 1). One of the most important ways that TVA fulfills its congressional mandate is by providing reliable, affordable electric power to its 154 municipal and cooperative LPCs. These LPCs take delivery of electricity generated and transmitted by TVA and perform the local distribution function for their approximately 9.7

million retail consumers of electricity. TVA also sells power to approximately 57 directly served retail customers with large or unusual power requirements.

TVA's wholesale rates for LPCs recover TVA's generation and transmission costs while each LPC's retail rates recover the LPC's wholesale power cost from TVA, plus the LPC's distribution costs.

TVA's success is measured by its effectiveness in meeting the public needs, rather than in creating financial wealth for private shareholders. TVA's ability to serve its customers at competitive wholesale power prices is critical to the success of TVA in accomplishing its mission.

In 2011, TVA changed its pricing structures to send better pricing signals and to more accurately reflect changes in power supply costs over time. The End-Use Wholesale rate structure that recovered TVA's fixed and variable costs entirely through variable, volume-based energy charges was replaced with a wholesale demand and energy pricing structure that included seasonal and time of use price differentials. For an interim period until October 2012, LPCs were able to choose between the time of use demand and energy and the seasonal demand and energy schedules. Since October 2012, all LPCs have been served under a time of use demand and energy rate structure. The wholesale demand and energy rates implemented in 2011 restored the price incentive for LPCs to undertake load management activities at the local level. In October 2015, TVA approved another rate change to further improve pricing signals. TVA refined the pricing structure of its wholesale electric power rates and programs to encourage cost-saving behavior to help to keep rates as low as feasible. TVA also made changes to better align the power rates for LPCs and directly served customers with their cost of service and to improve the competitiveness of industrial rates. TVA simplified the suite of demand response and other power products offered.

The largest component of an end-use consumer's retail bill is the LPC's cost of delivered wholesale power (what TVA charges the LPC), which is passed through to the consumer. A portion of the consumer's bill recovers the LPC's distribution costs and margins.

1.2.2 TVA Rate Setting Authority, Policies, and Procedures

The TVA Act grants to the TVA Board of Directors responsibility for establishing the rates charged to LPCs and other customers for electric power supplied by TVA, as well as broad regulatory authority over LPC resale rates and conditions of service. TVA has a statutory mandate to regulate LPC retail rates. The TVA Board exercises its rate responsibility within the framework of the TVA Act, specifically the underlying policies and requirements of Sections 10, 11, and 15d of the Act.

Section 10 of the TVA Act authorizes the TVA Board "to include in any contract for the sale of power such terms and conditions, including resale rate schedules, and to provide for such rules and regulations as in its judgment may be necessary or desirable for carrying out the purposes of this Act." Under Section 11 of the TVA Act, power projects are to "be considered primarily as for the benefit of the people" of the region as a whole, "particularly the domestic and rural consumers to whom the power can economically be made available…."

As part of the bond financing amendment to the TVA Act in 1959, Congress directed TVA to charge rates that produce gross revenues sufficient to provide funds for operation, maintenance, and administration; provide payments to states and counties in lieu of taxes; provide debt service on bonds; provide payments to the United States Treasury for repayment

of past government appropriations plus an additional return; provide additional margin for investment in power system assets; and for other purposes connected with TVA's power business having due regard for the primary objectives of the Act, including the objective that power shall be sold at rates as low as are feasible. (TVA Act, Section 15d(f)).

The TVA Board of Directors exercises the responsibility to establish rates, and the LPCs and TVA establish the procedures governing rate adjustments and rate changes. These procedures are set forth in the Schedule of Terms and Conditions of each LPC's wholesale power contract. The section of the wholesale power contract entitled "Adjustment and Change of Wholesale Rate and Resale Rates" provides that the wholesale rate and resale rates in the power contract are subject to adjustment and change from time to time "in order to assure TVA's ability to continue to supply the power requirements of [the LPC] and TVA's other customers on a financially sound basis . . . ."

The wholesale power contract further provides that:

> "Wholesale power rates and charges shall be sufficient to produce revenue from TVA's wholesale power customers, which, together with revenue from its other power customers, will assure TVA's ability each fiscal year to:
>
> (a) meet the requirements of the TVA Act . . .
>
> and (b) meet all tests and comply with the provisions of TVA's bond resolutions . . . in such a manner as to assure its ability to continue to finance and operate its power program at the lowest feasible cost."

TVA's wholesale rate structure and associated programs must be altered from time to time to better reflect cost to serve and to remain competitive within the market, so as to allow sales of power at the lowest feasible rates. TVA's wholesale power contracts with LPCs provide different processes for making "rate adjustments" and "rate changes."

A "rate change" is the process by which TVA changes the structure of the rates. The current proposal is an example of a rate change. Rate changes are designed to be "revenue neutral" to TVA. Revenue neutral means that the changed rates, when applied to the same underlying power usage, are intended to result in the same revenue being collected by TVA. Under the wholesale power contracts, either TVA or an LPC may request that the parties meet and endeavor to reach agreement upon changes to the contract's Schedule of Rates and Charges. If the parties cannot reach agreement within 180 days, TVA may provide 30 days' notice prior to implementing rate changes it determines to be necessary. Rate changes can involve changes in cost allocation and rate structure that can raise power bills for some customers and lower them for others, with an overall revenue-neutral impact to TVA.

A "rate adjustment" is the process by which TVA increases or decreases rates to match revenue needs. Rate adjustments tend to have similar impacts across customer classes. Following the rate review procedures set forth in the wholesale power contracts, the TVA Board of Directors can adjust the demand and energy charges in the wholesale and resale rate schedules as necessary to assure adequate revenues to TVA and the LPCs, as required by the TVA Act and the power contracts. A "customer charge" is a fixed monthly fee at the retail level. A "demand charge" is based on the peak amount of electric capacity expressed in kilowatts (kW) used during a billing cycle. An "energy charge" is based on volumetric electricity consumption over time, expressed in kilowatt-hours (kWh). Typically, residential customers are billed based on a monthly customer charge and an energy charge ($/kWh).

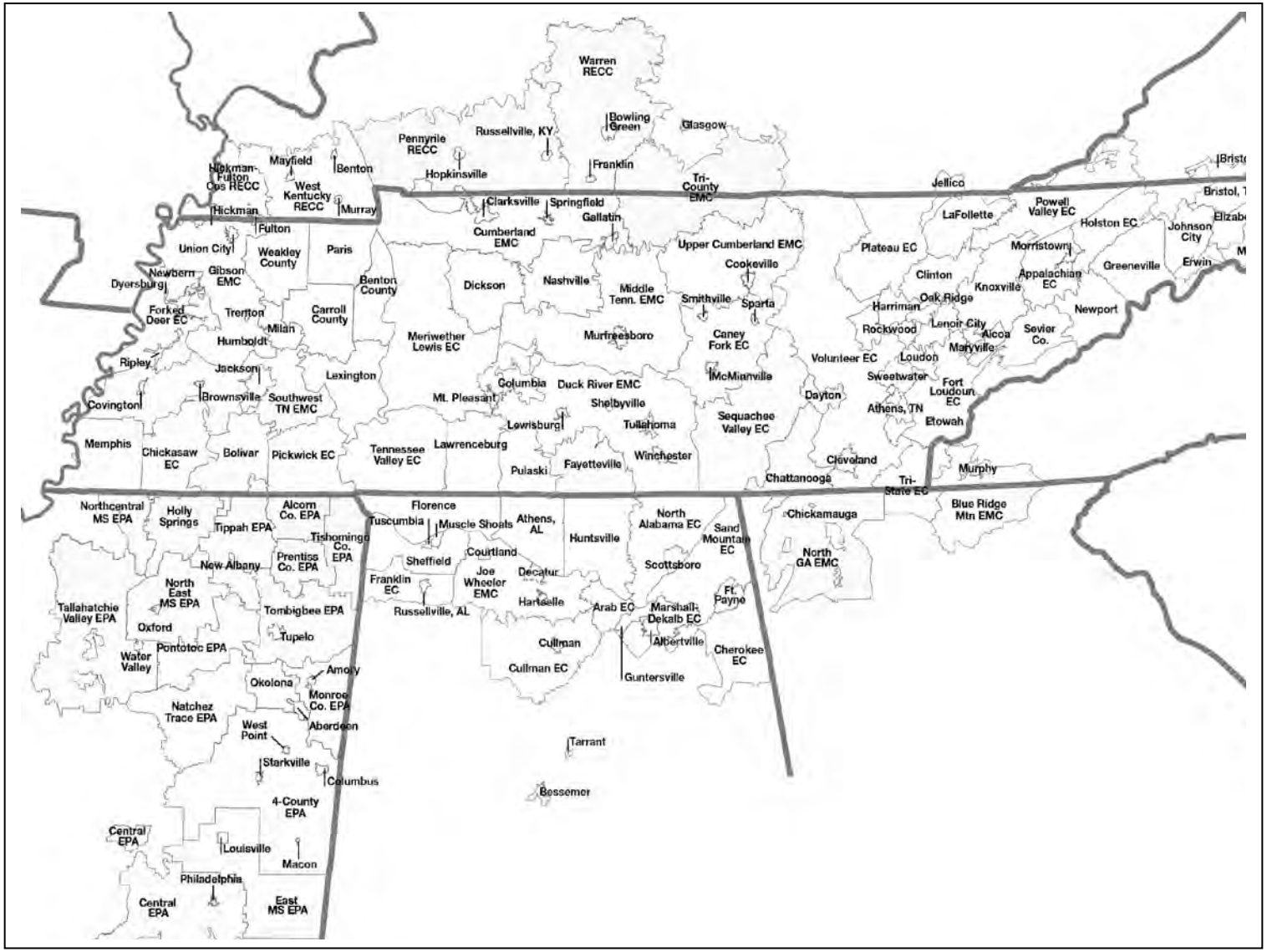

Figure 1. Map of the Seven-State TVA Power Service Area and LPCs

1.3 Other Pertinent Environmental Reviews or Documentation

This EA tiers from TVA's 2011 *Environmental Impact Statement (EIS) for TVA's Integrated Resource Plan* (IRP, TVA 2011), in which TVA identified and selected a long-range strategy to enable TVA to meet the needs of its customers for electricity for the subsequent 20 years. It also tiers from the 2015 supplement of the 2011 IRP EIS (*Integrated Resource Plan 2015 Final Supplemental Environmental Impact Statement,* TVA 2015), which describes the TVA power system and the anticipated impacts of its future operation. Relevant information from these EISs is incorporated by reference into this EA.

Other pertinent National Environmental Policy Act (NEPA) documents include:

- *Refining the Wholesale Pricing Structure, Products, Incentives and Adjustments for Providing Electricity to TVA Customers - Final Environmental Assessment* (TVA 2015)
- *Elimination of End-Use Wholesale Rate Structure and Introduction of Time-Of-Use Pricing of Electricity at the Wholesale Level - Final Environmental Assessment* (TVA 2010)
- *Public Utility Regulatory Policies Act (PURPA) Standards - Final Environmental Assessment* (TVA 2007)
- *Modification of Rate Structure for Pricing of Wholesale Electricity to Distributors Within the TVA Power Service Area Final Environmental Assessment* (TVA 2003)
- *Alternative Electric Power Rate Structures Final EIS* (TVA 1980)
- *Policies Relating to Electric Power Rates Final EIS,* Volumes 1 and 2 (TVA 1976)

Each of the above documents addresses aspects of TVA's fundamental rate structure and customer classes and TVA's historical relationship with both the LPCs and the consumers of the Tennessee Valley region. The 1976 and 1980 EISs and the more recent EAs concluded that the timing and magnitude of impacts on the physical environment (including air, water, land, and other primary natural resources) were somewhat speculative, primarily because rate change effects on the physical environment depend on numerous decisions to be made by persons and entities outside TVA's control. Despite these uncertainties, the EISs and the EAs conclude that in all likelihood, any resulting physical environmental impacts would be insignificant.

1.4 Public Involvement

TVA initiated the rate change process by sending letters to all LPCs on August 9, 2017 (see Appendix A). This notification was made in accordance with the rate change provisions of the existing TVA wholesale power contracts. The letter describes the process of meeting with LPCs and endeavoring to reach agreement on all aspects of the rate change proposal. TVA is continuing to meet with LPCs and directly served customers to endeavor to reach agreement on the proposal. These meetings, including presentations, discussions, and listening sessions, have aided in the scoping of issues and alternatives considered for this EA, and they provide important stakeholder input to the process. On March 9, 2018, TVA issued this draft EA for public review and comment. TVA will consider the public's input when completing the final EA and will respond to substantive comments.

Because there are no state or federal permits or licenses required for TVA to undertake this action, TVA has not consulted with other agencies relating to the proposal.

1.5 Necessary Permits or Licenses

There are no federal permits or licenses required for TVA to undertake this action.

CHAPTER 2 - ALTERNATIVES

This section describes the No Action Alternative and three Action Alternatives. As outlined in its August 2017 letter to LPCs, TVA proposes to reduce the Standard Service energy rate by 1¢ per kWh (about $1.2 billion) and establish a grid access charge to recover an equivalent amount of revenue. This proposal is analyzed under Alternative C.

In the EA, TVA considers two additional alternatives to represent a range of potential rate changes. One of the alternatives (Alternative B) would include grid access charges which amount to less than the proposed $1.2 billion (0.25¢ per kWh); the other (Alternative D) would include grid access charges which would amount to more than $1.2 billion in (2.5¢ per kWh).

2.1 Alternative A (The No Action Alternative)

Under the No Action Alternative, TVA would take none of the proposed actions. The currently available wholesale rate schedules would not be changed. A description of TVA's current wholesale and resale rate structure and other relevant matters is provided below.

TVA's wholesale rates have continued to evolve since the transition from End-Use Wholesale to demand and energy rates in 2011. In 2011, TVA moved from an End-Use Wholesale structure to a wholesale demand and energy structure that included seasonal and time of use options. TVA also modified the fuel adjustment clause to reflect monthly fuel costs rather than monthly adjustments to a base fuel rate. In 2015, the total fuel cost was further segmented into Standard Service and Non-Standard Service classes, the on-peak energy window was narrowed, and a maximum demand component was introduced. Compared to pre-2011 rate structures, these changes have resulted in better alignment of prices with TVA's costs and provide improved price signals that encourage wise use of electricity, while maintaining low cost, reliable electricity.

2.1.1 Current Wholesale Rates

The current wholesale rate schedule applicable to LPCs involves two components: the first for Standard Service and the second for Non-Standard Service. The costs to provide power to Standard Service and Non-Standard Service customers are different. Standard Service comprises the majority of LPC service and includes LPC sales to residential customers and small commercial and manufacturing customers. Non-Standard Service includes power delivered to large commercial and manufacturing customers with power demands over 5,000 kW and to fewer than 225 customers with contract demands between 1,000 kW and 5,000 kW that are served by LPCs or directly served by TVA under a time of use structure. This LPC-served Non-Standard Service power usage is removed from the LPCs' total demand and energy and billed separately at the Non-Standard Service wholesale rates. This is designed specifically to recover generation and transmission costs to serve these loads.

<u>Wholesale Standard Service</u>

Currently, LPCs are billed under a time of use (TOU) rate structure. The TOU structure uses pricing signals to compensate customers for shifting demand for electricity from high cost on-peak periods to lower cost off-peak periods. On-peak periods are from 1:00 pm to 7:00 pm Central Time during summer months as well as April, May, and October and from 4:00

am to 10:00 am Central Time during winter months and November. All hours not defined as on-peak are off-peak. Summer months are June, July, August, and September. Winter months are December, January, February, and March. Transition months are April, May, October, and November. LPCs are billed for on-peak energy, off-peak energy, maximum demand, and on-peak demand.

Wholesale Non-Standard Service

For LPCs that serve large customers under the Non-Standard Service rate, the current wholesale rate depends on the rate election of the retail customers. These retail customers previously had the option of either a TOU or a seasonal demand and energy (SDE) structure. The wholesale rate schedule includes corresponding TOU and SDE rates that are billed to the LPC for wholesale charges consistent with the retail structure applied. However, the optional SDE rate structure expired effective September 30, 2017. Since the expiration of the optional SDE option, all wholesale Non-Standard Service has been billed under the existing TOU rates.

General Service Rates for Large Consumers

Cost of service studies for recent years have demonstrated an excess of the revenues collected from large general service consumers over the costs incurred by TVA to serve those consumers (see Appendix C for the most recent Cost of Service study). Benchmarking studies place TVA in the 4th quartile for commercial rate competiveness. The current situation conflicts with two of TVA's objectives in setting rates: that revenue be recovered in proportion to costs by customer class; and that rates be competitive. These conflicts would continue under Alternative A.

Total Monthly Fuel Charge

Since October 1, 2006, the Adjustment Addendum to the Schedule of Rates and Charges has included a Fuel Cost Adjustment (FCA) formula to reflect changing fuel and purchased power costs on an ongoing basis. The FCA formula allocates costs between small customers and large customers. Small customers are Standard Service customers as well as all other customers with contract demands less than or equal to 1,000 kW. Large customers are TVA directly served customers with contract demands greater than 1,000 kW and large customers served by LPCs as defined in the wholesale rate schedules. The FCA formula uses a resource cost allocation methodology to allocate total fuel and purchased power costs in proportion to the average hourly load of large customers and small customers, weighted by the incremental hourly dispatch cost of the last 100 MW of TVA resources dispatched in that hour. This approach ensures a fair distribution of costs, which aligns revenue collected with costs to provide electricity by customer class.

2.1.2 Current Resale Rates

Retail Rates

The retail rates for each LPC are based on the wholesale power costs and distribution costs for that LPC. LPCs have the option to develop or adjust their own rates and rate structures, subject to final TVA regulatory approval. This process is known as a Local Rate Action (LRA). During this process, LPCs submit requests to TVA detailing the proposed adjustments and resulting impacts. TVA evaluates the LRA request based on three primary elements: cost basis, gradualism, and nondiscriminatory treatment. If the request is approved, the new rates are contractually agreed upon by TVA and the LPC through a supplement to their wholesale power contract.

