TENNESSEE VALLEY AUTHORITY

STAFF REPORT

ON

PRELIMINARY RECOMMENDATIONS

ON THE

FOUR PURPA STANDARDS

UNDER SECTION 111(d)

OF THE

PUBLIC UTILITY REGULATORY POLICIES ACT

PURSUANT TO THE

ENERGY INDEPENDENCE AND SECURITY ACT OF 2007

June, 2009

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Introduction

The Energy Independence and Security Act of 2007 (EISA), enacted December 19, 2007, established four standards under Section 111(d) of the Public Utility Regulatory Policies Act (PURPA). The EISA requires that each state regulatory authority and non-regulated electric utility must consider adopting the new PURPA standards. This includes consideration by the Tennessee Valley Authority (TVA) as a non-regulated electric utility with respect to its own operations and retail sales to directly served customers and in its separate capacity as the designated state regulatory authority under PURPA for the distributors of TVA power. EISA further requires that consideration of the new PURPA standards should be addressed in proceedings to be concluded by December 19, 2009. TVA conducted similar efforts with respect to other PURPA Standards.

As part of this process, which is detailed in a notice published in the Federal Register, TVA has requested comments from the public and TVA stakeholders on the four standards. The TVA staff has also developed this preliminary report that reviews each standard, including a discussion of TVA's current practices, and makes a preliminary recommendation with respect to each standard. The report will be posted, and the public and TVA stakeholders will again have an opportunity to provide input and comments before TVA's Board of Directors (the Board) makes its final determinations on the standards.

Under Section 111(d) of PURPA, each of the standards is to be evaluated in the context of the stated purpose of PURPA, which is to encourage (1) conservation of energy supplied by electric utilities, (2) optimal efficiency of electric utility facilities and resources, and (3) equitable rates to electric consumers. For TVA, any such evaluation needs to include whether the standards and their implementation within the region would further the three-part mission set out by the TVA

Act: to supply reliable and affordable power, manage the Tennessee River system and surrounding lands, and partner with Valley communities and states for economic success. After considering the staff's recommendations and public input, the Board must decide, with respect to each standard, whether or not TVA should adopt it as proposed, decline to adopt it, or adopt a modified version of the standard set out in EISA.

This document is based on various activities within TVA, industry research groups, and industrial standard organizations. It is intended to provide insights into the direction TVA may take toward the proposed PURPA standards as well as general education around these high-level concepts as they apply to TVA.

PURPA Standard 1 —Integrated Resource Planning

This section of the staff report addresses the Integrated Resource Planning standard. Under this standard, each electric utility is to integrate energy efficiency resources into utility, State, and regional plans and adopt policies establishing cost-effective energy efficiency as a priority resource. This section will examine the current policies and procedures implemented by TVA and power distributors to integrate energy efficiency resources into TVA's resource plan. It also will look at the history of TVA with respect to energy efficiency resources and measures taken and how this history has helped to shape the rationale for current policies. Finally, it will discuss policy changes TVA has adopted to recognize renewable energy resources and energy conservation, and describe future programs.

Proposed Standard

Integrated Resource Planning

Each electric utility shall

(A) Integrate energy efficiency resources into utility, State, and regional plans; and

(B) Adopt policies establishing cost-effective energy efficiency as a priority resource.

Preliminary Recommendation

TVA staff has considered this PURPA standard and recommends that it is appropriate to adopt this standard. This includes implementing policies that establish cost-effective energy efficiency as a supply resource, helping to promote energy efficiency options with customers, and ensuring ongoing integration of energy efficiency into TVA's processes.

Background (Benefits)

Purpose and Context of the Integrated Resource Planning Standard

This standard is consistent with one of the three PURPA purposes: to encourage conservation of energy supplied by electric utilities. Energy efficiency refers to programs that allow consumers to make choices on how to use less energy by altering their behavior. These programs include the deployment of new technologies or replacement of existing energy-consuming devices with newer energy efficient devices. Energy efficiency programs are usually distinguished from demand response programs. However, both are often included in integrated resource plans and will be addressed in this review. On the utility side, energy efficiency can be accomplished through upgrades to the system to improve generation heat rates and to reduce losses on the grid. TVA's efforts to optimize the efficiency of its generation portfolio were addressed during TVA's earlier consideration of another PURPA Standard (Standard 13) Fossil Fuel Generation Efficiency. TVA's Board adopted Standard 13 with modifications stating that current business practices complied with the intention and spirit of optimizing generating unit efficiency.

Current Practices (Challenges and Risks)

History of Integration of Energy Efficiency Resources at TVA

TVA has a long history of promoting energy efficiency. Almost 40 years ago, TVA initiated a Home Insulation Program (Tennessee Valley Authority, 1970, Appendix K.1) under which it paid for a free energy survey of customers' homes and provided no-interest loans (up to $2,000) for homeowners who decided to make the recommended improvements. TVA also made low-interest loans to consumers who were interested in replacing their heating system through the Heat Pump Financing Program (Tennessee Valley Authority, 1981). This program was conducted jointly by TVA and power distributors, and allowed repayments to be added to a customer's electric bill. The TVA practices discussed below to incorporate energy efficiency resources into integrated resource planning are a continuation of TVA's heritage of supporting energy efficiency in the Valley.

TVA Policies and Practices

Section A of the PURPA standard under consideration states that each electric utility is to "integrate energy efficiency resources into utility, State, and regional plans."

As indicated below, under existing TVA policies and practices, TVA already integrates energy efficiency resources into its utility planning efforts. As stated in TVA's 2008 Environmental Policy (Tennessee Valley Authority, 2008 Appendix K1), TVA is committed to investing in energy efficiency and demand response as tools for lowering emissions, reducing generating costs, potentially allowing for the earlier retirement of coal-fired generation.

TVA conducts a number of planning studies, several which deal with capacity planning and energy efficiency. The major efforts that are currently underway are described below.

1. Integrated Resource Plan

TVA will begin an updated and expanded integrated resource planning process in 2009. TVA's purpose for the Integrated Resource Plan (IRP) is to plan for a sustainable future and to engage Valley residents in a dialogue regarding the future of their power and resource agency. The existing process is completely separate from TVA's consideration of this PURPA standard.

Adopting the theme of TVA's 2008 Environmental Policy, TVA will also include in the IRP planning for the stewardship resources in the Valley, numerous natural resources and recreational opportunities on TVA land. The IRP will evaluate resource portfolios that TVA could utilize to implement its mission, the long-term goals of its Strategic Plan, and its Environmental Policy. In conducting this project TVA will not simply evaluate a power IRP with a stewardship addition, but instead will provide an integrated analysis of TVA's current power, environmental, and sustainability plans.

The purpose of the IRP is to explore the means by which TVA can develop a sustainable future and meet the future electrical energy and resource stewardship needs of the Tennessee Valley. The IRP's main purpose is to serve as a road map for shaping and implementing TVA's long-term resource and environmental strategies. Used as a public power planning tool, the IRP supports coordinated decision-making by TVA and its many stakeholders, including the power distributors, ratepayers, Valley residents, business owners, employees, environmentalists, prospective residents, and those in government at state and local levels. The report will provide a forum for discussing numerous topics, including resource purchases, efficiency programs, and reliability tradeoffs based on an analytic structure for assessing resource investments.

By engaging stakeholders in the IRP planning process, TVA will ensure that the results of the IRP are not narrowly focused. Instead, the resulting report will document the diverse and comprehensive ideas of all interested parties, not just a single narrow viewpoint. The IRP will provide a compilation not only of model runs and analyses but also a set of publicly-expressed ideas and alternative options, leading to what TVA believes will be the best plan for the Valley.

The initial public comment period for the IRP is planned to begin in 2009. Public scoping meetings will be held at several locations throughout the Valley to allow for input. This comment period will primarily serve to identify the relevant concerns of TVA's stakeholders. Once these concerns are categorized, evaluated, and prioritized they will be incorporated in the Draft Environmental Impact Statement (EIS). The draft EIS will also be made available for public comments, serving as an additional opportunity for the public to voice considerations. Once the IRP has been properly vetted by TVA and its stakeholders, it will represent TVA's plan of action until it is updated.

2. Power Supply Plan

The Power Supply Plan (PSP) serves as TVA's internal comprehensive generation and capacity planning process. It is an integral part of the IRP, and coordinates with TVA's other major planning processes, including its financial plan, environmental strategy, and land-use plan. The PSP is the strategic driver by which operational decisions are made, and different versions of the PSP are produced for different needs (short term, long term, and updates at different times during the year with alternative scenarios produced as needed).

The PSP is an ongoing cycle of analysis that incorporates studies from numerous departments in TVA, including load forecasting, generation planning, transmission reliability, commodity pricing, regional economic forecasting, financial analysis, risk management, and environmental

stewardship and policy. The goals, tools, methodologies, and processes by which the PSP is developed support the IRP. The PSP is routinely refreshed to incorporate updated information. Numerous "what if" analyses are developed, evaluated, and compared with the 'base case' to explore alternative futures.

Estimates of load reduction due to energy efficiency programs are forecast separately from the standard PSP modeling framework and then input into the PSP as an adjustment to the then-current load forecast. A bottom-up approach is used, where each energy-efficiency program is evaluated separately for its potential for kilowatt (kW) savings based on the number of expected program participants and estimated average kW savings potential.

For those programs that have an ongoing track record, historical statistics on participation rates and average kW and kilowatt-hour (kWh) savings have been collected and are used to develop forecasts. Other programs include contractual commitments that can be used to make refinements to the forecast. For some new programs, models derived from engineering calculations of appliances, equipment, and buildings are used to adjust forecasts. Pilot program estimates are utilized as a place holder until substantiated data is collected through new program initiatives. Once TVA-specific information is available, it will be substituted in the forecasts.

3. Integration of Energy Efficiency at TVA

TVA is taking steps to increase the opportunities to use energy efficiency to reduce peak load requirements and change end users' load patterns to assure that energy efficiency programs are cost-effective.

TVA is coordinating with power distributors to provide print, radio, and television advertising across the Valley, that promotes energy efficiency. TVA also has a Web site (TVA, 2009a, Appendix K.1) that uses the *energy right*® brand to encourage the saving of electricity. Anyone with Internet access can participate in a free online audit of their home energy use. This increased awareness and education, along with the programs being developed in coordination with the distributors, is allowing for the development of a portfolio of energy efficient, cost-effective resources.

In determining the estimates of energy efficiency impacts, new sample load shapes to reflect energy efficiency opportunities have been developed with the help of PA Consulting Group (PA Consulting Group, 2009, Appendix K1). A detailed analysis of the value of energy efficiency programs was conducted in 2008, with a focus on the value to TVA. In addition, a series of focus groups and in-depth customer, trade-ally, and power distributor interviews was conducted in 2008 with the help of Tradewind Group (Tradewind Group, 2009, Appendix K1). This information assisted in the design of the new programs that will be introduced in 2009 as pilot programs in coordination with the power distributors. The information was also used to estimate the number of people that would be interested in participating in energy efficiency programs that will ultimately result in refinements to the forecasts developed for the PSP and IRP.

Create Ongoing Integration of Energy Efficiency Considerations Across Utility Activities

Section B of the PURPA standard under consideration provides that each electric utility is to integrate energy efficiency resources into its plans for its system.

As the society at large is becoming increasingly aware of energy efficiency as an important resource, TVA is also including energy efficiency in its planning and processes across all of its activities, emphasizing it as an important supply resource.

TVA's demand forecasts are adjusted to reflect the anticipated improvements in appliance and housing standards being mandated to reflect energy efficiency improvements. In addition, consumers are demanding and buying higher-level energy efficient appliances in order to save money on their electric bill (Athavaley, 2009, Appendix K1). Therefore, in addition to including energy efficiency as an adjustment affecting capacity requirements, energy efficiency is also affecting the type of future generation that will be needed due to the change in load patterns.

Energy efficiency is one of the major program criteria in TVA's Valley Investment Initiative for existing and expanding customers (TVA, 2008b, Appendix K1). It is one of the factors that is used to determine the amount of economic development incentive a customer can receive under that program. Plans call for energy efficiency to be included in the economic development initiative for new customers as well.

As described in the discussions of the other Standards, TVA is looking into investments and ways of doing business that will support the ability of its customers to effectively implement and promote energy efficiency. These efforts include the implementation of time-of-use pricing and smart-grid technologies. All of these efforts will work together to make energy efficiency a viable alternative to building new capacity. How effective such efforts will be will determine how much reduction in TVA's future capacity can be achieved in this manner.

In accordance with its 2007 strategic plan, TVA is working with local power distributors and Valley stakeholders to become a leader in energy efficiency improvements and peak demand

reduction (Tennessee Valley Authority, 2007b, Appendix K1). Over the next few years, TVA will phase out the existing energy efficiency programs and transition into the new portfolio of product and service offerings supporting today's peak reduction goal of an incremental 1,400 megawatts (MW) by 2012. Details on the types of programs that TVA is in the process of developing are available in Appendix D

Benefits of Energy Efficiency

This section outlines the rationale behind the TVA's Staff recommendation to adopt this Standard. There are two main categories of rationale: one set is demand and energy-related and involves the long-term efforts to reduce system costs; the other is non-energy related, and is often more difficult to quantify, but still represents real benefits to consumers and society.

1. Ease Upward Pressure on Electricity Costs

The long-term goal of promoting energy efficiency at TVA is to reduce electricity costs by helping consumers use electricity in a more cost-effective way. This strategy is consistent with what other states have identified as a viable strategy (for example, see CPUC, 2008 and NYPSC, 2008, Appendix K1). The primary ways that TVA will reduce cost through efficiency involve teaching consumers better ways to use energy. The net effect of educating consumers will be to slow demand for new generators, cause less transmission congestion, and lower emissions. Each of these factors can have a major impact on a utility's cost of service. The detailed explanation of how energy efficiency will reduce the cost of electricity to consumers is available in Appendix E.

2. Additional Customer/Society Benefits

In addition to the financial benefits a utility derives from energy efficiency there are many other qualitative benefits resulting from such efforts which enrich society and the customers served. The primary qualitative benefits of creating greater energy efficiency in electricity system operations and customer use of electricity are: decreased foreign energy dependence, new green employment opportunities, cleaner air and water, and healthier, more comfortable living and working conditions. More detailed explanations of the qualitative benefits derived from increased energy efficiency are available in Appendix E.