Generally, for residential customers and for commercial and industrial customers with contract

demands less than 50 kW, the retail rate structure consists of a small monthly customer charge and an energy charge. For commercial and industrial customers with contract demands greater than 50 kW, the rate structure typically consists of a monthly customer charge, an energy charge, and a demand charge. For large commercial and industrial customers with contract demands greater than 5,000 kW, the rate structure consists of a monthly customer charge, an on-peak energy charge, an off-peak energy charge, a peak demand charge, and a maximum demand charge.

Hydro Preference Allocation Rebalancing

Beginning in 1952, the TVA Board has carried out requirements in sections 10 and 11 of the TVA Act by allocating the benefit of the hydroelectric generation to residential consumers. The TVA Board has assigned a value of $250 million to the hydro generation. TVA allocates the hydro preference by collecting $250 million annually from all nonresidential consumers and distributing $250 million annually to LPCs for further distribution to their residential consumers. The $250 million collected from nonresidential consumers are referred to as hydro debits, the $250 million distributed to residential consumers are referred to as hydro credits, and the hydro debits and credits are referred to collectively as hydro allocation adjustments. To ensure that the amounts distributed and the amounts collected approximate the $250 million allocation approved by the TVA Board, the hydro allocation adjustments are subject to yearly computation and adjustment. The amount of hydro preference allocation debits collected from nonresidential consumers for each of the most recent five years has fallen short of the $250 million level approved by the TVA Board because of a decrease in commercial and industrial sales. The amount of hydro preference allocation credits distributed to residential consumers has been close to the $250 million level approved by the TVA Board.

2.1.3 Other Matters

Hydro Preference Allocation Charges

The hydro allocation adjustments are designed to distribute the value of the hydro generation benefits to residential consumers and to collect the value of the hydro generation benefits from nonresidential consumers. The hydro allocation adjustment debits and credits are currently embedded in the base rates of the various wholesale and retail rate schedules. LPCs are required to report hydro allocation data to TVA on a monthly schedule.

Hydro Preference Allocation Mechanism

Currently, the LPCs receive a credit each month for each residential customer and for each kWh of residential energy sales. LPCs are charged each month for each kWh of small consumer sales and for each kW of large consumer demand and each kWh of large consumer energy sales. Hydro preference allocation debits for directly served customers are the same as those for like-sized LPC served consumers.

Adjustment Addendum Amounts

The adjustment addenda for TVA wholesale rate schedules and for LPC retail rate schedules contain columns for the environmental adjustment initially approved by the TVA Board in 2003 and in 2013 was extended indefinitely or until consolidated in base rates and for the amounts of all rate adjustments approved after 2014. These amounts are added to the base rates included in the various rate schedules to determine the total applicable rate for billing.

Mid-Month Billing

There are six LPCs for whom invoices are prepared mid-month rather than at month end. TVA would continue to work individually with these LPCs to standardize their billing cycles.

ESS Reporting
The power contract provides for monthly reporting data via the Electricity Sales Statistics (ESS) system.

Outdoor Lighting Rate Schedule
Outdoor lighting retail schedules consist of Parts A and B. Part A is street lighting, traffic signals, and athletic fields. Part B is private area lighting and includes a list of available fixtures which LPCs offer.

Rate Schedule Unification
There are currently three separate rate schedules for large general service customers and three rate schedules for large manufacturing service customers.

2.2 Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

2.2.1 Wholesale Rates

Wholesale Standard Service
TVA proposes to reduce wholesale Standard Service energy rates and to introduce a wholesale grid access charge that would recover an equivalent amount of revenue. The change would be revenue neutral for TVA and would become effective in October 2018. The proposed wholesale grid access charge would be allocated to each LPC based on the LPC's percentage contribution to the total Standard Service energy usage during a historical baseline period. Under Alternative B, the reduction in energy rates would be 0.25¢ per kWh.

Wholesale Non-Standard Service
TVA proposes to improve fixed cost recovery from consumers with contract demands greater than 5,000 kW served under TOU Service rate schedules by implementing a new rate design. The change would be revenue neutral for TVA and would be implemented in October 2019. TVA is continuing to negotiate with both TVPPA's Rates and Contracts Committee and TVIC to finalize the structures. A number of structures are under consideration, but the bill impacts are generally expected to fall within a range of -2 percent to +5 percent.

General Service Rates for Large Customers
TVA further proposes to decrease wholesale TOU Service energy rates under rate schedules General Service B, C, and D by $23 million and to increase wholesale Standard Service rates and large manufacturing service rates approximately 0.3 percent to maintain TVA revenue neutrality.

Total Monthly Fuel Charge
TVA proposes to change the wholesale rate schedule fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for large customers served under a manufacturing service rate from large customers served under a general service rate.

2.2.2 Resale Rates

Retail Rates
To enable LPCs to continue operating on a financially sound basis after the wholesale rate change, TVA proposes to change resale rates to reflect changes in wholesale power costs and to improve the alignment of retail charges with the new wholesale charges. TVA projects that due to the small changes in energy rates under Alternative B, most LPCs would not

change their retail rate structures. However, LPCs would have the option to develop customized rates, subject to the TVA Board-approved process.

Hydro Preference Allocation Rebalancing

TVA proposes to rebalance the hydro allocation credits distributed to residential consumers with the hydro allocation debits collected from nonresidential consumers to reflect the decrease in commercial and industrial sales. The process of rebalancing the credits and debits is not part of the rate change process as set forth in the power contract but is governed by other language in the wholesale and resale rate schedules. The exact amounts of the rebalancing cannot be determined until after June 30, 2018, in accordance with power contract requirements. Based on the imbalance observed in the previous four fiscal years, there is likely to be minimal change to the distribution of credits to residential consumers and a $30 million to $40 million increase in the collection of debits from nonresidential consumers, spread evenly among all nonresidential consumers.

2.2.3 Other Matters

TVA proposes the following additional administrative changes to simplify and improve processes:

a) Moving all hydro allocation adjustments to the appropriate adjustment addendum;
b) Providing LPCs flexibility in their administration of the hydro allocation credits distributed to residential consumers;
c) Incorporating the environmental adjustment and other adjustments currently on the adjustment addendum into the base rates;
d) Eliminating or phasing out mid-month wholesale billing;
e) Updating the ESS reporting requirements;
f) Revising Part B of the Outdoor Lighting rate schedule to replace the list of available fixtures with a cost-based formula; and
g) Consolidating the B, C, and D rate schedules into one manufacturing schedule and one general service schedule, maintaining the current rate structure and separate rates for each class.

2.3 Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charge)

Alternative C is similar to Alternative B, except that the reduction in the wholesale Standard Service energy rates that would be implemented would be 1¢ per kWh. TVA would introduce a wholesale grid access charge that would recover an equivalent amount of revenue. As with Alternative B, the changes would become effective in October 2018 and all associated decisions described under Alternative B relating to wholesale rates, resale rates, and other matters would be implemented.

Alternative C is the proposal TVA submitted to LPCs in TVA's August 2017 letter initiating the rate change process.

2.3.1 Implementing Guidelines

Although the proposed wholesale changes would be revenue neutral to TVA, they would affect the manner in which wholesale revenue is collected, and each LPC may be impacted differently. To address these varying impacts, TVA has developed and would apply a

methodology to allocate each LPC's wholesale grid access charge to each of its retail classes based on each retail class's contribution to the LPC's historic sales.

Under Alternative C, TVA would design default retail rate structures and rate levels for each LPC (excluding four LPCs that set their own retail rates) to allocate the proposed wholesale grid access charge to the retail rate classes based on the average contribution of each class to total Standard Service sales for TVA fiscal years 2013 through 2017. Changes may include implementation of a declining block rate structure, introduction of a demand charge where one did not previously exist, hours use of demand structure, and a demand ratchet on distribution delivery charges. New default rate designs are intended to be revenue neutral.

Rather than implementing the TVA-designed default retail rates, Each LPC may elect optional retail rates based on its non-fuel power cost recovery rates adjusted for its individual calculated maximum rate impact. Although the average impact of the proposed wholesale rate change for each LPC is zero, individual LPCs may see an increase in their wholesale bills if their actual Standard Service usage is below their average Standard Service usage. TVA has evaluated wholesale financial impacts of the wholesale rate change for each LPC for TVA fiscal years 2013 through 2017. The maximum annual bill impacts range from 0.08 percent and 1.56 percent.

In lieu of implementing either the default retail rates or the optional retail rates described above, LPCs would be able to propose their own rate structures and retail rate designs, subject to the retail rate review process established by the TVA Board in August 2014.

Under Alternative C, TVA would apply a series of thresholds to ensure that retail bill impacts associated with the translation of wholesale changes to retail are implemented gradually. Using these thresholds, TVA would limit the amount of revenue recovery allocated to any single retail rate class and the amount of rate increase for any single customer within that retail rate class. To ensure that retail bill impacts are consistent with the wholesale rate actions, TVA proposes that a maximum increase for residential customers would be no greater than $4 to $6 per customer per month. TVA would use a similar approach with the GSA1 rate class and with demand-metered customer classes. TVA expects that the bill impacts for typical nonresidential Standard Service consumers would range from -2 percent to +2 percent. LPCs must provide a definitive underlying cost basis if they choose to implement retail rate structures that fall outside these thresholds.

Because TVA does not determine whether or how each LPC responds to the proposed rate change or the extent to which Standard Service customers are affected, the potential impacts of Alternative C to these customers is difficult to assess precisely. Generally, however, these implementing guidelines would be employed to ensure a gradual transition and to minimize bill impacts. The analysis below assumes that LPCs would adopt the default rate, which TVA believes would closely approximate the actual effects.

2.4 Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative D, the reduction in wholesale Standard Service energy rates would be 2.5¢ per kWh. As with Alternatives B and C, TVA would introduce a wholesale grid access charge that would recover an equivalent amount of revenue. The changes would be implemented in October 2018; the decisions described under Alternative C relating to wholesale rates, resale rates, and other matters would be implemented.

2.4.1 Implementing Guidelines

Under Alternative D, TVA would apply the same implementing guidelines as described under Alternative C to minimize the potential impacts of the change.

Similar to Alternative C, each LPC may elect optional retail rates based on its non-fuel power cost recovery rates adjusted for its individual calculated maximum rate impact. Although the average impact of the proposed wholesale rate change for each LPC is zero, individual LPCs may see an increase in their wholesale bills if their actual Standard Service usage is below their average Standard Service usage. TVA has evaluated wholesale financial impacts of the wholesale rate change for each LPC for TVA fiscal years 2013 through 2017. Under Alternative D, the maximum annual bill impacts range from 0.2 percent and 3.9 percent.

Because TVA does not determine whether or how each LPC responds to the proposed rate change and the extent to which Standard Service customers are affected, the potential impacts of Alternative D to these customers is difficult to assess precisely. Generally, however, the implementing guidelines proposed under Alternatives C and D would minimize the degree to which the potential impacts of the alternatives vary.

2.5 Relevant Environmental Issues to be Addressed

Consistent with past environmental reviews conducted by TVA on rate changes, TVA has initially identified the following resources and issues as potentially affected by the proposal:

- Socioeconomics,
- Energy production and use,
- Air resources,
- Water resources,
- Land use, and
- Production of solid and hazardous waste.

As noted, the assessment of potential impacts on the physical environment is speculative because the effects of the rate change on the physical environment depend on decisions made by entities and consumers outside TVA's direct control.

2.6 Comparison of Alternatives

Because of the limited magnitude of the direct and cumulative effect of the alternative rate structures, TVA expects that any induced environmental impacts would be indirect, limited, and essentially indiscernible, for either the No Action or the three Action Alternatives. See Table 1 below.

TVA expects some minor socioeconomics impacts to result from all alternatives. Under Alternative A, cost shifting from DER participants to nonparticipants would continue and likely worsen over time. Higher retail energy rates would likely stimulate minor additional investment in DER compared to the current conditions, if all else is equal. However, this would increase the amount of cost shifting to nonparticipant consumers compared to current conditions. In contrast, Alternatives B, C, and D would avoid or lessen potential cost shifting while maintaining revenue neutrality. Under Alternative B, no change in the trend of DER adoption is expected, while under Alternatives C and D, it is expected that the

penetration of DER may be slowed marginally. For existing DER investments where rates are specified by contract, the time for those investments to break even would not be affected.

TVA expects that under Alternative B (reduction in Standard Service energy rate by 0.25¢ per kWh and adding a corresponding grid access charge), most LPCs would not change retail Standard Service rates. Therefore, there would be no to very limited effects on energy use or monthly bills at the retail level for Standard Service customers. Alternatives C and D would have minor effects on energy use and monthly bills to Standard Service customers, with negative effects to some customers and positive effects to some customers. The proposed implementing guidelines set by TVA under Alternatives C and D, however, would limit negative economic impacts to customers, lessen potential cost shifting, and would limit any changes in energy use.

Across the alternatives, there would be a mix of minor negative and minor positive effects on households for all alternatives. Each alternative has the potential to slightly increase the monthly bill for a majority of residential customers. Under Alternative C and D, for instance, high-usage households would likely see a decrease of more than 1.5 percent in their average monthly bills while low-usage households would likely see a small increase in their average monthly bills. Low-usage households' monthly bills would increase more than other households as a proportion of household income.

Under Alternatives B and C, the average consumer would experience a $1 increase to their monthly electricity bill; the maximum increase in a consumer's monthly bill would be small, generally no more than $2. Alternatives C and D would likely have the beneficial effect of lowering households' bills in months of high usage (i.e., summer and winter), therefore helping to stabilize bills from fluctuations due to seasonal variation in weather. This would be more beneficial for low-income households, for whom variations in bills due to season or weather are more likely to cause a problem than for other households. While the exact changes in Standard Service customers' monthly bills would vary by LPC, TVA projects that the changes would likely be similar across the entire TVA service area. Therefore, no particular minority or other socioeconomic group would bear a disproportionate share of negative effects. None of the alternatives would create environmental justice issues requiring mitigation, as no meaningful environmental or health effects would occur.

TVA expects minor positive effects to large commercial customers and minor negative effects to Standard Service and large manufacturing customers under Alternatives B, C, and D. Alternatives B, C, and D would lower rates for large commercial customers and make the rates more competitive. Rates for Standard Service and large manufacturing customers would increase, however, but remain competitive (see Appendix B for recent state, regional and national rate comparisons). Combined, these changes are expected to have negligible to minor economic effects on the TVA service area, including negligible changes in revenue and employment for existing firms.

Environmental Impacts	Alternative			
	A	B	C	D
Socio-Economics	No change; potential effect to TVA and LPCs	Minor bill impacts, although less likely than under Alternatives C and D	Minor bill impacts = typical consumer would experience $1/month bill increase; stabilization of seasonal bill variation	Minor bill impacts = typical consumer would experience $1/month bill increase; stabilization of seasonal bill variation
Energy Production and Use	No change	No impacts on rates or customer behavior expected; thus, no need for changes in generation or operations	Negligible; price elasticity analysis shows potential decrease of energy sales (kWh) of 0.01%, which would not change TVA generation or operations	Negligible; price elasticity analysis shows potential decrease of energy sales (kWh) of 0.01%, which would not change TVA generation or operations
Air Resources	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to result in any identifiable impacts to air resources or GHG releases	Negligible change in energy sales, not substantial enough to result in any identifiable impacts to air resources or GHG releases
Water Resources	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to water resources	Negligible change in energy sales, not substantial enough to discern impacts to water resources
Land Use	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to land use	Negligible change in energy sales, not substantial enough to discern impacts to land use
Waste	No change	No effects; current conditions continue	Negligible change in energy sales, not substantial enough to discern impacts to waste generation	Negligible change in energy sales, not substantial enough to discern impacts to waste generation

Table 1. Comparison of Potential Environmental Impacts

Although economic impacts may vary slightly among the alternatives, there would generally be no variation in impacts to the environment among the alternatives. TVA found that none of the alternative rate changes is substantive enough to result in market responses and customer behavior changes that would require TVA to modify its power generation operations or to alter its power generation and transmission systems. Thus, there would be no discernible impacts to air resources, water resources, land use, or waste production resulting from implementing the alternative rate changes. Because of the absence or limited magnitude of the direct and cumulative effects of the alternative rate structures, TVA expects that any induced environmental impacts would be indirect and essentially indiscernible for any of the alternatives. The comprehensive environmental regulatory programs that exist throughout all of the Valley states would further ensure that any resulting environmental impacts are minor. The potential for derivative secondary impacts to resources such as cultural resources, floodplains, biological resources, endangered species, or wetlands would accordingly be highly unlikely.

Other than implementing guidelines that would be applied under Alternatives C and D, TVA has not identified any additional mitigation measures necessary to offset or reduce the level of impacts of the alternatives.

2.7 The Preferred Alternative

At this time, TVA's preferred alternative is Alternative C. TVA is currently meeting with LPCs to discuss all aspects of this proposal, including the appropriate reduction in the standard energy rate. The preferred alternative identified in the final EA is expected to be within the range of a 0.25 to 1.0 cents per kWh reduction in the Standard Service energy rate as discussed as alternatives in this Draft EA. This range of alternatives would provide the NEPA analysis for the alternative ultimately selected by TVA.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Framework for Environmental Impact Analyses - The Electric Power Industry, Need and Supply, and Sources of Impacts

This section describes how TVA acts in the energy market, potential environmental impacts that could be associated with the proposed actions, and the relative level of predicted effects. The area served by TVA will continue to need electricity, and TVA expects that it will continue to provide that energy in the future. As evaluated and discussed in TVA's 2015 IRP Supplemental EIS, TVA expects to provide this energy by generating it from its own facilities or by buying it from specific energy generators or from the general power market.

The potential for environmental impacts to air quality, water quality, waste, or land use depends upon: (1) how and when the wholesale rates set by TVA are reflected in the retail rates established by LPCs; (2) the related decisions made by consumers of electricity in the region in response to rate structure revisions, and (3) how TVA provides energy and meets demand in response to the decisions made by LPCs and the retail consumers.

As shown in Figure 2, the primary source of potential impacts results from the responses of retail consumers of electricity. Different pricing structures for electricity may encourage behavior that leads to the creation, maintenance, or elimination of jobs as consumers make decisions to construct, expand, contract, or close plants and businesses or to increase, maintain, or decrease residential electricity usage by choices of housing, transportation, or consumer goods. Because TVA supplies wholesale power to LPCs who in turn supply retail power to end-use consumers, there is an additional layer of decision-making by LPCs that adds complexity to the analysis of potential impacts. Consequently, assessing environmental impacts based on predicting behavioral changes involves substantial speculation.

The proposed actions focus on the pricing structures and rates. If approved, the actions would impact two broad groups of consumers: Standard Service customers and large customers. Standard Service customers include residential consumers, small commercial consumers, and small manufacturing consumers. Large customers are commercial or manufacturing consumers with contract demands greater than 5,000 kW.

It is difficult for TVA to predict how each LPC would respond to the proposed wholesale rate change and, consequently, the extent to which Standard Service customers would be affected. LPCs may implement a rate change in a variety of ways. The varying responses by LPCs further complicate assessing potential behavioral changes and estimating potential environmental impacts.

TVA must consider the degree to which consumers at the retail level would likely be affected under each of the three action alternatives. TVA anticipates the following potential responses by LPCs to the wholesale rate change under consideration: (1) LPCs would make no changes to their retail rate structures and minimal changes to their rate levels; (2) LPCs would make changes to their retail rate structures and minimal changes to their rate levels; or (3) LPCs would make changes both to their retail rate structures and to their rate levels.

The potential environmental impacts of the proposed action (see Figure 2) would depend on (1) whether LPCs decide to revise their retail rates in line with the wholesale rates, (2) the extent to which directly served customers and LPC-served customers increase or decrease their energy use in response to TVA's proposal, and (3) the extent to which new generation facilities must be constructed, existing facilities must be operated or shut down, and the mix of energy resources is modified. With increases or decreases in usage or demand, transmission capabilities may also need to be modified. This attenuation in the chain of causation makes it difficult to predict environmental impacts without engaging in some speculation.

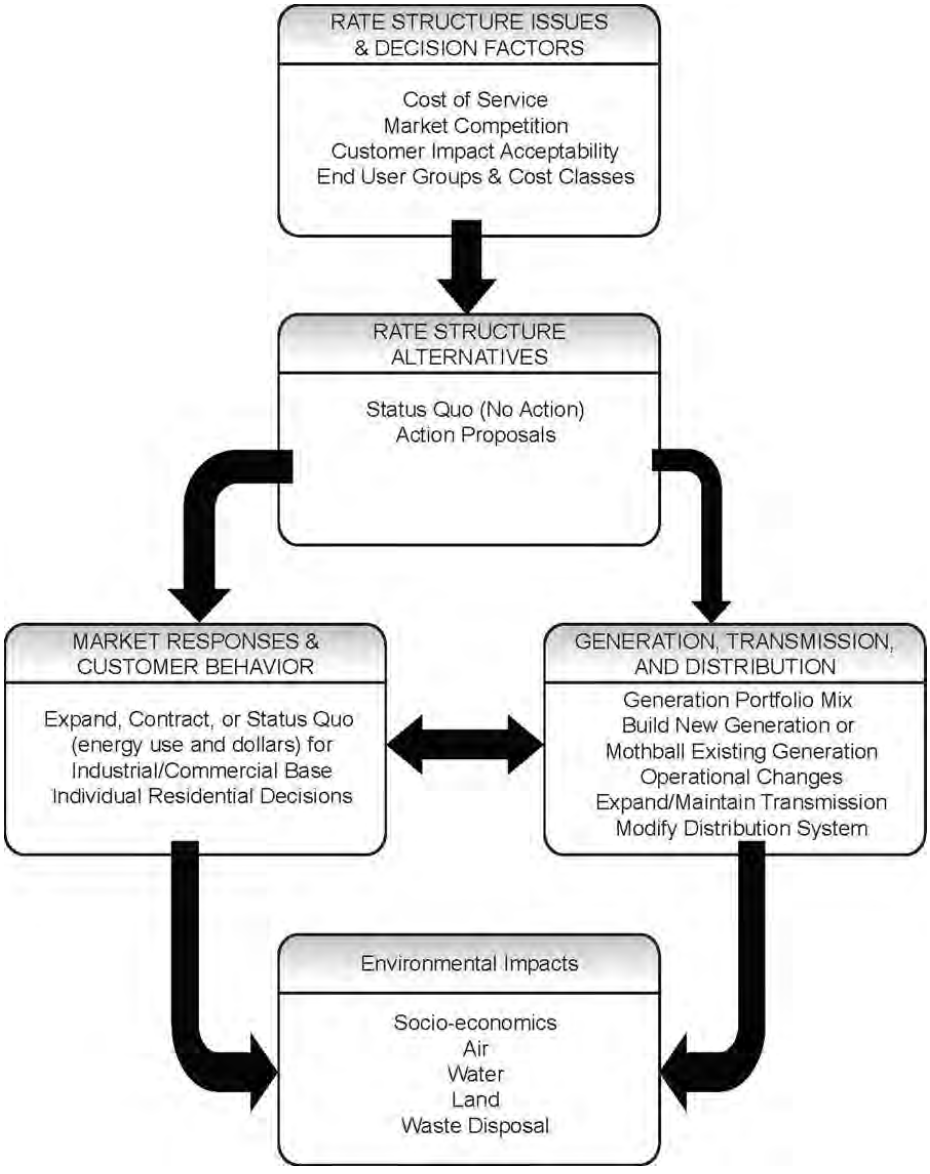

Figure 2. General Framework for Consideration of Issues and Environmental Impact Analyses of Effects from Rate Changes

In this chapter, TVA will review potential environmental impacts consistent with the analysis of TVA's 2015 IRP Supplemental EIS, which established a framework for environmental impact analysis. As noted above, this EA tiers from the 2015 IRP Supplemental EIS. Consistent with

past environmental reviews conducted by TVA on rate changes, TVA has identified the following resources and issues as potentially affected by the proposal: socioeconomics, air quality, water quality, land use, production of solid and hazardous waste, and energy production and use.

As noted, the assessment of potential indirect impacts on the physical environment is speculative because the effects of the rate change on the physical environment depend on decisions made by entities and consumers outside TVA's direct control.

3.2 Components Not Affecting the Evaluation of Environmental Effects

Several components of the proposed rate change are administrative in nature. The proposed administrative components would result in no changes to rates and have no potential to impact the environment. The administrative items include:

- all items relating to moving the components of hydro preference allocation debits or credits from base rates to the appropriate adjustment addenda;
- providing flexibility to the LPCs in administering hydro allocation credits;
- consolidating environmental adjustment amounts and rate adjustment amounts from the adjustment addenda into base rates;
- eliminating mid-month billing arrangements with LPCs;
- modifications to ESS reporting requirements;
- revision of the outdoor lighting schedule; and
- unification of the large customer rate schedules.

Altering where the hydro preference allocation debits and credits, the environmental adjustment amounts, and the amounts of previous rate adjustments are presented within the various rate schedules would not change the currently effective rates nor the calculation of subsequent rate adjustments. Likewise, the elimination or continuation of mid-month billing for the six LPCs currently not billed on a calendar-month billing cycle would not affect TVA's electric rates.

Providing optional flexibility to the LPCs in administering the distribution of hydro allocation credits to residential customers would not result in a change in the total hydro allocation credits distributed by TVA, nor in the total hydro allocation credits received by any LPC, nor in the total hydro allocation credits distributed to the residential class customers of any LPC.

Modifying the contractually required ESS reporting would facilitate rate and cost analysis but would not affect rates. The proposed revisions to the outdoor lighting rate schedule would enable LPCs to add lighting fixtures to their rate schedules more easily and more quickly but would not result in changes to the rates for outdoor lighting or the utilization of outdoor lighting. Similarly, the consolidation of the rate schedules for large consumers from six schedules to two schedules would not affect the rates applicable to large consumers. The three rate schedules currently applicable to large general service customers would be consolidated into a single rate schedule, as would the three rate schedules currently applicable to large manufacturing customers.

Because these administrative items would not affect rates and do not have potential to affect the environment, they will not analyzed further in the EA.

3.3 Socioeconomics

TVA balances the need to meet multiple social and economic goals in the design of its rate structure and rate setting. These goals, described in TVA's Service Commitment, are categorized as the three "E"s:

- Energy: generate safe, clean, reliable and affordable power.
- Economic Development: provide for the industrial development of the Valley by providing low cost, safe, clean, reliable and affordable electricity to help bring and maintain new investments and good jobs to the region.
- Environment: serve as stewards of the region's natural resources and manage the waterways and surrounding lands to provide multiple benefits to the people in the Valley into the future. (TVA, 2018)

Assuring that power is reliable requires TVA to build or purchase capacity to meet peak demands. Therefore, the fixed costs associated with building to meet peak demand comprise a large portion of TVA's total costs. Simultaneously, TVA is tasked with setting rates that are as low as are feasible. As described in the TVA Act, TVA shall (TVA Act, Section 15d(f)):

> "…*charge rates for power which will produce gross revenues sufficient to provide funds for operation, maintenance, and administration of its power system; payments to States and counties in lieu of taxes; debt service on outstanding bonds, including provision and maintenance of reserve funds and other funds established in connection therewith; payments to the Treasury . . . having due regard for the primary objectives of the Act, including the objective that power shall be sold at rates as low as are feasible*."[1]

It is widely understood that electric utilities are facing challenges meeting their fixed costs. Several studies suggest that utilities, facing changes in both energy use and methods of energy generation, must consider changing rate structures. A recent article published in the Electricity Journal states:

> *In recent years the fixed cost recovery problem has grown as more costs have been added to utility operations that are not directly tied to providing an incremental kWh of electricity. For instance, energy efficiency programs, discounts to low-income customers, and subsidies for installing distributed generation are now costs that the utility must recover, but are not part of the marginal cost of providing a kWh to a specific customer. In addition, energy efficiency programs and distributed generation have reduced demand and thus required that the revenue shortfall from marginal-cost pricing be made up over a smaller number of kWh. (Borenstein, 2016)*

Most electric utilities throughout the United States charge a fixed charge each month that is independent of the quantity of electricity consumed. These fixed charges can be useful because they can reduce the amount of fixed costs collected through volumetric charges and thus minimize the risk that revenue will not cover fixed costs, and allow the utility to invest in sufficient capacity to assure a reliable power supply. However the perceived downside of a fixed charge is that there is no price-incentive for the consumer to change their consumption patterns as power costs increase or simply to increase energy efficiency. TVA is proposing a revised rate structure that balances the fiscally responsible fixed charge with maintaining a

[1] The TVA Act of 1933 is available at: https://www.tva.gov/file_source/TVA/Site%20Content/About%20TVA/TVA_Act.pdf

volumetric price that does not discourage energy efficiency or investment in DER. The potential impacts of that proposed change in rate structure and levels are discussed below.

3.3.1 Affected Environment

The socioeconomic conditions and trends of the TVA region are discussed in detail in the 2015 IRP Supplemental EIS from which this EA tiers, with minor updates to characteristics based on more recent data (Table 2). TVA supplies electricity across 178 counties in portions of 7 states. These counties have a population of more than 9 million. Between 2000 and 2016 the region experienced a 14.7 percent growth in population, a rate marginally higher than the 14.5 percent growth experienced across the United States as a whole. In 2016 the TVA region had an economy of $448 billion in gross product and total personal income of about $397 billion, about 2.5 percent of the national total (Bureau of Economic Analysis 2016, in current dollars). Income levels in the region have continued to increase relative to the nation in recent years, with median household income of approximately $47,000, 81 percent of the national average (Table 2). The economy of the TVA region depends more on manufacturing than does the nation as a whole. Manufacturing employment accounts for about 14 percent of regional employment and about 9 percent of regional personal income.

The minority population of the region is estimated to be 26.3 percent of the region's total population. This is well below the national minority population share of 38.7 percent. Minority populations are most concentrated in metropolitan areas of the western half of the region and in rural counties of Mississippi and western Tennessee. The estimated poverty level for counties in the TVA region is 16.6 percent, higher than the national poverty level of 14 percent. Counties with the higher poverty levels are generally outside the metropolitan areas and most concentrated in Mississippi.

Table 2: Summary of Socioeconomic Characteristics

Geographic Region	Population (millions) [c]	Proportion Minority [c]	Median Household Income ($) [c]	Proportion below Poverty Level [d]	Unemployment Rate [c]	Average Monthly Electricity Use (kWh) [e]	Average Monthly Electricity Bill ($) [e, f]
TVA Service Area [a]	11.5	26.3%	47,347	16.6%	5.1%	1,150	121.34
Southeastern United States [b]	79.9	37.7%	51,355	15.7%	5.1%	1,160	128.07
United States	326.5	38.7%	58,161	14%	5%	897	112.59

[a] The TVA service area includes portions of seven states: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. This row includes information from any counties that are fully or partially served by TVA power, either directly or through LPCs.
[b] Includes all states in the TVA service area plus Florida, Louisiana, South Carolina, and West Virginia.
[c] Economic Research Service, Department of Agriculture (2016)
[d] Bureau of Census (2016)
[e] EIA (2017)
[f] For TVA service area, $18.41 customer charge and $0.0895/kWh is assumed.

Figure 3 shows the distribution of monthly residential bills in the TVA service area by kWh consumed. Approximately 50 percent of monthly bills do not exceed 1,000 kWh and only 15 percent exceed 2,000 kWh.

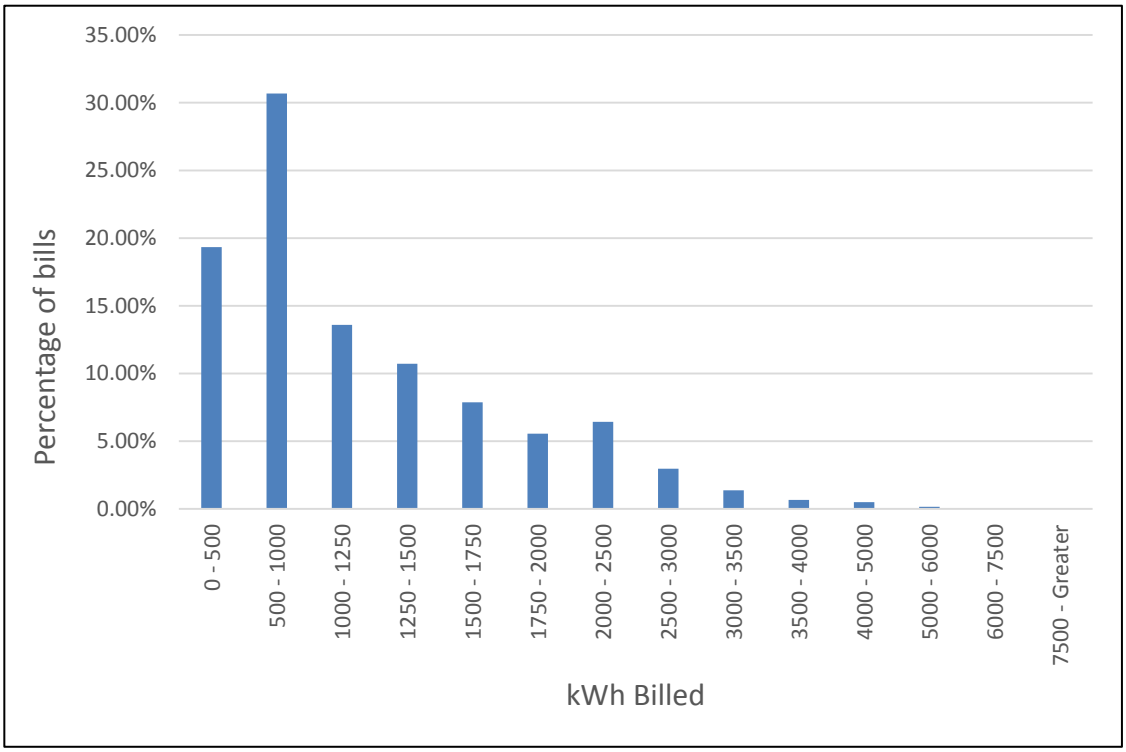

Figure 3: Distribution of monthly residential bills in the TVA service area in Fiscal Year 2017

3.3.2 Environmental Consequences

Alternative A (No Action)

Under this alternative, there would be no short-term changes in the rate structures or the way that TVA currently determines and applies electricity pricing.

TVA considers potential socioeconomic effects by three general groups of stakeholders: TVA and the LPCs it serves; residential customers; and nonresidential customers. In general, potential effects to TVA and LPCs would be financial, and potential effects on customers would be the result of changes in customers' electricity bills and/or changes in behavior resulting from price changes.

There would be no effects on energy use or socioeconomic impacts in the short term. However, the problems leading TVA to propose a rate change would likely worsen over time, including misalignment of revenue recovered and costs of service for different customer classes and cost shifting among customers due to DER installation. Therefore, Alternative A would have negative future effects on customers.

Large commercial customers served under General Service rate schedules would continue to pay significantly more than it costs to serve them and would continue to have less competitive rates and increased incentives to pursue uneconomic DER.