Challenges/Risks

One of the reasons utilities have been slow to incorporate energy efficiency into their planning is that it presents challenges to the planning process they are used to employing and is more difficult to incorporate into the supply portfolio than more traditional resources. A detailed explanation of the challenges and risks associated with developing energy efficiency programs and what may be done to mitigate those issues is available in Appendix E.

Staff Findings and Conclusion

TVA should continue to integrate energy efficiency resources, including demand response programs, into its resource portfolio. Current policies and procedures should be enhanced to further encourage the evaluation and implementation of cost-effective energy efficiency options

for our consumers. Energy efficiency should be an important resource in TVA's portfolio planning process and be given the same consideration as TVA's supply-side resource options.

PURPA Standard 2 —Rate Design Modifications to Promote Energy Efficiency Investments

This section of the staff report addresses the Rate Design Modifications to Promote Energy Efficiency Investments standard, which proposes that the rates allowed to be charged by any electric utility, shall (i) align utility incentives with the delivery of cost-effective energy efficiency; and (ii) promote energy efficiency investments. The standard also sets forth six policy options for consideration, in order to comply with the standard.

Proposed Standard

Rate Design Modifications to Promote Energy Efficiency Investments

(A) In General. The rates allowed to be charged by any electric utility shall—

- **(i) align utility incentives with the delivery of cost-effective energy efficiency; and**
- **(ii) promote energy efficiency investments.**

(B) Policy Options. In complying with subparagraph (A), each State regulatory authority and each non-regulated utility shall consider—

- **(i) removing the throughput incentive and other regulatory and management disincentives to energy efficiency;**
- **(ii) providing utility incentives for the successful management of energy efficiency programs;**

(iii) including the impact on adoption of energy efficiency as one of the goals of retail rate design, recognizing that energy efficiency must be balanced with other objectives;

(iv) adopting rate designs that encourage energy efficiency for each customer class;

(v) allowing timely recovery of energy efficiency-related costs; and

(vi) offering home energy audits, offering demand response programs, publicizing the financial and environmental benefits associated with making home energy efficiency improvements, and educating homeowners about all the Federal and State incentives, including the availability of low-cost loans, that make energy efficiency improvements more affordable.

Preliminary Recommendation

The TVA staff views the standard on rate design modifications to promote cost-effective energy efficiency and energy efficiency investments as fully consistent with TVA's mission of providing power at the lowest feasible rates. The staff recommends that the standard be adopted and that all policy options set out in the standard be considered for applicability in the TVA service area in discussions with distributors regarding rate changes and energy efficiency program development.

Background (Benefits)

This standard focuses on the role of electric rates and rate setting processes in promoting energy efficiency and energy efficiency investments. It proposes that rates be set in a manner that will incentivize cost-effective energy efficiency activities. This can be considered both from a regulatory point of view in terms of what rates a regulatory body approves, and also from a utility point of view in terms of what pricing by a utility will incentivize energy efficiency by its customers and thus help manage the utility's overall cost of providing service to its ratepayers.

A cost-effective energy efficiency activity is defined as one in which the cost to implement the energy efficiency (either conservation of energy or shift of energy use to a lower-cost time period) is less than or equal to the cost of continued energy use on the current basis (the status quo). In financial terms the avoidable cost of continued energy use in this comparison is usually determined by the rate applicable to electric service.

In general, electric rates that accurately reflect the cost of providing the electric service will incentivize cost-effective energy efficiency. If electric rates do not accurately reflect the cost of providing service, energy efficiency activities that are cost-effective in terms of real resource use may not be identified as being cost-effective financially, and as a result not be pursued. Therefore rates that are cost-based play a key role in accomplishing the goals of this standard.

Rate structures can also play a role in incentivizing cost-effective energy efficiency. The cost to supply electricity can vary significantly by season and by time of day. Rate structures such as seasonal, time-of-use, or hourly real-time pricing rates better communicate to customers when conservation or load shifting is worth the most to the power system and thus improve the effectiveness of energy efficiency efforts. Some of these rates require additional investments in advanced metering, billing, and communication systems on the part of the utility. These additional administrative costs have to be considered in evaluating the cost-effectiveness of applying such rate structures. In many cases advanced rate structures are made available on an optional basis such that customers with the flexibility to respond to them effectively may take advantage of them on a case-by-case basis.

The standard also states that electric rates should be set in a manner that promotes energy efficiency investments. Some energy efficiency activities involve simply varying energy use

patterns without making any investments in new equipment or technologies. For example, prepayment programs allow consumers to change the way they view energy. Prepayment allows them to view energy as an asset they control and monitor. Some people think of this much like a cell phone rate plan with a set of predefined minutes. With respect to energy efficiency, it may be as simple as lowering a thermostat or washing clothes in the evening rather than in the middle of the afternoon. Higher levels of energy efficiency may need to be enabled through investment by the customer in new energy use equipment and technology to enable load shifting. As mentioned above, rate structures that will incentivize installation of such equipment typically involve additional investment by the utility in metering and communication systems. In order for these investments to be made, both the utility and the consumer need to have a reasonable expectation that these additional investment costs will be recovered.

The standard includes a list of several policy options that are to be considered in application of this standard. These options are discussed below.

(1) Removal of throughput incentives and other regulatory and management disincentives to energy efficiency.

In most businesses, profit is to a certain extent a function of sales volume. The higher the sales volume, the higher the profit. This "throughput incentive" can be present in the electric utility area as well. A direct relationship between sales and profitability can be a disincentive to utilities to pursue energy efficiency measures such as conservation. This PURPA standard requires that regulators and self-regulated utilities consider revisions to rates to remove this disincentive to energy efficiency.

In some jurisdictions regulators have accomplished this by establishing administrative procedures to decouple utility profit from sales volume. These procedures involve approval of a profit level

for the utility and a return of excess profits or recovery of profit shortfalls if actual sales volumes differ from forecasts.

Even for nonprofit public utilities, if rate structures include recovery of fixed costs on variable sales units, conservation can reduce cost recovery and present an issue for the utility. For such utilities, the reallocation of such fixed cost recovery to sales units not likely to be impacted by conservation may be appropriate.

(2) Provide utility incentives for the successful management of energy efficiency programs. This policy option suggests that it may be appropriate not only to remove financial disincentives for energy efficiency such as throughput incentives but also to provide positive incentives for utilities to actively pursue energy efficiency programs. Such incentives might involve the sharing of a portion of the energy efficiency savings with the utility so that the utility's financial performance improves as energy efficiency is achieved. For nonprofit public utilities, a principal objective of the organization is usually to keep electric rates as low as feasible. Since this is the objective rather than profit maximization, pursuing cost-effective energy efficiency should be fully aligned with organizational goals for public power companies, and further incentives may not be required.

(3) Include the impact on adoption of energy efficiency as one of the goals of retail rate design, recognizing that energy efficiency must be balanced with other objectives. There is normally a set of goals or objectives that a utility will consider in developing retail rates and a regulator may consider these in evaluating rates for approval. These goals may include alignment with cost of service, adequate cost recovery, simplicity in rate structure, and others. These goals can help determine how customer classes are defined, what rate structures are applied, and other features of electric rates.