Alternative A would continue to have minor negative effects on most residential customers from cost shifting due to DER installation. While most types of DER provide benefits through increasing the use of clean renewable energy in the Tennessee Valley,[2] it has costs as well. Under current electric rates, DER create cost-shifting from customers with DER (participants) to those without (non-participants). Retail consumers with DER connected to the grid currently offset retail electricity purchases at the retail energy rate. Because the retail energy rate is higher than TVA's marginal cost of providing electricity (even after accounting for avoided TVA costs), TVA effectively loses revenue on energy that DER send to the grid. Stated another way, the compensation paid for DER electricity is greater than the corresponding reduction in costs. Retail consumers who install DER that is not connected to the grid can reduce their energy usage from the TVA system, but that requires TVA and LPCs to raise rates in order to fully recover their costs, including the costs of assets installed to serve those customers. This would shift the costs to other customers. Because most of TVA's costs of providing energy for Standard Service are recovered through variable energy charges rather than fixed charges, this means that DER prevents TVA from recovering its full costs from all customers connected to the system. This is not unique to TVA; a California Public Utility Commission report found that customers with DER on average pay just 81 percent of the cost to serve their electricity needs (CPUC, 2013). Due to the costs of installing these systems, customers installing DER tend to have above-average incomes. The cost shifting therefore benefits households with above-average incomes at the expense of other households.

The cost shifting issue will likely worsen over time under Alternative A. The future increase in rates would, if all else is equal, result in a higher incentive for DER installation, which would lead to more cost shifting.

Based on TVA forecasting, DER is expected to increase over time, with 2 percent of households in the Tennessee Valley expected to have DER installations by 2030. Therefore, the vast majority of higher energy costs would be borne by the residential customers without DER. Nationwide, customers without DER tend to be lower income households. Therefore, current policies would result in lower income households paying increasing shares of the cost of residential electricity over time. These increased rates could potentially impose meaningful financial costs on the lowest income residential customers. For example, Auffhammer and Rubin (2018) find that low-income households react more to energy costs, heating their homes less than high-income households in winter. Because residences in the TVA service area are heated primarily with electricity, price increases may result in lower income households heating their homes to less than comfortable temperatures than they would have otherwise.

TVA's desire to avoid shifting costs to customers without DER, and particularly to avoid shifting costs onto low-income households, is one of the reasons why TVA has proposed a rate change. Applying a rate change would reduce the effects of DER cost-shifting while continuing to provide an incentive for DER investment.

Another drawback of Alternative A in the event of additional DER investment is that small-scale DER investments reduce the future incentive for utility-scale investment in renewable energy generation (including solar). DER marginally increase current grid capacity and reduce the need for additional generation resources. Utility-scale renewable energy would cost substantially less per unit of energy than small-scale DER; therefore, more small-scale DER tend to increase the total costs of electricity in the region.

[2] Some DER are based on fossil fuels, but the vast majority is solar or other clean renewable energy.

In summary, Alternative A would have some minor negative socioeconomic impacts.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

TVA considers the combined effects of the various components of the rate change when analyzing socioeconomic impacts to end-use customers. There are six components of the proposed rate change that may have the potential to result in socioeconomic consequences: proposed changes to TVA's wholesale Standard Service rate structure; proposed changes to TVA's wholesale Non-Standard Service rate structure; proposed reductions to general service power rates for large commercial consumers; proposed modifications to the total monthly fuel charge allocation methodology; proposed changes to retail power rates and their alignment with wholesale power rates; and the rebalancing of the hydro preference allocation adjustments.

TVA expects no negative financial effects on TVA and the LPCs due to the proposed change in wholesale Standard Service energy rates and introduction of a grid access charge, as the expected change would be revenue neutral for TVA, and analysis of the expected impacts to LPCs over a five-year period demonstrated that there would be no bill impact to LPCs (i.e., the average bill impact would be $0).

There would also be no expected socioeconomic effects resulting from changing resale rates to reflect changes in wholesale power costs and to improve the alignment of retail charges with the new wholesale charges under Alternative B. TVA expects that most LPCs would not alter their Standard Service retail rate structures under Alternative B because the change in the energy rates is small. Therefore, the socioeconomic effects on residential customers for Alternative B would be essentially the same as under Alternative A.

Alternative B would lower rates for large commercial customers by approximately 8 percent and slightly raise rates by approximately 0.3 percent for both Standard Service and large manufacturing customers, resulting in a mix of positive and negative financial effects for these customer classes. The rates for large commercial customers would be more competitive than the current conditions and the rates for both Standard Service and large manufacturing customers would continue to be competitive. The change would be beneficial to commercial customers and only mildly adverse to Standard Service and large manufacturing customers. These changes are expected to have negligible to minor economic effects for the TVA service area.

In its analysis, TVA found that there would be no expected socioeconomic effects resulting from improving fixed cost recovery from consumers with contract demands greater than 5,000 kW served under TOU Service rate schedules by implementing a new rate design. The change under Alternative B would be revenue neutral for TVA, and the bill impacts would be expected to fall within the -2 percent to +5 percent range of proposed structures currently under consideration by TVPPA and TVIC. Analysis of 6 proposed structures for a sample of approximately 50 large consumers has demonstrated that fewer than 10 percent would likely have bill impacts greater than 3 percent under any of the structures currently under consideration.

TVA also found that there would be no expected socioeconomic effects resulting from changing the wholesale rate schedule fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for large customers served under a manufacturing service rate from large customers served under a general service rate. The

change would have no effect on Standard Service power rates and, thus, no effect on residential power rates. Isolating the large general service consumer allocation from the large manufacturing service consumer allocation would have the expected effect of increasing the effective power rates for large general service consumers by approximately 0.3 percent while decreasing the expected effective power rates for large manufacturing service consumers by 0.1 percent. The effect on the large general service consumers would be more than offset by the effects of the reduction in large general service power rates discussed above. The effect on the large manufacturing consumers would be so small as to be undetectable by analysis.

TVA proposes to rebalance the hydro allocation credits (which are distributed to residential consumers) with the hydro allocation debits (which are collected from nonresidential consumers) to reflect the decrease in commercial and industrial sales. This rebalancing has the potential to affect all consumers. Based on the imbalance observed in the previous four fiscal years, there is likely to be no or minimal change to the distribution of credits to residential consumers and a $30 million to $40 million increase in the collection of debits from nonresidential consumers, spread evenly among all nonresidential consumers. The potential increase in rates for nonresidential consumers is estimated to be 0.6 percent. The expected decrease in kWh sales for nonresidential consumers resulting from the increase is 0.04 percent. Consequently, there would be no expected socioeconomic effects for the residential consumers because the level of credits distributed over the most recent four years has been at the Board-approved level of $250 million annually, and the expected socioeconomic effects for nonresidential consumers would be negligible to minor.

Under Alternative B, the cumulative impact of the six components that have the potential for socioeconomic consequences would be an expected net 0.05 percent decrease in kWh sales.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

The proposed changes to rate structures under Alternative C are mostly the same as those proposed under Alternative B, except the amounts of the changes to the Standard Service class would change. Under Alternative C, the wholesale Standard Service energy rates would decrease by $0.01 per kWh, greater than the decrease for Alternative B, and the grid access charge required to maintain revenue neutrality would be correspondingly higher.

As with Alternative B, TVA expects no negative effects to TVA or the LPCs due to revenue neutrality. Analysis of the expected impacts to LPCs over a five-year period demonstrated that the average bill impact for each LPC was zero. Due to the higher grid access charge, cost recovery for TVA would be more stable across months than under Alternatives A and B, a minor positive impact. The expected socioeconomic effects of the proposed wholesale rate change on the resale power rates are discussed in subsequent paragraphs.

Potential effects on residential customers would be different under Alternative C than under Alternative B. TVA expects that most LPCs would change their Standard Service retail rates under Alternative C. As previously discussed, LPCs would have three approaches to changing their retail rates. TVA expects that the effects of the various options would be similar and performed the analysis below assuming that all LPCs adopt LPC-specific default rates developed by TVA. The default rates currently under discussion with TVPPA would provide for no change to the monthly customer charge, a $0.002 increase in the existing energy rate for both the first 500 kWh and second 500 kWh consumed in a month, and a slight decrease in the existing energy rate for electricity over 1,000 kWh in a month.

This change would affect residential households and small businesses differently depending on how much electricity they typically consume. The current monthly customer charges and energy rates vary across LPCs in TVA's service area, and are close to $18.41 per month and $0.0895 per kWh on average, respectively. Table 3 illustrates how monthly bills would change assuming these average values for current rates and new rates under Alternative C of $0.0915 per kWh for the first 1,000 kWh and $0.08571 per kWh for the remaining kWh.

Monthly Electricity Used (kWh)	Current Monthly Bill ($)	Monthly Bill under Alternative C ($)	Difference ($)	Percent Increase
250	$40.79	$41.29	$0.50	1.2%
500	$63.16	$64.16	$1.00	1.6%
1000	$107.91	$109.91	$2.00	1.9%
1500	$152.66	$152.77	$0.10	0.1%
2000	$197.41	$195.62	-$1.79	-0.9%
2500	$242.16	$238.48	-$3.69	-1.5%

Table 3: Illustrative Changes in Monthly Standard Service Bills under Alternative C

The differences in monthly bills are small for a wide range of electricity use, both as absolute amounts (no more than a $2 increase) and as percent changes (no more than a 1.9 percent increase). The maximum increase occurs for households that use exactly 1,000 kWh. Over 2,000 kWh, monthly bills would decrease. The expected decrease for particularly high-usage customers would be about 4 percent (Figure 4).

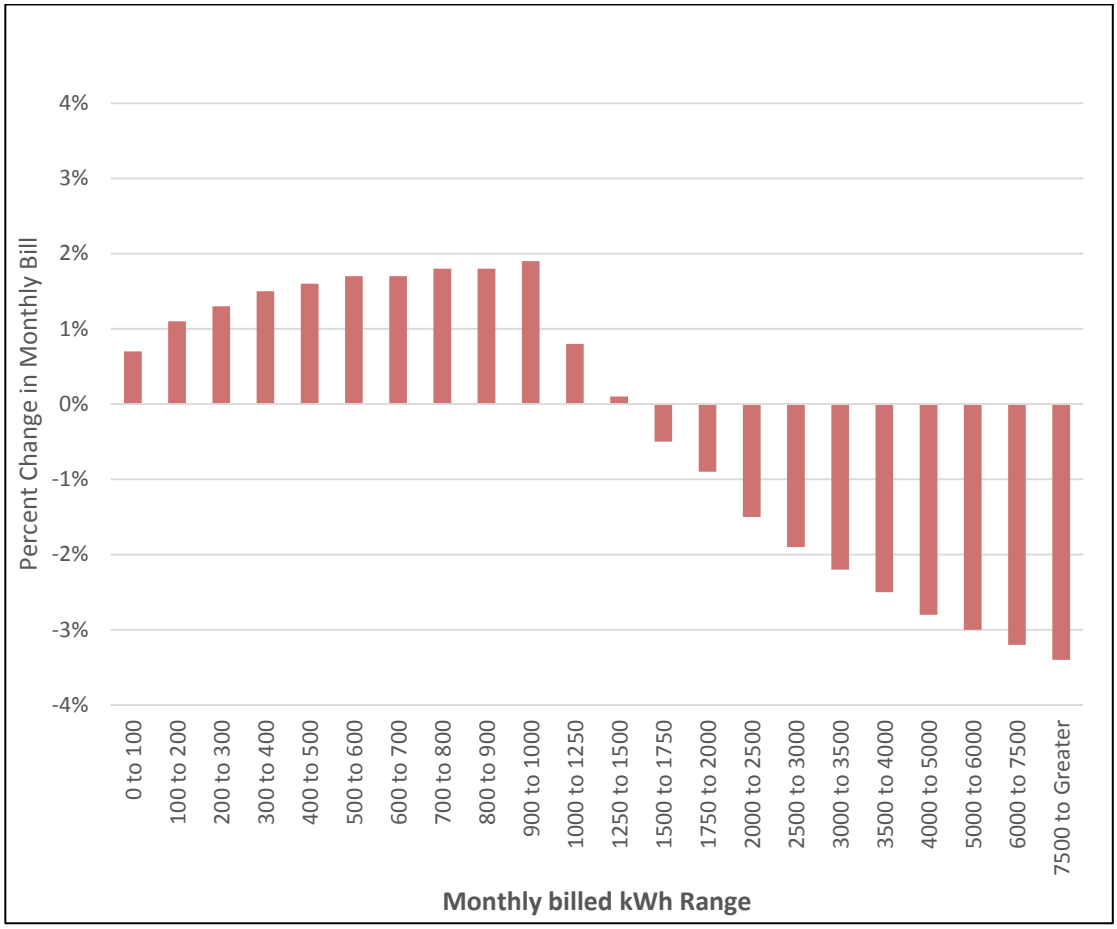

Figure 4: Percent Change in Standard Service Monthly Bills under Alternative C

A difference in Alternative C compared to Alternative A that is not reflected in the calculations above is that for any particular household, the differences may vary throughout the year depending on the season and weather. For example, a household may use more than average electricity during the coldest and warmest months, and less than average electricity in other months. In this case, the household's electricity bills would decrease under Alternative C compared to Alternative A in the colder and warmer months, and would increase in the other months. This additional stability in bill amounts across the seasons results in a potential benefit to all households and particularly to low-income households, for which seasonal fluctuations can result in financial hardships.

The above calculations assume for the purposes of example that households would not change the energy consumed in response to the change in prices. However, it is expected that some households would change the amount of electricity consumed as prices change. TVA estimates that for each 1 percent increase in the total monthly bill, households will reduce consumption by 0.15 percent. For example, for a bill increase of 2 percent, electricity consumed would decrease by 0.3 percent. Alternative C would therefore slightly reduce electricity consumed by lower-use and average-use households and a slight increase in electricity use for higher-use households. Combined, the overall change in residential electricity use is expected to be small.

The expected socioeconomic effects of (1) the proposed changes to TVA's wholesale Non-Standard Service rate structure; (2) the proposed reductions to general service power rates for large commercial consumers; (3) the proposed modifications to the total monthly fuel charge allocation methodology; and (4) the rebalancing of the hydro preference allocation adjustments would be the same under Alternative C as under Alternative B as discussed above.

Under Alternative C, TVA estimates that there would be an expected increase in Standard Service sales of approximately 0.04 percent due to changes in the Standard Service resale rate structures. The cumulative impact of the six components that have the potential for socioeconomic consequences would be an expected net decrease in sales 0.01 percent under Alternative C.

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Socioeconomic effects under Alternative D would be the same as Alternative C, except that the changes in Standard Service wholesale energy rates would be larger (a reduction of $0.025 compared to $0.01), as would the corresponding grid access charge. Alternative D would provide reduced risk for TVA customers resulting from to cost shifting compared to Alternative C due to the larger energy rate reductions with corresponding higher grid access charges. While TVA's proposed default resale rates would be similar under Alternative D as under Alternative C, the larger change in wholesale rate structure to LPCs would provide additional incentive for LPCs to pursue customized rate structures.

There would be an expected increase in Standard Service kWh sales of approximately 0.04 percent due to changes in the Standard Service resale rate structures. The cumulative impact of the six components that have the potential for socioeconomic consequences would be an expected net 0.01 percent decrease in kWh sales under Alternative D. Therefore, all potential socioeconomic impacts on end customers are expected to be similar to Alternative C, but with the potential for larger effects on households depending on how many LPCs pursue customized rate structures.

3.4 Energy Production and Use

3.4.1 Affected Environment

TVA is the largest public power supplier in the United States. Dependable generating capacity on the TVA system is approximately 37,000 megawatts (MW). TVA generates most of this electricity with 3 nuclear plants, 7 coal-fired plants, 9 simple-cycle combustion turbine plants, 7 combined-cycle plants, 29 hydroelectric dams, a diesel generator plant, a pumped storage plant, a methane-gas co-firing facility, a windfarm, and 16 small photovoltaic facilities (TVA 2017). A portion of delivered power is also provided through long-term power purchase agreements. TVA transmits electricity from these facilities over 16,000 circuit miles of transmission lines. Like other utility systems, TVA has power interchange agreements with utilities surrounding its region and purchases and sells power on an economic basis almost daily.

Consumers of TVA-generated electricity consist of a mix of residential, commercial, and industrial customers in the power service area. Recent (2009–2017) energy sales totaled between 133,000 and 161,000 gigawatt-hours (GWh) annually, with sales in fiscal year 2017 of 152,352 GWh. The sales included those to the 154 distributors serving residential, commercial, and industrial customers and 57 directly served large industrial customers and federal installations. In 2017, 25 percent of TVA's power supply was from coal; 38 percent from nuclear; 16 percent from natural gas; 9 percent from non-renewable purchases; 7 percent from hydro; and 5 percent from renewable power purchase agreements.

Although TVA's 2015 IRP study found that that both peak demand and energy demand in the TVA Power Service Area would grow at relatively steady rates into the future (averaging 1.1 and 1.0 percent per year, respectively), more recent predictions indicate that the forecasted load is expected to be flat or even declining slightly, over the next decade. The most recent TVA data and current outlook (TVA 2017) indicate that peak demand and energy demand in the TVA Power Service Area will grow at relatively flat rates, averaging 0.1 and -0.1 percent per year, respectively. These more recent predictions indicate a slightly slower rate for peak and energy demand than was predicted in TVA (2015). In both TVA (2015) and the TVA (2017), bounding scenarios for power planning were analyzed with both greater and lesser growth rates.

When forecasting load demand, TVA must consider how changes to its rate structure may influence demand. The effects of a price change can be gauged by estimating how demand for a product changes as a result of a change in price (Price Elasticity = % Change in Quantity / % Change in Price). In other words, for every 1 percent change in price, demand will change by a certain percentage. Price can be an important driver that explains changes in demand. This estimation is usually done with a statistical regression that controls for changes in historical weather, economics and end-uses, which then isolates the effects of price changes directly.

Based on analysis of TVA's historical price response, the price elasticity in the TVA region is estimated to be -0.15 percent; that is, for every 1 percent increase in bill, TVA expects to see a 0.15 percent decrease in electricity consumption and vice versa.[3] As consumers gain more information about their energy consumption and better technology to manage it, price elasticity may change over time since consumers have greater opportunities to alter their appliance and lighting choices.

[3] This estimate is supported by studies highlighted in Bernstein and Griffin (2006), notably the mean of estimates found in Maddala et al (1997) and Garcia-Cerrutti (2000).

TVA currently has approximately 7,500 MW of renewable energy sourced from approximately 3,200 locations, which puts TVA in the 1st quartile for the percent of utility-scale renewable generation compared to regional peers, and at or above the national median for the amount of distributed generation capacity and average capacity factors for biomass, solar, and wind.

In 2012, there were 1,186 renewable generating systems with a total combined capacity of about 67 MW (DC). (TVA 2015 IRP) Through May 2015, participation had increased to 2,400, with the participation by technology type shown in Table 4 below.

Technology	Residential	Commercial	Total
Solar < 20 kW	1,252	354	**1,606**
Solar > 20 kW	111	639	**750**
Wind	19	10	**29**
Biomass, Landfill Gas	0	10	**10**
Biomass	0	3	**3**
Biomass, Wastewater Gas	0	1	**1**
Low Impact Hydro	0	1	**1**
Total	**1,382**	**1,018**	**2,400**

Table 4. Green Power Providers Participation by Technology Type, May 2015

Through January 2018, there were more than 3,300 installations with a capacity of about 106 MW, with about 90 percent of the capacity from solar photovoltaic energy systems. Although participation in the program increased approximately 38 percent between May 2015 and January 2018, the overall capacity generated from these resources remains very small, at about 0.2 percent of TVA's total generation capacity. Since 2015, TVA has incorporated a distributed solar forecast in its load outlook. The current outlook (TVA 2017) includes a solar customer adoption rate of 2 percent of our customer base during the next decade (i.e., TVA estimates that 2 percent of its customers are likely to install solar photovoltaic systems by 2030).[4]

3.4.2 Environmental Consequences

As noted in Section 3.1, a potential source of environmental impacts results if directly served customers or LPC-served customers increase or decrease their energy use in response to TVA's restructuring of power rates to the extent that TVA must construct new generation facilities, change its operation of existing facilities (either more or less), or alter its mix of energy resources, in response to this change in energy use. With increases or decreases in energy demand, more or less transmission capability may also be needed. This section provides analysis of the potential for each rate change alternative to result indirectly in changes to TVA operations. TVA notes that such an analysis involves speculation, especially

[4] In 2017, TVA estimated that the 2% rate would be achieved within 10 years. After a 30% tariff on imported solar photovoltaic systems was implemented by executive action of the President in January 2018, TVA estimated that the rate of adoption would slow slightly during the 4 years that tariffs are applied, delaying the 2% adoption rate by one to two years.

given that the potential for effects depend on numerous decisions to be made by intervening persons and entities outside TVA's control.

Alternative A (No Action)

Under this alternative, there would be no change in the way TVA currently determines and applies pricing for electricity or the related products, credits and adjustments. Therefore, there would be no short-term effects on energy use.

In the long run, however, TVA may be required to adjust its rates in a manner to address the revenue deficit that may result from flat to declining sales. Adjustments that increase costs to LPCs and consumers may result in changes in behavior and result in the need for TVA to alter its generation, although the extent of such changes remain speculative at this time.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

Six components of the proposed rate change have the potential to result in environmental consequences because they may influence energy use by consumers: proposed changes to TVA's wholesale Standard Service rate structure; proposed changes to TVA's wholesale Non-Standard Service rate structure; proposed reductions to general service power rates for large commercial consumers; proposed modifications to the total monthly fuel charge allocation methodology; proposed changes to retail power rates and their alignment with wholesale power rates; and the rebalancing of the hydro preference allocation adjustments.

Under Alternative B, TVA would reduce wholesale Standard Service energy rates by 0.25 cents per kWh and introduce a wholesale grid access charge that would recover an equivalent amount of revenue. There would be no expected environmental effects due to reducing wholesale Standard Service energy rates by 0.25 cents and introducing a wholesale grid access charge that would recover an equivalent amount of revenue. The change would be revenue neutral for TVA. An analysis of the expected impacts to LPCs over a five-year period demonstrated that the average bill impact for each LPC would be zero. The expected environmental effects of the proposed wholesale rate change under Alternative B to the resale power rates are discussed in subsequent paragraphs.

There would be no expected environmental effects due to improving fixed cost recovery from consumers with contract demands greater than 5,000 kW served under TOU Service rate schedules by implementing a new rate design under this alternative. The change would be revenue neutral for TVA. TVA analysis indicates that the bill impacts would be expected to fall within the -2 percent to +5 percent range of proposed structures previously presented to TVPPA and TVIC. Analysis of six proposed structures for a sample of approximately 50 large consumers has demonstrated that fewer than 10 percent would likely have bill impacts greater than 3 percent under any of the structures previously presented. There are no expected changes in total sales or generation related to the proposed structures under this alternative.

Likewise, no impacts to the environment would result from decreasing wholesale TOU Service energy rates under rate schedules General Service B, C, and D by $23 million and increasing wholesale Standard Service rates and TOU manufacturing service rates approximately 0.3 percent to maintain TVA revenue neutrality. Analysis of the expected changes in sales due to the decreases in large general service power rates and the increases in the Standard Service and large manufacturing service power rates indicates that there would be a less than 0.01 percent decrease in total TVA generation to supply the associated sales.

There would also be no environmental impacts of changing the wholesale rate schedule fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for large customers served under a manufacturing service rate from large customers served under a general service rate. The change would have no effect on Standard Service power rates, and, thus no effect on residential power rates. The effects of isolating the large general service consumer allocation from the large manufacturing service consumer allocation would have the expected effect of increasing the effective power rates for large general service consumers by approximately 0.3 percent while decreasing the expected effective power rates for large manufacturing service consumers by 0.1 percent. Analysis of the expected changes in sales due to the increase in effective large general service rates and the decrease in effective large manufacturing service rates indicates that there would be an approximately 0.002 percent increase in generation to supply the associated sales.

No environmental effects would result from changing resale rates to reflect changes in wholesale power costs and to improve the alignment of retail charges with the new wholesale charges. A reduction in wholesale Standard Service energy rates of 0.25 cents and the introduction of a wholesale grid access charge that would recover an equivalent amount of revenue would not be a change of sufficient magnitude to cause TVA to seek to restructure resale rates. The current resale rates would likely continue to remain in effect. There would be no expected change in sales or in generation.

Finally, there would no environmental impacts from rebalancing the hydro allocation credits distributed to residential consumers with the hydro allocation debits collected from nonresidential consumers to reflect the decrease in commercial and industrial sales. Based on the imbalance observed in the previous four fiscal years, there is likely to be minimal change in the distribution of credits to residential consumers corresponding to a $30 million to $40 million increase in the collection of debits from nonresidential consumers, spread evenly among all nonresidential consumers. Analysis of the expected changes in sales due to the approximately 0.6 percent increase in the effective rates for nonresidential consumers indicates that there would be an approximately 0.04 percent decrease in generation to supply the associated sales.

Cumulatively, the primary components of rate change under Alternative B would be very minor. Alternative B would not require TVA to change its operations or alter its generation and transmission systems. The economic effect, as addressed above, is unlikely to influence the rate of investment in DER among TVA consumers. TVA does not anticipate any direct, indirect or cumulative impacts.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

The six components of the proposed rate change under Alternative C that have the potential to impact the environment are the same as those discussed under Alternative B: proposed changes to TVA's wholesale Standard Service rate structure; proposed changes to TVA's wholesale Non-Standard Service rate structure; proposed reductions to general service power rates for large commercial consumers; proposed modifications to the total monthly fuel charge allocation methodology; proposed changes to retail power rates and their alignment with wholesale power rates; and the rebalancing of the hydro preference allocation adjustments.

TVA's analysis of price elasticity indicates that the total expected change in power sales (kWh) as a result of changing these six components would be a minor decrease of 0.01 percent of those sales. See Table 5 below. The decrease is negligible and would not result in any alterations of TVA operations and would not require any changes to TVA's generation and

transmission systems. The resulting change in energy use is well within the boundaries for energy use in planning scenarios analyzed in TVA (2011) and TVA (2015). This level of change (bounded by the 2011 and 2015 analyses) would be minor and the only likely result is a slight reduction in TVA purchases of energy from other sources or a minor reduction in total energy production from TVA generating facilities.

Of the six components identified above, the potential energy use effects of the proposed changes to TVA's wholesale Non-Standard Service rate structure, proposed reductions to general service power rates for large commercial consumers, proposed modifications to the total monthly fuel charge allocation methodology, and the rebalancing of the hydro preference allocation adjustments would be the same under Alternative C as under Alternative B.

There would be no expected energy use effects due to reducing wholesale Standard Service energy rates by 1 cent and introducing a wholesale grid access charge that would recover an equivalent amount of revenue. The change would be revenue neutral for TVA, and analysis of the expected impacts to LPCs over a five-year period demonstrated that there would be no impact on the average bill for each LPC.

The negligible decrease of 0.01 percent in energy use resulting from the proposed rate change under Alternative C is not expected to have significant net impacts to TVA power supply requirements. Other factors affecting TVA power supply requirements such as weather conditions and the level of economic activity are expected to have much larger influence on TVA energy production. Because of the degree of uncertainty regarding customer response and the expected minor magnitude of any such response, TVA would not alter its demand or energy requirements forecast as a result of proposed rate structure changes. The economic effect - as addressed above - is unlikely to influence the rate of investment in DER among TVA consumers. TVA does not anticipate any direct, indirect or cumulative impacts.

Table 5. Alternative C Price Elasticity Analysis and Potential Change To TVA Power Sales

ALTERNATIVE C ANALYSIS OF PRICE ELASTICITY	Standard Service		Large General Service	Large Manufacturing Service	Total kWh	% Change in kWh Sales
	Residential	Small C&I				
FY 2016 kWh Sales	63,147,047,691	54,504,212,007	4,220,782,935	33,653,180,522	155,525,223,155	
Wholesale Standard Service: The change would be revenue neutral to TVA. Elasticity analysis indicates no expected change in sales volume.	0*	0	0	0	0	0.00%
Wholesale Non Standard Service: The change would be revenue neutral for TVA. Elasticity analysis indicates no expected change in sales volume.	0	0	0	0	0	0.00%
General Service Rates for Large Consumers: Decrease wholesale TOU Service energy rates under schedules General Service B, C, and D by $23 million and to increase wholesale Standard Service rates and TOU manufacturing service rates approximately 0.3% to maintain TVA revenue neutrality. Elasticity analysis indicates a very small net decrease in kWh sales.	(20,131,096)	(18,288,230)	32,434,440	(7,326,356)	(13,311,243)	(0.01%)
Total Monthly Fuel Charge: Change the wholesale rate schedule fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for large customers served under a manufacturing service rate from large customers served under a general service rate. Elasticity analysis indicates a net change in kWh sales that approaches zero.	1,382,152	1,255,625	(1,220,496)	2,322,956	3,740,237	0.00%
Retail Rates: Change resale rates to reflect changes in wholesale power costs and to improve the alignment of retail charges with the new wholesale charges.	30,907,792	31,672,343	0	0	62,580,135	0.04%
Hydro Preference Allocation Rebalancing: No change to residential hydro allocation credits or residential sales volume is expected. Elasticity analysis indicates that the increase in the effective rates for non residential consumers will result in a 0.04% decrease in total sales volume.	0	(38,095,016)	(2,410,145)	(26,985,056)	(67,490,217)	(0.04%)
Total Expected Change in Sales Volume	***12,158,848***	***(23,455,279)***	***28,803,799***	***(31,988,456)***	***(14,481,088)***	***(0.01%)***

* The zero inserted for Wholesale Standard and Non Standard Service denotes that the changes at wholesale are unlikely to prompt or incent any changes by LPCs in their behavior.

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative D, TVA would reduce wholesale Standard Service energy rates by 2.5 cents per kWh and would introduce a wholesale grid access charge that would recover an equivalent amount of revenue. The six components of the proposed rate change that may have environmental consequences are the same as previously identified for Alternatives B and C: proposed changes to TVA's wholesale Standard Service rate structure; proposed changes to TVA's wholesale Non-Standard Service rate structure; proposed reductions to general service power rates for large commercial consumers; proposed modifications to the total monthly fuel charge allocation methodology; proposed changes to retail power rates and their alignment with wholesale power rates; and the rebalancing of the hydro preference allocation adjustments.

TVA's analysis of price elasticity indicates that the total expected change in power sales (kWh) as a result of changing these six components would be a minor decrease of 0.01 percent of those power sales. See Table 6 below. The decrease is negligible and would not result in any alterations of TVA operations and would not require any changes to TVA's generation and transmission systems. The resulting change in energy use is well within the boundaries for energy use in planning scenarios analyzed in TVA (2011) and TVA (2015). This level of change (bounded by the 2011 and 2015 analyses) would be minor and the only likely result is a slight reduction in TVA purchases of energy from other sources or a minor reduction in total energy production from TVA generating facilities.

As shown in the table, under Alternative D, there would be no effects resulting from reducing wholesale Standard Service energy rates by 2.5 cents and introducing a wholesale grid access charge that would recover an equivalent amount of revenue. The change would be revenue neutral for TVA. TVA's analysis of the expected impacts to LPCs over a five-year period demonstrated that there would be no bill impact on the average bill for each LPC by altering the wholesale Standard Service energy rate as proposed under Alternative D. TVA does not foresee, therefore, that the wholesale rate change would result in change to energy use.

Likewise, the expected energy use effects of the proposed changes to TVA's wholesale Non-Standard Service rate structure; proposed reductions to general service power rates for large commercial consumers; proposed modifications to the total monthly fuel charge allocation methodology; and the rebalancing of the hydro preference allocation adjustments would be the same under Alternative D as under Alternative B and C, as discussed above.

As under Alternative C, the negligible decrease of 0.01 percent in energy use resulting from the Alternative D is not expected to have significant net impacts to TVA power supply requirements. Other factors affecting TVA power supply requirements have much larger influence on TVA energy production. Because of the degree of uncertainty regarding customer response and the expected minor magnitude of any such response, TVA would not alter its demand or energy requirements forecast as a result of proposed rate changes. The economic effect, as addressed above, is unlikely to influence the rate of investment in DER among TVA consumers. TVA does not anticipate any direct, indirect or cumulative impacts.

Table 6. Alternative D Price Elasticity Analysis and Potential Change To TVA Power Sales

ALTERNATIVE D ANALYSIS OF PRICE ELASTICITY	Standard Service		Large General Service	Large Manufacturing Service	Total kWh	% Change in kWh Sales
	Residential	Small C&I				
FY 2016 kWh Sales	63,147,047,691	54,504,212,007	4,220,782,935	33,653,180,522	155,525,223,155	
Wholesale Standard Service: The change would be revenue neutral to TVA. Elasticity analysis indicates no expected change in sales volume.	0	0	0	0	0	0.00%
Wholesale Non Standard Service: The change would be revenue neutral for TVA. Elasticity analysis indicates no expected change in sales volume.	0	0	0	0	0	0.00%
General Service Rates for Large Consumers: Decrease wholesale TOU Service energy rates under schedules General Service B, C, and D by $23 million and to increase wholesale Standard Service rates and TOU manufacturing service rates approximately 0.3% to maintain TVA revenue neutrality. Elasticity analysis indicates a very small net decrease in kWh sales.	(20,131,096)	(18,288,230)	32,434,440	(7,326,356)	(13,311,243)	(0.01%)
Total Monthly Fuel Charge: Change the wholesale rate schedule fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for large customers served under a manufacturing service rate from large customers served under a general service rate. Elasticity analysis indicates a net change in kWh sales that approaches zero.	1,382,152	1,255,625	(1,220,496)	2,322,956	3,740,237	0.00%
Retail Rates: Change resale rates to reflect changes in wholesale power costs and to improve the alignment of retail charges with the new wholesale charges.	30,907,792	31,672,343	0	0	62,580,135	0.04%
Hydro Preference Allocation Rebalancing: No change to residential hydro allocation credits or residential sales volume is expected. Elasticity analysis indicates that the increase in the effective rates for non residential consumers will result in a 0.04% decrease in total sales volume.	0	(38,095,016)	(2,410,145)	(26,985,056)	(67,490,217)	(0.04%)
Total Expected Change in Sales Volume	***12,158,848***	***(23,455,279)***	***28,803,799***	***(31,988,456)***	***(14,481,088)***	***(0.01%)***

3.5 Air Resources

3.5.1 Affected Environment

Air quality is an important environmental resource. Poor air quality can affect our health, ecosystem health, forest and crop productivity, economic development and our enjoyment of scenic views.

Through its passage of the Clean Air Act (CAA), Congress has mandated the protection and enhancement of our nation's air quality resources. National ambient air quality standards (NAAQS) for the following criteria pollutants have been set to protect the public health and welfare:

- Sulfur dioxide (SO_2)
- Ozone (O_3)
- Nitrogen dioxide (NO_2)
- Particulate matter whose particles are $\leq$10 micrometers
- Particulate matter whose particles are $\leq$ 2.5 micrometers ($PM_{2.5}$)
- Carbon monoxide
- Lead

TVA coal-fired and natural gas fired electric generating facilities either directly emit these pollutants or contribute to their formation (O_3 and $PM_{2.5}$) in certain atmospheric conditions. Generally, TVA's hydro, nuclear, and renewable energy facilities do not directly contribute to air emissions. TVA has installed air emission controls at its fossil fueled facilities to reduce air emissions. For instance, TVA has installed selective catalytic reduction systems on 21 of its coal units and all of its natural gas fired combined cycle plants to reduce nitrogen oxide emissions, and has equipped 60 percent of its coal-fired capacity with scrubbers to address reduce sulfur-dioxide emissions. These emissions are expected to go down even further when coal-fired units at Allen are replaced with a combined cycle gas plant. Areas not meeting the standards are called "nonattainment" areas; there are no nonattainment areas designated within the TVA Power Service Area.