The inclusion of the impact on rates of the adoption of energy efficiency as a goal of rate design could have a significant impact on the choice of rate structure or the variety of retail rate options that are made available. The availability of time-of-use or hourly pricing options can provide consumers with the information to maximize the effectiveness of energy efficiency activities by communicating when the potential savings are greatest. At the same time, this goal would need to be balanced with other objectives such as the need to provide rate structures that are not overly complicated for consumers to understand.

(4) Adopting rate designs that encourage energy efficiency for each customer class.

This policy option would have regulators and utilities provide rate structures that encourage broad-based consumer participation in energy efficiency rather than focusing on certain customer classes. For example, it might be decided that optional time-of-use rates should be available to all customer classes rather than just the largest power consumers.

(5) Allowing timely recovery of energy efficiency-related costs.

This policy option focuses on the regulatory aspect of rate setting, in particular how energy efficiency-related costs are treated in defining the utility's allowed revenue recovery. If regulators allow timely recovery of energy efficiency-related costs in regulatory processes, that can enhance the attractiveness of such activities to utilities.

(6) Offering home energy audits, demand response programs, publicizing the financial and environmental benefits of energy efficiency, and publicizing Federal and State incentives including availability of loans.

This policy option points out actions other than those that are strictly rate actions that can promote energy efficiency. Programs such as home energy audits, demand response programs,

and educational programs can be important tools to enable consumers to participate effectively in energy efficiency programs.

Current Practices (Challenges and Risks)

TVA and Distributor Practices

Rates for the sale of TVA power are set by the TVA Board of Directors to carry out the objectives of the TVA Act, including the objective that rates should be set "as low as feasible." In addition, Section 10 of the TVA Act provides express authority for the TVA Board to carry out the purposes of the TVA Act by employing a wholesale power contract that specifies the resale rate schedules to be applied by distributors of TVA power.

The Schedule of Rates and Charges that is incorporated into TVA's wholesale power contracts includes not only the wholesale rate schedule but also the resale rate schedules to be applied by the distributor.[1] Because there is variation among distributors in the need for net revenue over and above wholesale power cost due to customer mix, amount of debt, and other factors, the TVA-approved resale rate schedules for each distributor reflect varying levels of margin over the wholesale power cost. Further, the power contract provides that resale rates will be increased if necessary to maintain the distributor's operations on a self-supporting and financially sound basis. Conversely, to assure that the benefits of TVA power are passed on to the ultimate consumer, the contract also provides that if revenues are more than sufficient for a financially sound operation, there is to be a rate reduction.

[1] Four distributors elected a resale rate flexibility option that TVA offered from 2002 until 2007. With the exception of the non-discrimination provision required by Section 12 of the TVA Act, the flexibility agreements with such distributors either eliminate the resale rate provisions (Knoxville, Scottsboro, Meriwether Lewis) or modify them to be of only very limited application (Memphis).

The power contract also sets out processes by which both wholesale and resale rates can be changed or adjusted by TVA. Subject only to the procedural limitations set forth in the section of the Terms and Conditions to the power contract entitled "Adjustment and Change of Wholesale Rate and Resale Rates," adjustments or changes may be made to the wholesale rate and the resale rates set forth in the Schedule of Rates and Charges. Separate procedural requirements are applicable for Rate Adjustments and Rate Changes.

Under the Rate Adjustment provisions, TVA can adjust rates as often as quarterly "to assure (a) revenues to TVA are adequate to meet the requirements of the TVA Act and the tests and provisions of TVA's bond resolutions, and (b) revenues to the [distributors] are adequate to compensate" for any corresponding changes in the distributor wholesale power costs. Under the Rate Change provisions, whenever TVA or a distributor believes that general or major changes in the Schedule of Rates and Charges are warranted, either may request that the parties meet and endeavor to reach agreement upon such changes. In the event such an agreement cannot be reached, the contract provides for TVA to make such changes "as it determines will enable TVA to carry out the objectives of the TVA Act, meet the requirements and tests and comply with, the provisions of its bond resolutions… and enable the [distributors] to continue on a financially sound basis."

In its rates and other power pricing products, TVA has long sought to encourage efficient use of resources to help achieve the objective of the TVA Act that rates be "as low as feasible." Consistent with this objective, TVA has for many years included in its rate portfolio pricing arrangements to encourage demand response and energy efficiency. These have included various time-of-use, interruptible, and other pricing arrangements providing price benefits in return for demand response. TVA introduced its first real-time pricing product, Economy Surplus Power (ESP), in 1986. In 2000, Variable Price Interruptible Power, a similarly priced product, replaced

ESP. These widely used interruptible products provided hourly prices based on hourly marginal costs. TVA continues to make hourly pricing available under its 2-Part Real Time Pricing program and provides interruptible products under separate programs. TVA has also tested some advanced time-of-use rate structures in recent years, including Critical Peak Pricing pilots, a hybrid of time-of-use and real-time pricing, and seasonal time-of-use pilots where rates are structured based on near-term forecasts of system marginal costs.

The incorporation of time varying cost into the rate design provides appropriate price signals for cost-effective energy efficiency. Customers may make rational economic decisions to adopt energy efficiency when they are provided with appropriate price signals. Most of the pricing that TVA has offered in the past to incentivize energy efficient customer response have been optional pricing products that customers could select if they had the flexibility to respond to the price signals. TVA is discussing with power distributors whether it would be appropriate to apply rates that more closely reflect variations in cost to serve over time on a broader basis. On August 1, 2007, the TVA Board made a determination to adopt a modified version of the PURPA standard on "Time-Based Metering and Communication," which provides that:

> TVA will initiate a rate change in accordance with the provisions of its wholesale power contract with the distributors of TVA power to assess in detail (1) the benefits and cost of implementing a mandatory time-based rate schedule for large retail customers, under which the retail rates reflect seasonal and time-of-day variations in the costs of generating and purchasing electricity, (2) the benefits and cost of implementing advanced metering and communications technology to help the electric consumer manage energy use and costs, and (3) other factors affecting the implementation of such structures as soon as feasible.

Informal discussions are currently ongoing and it is anticipated that formal Rate Change discussions will begin soon.

The TVA staff has the following comments for the specific policy options listed under subsection B of the standard:

(1) Removal of throughput incentives.

The objective of public power is to minimize cost to the customers, not to maximize profit, so throughput incentives are not as big a factor for TVA and municipal and cooperative distributors as they are for investor-owned utilities. On the other hand, it is important that public power utilities adequately recover their fixed costs, and erosion of fixed cost coverage due to conservation has been raised as an issue in discussion of energy efficiency programs with distributors. TVA and the distributors should continue to work together in discussions of rate changes and energy efficiency program development to create mechanisms for ensuring that distributors reasonably recover their fixed costs when cost-effective energy efficiency measures are adopted.

(2) Provide utility incentives for the successful management of energy efficiency programs.

Again, since a basic objective of TVA and local power distributors is to have rates as low as feasible rather than to maximize profit, it should not be necessary to provide financial incentives for TVA or power distributors.

(3) Include the adoption of energy efficiency as one of the goals of retail rate design, given that this goal must be balanced with other ratemaking objectives.