Hazardous Air Pollutants (HAPs) are toxic air pollutants, which are known or suspected to cause cancer or other serious health effects or adverse environmental conditions. The CAA identifies 187 pollutants as HAPs. Most HAPs are emitted by human activity, including motor vehicles, factories, refineries and power plants. Mercury is the HAP compound most associated with the burning of coal and power plant emissions. Other important issues concerning power plant emissions are acid deposition related to SO_2 and NO_x emissions, and visibility impairment, related in the TVA region mostly to ammonium sulfate particles formed from SO_2 emissions from coal-fired power plants. The most sensitive areas in the region are high elevation, forested areas such as the Great Smoky Mountains National Park. The nature of these pollutants, their effects and relationships to power production and industry are discussed more fully in TVA's 2015 IRP Supplemental EIS.

The primary greenhouse gas emission emitted by electric utilities is CO2, produced by the combustion of coal, natural gas, and other fossil fuels. Under the IRP, TVA CO_2 emissions (measured by tons and by the emissions rate) resulting from the power generated by TVA and non-TVA facilities and marketed by TVA are anticipated to decline (see Figures 4-7 and 4-8 of TVA 2015).

The particular environmental attributes including emissions for the TVA generation fleet and totals for individual types of generating units (including natural gas-fired combustion turbines and combined cycle turbines), are presented in Tables 7-1 and 7-2 of TVA's IRP Supplemental EIS (2015).

3.5.2 Environmental Consequences

Alternative A (No Action)

Under the No Action Alternative there would be no incremental effect from a rate change on air pollutant emissions and air quality of the region. As identified above and in TVA (2015), current trends in air quality would continue.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

As discussed in the socioeconomic and energy use sections, implementing Alternative B is unlikely to result in any change to retail rates of customers. Thus, there would be no discernible change in energy use. The proposed rate change under Alternative B is relatively small and TVA projects that it is unlikely that most LPCs would pass on the grid access charge to customers. Because the change would not result in any alteration of TVA's generation operations, the current conditions and trends in air quality for the region, as discussed above and in TVA (2015), would continue.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

As discussed above in the socioeconomic and energy use sections, the potential economic impacts and energy use changes under Alternative C are expected to be so small as to be indiscernible. Energy use changes, if any, would be so small that associated increases in ambient air pollution levels (air quality) would not be identifiable. Thus, as under Alternative B, the current conditions and trends in air quality for the region are generally expected to continue.

While an increased fixed cost may influence customers' investment in on-site energy (if LPCs elect to pass along the rate change to customers), any change in customer use of the energy source would be so small that any associated changes in TVA power generation and any resulting ambient air pollution or GHG levels would not be identifiable (TVA assumes that any additional generation needs would be met by natural gas generation due to its low cost).

Although such increases would be indiscernible, TVA notes that any potential changes to air emissions, including release of greenhouse gases, associated with Alternative C are easily bounded by analysis in its 2015 IRP.

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative D, TVA would implement the greatest reduction in wholesale Standard Service energy rates and correspondingly grid access charge. Although the proposed reduction in energy rates and corresponding grid access charge under Alternative D are greater than under Alternative C, the proposed rate change would result very small economic and energy use changes. Similar to Alternatives B and C, then, TVA does not foresee that the rate change would require TVA to change its operations or make modifications to its generation or transmission system. If any change to TVA operations were to result, it would likely be so small that associated increases in ambient air pollution levels would not be identifiable. As with under Alternative B and C, the current conditions and trends in air quality for the region are generally expected to continue.

As with Alternative C, the rate change may influence customers' investment in on-site energy sources but such effects would be so small that associated changes in TVA power generation (and resulting ambient air pollution or GHG levels) would not be identifiable. Although generation changes would be indiscernible, TVA notes that any potential changes to air emissions, including release of greenhouse gases, associated with Alternative C are easily bounded by analysis in its 2015 IRP.

3.6 Water Resources

3.6.1 Affected Environment

The quality of the region's water (surface water and groundwater) is critical to protection of human health and aquatic life. Major watersheds in the TVA region include the entire Tennessee River basin, most of the Cumberland River basin, and portions of the lower Ohio, lower Mississippi, Green, Pearl, Tombigbee, and Coosa River basins. As described in detail in TVA's 2015 IRP EIS, these water resources provide habitat for aquatic life, recreational opportunities, domestic and industrial water supplies, and other benefits. Wastewater discharges from cities or industries and runoff from nonpoint source activities such as construction, agriculture, mining, and air deposition can potentially degrade water quality.

Pollution involves the presence or introduction of a substance or thing into water resources that may harm the water resource and impact its beneficial uses, such as swimming or aquatic life. Every two years, states are required to submit a 303(d) report to the U.S. Environmental Protection Agency (EPA). This report identifies the "impaired" lakes and streams that are not complying with water quality criteria and, consequently, are not suitable for their designated use. Thus, each state's 303(d) reports provide an updated overview of assessed water quality in each state.

Sources of degraded water quality include:

- Wastewater discharges from municipal sewage treatment systems, industrial facilities, concentrated animal feeding operations and other sources;
- Runoff discharge from agriculture, forest management activities, urban uses and mine lands, which transport sediment and other pollutants into streams and reservoirs. Runoff from commercial and industrial facilities and some construction sites is regulated through state National Pollutant Discharge Elimination System (NPDES) storm water permitting programs. The other sources not regulated through the NPDES program are referred to as "nonpoint source" runoff;
- Cooling systems such as those used by electrical generating plants and other industrial facilities to withdraw water from streams or reservoirs, use it to cool facility operations, and then discharge the heated water into streams and reservoirs. Impacts result from temperature changes, the trapping of organisms against intake screens or sucking them through the facility cooling system. These water intakes and discharges are controlled through state-issued NPDES permits; and
- Air pollution in the form of airborne pollutants such as mercury being spread through rainfall and deposition.

Additional regulatory protections for water quality and the mechanisms of how power generation can affect water quality and aquatic life are discussed in detail in the TVA (2011) and TVA (2015) EISs.

Groundwater refers to water located beneath the surface in rock formations known as aquifers. Eight major aquifers occur in the TVA region. Approximately half of the region has limited groundwater availability because of natural geo-hydrological conditions. More than 64 percent of the region's residents rely totally, or in part, on groundwater for drinking water. More than 1.7 million residents (22 percent) in the region maintain individual household groundwater systems, usually a well. All areas in the Tennessee Valley region can generally supply enough water for at least domestic needs. For the most part, the groundwater quality is adequate to support existing water supply uses even though some minimal treatment, such as filtration and chlorination, is sometimes required. Generating facilities involving combined-cycle combustion turbines often make use of groundwater for either cooling or reinjection of heated water.

3.6.2 Environmental Consequences

Impacts potentially occurring from rate changes are associated with changes in economic activity and those associated with changes in power demand. Increases in regional employment, income, or population can result in increased water demands, construction activities, and wastewater discharges. Likewise, increases in power demand can require additional generation and transmission facilities or longer operation of existing facilities.

Alternative A (No Action)

Under this alternative there would be no rate-related, incremental changes associated with operation of TVA generating facilities and consequently no addition or lessening of operational effects as identified in TVA's 2011 IRP or its 2015 update.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

The potential economic and energy use changes for Alternative B are not expected to result in any change in energy use. The change would not result in any alteration of TVA's generation or transmission systems, and no changes of any kind are expected to energy use. Thus, no impacts to water resources would result from implementing Alternative B and the current condition of water quality for the region is generally expected to continue.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

A greater energy rate reduction and grid access charge is proposed under Alternative C than Alternative B. As noted above, very small economic and energy use changes may be associated with Alternative C. TVA's analysis indicates that such small changes would not necessitate changes to TVA's operations, modifications to TVA's generation or transmission systems; if changes are necessary, it is most likely that they would be very small. As with Alternative B, then, there would be essentially no or only extremely minor impacts to water resources from implementing this alternative and current water quality conditions for the region would be unaffected.

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Alternative D would result in the greatest reduction in wholesale Standard Service energy rates and correspondingly highest grid access charge. As noted above in the economic and energy use sections, Alternative D is expected to result in a very small change in energy use. Such a small change would not necessitate changes to TVA's operations or modification of its generation or transmission systems. Similar to Alternative C, there would be essentially no or only extremely minor impacts to water resources from implementing Alternative D and the current condition of water quality for the region is generally expected to continue.

3.7 Land Use

3.7.1 Affected Environment

TVA provides wholesale power to portions of a seven state region of 80,000 square miles. Major land uses in the TVA region include forestry, agriculture and urban/suburban/industrial development. Regional development is described in detail in TVA (2015). Of the non-federal land in the TVA region about 12 percent is considered developed and 88 percent as rural.

TVA's existing power plant reservations, excluding the hydroelectric plants associated with multi-purpose reservoirs, occupy about 25,000 acres. The actual disturbed acreage of these non-hydroelectric facilities is about 17,400 acres. Existing non-TVA generation facilities from which TVA purchases power under power purchase agreements utilize an area of approximately 2,400 acres.

3.7.2 Environmental Consequences

As stated in Section 3.1, different pricing structures for electricity may induce behavior that leads to creating, maintaining, or eliminating jobs and the development of new plants or facilities. Estimating potential changes to land use and development from rate change is a largely speculative undertaking because power rates are just one factor among many that influence decisions about land use and development.

Alternative A (No Action)

Under the No Action Alternative customers would continue to factor the current TVA rate structure into their decisions about siting of facilities and use of electricity. Since TVA would take no actions that might induce substantive increases in use of energy, there would be no need for additional generation facilities related to this rate change. Regional land use, trends and development in the TVA region would continue as identified in TVA's 2011 IRP and its 2015 update.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative B, a minor change to power rates would be implemented. The potential for these changes to result in an appreciable change in energy use is highly unlikely; TVA projects that most LPCs will not pass along the rate change to customers. As noted above, Alternative B would not result in changes in energy use nor changes to TVA's operations or generation or transmission systems. Thus, the change would not influence the construction of new industrial or commercial facilities, the expansion of existing facilities, or the closing of existing facilities; it would not require the construction of new generating or transmission facilities or even any discernible changes in how existing facilities are operated. Therefore, there would be no land use impacts from Alternative B.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative C, the change in energy use predicted is expected to be very small. The very small changes to energy use are not expected to require the construction of new industrial or commercial facilities, the expansion of existing facilities, or the closing of existing facilities or require the construction of new generating or transmission facilities. There would be no discernible changes in how existing TVA facilities are operated. The very small change in energy use would be unlikely to spur or slow economic activity that would lead to land use trends across the Valley, although the change could influence some individuals' and companies' decisions related to investment in self-generation and the associated use of their property. Decisions made by some individuals or companies to invest in self-generation would

not result in any change in land use trends across the Valley

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative D, TVA would implement the greatest reduction in wholesale Standard Service energy rates and correspondingly highest grid access charge. The potential impacts to land use trends under Alternative D are the same as Alternative C. The very small change in energy use is not expected to impact land use.

3.8 Solid and Hazardous Waste Generation

3.8.1 Affected Environment

Residential, Commercial and Industrial Wastes

Residential and commercial wastes are usually generated in many, diffusely located areas and handled at municipal solid waste landfills. Most municipalities and counties currently engage in long-range planning processes to ensure that adequate capacity is provided for solid wastes generated within their jurisdictions. Solid waste reduction and recycling is an important emphasis in most of these plans. For example, in the state of Tennessee, in 2014 Tennessee businesses, industries, citizens and others disposed of 11,66,791 tons of solid waste, which equated to 5.15 pounds of waste per person per day. Of this amount 6,142,247 tons went to Class 1 landfills and 5,524,544 tons were recycled, reused or diverted to other facilities. Using 1995 as the base year, per capita waste reduction and diversion rate for 2014 was 30.0 percent, compared with 22.6 percent in 2000 (TDEC 2015).

Tennessee, as well as other states in the Valley, has also implemented a program for collection and safe storage and disposal of household hazardous waste (HHW). The program collects and properly disposes of paint, flammable liquids, corrosives, oxidizers, batteries, and pesticides. Ninety-four counties in Tennessee have participated in the mobile collection service since it began in 1993 and an average event yielded 4,592 pounds of HHW (with a 0.6 percent participation rate). (TDEC 2015)

Industrial solid and hazardous waste generation and handling is similar. Current legislative and regulatory programs encourage and/or mandate the reduction, recycling, and proper disposal of industrial solid and hazardous wastes. The states within the TVA power service area have state-administered, Resource Conservation and Recovery Act *(*RCRA) equivalent programs, which emphasize waste reduction, recycling, and proper handling and disposal of solid and hazardous wastes. Industries benefit both financially and from a public relations standpoint by engaging in waste reduction and recycling opportunities in the same way that TVA benefits from its marketing and utilization of coal combustion residuals (CCR) that are a by-product of coal-based generation. It is, therefore, likely that industrial solid and hazardous waste generation and disposal will continue to decline in the future.

TVA-Generated Wastes

Types of wastes typically produced by construction activities whether by TVA or others include vegetation, demolition debris, oily debris, packing materials, scrap lumber, and domestic wastes or garbage. Non-hazardous wastes (excluding CCR) typically produced by common operation of TVA facilities include sludge and demineralizers from water treatment plant operations, personal protective equipment, oils and lubricants, spent resins, desiccants, batteries and domestic waste. Between 2010 and 2013, TVA facilities produced approximately 21,000 tons of solid waste per year.

TVA facilities include large, small, and very small quantity generators (previously conditionally exempt generators) of hazardous waste. Hazardous non-radiological wastes typically produced by common TVA facility operations include paint and paint solvents, paint thinners, discarded out-of-date chemicals, parts washer liquids, sand blast grit, chemical waste from cleaning operations and broken fluorescent bulbs. Routine operations between 2010 and 2013 annually created about 35,537 kilograms of hazardous waste annually and 39,710 kilograms of Toxic Substances Control Act (TSCA) and universal wastes. TVA's hazardous wastes and those requiring special handling (TSCA and universal waste) are generally shipped to Waste Management's Emelle, Alabama facility for disposal. TVA reduction programs for hazardous waste, based upon source reduction, have been in place on the TVA system for some time.

Coal combustion solid wastes or residues (i.e. CCR) include fly ash, bottom ash, boiler slag, char spent bed material and sludge from operation of wet flue gas desulfurization systems. In the past, the EPA has determined that CCRs are not hazardous and in April 2015 decided to continue to regulate them as nonhazardous, solid waste. In 2015, TVA produced approximately 3.9 million tons of CCRs of which 33.6 percent was utilized or marketed (TVA 2016). Annually CCR production at TVA's coal-fired plants fluctuates due to a variety of factors including primarily: plant planned and forced maintenance outages, load swings, plant dispatch (the process by which plants are directed to increase or decrease power generation based on the cost of production at each plant—generally the larger, more efficient units run more and the smaller, less efficient units run less), and variation in fuel supplies (BTU, sulfur, and ash content of the fuels burned). Additionally, recent decisions to retire coal-fired generation further reduce the amount of CCRs generated by TVA at its plants. The amount of CCRs that are disposed also is reduced through marketing and utilization of these by-products in a number of commercial applications including use of fly ash in concrete products, bottom ash as aggregate in cement block manufacturing, boiler slag for roofing granules and industrial abrasives, and scrubber gypsum in gypsum wallboard and cement manufacturing.

3.8.2 Environmental Consequences

Alternative A (No Action)

Current trends in waste production and reduction as identified in the example for Tennessee above and in TVA (2011) and TVA (2015) would continue for TVA in the region.

Alternative B (Reducing the Wholesale Standard Service Energy Rate by 0.25¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative B, a minor change to power rates would be implemented. As noted above, no changes to energy use and no changes to TVA operations or its systems would result. Because TVA does not project any change to energy use, no additional waste generation, by TVA or others, would result from the implementation of Alternative B.

Alternative C (Reducing the Wholesale Standard Service Energy Rate by 1¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative C, the change in energy use predicted is expected to be very small. Energy use changes, if any, would be so small that any associated increases in waste generation would not be identifiable. The rate change would not result in discernible changes in residential, commercial or industrial waste generation as well; the rate change would be unlikely to spur or slow economic activity in the TVA service area that may affect the generation of waste.

Alternative D (Reducing the Wholesale Standard Service Energy Rate by 2.5¢ per kWh and Adding Corresponding Grid Access Charges)

Under Alternative D, TVA would implement the greatest reduction in wholesale Standard Service energy rates and correspondingly highest grid access charge. However, like Alternative C, the change in energy use predicted is expected to be so small that any associated increases or decreases in waste generation would not be identifiable. No discernible change to the residential, commercial or industrial waste generation is anticipated. Thus, minimal to no effects to waste generation are anticipated.

3.9 Summary of TVA Commitments and Proposed Mitigation Measures

Due to the minor and insignificant impacts identified for the action alternatives, there are no TVA commitments or proposed mitigation measures identified for implementation of this action.

3.10 Cumulative Impacts

The nature of conducting analyses of proposed rate changes complicates the review of potential cumulative impacts of such actions. By following the analytical framework presented in section 3.1, some estimations may be made regarding the potential that such actions may result in cumulative impacts.