The promotion of energy efficiency is a current ratemaking goal that TVA and distributors have set out in their current rate discussions. TVA and TVPPA have set out rate structure guiding principles that consider other factors such as recovery of all costs, efficient price signals, improved load management, simplicity and stability of rate design through a phased approach to implementing rate changes.

(4) Adopt rate designs that encourage energy efficiency for each customer class.

TVA and the distributors have focused to date on making optional rates available to larger commercial and industrial customers. Typically, these customers already have the metering required to apply advanced pricing structures and so have been seen as the group that could provide the largest response for the least incremental investment. Rate options that provide enhanced incentives for energy efficiency have been much less available to residential and small commercial customers.

This policy option suggests that customers in all classes should have an opportunity to participate in rates that encourage energy efficiency as a matter of policy. The topic is currently being considered by TVA and the power distributors in rate change discussions. Rate design principles that send efficient price signals while recovering revenue requirements provide the appropriate rate design incentives for energy efficiency.

(5) Allowing timely recovery of energy efficiency related costs

To the extent that energy efficiency actions are cost-effective and the erosion of fixed cost coverage can be controlled, energy efficiency should lower rates over the long run through the avoidance of capital expenditure to create new generation capacity. Nevertheless, there may be timing differences between when investments are made and benefits are realized. In such cases, it may be appropriate to allow rate increases to cover near-term investments that provide long-term benefits.

(6) Offering home energy audits, demand response programs, publicizing financial and environmental benefits of energy efficiency, educating homeowners about federal and State incentives and low cost loans for energy efficiency investments.

TVA and the distributors of TVA power are currently considering what non-rate programs may best incentivize cost-effective energy efficiency and demand response in the Valley. This work is being done through the TVA Energy Efficiency and Demand Response group working with the Tennessee Valley Public Power Association Energy Services Committee. A brief description of the energy efficiency programs offered by TVA and distributors is provided in Appendix D.

Staff Findings and Conclusion

The TVA staff views this standard on rate design modifications to promote cost-effective energy efficiency and energy efficiency investments as fully consistent with TVA's mission of providing power at the lowest feasible rates. The staff recommends that the standard be adopted and that all policy options set out in the standard be considered for applicability in the TVA service area in TVA discussions with distributors regarding rate changes and energy efficiency program development.

PURPA Standard 3 —Consideration of Smart Grid Investments

This section will discuss the industry landscape, the history of smart grid programs at TVA, and the current and future planned process for evaluating and enabling smart grid investments. Also, it will separately address the three sections of the standard and their specific relevance to TVA.

Proposed Standard

Consideration of Smart Grid Investments

(A) In General - Each State shall consider requiring that, prior to undertaking investments in non-advanced grid technologies, an electric utility of the State shall

demonstrate to the State that the electric utility considered an investment in a qualified smart grid system based on appropriate factors, including:

(i) Total costs;

(ii) Cost–effectiveness;

(iii) Improved reliability;

(iv) Security;

(v) System performance; and

(vi) Societal benefit.

(B) Rate Recovery – Each State shall consider authorizing each electric utility of the State to recover from ratepayers any capital, operating expenditure, or other costs of the electric utility relating to the deployment of a qualified smart grid system, including a reasonable rate of return on the capital expenditures of the electric utility for the deployment of the qualified smart grid system.

(C) Obsolete Equipment – Each State shall consider authorizing any electric utility or other party of the State to deploy a qualified smart grid system to recover in a timely manner the remaining book-value costs of any equipment rendered obsolete by the deployment of the qualified smart grid system, based on the remaining depreciable life of the obsolete equipment.

Preliminary Recommendation

The TVA staff finds that the approach of the proposed standard is in keeping with TVA's energy efficiency and conservation strategic objective as outlined in the TVA 2007 Strategic Plan. With respect to the standard, the staff proposes that the Board adopt only the Smart Grid Investments

evaluation factors outlined in Section (A) of the standard, finding that current TVA practices are consistent with the intent of this standard. As the discussion below indicates, the staff has determined that the Rate Recovery provisions contained in Section (B) and the Obsolete Equipment provisions contained in Section (C) of the standard apply to TVA and distributors from a cost recovery perspective because of their status as public power entities and not from a return on investment that is more relevant to investor-owned utilities.

Background (Benefits)

PURPA does not define the term "smart grid." The term generally refers to the use of intelligent electronic devices (IEDs) and communications between the devices for feedback to achieve a self-healing, performance-optimized electric grid. This includes adaptive, predictive, and integrated technology that is interactive with grid operators and consumers. A smart grid can be achieved through an integration of enabling and complementary technologies and applications. The network applications and components that make up the smart grid include wide-area, ubiquitous telecommunications at all points on the grid from a generation plant to a customer's premises; IEDs such as transformer and breaker equipment monitors, phasor measurement units, and power quality monitors located at key points on the grid; smart meters and supporting information systems that provide real-time load information to both customers and utilities; and advanced algorithms and computer applications able to take advantage of new data streams and run complex contingency scenarios in real time.

The EISA supports a national policy for the development of a smart grid intended to modernize the electric transmission and distribution system, and Section 1309 of the EISA lists the characteristics of a smart grid. The U.S. Department of Energy (DOE) has a separate list of characteristics for a smart grid. Smart grid enabling technologies create a foundation for such a grid, which is really made up of two parallel networks: the electric grid itself and the

"intelligence" grid behind it. The electric grid includes all of the equipment required to generate and distribute electricity as well as the control devices attached to it. The intelligence grid consists of the core communications and information-management systems plus the applications that process the data received from the devices. The integration of the foundational platforms with the communications and information technology (IT) allows the applications to gather and translate data received from the field and present it to analysts, engineers, and operators, enabling them to make timely, accurate decisions with confidence. The benefits of these fully communicating, interconnected, and interoperating networks bring with them increased security requirements. Penetration into any networked cyber environment has the potential to result in impaired service levels or disruption of expected quality of service. The North American Electric Reliability Corporation (NERC) has mandated Critical Infrastructure Protection Standards (CIPs) for bulk transmission systems to which the industry must be fully compliant by December 31, 2010. Smart grid devices will be designed with strong security protections in place to provide a secure infrastructure utilizing a defense-in-depth strategy.

There are benefits to smart grid investments. Smart meters will pave the way for real-time pricing, where energy is priced at different rates depending on the time of day and how much demand there is for the electricity. Utilities can use real-time pricing to better manage the load on the grid, while homeowners can use it to cut their monthly energy bills. The smart grid will also be able to pull energy from distributed clean power projects such as solar panels and small wind turbines on rooftops, feed it back into the grid, and compensate the power generators accordingly. End-use customers will benefit by a slower rate of increase in their electricity rates from their utility service providers when subscribing to programs or electric rates that reward the consumer for participation, thereby reducing their electric bill. As these types of projects expand, customers will also benefit by understanding how energy (and electricity) is being used by devices and appliances in their homes, thereby providing opportunities to save energy. Finally,

with transparent control such projects provide will produce maximum energy savings during an event with minimal inconvenience and discomfort. TVA should be able to reduce peak demand, improve reliability of the transmission and distribution grid, and mitigate the need to add new generation capacity (particularly peaking plants) as well as new transmission and distribution facilities. Smart grid investments can also provide societal benefits such as stronger energy security and clean energy jobs.

A smart grid system has many components and will be built incrementally as technologies emerge and are proven and consumer demand dictates. Since the smart grid is not the responsibility of a single entity, there are differing interests represented. TVA in cooperation with the distributor community will strive to balance these different stakeholder interests with its primary objectives of keeping rates as low as feasible and providing an ample supply of power for the customers in the region.

Utilities around the nation are working on various aspects of the technologies and are at varying stages on their way to being full participants in a smart grid. The DOE is actively engaged in supporting a wide variety of smart grid projects. Its role is to act as an objective facilitator, allowing the best ideas to prove themselves. Appendix F is a sampling of some smart grid efforts in progress around the nation and illustrates the diverse paths to a smarter grid.

Current Practices (Challenges and Risks)

Smart Grid Programs at TVA and Power Distributors

TVA has a long history of promoting innovation in the energy market. Almost 30 years ago, TVA developed the Cycle and Save Program under which it paid for the curtailment of air

conditioning and heating (water/air) load in customers' homes. Controls are still in operation today from this program, which are estimated to cycle 30 MW of demand when called upon. A one-way communication path is utilized to send signals to direct load control devices that interrupt the power source to these residential sites for a period of time to reduce demand on the power system. The program has been successful and we want to build on those successes by enhancing the current capability with more recent industry innovations.

TVA and the distributors in the Tennessee Valley have made use of a wide range of metering capabilities, ranging from basic to enhanced, to the more advanced. They have invested in and implemented infrastructure that currently provides a high level of reliability to consumers. Several distributors have also implemented various automated meter reading (AMR) and Advanced Metering Infrastructure (AMI) solutions. In the spirit of our shared heritage, TVA and the power distributors are seeking to forge a solution that leverages current investments and provides options for future Tennessee Valley smart grid capabilities.

The Electric Power Research Institute (EPRI) is currently assisting with assessments with each distributor to account for the wide range of metering and communication network infrastructure that is in place today or planned in the near future. While these assessments are being completed, an analysis is being performed by high level planning teams that are creating a strategy to address the smart grid needs of the Tennessee Valley. The strategy will identify the elements of what is required and the options for how it might be undertaken. TVA is working with the TVPPA Technology Applications Committee to provide the distributors a set of options that enable certain capabilities that are consistent with the Tennessee Valley smart grid strategy.

The Tennessee Valley smart grid strategy is envisioned to leverage sensor networks, application software, and currently available computer solutions to enable TVA and the distributors to see

how much and where energy is being consumed, and if there are pending or current outages in the network. Once all the elements of a smart grid strategy are in place, consumers will be able to see how much energy they have consumed and adjust their consumption habits accordingly. Two-way connected smart meters will be installed in homes in order to provide these measurements and the needed verification.

TVA has a substantial opportunity to leverage existing technology investments such as the upgraded communications infrastructure to implement and realize business value from smart grid applications. TVA already has a considerable installed base of infrastructure investments. For example, the extensive fiber communications network for its electric operations can be leveraged to further enable smart grid information to and from customers.

TVA began building a fiber communications network using its transmission infrastructure to provide data communications between substations and its energy management system. Fiber-optic cables are made up of multiple fiber-optic strands, each approximately the diameter of a human hair. TVA began installing optical ground wire in 1988, and currently has approximately 3,000 miles of fiber-optic cable, or about 144,000 strand miles of cable. TVA has fiber to approximately 30 percent of its substations. This infrastructure can be leveraged to provide smart grid technology communications backhaul in the future such as readouts from smart meters and potential new customer energy information services.

At the transmission level TVA continues to distinguish itself in the industry. By developing a state-of-the-art substation in Bradley County, Tennessee, TVA will provide reliable power to the southeast Tennessee region. Bradley is the first totally integrated, fully functional substation utilizing IEDs placed on all breakers and transformers, fiber-optic communications, and the IEC 61850 standard protocol. Bradley will deliver an unprecedented 90% of the substation's data to

transmission operators and feed complex system models at the TVA System Operation Center (SOC) which employs supervisory control and data acquisition and energy management systems for power system control.

Distributors of TVA power currently deploy distribution feeder automation (DFA) devices on their systems to quickly restore power remotely, as opposed to sending field personnel to manually switch load in times of feeder faults. DFA involves adding supervisory control and monitoring capability to devices beyond the distribution substation at the 12-kV voltage level. Distribution automation can minimize the effects of outages on customers by improving feeder reliability and reducing restoration times; increase labor savings by reducing the number of manual switching operations required; reduce claims due to customer outages; provide the distribution operations center with increased visibility and information from devices beyond the substation; and provide an opportunity for automatic reclosing and sectionalizing.

TVA is taking steps to increase the opportunities to use smart grid technologies where direct consumer-load control techniques can reduce peak load requirements. If applied effectively, these controls can help defer investments in new generation facilities.

In accordance with its 2007 Strategic Plan, TVA is working with local power distributors and other Tennessee Valley stakeholders to become a leader in smart grid technology improvements and peak demand reduction techniques. Over the next few years, TVA plans to phase out or modernize several existing energy efficiency programs. TVA is transitioning into a new portfolio of product and service offerings that will support energy reduction goals set for 2012.

TVA in collaboration with the distributors continues to work with its commercial and industrial customers to provide solutions to their energy-related problems and to encourage the selection of

energy efficient smart-home technology equipment and solutions. TVA and the distributor pilots, programs, and initiatives in demand response for residential and industrial customers are shown in Appendix G.

Current TVA Process for Evaluation of Smart Grid Technologies

A new TVA organization (called Energy Efficiency and Demand Response), formed in July 2008, will provide leadership for the smart grid program at TVA and establish a company-wide identity for it. Partnering with EPRI, the Oak Ridge National Laboratory (ORNL), and the Tennessee Valley Public Power Association (TVPPA), TVA is supporting the road map to guide advanced metering infrastructure implementation in the Valley. Leadership teams will recommend the optimal approach for deployment of the road map and coordination to achieve the vision based on knowledge gained from pilot programs now underway. The team will also coordinate communication about smart grid activities at TVA; promote general education about the Tennessee Valley Smart Grid Vision (TVSGV) and smart grid strategies; communicate the status of smart grid efforts to executive management and across TVA; monitor industry trends and communicate to impacted groups; and provide a forum for review and collaboration on all smart grid activities. TVA continues to work with the power distributors in the TVA service area to develop uniform guidelines that promote the consideration of smart grid investments in the joint planning process prior to undertaking investments in non-advanced grid technologies.

TVA is also working with distributors and directly served customers to implement smart grid investments in the TVA region. The TVPPA which includes all of the TVA distributors has a Technology Applications Committee that is currently formulating policies for the distributors in the technology area. In August 2006, TVPPA and TVA conducted a survey regarding AMR

deployment by the power distributors. The response showed considerable interest by the power distributors in deployment of AMR capabilities, and since then several of the distributors have installed metering infrastructure technology solutions that have greater functionality than AMR alone.

TVA introduced the smart grid vision (TVSGV) to the TVPPA Technology Applications committee on January 22, 2009. The TVSGV will serve as TVA's road map to DOE's Smart Grid 2030.