Cumulative impacts are addressed in the socioeconomics section above. As noted therein, economic impacts could be experienced by consumers if TVA implements additional rate changes in the future to recover greater portions of its fixed costs. Should TVA implement additional rate changes in the future, the cumulative impacts of those changes may resemble the impacts analyzed in the review of Alternative D, which would implement a much greater fixed cost recovery than other alternatives and result in the greatest grid access charge and corresponding energy rate decrease. As noted above, TVA found very minor economic effects associated with implementation of Alternative D and found that there would be no or indiscernible environmental impacts. Potential future rate changes to recover fixed costs would most likely be minor and implemented gradually, when compared to Alternative D, thereby further minimizing the potential for effects. Generally, when a proposed action does not result in direct or indirect effects on a resource, there would be no cumulative impacts to that resource. In its analysis, TVA found there would be no direct environmental impacts and that there would be indiscernible or no indirect environmental impacts associated with the rate change alternatives. Therefore, no cumulative impacts or only marginal cumulative impacts associated with the rate change alternatives are predicted.

TVA has identified numerous other related activities that may cumulatively affect resources of concern. Among the other activities conducted by TVA with potential to influence consumer behavior and investment in DER are the Green Power Providers (discussed above) and Green Power Switch programs, TVA economic development efforts, and TVA energy efficiency programs for residences, businesses, and industries (e.g., EnergyRight Solutions). Some of these activities have potential to influence the rate of adoption of DER across the Tennessee Valley. Other Federal programs and policies may influence energy use in the Tennessee Valley as well as the rate of investment in DER by private consumers. These include tax credits or deductions for renewable energy initiatives, trade tariffs applied to DER components, and programs by other Federal agencies (e.g., Department of Energy) addressing DER. In addition, many LPCs conduct related activities that influence customer behavior, investments in DER, and energy efficiency, which influences energy use.

TVA utilizes its Integrated Resource Planning process to consider the cumulative market and social forces that these programs, as well as other relevant inputs, have on TVA's energy generation and to provide direction on how to best meet future electricity demand. The 2015 IRP provides an important discussion regarding past, present, and foreseeable activities that influence energy use, and the EIS that accompanied it describes cumulative impacts. The impacts associated with the alternatives analyzed in this EA are easily bounded by analyses in TVA's IRP.

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CHAPTER 5 - LITERATURE CITED

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APPENDIX A

TVA Rate Change Letter to Local Power Companies (August 9, 2017)

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

August 9, 2017

Dear Local Power Company:

Since the fall of 2013, TVA, local power companies (LPCs), and their customers have worked collaboratively to develop and implement a Strategic Pricing Plan (SPP) which focuses on TVA's long-term pricing efforts. The SPP provides a long-term direction in three areas: improved pricing, fixed-cost recovery, and encouraging economic technology investments. The rate change implemented in 2015 focused primarily on improving pricing by better aligning rates with underlying cost drivers. The 2018 rate change will maintain this focus. Accordingly, TVA is proposing changes to the Schedule of Rates and Charges attached to and made a part of our Power Contract.

TVA and the Tennessee Valley Public Power Association's Rates and Contracts Committee (TVPPA) have discussed changes to wholesale and resale rates since the fall of 2016. The enclosure to this letter describes TVA's rate change proposal. In accordance with the provisions of the section entitled "Adjustment and Change of Wholesale Rate and Resale Rates" of the Schedule of Terms and Conditions of the Power Contract, and consistent with our collaboration with you, we believe revenue-neutral structural changes are warranted to the Schedule of Rates and Charges. TVA is requesting that you or your representative continue to meet with us and endeavor to reach agreement with respect to the proposed changes.

We understand that TVPPA will be serving as the representative for most LPCs. If that is not the case for your system, please contact your TVA Customer Service Manager.

The proposed changes described in the enclosure do not reflect any rate adjustments that may take place between today and the implementation date of the rate change. The proposed rate change is not intended to raise additional revenue for TVA. However, individual systems and their customers may see some effects on their bills, and we will assist you in analyzing, understanding, and planning for these changes in the coming months.

We look forward to discussing this proposal with you. If you have any questions or need any additional information, please contact your TVA Customer Service Manager.

Sincerely,

Cass Larson
Vice President
Pricing & Contracts

Daniel P. Pratt
Vice President
Customer Delivery

TVA RATE CHANGE PROPOSAL

TVA has worked since the fall of 2016 with the Tennessee Valley Public Power Association's Rates and Contracts Committee (TVPPA) and is proposing the rate change and related matters set forth below:

I. Wholesale Rates

The currently available wholesale rate schedule (Schedule WS) would be replaced by a changed wholesale rate schedule that would be more particularly developed in conjunction with Local Power Companies (LPCs) over the next 180 days. Generally, the proposed wholesale rate changes include, but are not limited to, the following:

1. Reducing seasonal wholesale standard service energy charges by $1.2 billion per year (which is approximately 1 cent per kWh) and introducing a new wholesale fixed-cost recovery charge that would recover an equivalent amount of revenue. TVPPA has suggested modifying this proposal by reducing standard service energy charges by a lower amount, such as $300 million per year (which is approximately 0.25 cent per kWh). Currently, the proposed design for a new wholesale fixed-cost recovery charge is a fixed-cost recovery charge that would be allocated to each LPC based on its percentage contribution to the total TVA standard service energy usage during a historical baseline period and reset on an agreed upon schedule (such as a 5-year baseline with a rolling reset)

Alternative allocation methodologies would also be considered. Examples of such alternatives have included allocations based on cost-of-service or a contract demand requirement. Under any alternative, all such new wholesale fixed-cost recovery charges would be subject to TVA rate adjustments.

2. Changing TOU Service rates applicable to Large Customers (as defined in the wholesale power rate schedule) and all corresponding retail rates to reflect new fixed-cost recovery charges designed (a) to recover a percentage of TVA total revenue from all Large Customers and (b) to convert volumetric energy rates into a contract demand charge. The wholesale power rate schedule and all corresponding retail rate schedules would be re-issued and their underlying rates would be modified to appropriately reflect the new fixed-cost recovery charges.

3. Moving specifically stated hydro allocation wholesale rate schedule adjustment 2 charges (debits and credits) from the wholesale rate schedule to the Adjustment Addendum. The changed adjustment 2 would instead provide that LPCs' power bills are subject to the hydro allocation adjustments in the current Adjustment Addendum published by TVA to reflect the value of the hydro generation benefits allocated by TVA to residential customers. The hydro allocation adjustments would continue to be subject to the same yearly re-computation and adjustment schedule, and LPCs would also continue to report required hydro allocation data to TVA on a monthly schedule.

4. Moving the embedded hydro allocation wholesale rate schedule adjustment 4 charges from the TOU Service demand and energy charges to the Adjustment Addendum. The currently effective wholesale schedule adjustment 4 recognizes that the TOU Service demand and energy charges contain embedded debit components which, together with the wholesale rate schedule adjustment 2, are designed to reflect the value of the hydro generation benefits allocated by TVA to residential customers. The changed adjustment 4 would provide that TOU Service demand and energy charges would be increased or decreased to appropriately reflect the value of the hydro generation benefits allocated by TVA to residential customers in accordance with the hydro allocation adjustments in the current Adjustment Addendum published by TVA. The adjustment 4 hydro allocation adjustments would continue to be subject to adjustment by TVA from time to time.

5. Changing the hydro allocation debit and credit methodology. TVA and TVPPA will analyze alternative hydro debit and credit structures and credit levels with special attention focused on residential customer impacts. Any changes would be revenue-neutral relative to the currently designated value of the hydro generation benefit and implemented via the Adjustment Addendum.

6. Decreasing wholesale TOU Service demand and energy rates under general power rate schedules GSB, GSC, and GSD. In order to maintain revenue neutrality, wholesale Standard Service rates and/or TOU Service manufacturing power rates would be increased. Changes proposed under this section would be guided by cost of service and commercial competitiveness study data.

7. Transitioning all non-fuel wholesale adjustment addendum amounts, including the environmental adjustment, that are applicable prior to the effective date of the Rate Change, into the wholesale base charges. This section would be applied only to the extent it is administratively practical.

8. Eliminating or phasing-out, by October 2018, the availability of wholesale mid-month billing arrangements. Such wholesale mid-month billing arrangements are currently implemented through a rider to the wholesale power rate schedule. Under this proposal, the availability of those riders would be eliminated or phased-out.

9. Changing the wholesale rate schedule adjustment 1 fuel cost adjustment resource cost allocation methodology to isolate the cost allocation weighting for Large Customers served under a manufacturing service rate from Large Customers not served under a manufacturing service rate. This change would be expected to have the effect of lowering these manufacturing customers' fuel cost adjustment amounts.

II. Resale Rates

To enable LPCs to continue operating on a financially sound basis after the wholesale rate change, TVA would make the following changes to the resale rate schedules:

1. Change resale rates to reflect changes in wholesale power costs.

2. Improve the alignment of new wholesale charges with retail, provided, however, that any such change for Large Customers at retail would occur concurrently with wholesale changes made under section I.2 above.

3. Transition hydro allocation adjustments from the rate schedule base charges to the Adjustment Addendum.

4. Transfer all non-fuel Adjustment Addendum amounts, including the environmental adjustment, that are applicable prior to the effective date of the Rate Change, into the rate schedule base charges. This section would be applied only to the extent it is administratively practical.

5. For service to customers for which the LPC is billed under Standard Service charges, increase the power cost recovery component of resale rates to account for anticipated bill impacts resulting from changed Standard Service wholesale rates.

III. Other matters to be discussed in conjunction with the Rate Change

TVA proposes to explore with LPCs additional opportunities to simplify rate schedule language and improve processes for approving and publishing rates and rate-related documents. Proposed improvements include, but are not limited to, the following:

1. ESS Reporting. Revise the current ESS reporting requirements to remove outdated references and reflect the intent of reporting requirements in a more general manner.

2. Outdoor Lighting Rate Schedule. Revise Part B of the current Outdoor Lighting Schedule in order to replace current listing of available fixtures to a cost-based formula.

3. B, C, and D Rate Schedule Unification. Combine General Service B, C, and D rates into one rate schedule and combine Manufacturing B, C, and D rates into one rate schedule.

Hydro Allocation Re-balancing. The monetary amounts used in determining the Hydro Allocation Adjustment (debits and credits) would be recomputed to take account of changed sales and customer account data and applied to wholesale and retail rates accordingly.

APPENDIX B

Average Price of Electricity to Ultimate Customers by End-Use Sector, by State

Table B-1. Average Price of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date Through July 2017 and 2016 (Cents per kilowatt-hour)

	Residential		Commercial		Industrial		Transportation		All Sectors	
Census Division and State	July 2017 YTD	July 2016 YTD	July 2017 YTD	July 2016 YTD	July 2017 YTD	July 2016 YTD	July 2017 YTD	July 2016 YTD	July 2017 YTD	July 2016 YTD
New England	*19.28*	*19.03*	*15.19*	*15.16*	*12.38*	*12.07*	*8.42*	*8.49*	*16.41*	*16.21*
Connecticut	20.10	20.61	15.99	15.82	13.26	13.10	10.79	10.98	17.50	17.58
Maine	16.03	15.57	12.28	12.08	9.29	8.90	--	--	13.17	12.71
Massachusetts	19.96	19.29	15.43	15.51	13.46	13.06	6.38	6.43	16.82	16.53
New Hampshire	19.01	18.29	14.63	14.40	12.26	12.32	--	--	16.04	15.61
Rhode Island	18.13	18.40	15.10	15.05	14.30	13.60	19.47	18.55	16.27	16.27
Vermont	17.60	17.21	14.61	14.49	10.14	10.07	--	--	14.59	14.37
Middle Atlantic	*15.99*	*15.63*	*12.56*	*12.42*	*6.93*	*7.02*	*11.22*	*10.86*	*12.66*	*12.51*
New Jersey	15.88	15.74	12.54	12.46	10.26	10.23	9.03	8.75	13.58	13.50
New York	17.92	17.32	14.60	14.17	5.87	5.94	12.57	11.97	14.67	14.22
Pennsylvania	14.26	14.03	9.04	9.35	6.80	6.93	7.28	7.73	10.21	10.29
East North Central	*13.20*	*12.86*	*10.10*	*9.78*	*7.04*	*6.84*	*6.81*	*6.93*	*10.09*	*9.83*
Illinois	12.62	12.25	8.94	8.71	6.44	6.33	6.49	6.71	9.36	9.15
Indiana	11.92	11.13	10.28	9.54	7.40	6.81	11.41	9.50	9.59	8.89
Michigan	15.55	15.05	11.07	10.53	7.38	6.92	12.10	11.51	11.47	10.96
Ohio	12.31	12.38	9.94	9.81	6.65	6.81	7.56	7.67	9.68	9.76
Wisconsin	14.63	14.40	11.11	11.02	7.81	7.74	14.30	14.42	11.07	10.97
West North Central	*12.02*	*11.62*	*9.81*	*9.44*	*7.29*	*7.05*	*8.85*	*9.07*	*9.85*	*9.53*
Iowa	12.49	12.16	9.57	9.31	6.18	6.08	--	--	8.87	8.72
Kansas	13.25	12.98	10.47	10.33	7.54	7.47	--	--	10.58	10.47
Minnesota	13.10	12.55	10.63	9.74	7.74	7.22	9.47	10.03	10.55	9.92

	Residential		Commercial		Industrial		Transportation		All Sectors	
Census Division and State	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**
Missouri	11.37	10.83	9.38	9.06	7.06	6.73	8.21	7.98	9.92	9.49
Nebraska	10.79	10.70	8.99	8.87	7.66	7.82	--	--	9.12	9.12
North Dakota	10.25	10.04	9.18	9.04	8.63	8.11	--	--	9.23	8.93
South Dakota	11.46	11.24	9.53	9.39	7.74	7.55	--	--	9.88	9.71
South Atlantic	*11.93*	*11.61*	*9.44*	*9.31*	*6.45*	*6.35*	*7.96*	*7.87*	*10.00*	*9.82*
Delaware	13.42	13.42	10.11	10.19	7.83	8.06	--	--	11.09	11.18
District of Columbia	12.73	12.96	11.73	11.71	8.41	9.08	9.44	9.36	11.83	11.86
Florida	11.75	11.17	9.55	9.12	7.91	7.72	8.47	8.30	10.56	10.09
Georgia	11.85	11.40	9.98	9.66	5.82	5.56	5.26	4.91	9.75	9.43
Maryland	14.16	14.26	10.89	10.97	8.44	7.88	7.87	7.80	12.16	12.24
North Carolina	11.06	11.11	8.52	8.65	6.09	6.16	8.70	7.85	9.11	9.23
South Carolina	12.80	12.39	10.46	10.11	6.05	5.94	--	--	9.79	9.59
Virginia	11.54	11.45	7.88	8.13	6.58	6.72	7.77	7.89	9.14	9.26
West Virginia	11.61	10.99	9.62	9.29	6.71	6.54	--	--	9.07	8.82
East South Central	***11.27***	***10.66***	***10.55***	***9.99***	***5.98***	***5.68***	**--**	**--**	***9.30***	***8.88***
Alabama	**12.64**	**11.88**	**11.61**	**11.01**	**6.20**	**5.92**	**--**	**--**	**9.87**	**9.42**
Kentucky	**10.57**	**10.11**	**9.64**	**9.33**	**5.60**	**5.39**	**--**	**--**	**8.41**	**8.15**
Mississippi	**11.27**	**10.57**	**10.31**	**9.57**	**6.14**	**5.76**	**--**	**--**	**9.19**	**8.64**
Tennessee	**10.68**	**10.10**	**10.45**	**9.84**	**6.01**	**5.62**	**--**	**--**	**9.53**	**9.05**
West South Central	*10.76*	*10.50*	*8.36*	*7.79*	*5.47*	*5.09*	*8.03*	*5.64*	*8.31*	*7.97*
Arkansas	10.15	9.76	8.42	8.11	5.87	5.79	11.82	9.26	8.12	7.94
Louisiana	9.47	8.92	8.93	8.40	5.36	4.81	10.04	8.93	7.69	7.19
Oklahoma	10.46	9.86	7.96	7.26	5.29	4.71	--	--	8.11	7.53

	Residential		Commercial		Industrial		Transportation		All Sectors	
Census Division and State	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**	**July 2017 YTD**	**July 2016 YTD**
Texas	11.14	11.04	8.31	7.73	5.47	5.14	7.87	5.41	8.50	8.23
Mountain	*11.84*	*11.61*	*9.66*	*9.50*	*6.46*	*6.24*	*9.91*	*9.53*	*9.50*	*9.25*
Arizona	12.36	12.21	10.61	10.49	6.41	5.86	9.30	9.08	10.65	10.34
Colorado	12.08	11.79	9.84	9.42	7.27	6.96	10.02	9.40	9.89	9.57
Idaho	10.02	9.97	8.01	7.80	6.75	6.65	--	--	8.28	8.12
Montana	10.99	10.95	10.18	10.15	5.03	4.94	--	--	8.97	8.86
Nevada	11.83	11.53	7.84	8.08	5.82	5.69	8.21	7.80	8.57	8.36
New Mexico	12.91	11.73	10.32	9.64	6.08	5.74	--	--	9.71	9.00
Utah	11.12	11.05	8.81	8.81	6.21	6.37	10.09	9.98	8.72	8.76
Wyoming	11.29	11.07	9.74	9.41	6.96	6.91	--	--	8.32	8.18
Pacific Contiguous	*14.87*	*14.35*	*13.38*	*12.95*	*9.11*	*8.88*	*8.30*	*8.75*	*13.02*	*12.55*
California	18.24	17.28	15.36	14.74	12.22	11.76	8.27	8.73	15.77	15.01
Oregon	10.66	10.51	8.87	8.82	6.13	6.09	9.30	9.24	8.95	8.83
Washington	9.47	9.32	8.44	8.36	4.60	4.48	9.02	9.01	7.87	7.67
Pacific Noncontiguous	*25.79*	*24.21*	*23.26*	*21.27*	*20.99*	*18.88*	*--*	*--*	*23.29*	*21.35*
Alaska	21.41	20.41	19.69	18.09	16.87	15.34	--	--	19.65	18.24
Hawaii	29.39	27.22	26.52	24.12	22.58	20.18	--	--	25.78	23.41
U.S. Total	*12.86*	*12.47*	*10.60*	*10.30*	*6.85*	*6.65*	*9.67*	*9.45*	*10.48*	*10.19*

Source: U.S. Energy Information Administration, Form EIA-861M (formerly EIA-826), Monthly Electric Power Industry Report.