Rate Recovery

Subsection (B) of the Standard specifies that:

"Each State shall consider authorizing each electric utility of the State to recover from ratepayers any capital, operating expenditure, or other costs of the electric utility relating to the deployment of a qualified smart grid system, including a reasonable rate of return on the capital expenditures of the electric utility for the deployment of the qualified smart grid system."

This direction is intended to mitigate the concern, primarily of investor-owned utilities, that smart grid investments and expenditures may not be completely recovered, or recovered in a timely manner. This concern may limit utility investment in smart grid technology. The subsection also encourages states to consider allowing a return on investments that utilities make in smart grid technologies.

The standard suggests that investments in smart-grid technology should be afforded the same level of cost recovery through rates as other investment in conventional utility equipment devoted to public use. Such rate treatment includes both periodic recovery of initial investment and return on the remaining investment balance.

In general, public power entities must recover through power revenues the cost of all of their power-equipment investments, since there is no equity shareholder to absorb under-recovery. This applies equally to TVA and its power-distributor customers. The TVA Board sets TVA's power rates to recover investments over the useful lives of the assets, as well as interest costs, periodic expenses, and payments in lieu of taxes. The TVA Board also has regulatory responsibilities over the rates of most of TVA's power distributors, and it adheres to cost recovery principles that maintain distributors' financial viability. However, there may be timing differences between when investments are made and when benefits are realized. In such cases it may be appropriate to allow rate increases to cover near-term investments that will produce long-term benefits. TVA and the distributors will work together in discussions of rate impacts associated with such investments and develop mechanisms to ensure that distributors reasonably recover their costs in smart grid investments.

Obsolete Equipment

Subsection C of the Standard specifies that:

"Each State shall consider authorizing any electric utility or other party of the State to deploy a qualified smart grid system to recover in a timely manner the remaining book-value costs of any equipment rendered obsolete by the deployment of the qualified smart grid system, based on the remaining depreciable life of the obsolete equipment."

This direction is intended to remove another possible impediment to smart grid investment by utilities, primarily investor-owned. The concern is that a state regulatory authority may conclude that recovery is barred because the obsolete equipment is not "used and useful" or that the initial investment in "old" technology was imprudent because the utility should have moved to newer technologies sooner. The standard is intended to remove a possible impediment to smart grid investment by investor-owned utilities, whose regulators may expect shareholders to absorb the

unrecovered cost of assets rendered obsolete by new smart-grid investments. While TVA is certainly not opposed to the idea that investors should recover their investments in utility assets that were considered prudent at the time they were undertaken, TVA and its distributors have no shareholders to absorb any such costs. As described previously, public power entities have little recourse within the bounds of financial viability but to recover such costs through their various revenue streams. For TVA and its distributors, obsolescence of assets is dealt with according to standard utility accounting practices, and the ratemaking principles for TVA and its distributors achieve cost recovery consistent with those practices. Timing differences when new investments are made to replace obsolete equipment may make it appropriate to adjust rates to recover the unamortized portion of the displaced equipment costs.

Staff Findings and Conclusion

The TVA staff views this standard on smart grid investments to be fully consistent with TVA's mission of providing power at the lowest feasible rates. The staff finds that the approach of the proposed standard is in keeping with TVA's energy efficiency and conservation strategic objective as outlined in the TVA 2007 Strategic Plan. With respect to the standard, the staff proposes that the Board adopt only the Smart Grid Investments evaluation factors outlined in Section (A), finding that current TVA practices are consistent with the intent of this standard. With respect to how TVA analyzes investments generally, as a provider of electrical energy to its customers, TVA uses a common approach and consistent methods for analyzing investments, similar to the factors identified in the standard. With respect to smart grid investments specifically, the staff proposes to recommend that TVA work with power distributors in the TVA service area to develop guidelines that will promote consideration of smart grid investments in the joint planning process, prior to making investments in non-advanced grid technologies. The staff has determined that the Rate Recovery provisions contained in Section (B) and the Obsolete

Equipment provisions contained in Section (C) of the standard apply to TVA and distributors from a cost recovery perspective because of their status as public power entities and not from a return on investment perspective that applies to investor-owned utilities.

PURPA Standard 4 —Smart Grid Information

This section of the report addresses the Smart Grid Information standard and, in particular, will discuss the three separate sections of the standard and their relevance to TVA and distributors of TVA power.

Proposed Standard

Smart Grid Information

(A) STANDARD. - All electricity purchasers shall be provided direct access, in written or electronic machine-readable form as appropriate, to information from their electricity provider as provided in subparagraph (B).

(B) INFORMATION. - Information provided under this section, to the extent practicable, shall include:

(i) PRICES. - Purchasers and other interested persons shall be provided with information on-

(I) time-based electricity prices in the wholesale electricity market; and

(II) time-based electricity retail prices or rates that are available to the purchasers.

(ii) USAGE. - Purchasers shall be provided with the number of electricity units, expressed in kWh, purchased by them.

(iii) INTERVALS AND PROJECTIONS. - Updates of information on prices and usage shall be offered on not less than a daily basis, shall include hourly price and

use information, where available, and shall include a day-ahead projection of such price information to the extent available.

(iv) SOURCES. - Purchasers and other interested persons shall be provided annually with written information on the sources of the power provided by the utility, to the extent it can be determined, by type of generation, including greenhouse gas emissions associated with each type of generation, for intervals during which such information is available on a cost-effective basis.

(C) ACCESS. - Purchasers shall be able to access their own information at any time through the Internet and on other means of communication elected by that utility for Smart Grid applications. Other interested persons shall be able to access information not specific to any purchaser through the Internet. Information specific to any purchaser shall be provided solely to that purchaser.

Preliminary Recommendation

TVA staff believes the Smart Grid Information standard should be implemented in a modified form, which is set out below. While the staff believes the intent of the standard is consistent with TVA's objective to provide the public power at the lowest feasible rates, adjustments to the specific language of the standard are appropriate. Because TVA does not currently have all the elements of smart grid investments in place, the details regarding how smart grid information will be made available and the timing of its implementation across the Valley cannot be specified at this time but need to evolve as these programs mature. Additionally, we believe it is imperative that field trials be conducted with distributors in order to make informed and cost-effective decisions on what information is to be presented to customers and what the appropriate delivery mechanism should be.

In addition, because of the unique structure that TVA has with its 158 distributors, involving limited oversight in their day-to-day administrative actions and different stages of implementation of the smart grid information standard for each one, the TVA staff does not believe it is appropriate for TVA to apply a uniform customer information standard to its power distributors.

For the above reasons, the TVA staff proposes that TVA adopt a modified standard as follows: **TVA will endeavor to provide its power distributor and directly served customers with appropriate price and usage information to facilitate cost-effective smart grid and other energy efficiency activities in the Valley. TVA also will work with its wholesale distributor customers on a cooperative basis to make available information systems and data that will facilitate cost-effective smart grid and energy efficiency activities at the distributor retail level. TVA will prepare and present to its distributor and directly served customers on an annual basis information on sources of generation by fuel type and estimated greenhouse gas emissions, and recommends that this information be shared with the distributors' retail customers where possible.**

Background (Benefits)

Under this standard, utilities would consider whether communicating certain information on electric power sources, costs, and pricing is appropriate. To the extent that consumers can respond to this information, electric power costs could be lowered. Providing this information to consumers would involve added administrative costs, however, so the possible customer response benefit of having the additional information available has to be weighed against the additional cost of making the information available. Additional information for consumers is most likely to be cost-effective where the customer is on a time-differentiated rate structure. Certain research findings indicate that customers more informed about energy usage will make wiser energy

choices, typically reducing usage 5 % to 15% percent (Oxford Study, see Darby 2006, Appendix K4).