Displayed values of zero may represent small values that round to zero. Utilities and energy service providers may classify commercial and industrial customers based on either NAICS codes or demands or usage falling within specified limits by rate schedule. Changes from year to year in consumer counts, sales and revenues, particularly involving the commercial and industrial consumer sectors, may result from respondent implementation of changes in the definitions of consumers, and reclassifications. Totals may not equal sum of components because of independent rounding.

APPENDIX C

Cost of Service Fiscal Year 2016: A Summary of Wholesale Cost of Service Methodologies and Results

Cost of Service Fiscal Year 2016

A Summary of Wholesale Cost of Service Methodologies and Results

May 2017

Cost of Service

1.1 OVERVIEW

Cost of service is a detailed analysis of financial and operational data that culminates in the assignment of system level costs to rate classes and to customers within rate classes. Each year as part of the cost of service study, revenue to cost relationships are analyzed to determine how well the rates and the rate design structures are working. Ideally, the revenue received from each rate class or customer equals the costs incurred to serve that rate class or customer.

There are almost an infinite number of ways to do an embedded cost of service study, but all include three basic steps: functionalization, classification, and allocation. Costs are **functionalized** by specific utility function (i.e., generation, transmission, distribution, customer, etc.). Generation costs are further **classified** based on whether they are capacity (also referred to as fixed generation or demand) costs or energy (also referred to as variable generation) costs. In the final step, the functionalized and classified costs are **allocated** to rate classes and to customers within rate classes.

Both functionalization and classification are primarily based upon account number under the Federal Energy Regulatory Commission's (FERC) Uniform System of Accounts for Electric Utilities. Allocation to rate classes and to customers within rate classes is done in a manner reflective of cost causation. The allocation to each rate class or customer is based on the portion of each cost category deemed to have been incurred to serve that rate class or customer.

2.1 BACKGROUND

From 1992 to 2011, TVA sold power to local power companies (LPCs) under an End-Use Wholesale structure. Each LPC's wholesale power cost was dependent upon the classification of the retail customers to whom the power was resold. The End-Use Wholesale rate structure did not reflect the variation in production costs by time of day and by season nor did it encourage LPCs or their customers to manage peak demands or energy consumption. While the End-Use Wholesale rate structure was in effect, the cost of service study was based on precise load data for the LPCs and most of the larger customers but on decades-old load profiles for the LPC-served residential, commercial, and industrial end-use segments.

In April 2011, TVA implemented its first major rate change in nearly two decades. The End-Use Wholesale structure was replaced with a Seasonal Demand and Energy rate structure similar to those commonly used by other electric utilities. The cost of service studies for subsequent fiscal years have been based on metered load data due to the availability of metered load data for not only the LPCs and directly served customers, but also for the large LPC-served customers with power contract demands in excess of 5 MW.

3.1 DEFINITON OF RATE CLASSES FOR EVALUATION

There are three major rate classes with common service attributes over which the fiscal year 2016 cost of service study is evaluated: standard service, large general service, and large manufacturing service. Standard service (SS) comprises the LPCs' power sales to residential, small commercial, and small manufacturing customers. Large general service (LGS), also known as large commercial service, is service to non-manufacturing customers with power contract demands greater than 5 MW. Large manufacturing service (LMS), also known as large industrial service, is service to manufacturing consumers with power contract demands greater than 5 MW. LGS and LMS may be provided to a customer directly by TVA or by an LPC. LGS and LMS customers are subject to the same rate structure regardless of whether the service is provided by TVA or an LPC. TVA provides service directly to 52 LGS and LMS customers. The LPCs provide service

to approximately 400 LGS and LMS customers.

4.1 GUIDING PRINCIPLES

In preparation for the 2011 rate change, TVPPA and TVA adopted guiding principles to lead the collaborative process. These guiding principles, as amended, continue to inform the 2018 rate change.

1. **Rates must recover all costs.** Both TVA and LPCs need to recover their total costs to provide service in order to remain financially sound.

2. **Rates must track cost of service**. Rates that do not accurately track cost of service create unsustainable subsidies among customers and among customer classes. The objective of this principle is to create awareness that rates must track cost of service to ensure an overall lower cost of electric service across the Valley.

3. **Rates must send pricing signals.** The cost to provide electric service comprises two broad categories of costs: variable and fixed. Variable costs are primarily fuel and purchased power costs and vary by hour of day, by day of week, and by season of year. Fixed costs include operations and maintenance costs, interest expense, and depreciation and are relatively constant throughout the year. Pricing signals are useful in communicating the inherent differences in variable and fixed costs and provide customers incentives to plan accordingly.

4. **Rates must balance precision with simplicity.** Rates and rate design cannot be so complex that they create confusion or administrative and communication issues.

5. **Rates must be stable.** We need rates and rate design which create a stable environment for customers.

6. **Rates must be competitive.** TVA has set a goal of having effective rates in the top quartile with an initial focus on maintaining competitive industrial rates.

5.1 FUNCTIONALIZATION and CLASSIFICATION

TVA uses the FERC Uniform System of Accounts for Electric Utilities. Table 1 on the following page lists the cost categories used by TVA for cost of service functionalization and classification and provides the specific FERC account numbers, their descriptions, and the amounts and percentages of total costs as categorized for fiscal year 2016. TVA, TVPPA, and TVIC agree generally on the functionalization and classification of fiscal year 2016 costs.

Costs fall into two broad categories: fixed and variable. Fixed costs do not vary in relation to generation or sales. Variable costs vary directly in relation to generation or sales.

Generation costs are classified as either capacity or energy. Capacity costs are costs incurred to generate electricity that do not vary with generation, and are considered fixed. Energy costs are costs incurred to generate electricity that vary with generation and are considered variable.

Transmission costs are the costs associated with the transmission of power through the TVA system, from the generation source or interchange point to customer delivery points. Transmission costs are considered fixed.

Other costs are costs not associated with generation or transmission. Other costs include amortization of regulatory assets, customer service expenses, and payments in lieu of taxes. Other costs are generally fixed.

6.1 **Table 1**

Functions and Classes	FERC Account Numbers Included	2016 $ millions	2016 %
Capacity	*500 through 554.1 Power Production Expenses (excluding 501, 518, 547, and energy-related portion of 555) Allocations of 427 through 432 Interest Charges Allocations of 403 Depreciation Expense Allocations of 920 through 935 Administrative and General Expenses*	$4,292	40%
Energy	*501 Fuel 518 Nuclear Fuel Expense 547 Fuel 555 Purchased Power*	$3,001	28%
Transmission and Ancillary	*556 through 557 Other Power Supply Expense 560 through 574 Transmission Expenses Allocations of 427 through 432 Interest Charges Allocations of 403 Depreciation Expense Allocations of 920 through 935 Administrative and General*	$871	8%
Other	*407.3 Regulatory Debits (amortization) 411.1 Accretion (not the FERC name) 901 through 917 Customer and Sales Expenses Allocations of 427 through 432 Interest Charges Allocations of 920 through 935 Administrative and General*	$2,113	19%
Taxes	*408.1 Taxes Other Than Income Taxes*	$522	5%
Total Costs		$10,799	100%

ALLOCATION

There are four categories of costs to be allocated in the cost of service for TVA: capacity, energy, transmission, and other. While there is general consensus among TVA, TVPPA, and TVIC regarding the functionalization and the classification of TVA system costs, there is considerable disparity in their respective approaches to the allocation of those costs to rate classes and to customers within rate classes.

7.1 **Capacity**

Capacity costs allocators generally assign costs based on the rate class or customer contribution to system peak. Common variations include consideration of the annual system peak (1 CP), a weighting of peaks from summer and winter (2SW CP), the average of the twelve monthly coincident peaks (12 CP), multiple coincident peaks within 5 to 10% of the system peak (Top 50, Top 200) , and all hours (in essence an average energy allocator).

TVA's position is that capacity costs are incurred to serve load that is consistently coincident with system peak

and has used the Top 200 system peaks as an approximation of all peaks within 10% of the annual system peak. At the suggestion of TVIC, TVA has fine-tuned this allocator to the Top 200 native load peaks, thus excluding wheeling and interchange customers. Capacity costs are allocated based on the average coincident load of each rate class or customer for each of the Top 200 native load peaks.

TVPPA recommends that capacity costs be spread throughout the year by plant based on actual generating hours and that the costs redistributed to each month be allocated to rate classes and customers based on monthly coincident peak. This allocation methodology produces an allocation virtually identically to a traditional 12CP allocation, with a less than one fourth of one percent variation. Based on this close cost relationship, TVA used the 12 CP capacity cost allocation to represent TVPPA's perspective.

TVIC agrees that capacity costs should be allocated over a relatively large number of coincident peaks, but prefers the Top 50 native load peaks as an approximation of all peaks within 5% of the annual native load peak.

8.1 **Energy**

Energy costs allocators generally assign costs based on energy usage with perhaps a time of use element. Common variations include average energy usage, average on peak and off peak usage, rate class or customer usage of the generation from each generating unit, and rate class or customer usage weighted by hourly marginal cost.

TVA's position is that energy costs are incurred unevenly throughout the year, the month, and the day, as less efficient or more expensive generation is dispatched to serve peak loads. In the absence of an independent power market from which to derive hourly marginal costs, TVA uses hourly power supply cost as a proxy. Actual embedded energy costs are allocated to each rate class or customer based on the hourly load-weighted incremental costs as a percentage of total system hourly load-weighted incremental costs. TVA refers to this methodology as "Resource Cost Allocation" or RCA.

TVPPA prefers the allocation of energy costs based solely on the usage of each rate class or customer without reference to the time of the usage.

TVIC favors the RCA methodology of allocating energy costs to rate classes or customers based on hourly load-weighted incremental costs.

9.1 **Transmission**

Transmission costs allocators generally assign costs based on the rate class or customer contribution to system peak in a manner similar to capacity costs allocations. Common variations include consideration of the annual system peak (1 CP), a weighting of peaks from a single season, the average of the twelve monthly coincident peaks (12 CP), the single non- coincident peak (1 NCP), and the average monthly non-coincidental peak (12 NCP).

TVA's position is that the transmission and ancillary services tariffs are calculated based on the assignment of the transmission and ancillary services revenue requirements to both native and non-native transmission customers using a 12 CP allocator and that to maintain parity between the non-native transmission customers and the various rate classes of native transmission customers, embedded transmission and ancillary services costs should be allocated on the same basis.

TVPPA's position is that transmission and ancillary services costs should be allocated to rate classes and customers based on a 12 CP allocator.

TVIC recommends that transmission and ancillary services costs be allocated to rate classes and customers on the same basis as capacity costs are allocated. It is their position that the transmission system, like the generation system, is built to serve the peak demands of the system.

10.1 **Other**

It is the consensus of TVA, TVPPA, and TVIC that other costs should be allocated on the basis of each rate class or customer allocated share of total capacity, energy, and transmission costs.

11.1 **Allocations by Customer Class**

The allocation of the costs presented in Table 1 to the three major rate classes based on the methodologies discussed above is shown in more detail below in Table 2. The loads for each rate class and the costs in each cost category are the same for each of the three perspectives presented.

The specific allocations vary by perspective and methodology but are consistent. Each of the methodologies allocates significantly more capacity and transmission costs per kWh to standard service than to large general service and large manufacturing service. Each of the methodologies allocates similar energy costs per kWh to each of the three rate classes. All three perspectives use the same proportional methodology to allocate other costs. Consequently, all three allocate more other costs per kWh to standard service than to large general service and large manufacturing service.

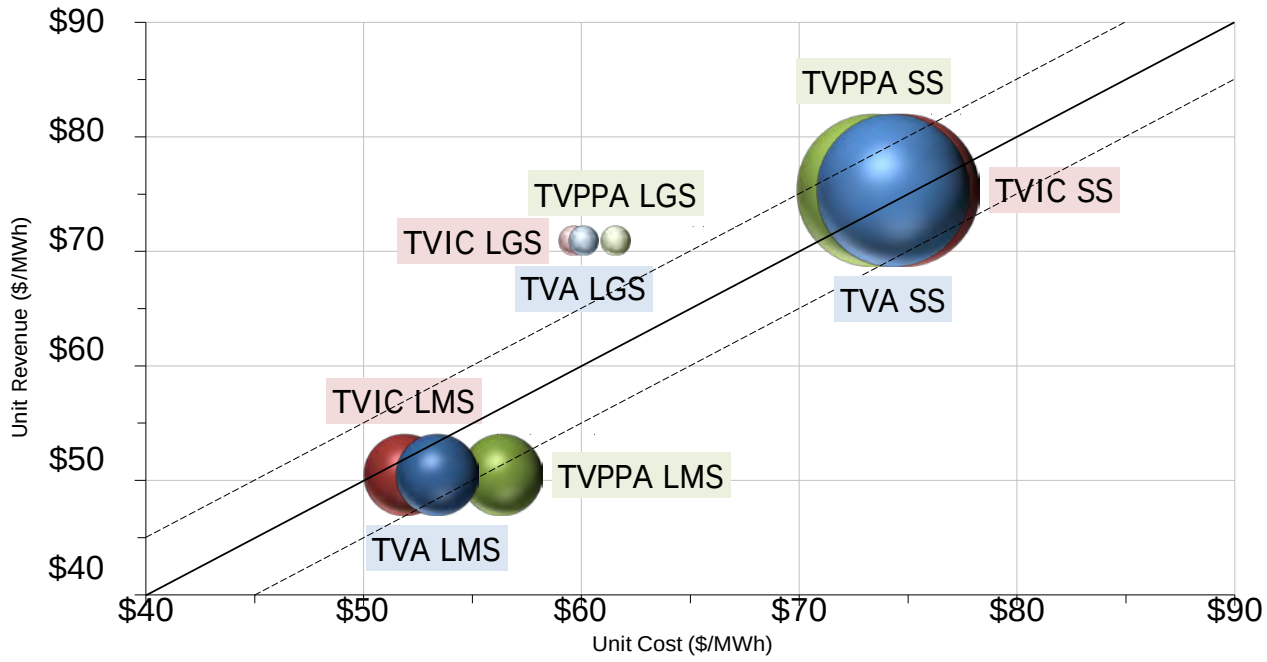
12.1 **Table 2**

TVA Perspective	Load GWh	Capacity	Energy	Transmission	Other	Total
Standard Service	117,692	$ 3,587	$ 2,308	$ 718	$ 2,134	$ 8,747
Large General Service	4,221	94	79	19	62	254
Large Manufacturing Service	33,695	611	614	134	439	1,798
TVPPA Perspective	**Load GWh**	**Capacity**	**Energy**	**Transmission**	**Other**	**Total**
Standard Service	117,692	$ 3,545	$ 2,270	$ 718	$ 2,108	$ 8,641
G BCD	4,221	96	81	19	63	260
M BCD	33,695	651	650	134	463	1,898
TVIC Perspective	**Load GWh**	**Capacity**	**Energy**	**Transmission**	**Other**	**Total**
Standard Service	117,692	$ 3,611	$ 2,308	$ 733	$ 2,147	$ 8,799
G BCD	4,221	93	79	19	61	252
M BCD	33,695	588	614	119	426	1,748

MULTIPERSPECTIVE PRESENTATION OF RESULTS

In recognition of and with respect for the diversity among TVA's customers, the results of the fiscal year 2016 cost of service study are presented from three perspectives: TVA's, TVPPA's, and TVIC's. The cost of service study can be used to compare and contrast results among both the perspectives and the rate classes. This multiperspective presentation facilitates awareness and understanding of the sometimes competing priorities of fairness, affordability, and competitiveness. The perspectives are presented based on each party's preferred cost allocation methodologies and the resulting relationships of the revenue to cost ratios of the three previously defined aggregated rate classes to tolerance band around cost parity. The five dollar tolerance band around cost parity recognizes the differences among perspectives and the common goal for rates to recover underlying costs.

13.1 **Chart 1**



14.1 **RESULTS**

The **TVA** perspective is presented in blue in Chart 1 and is based on Top 200 allocated capacity, RCA allocated energy, 12 CP allocated transmission, and proportionally allocated other costs.

The **TVPPA** perspective is presented in green in Chart 1 and is based on 12 CP allocated capacity, average allocated energy, 12 CP allocated transmission, and proportionally allocated other costs.

The **TVIC** perspective is presented in red in Chart 1 and is based on Top 50 allocated capacity, RCA allocated energy, Top 50 allocated transmission, and proportionally allocated other costs.

The size of the bubbles is directly proportional to the volume of sales to each of the aggregated rate classes.

The three perspectives of estimating the cost to provide electric service to customer classes produced remarkably similar results. All three methodologies indicate approximately the same revenue to cost ratios for all three rate classes (LPC Standard Service, Large Manufacturing Service, and Large General Service). Furthermore, all three perspectives also concur that the aggregated Large General Service class has rates which currently generate revenues significantly in excess of their allocated costs.

15.1 **CONCLUSIONS**

The commonalities highlighted by the multiperspective approach provide a solid basis for moving forward with the October 2018 rate change. The differences point to areas for continued exploration in the future, both to clarify mutual understanding and to ensure rate structures and long-term directions are both competitive and equitable.