This information can be particularly important where consumers are considering making investments in smart grid technologies discussed under the previous standard.

In order for the benefits of smart grid technology to be realized, the technology cannot just be installed and assumed to work with little oversight. How the technology is implemented and how effectively consumers and utilities use the information generated from the smart grid will affect the size of the benefits realized (Neenan and Hemphill, 2008, Appendix K4). At its best, information on usage and electricity price can give consumers the information they need to better manage their energy costs. With automatic devices, such as thermostat controls, consumers have tools that can give them powerful alternatives to the way most of us presently consume energy. With the installation of sensors and automated monitoring as part of the smart grid, the new systems will tend to see fewer outages, and when outages do occur, the system will be restored more quickly. Utilities should be able to take advantage of network automation and analytics to optimize transmission and distribution systems. These transmission benefits can shorten transmission paths and reduce losses, which can even have environmental benefits in terms of lowering greenhouse gas emissions through the lowering of generation requirements (Valococchi et al., 2007, p. 6, Appendix K4).

There is considerable evidence that having feedback about electricity usage affects consumers' consumption. The range in reported usage from a number of pilot studies is between 2% and 28% (Neenan and Hemphill, 2008, p. 38, Appendix K4). So as the society moves toward having wiser use of energy as one of the objectives of overall energy planning, the provision of smart grid information is an important tool to achieving this objective.

Smart metering is the enabling technology for the development of plug-in hybrid electric vehicles, electric vehicles, and extended range electric vehicles, such as the Chevrolet Volt (Neenan and Hemphill, 2008, p. 38. Appendix K4). The smart grid is required for the electric utility to "know" when the car was plugged in and allow it to impose a special rate class, if it chooses to do so (i.e., imposing a higher rate if charging occurred on peak). It could also ensure that the car owner was correctly charged, even if the person charged the car at a public station. It might also be possible to have two-way use of the battery, where the utility could draw on the car battery during times of peak. There might be management of other grid issues associated with vehicle charging that could be explored under the smart grid. All of these capabilities would provide for additional information streams that should be made available to the consumer.

The specific information items set out under this standard to be made available to electricity purchasers include the following:

1. Information on time-based electricity prices in the wholesale market and also time-based prices available to the purchaser.

As mentioned under previous standards, the cost to supply electricity may vary significantly by season and by time of day. In wholesale markets power may be bought and sold on a daily, weekly, or monthly basis and on hourly, on-peak, off-peak, or 24-hour time intervals. These wholesale market prices frequently indicate the incremental cost of power supply to utilities in the market and so may provide a good indication of potential cost savings from energy efficiency actions taken at different points in time. Where organized power trading markets are in place, market clearing prices may be published and could potentially be communicated to consumers. Not all areas, including the Southeast, have markets organized to this extent. In such areas,

wholesale power transactions are made on a bilateral contract basis, and the availability of wholesale market information is more limited.

Most utilities have some form of time-based pricing available to retail customers. Seasonal pricing arrangements have different prices in effect during different seasons of the year. Time-of-use rates generally involve structures where there is a different price in effect during peak load hours of the day versus off-peak hours. Real-time pricing arrangements provide hourly pricing that may closely track wholesale market prices. In some cases, such time-varying rates are applied as the standard rate for a rate class; more typically such pricing arrangements are optional alternatives to standard rates with the consumer electing to participate in the structure. In either case, consumers billed under such rates need to understand the pattern of pricing within the time-based structure in order to be able to respond appropriately to the pricing. This standard provides that pricing for such time-based arrangement be appropriately communicated to purchasers.

2. Usage – Purchasers shall be provided with the number of units of electricity usage in kWh consumed by them.

The abbreviation kWh represents kilowatt-hour, a standard measure of electricity usage that is a primary billing unit basis for virtually all electricity pricing arrangements. A kilowatt-hour represents 1,000 watt-hours. A 100-watt light bulb that is burned for 10 hours will consume 1,000 watt-hours, or one kilowatt-hour, of electrical energy. This section of the standard states that utilities should provide consumers with information on their kWh usage.

The standard does not indicate a time frame for this kWh usage information. In most cases kWh electricity usage is provided to customers on a monthly basis in their electric bill. Some utilities offer their consumers online access to usage history information through the company website.

Large electric consumers that are on advanced pricing structures may receive data files with energy usage information on an hourly basis.

Again, usage information can help educate users so that they may be more effective in their energy efficiency activities.

3. Intervals and Projections – updates of information on prices and usage shall be provided on not less than a daily basis, shall include hourly price and use information, where available, and shall include a day-ahead projection of such price information to the extent available.

Daily updates of price information are most relevant to real-time pricing arrangements where prices change hourly. Most utilities that have such pricing arrangements will provide a day-ahead projection of these prices and may even provide hourly updates of actual prices as they occur. This information is usually communicated to customers through a web-based platform.

Daily updates on usage are more challenging to accomplish. This requires the customer to have metering that can be remotely interrogated by the utility and the capability to download that data to a data platform on a daily basis. This is not a capability that utilities have with the majority of their customers at this time. Nevertheless, such information could be helpful to customers seeking to manage their power usage in an efficient manner.

4. Purchasers and other interested persons shall be provided annually with written information on the sources of power provided by the utility including type of generation and also greenhouse gas emissions by type of generation.

This information appears intended not so much to help consumers evaluate specific energy efficiency actions as much as to raise the general level of consciousness concerning the potential

environmental impacts of power usage and so the overall need for energy efficiency. Such information may typically found in utility annual reports and on utility websites.

Current Practices (Challenges and Risks)

Applicability to TVA and Distributors of TVA Power

TVA's customers are the 158 municipal and cooperative local power distributors to which it sells power at wholesale and also about 50 retail customers served directly by TVA. At one level, this standard must be evaluated in terms of what information TVA makes available to these customers.

Another level of consideration with regard to smart grid information is the information that power distributors make available to their retail customers. In many cases such information as discussed in the standards relates to hourly generation costs, and therefore, what distributors could provide their customers would depend on what TVA is able to make available to them.

The standard appears to be written to apply to a traditional regulatory body that can require that utilities under its jurisdiction provide this information to its customers. TVA's oversight of its power distributors is a function of its power contract with the distributors and the fact that under this contract TVA agrees to the retail rates charged by the local distributor. TVA can work with the power distributors on a cooperative basis to make appropriate information available to Valley consumers in support of energy efficiency goals and as part of their participation in cooperative programs promoting greater energy efficiency.

Pricing and Usage Information Currently Provided by TVA

Standard Rate Billing

TVA's current wholesale pricing is done under its End Use Wholesale rate schedule. The current base wholesale rate schedule was implemented in October 2003 and is subject to periodic revision through Adjustment Addendum and Statement of Amounts documents. Table 1 in Appendix H shows the wholesale rates in place during the first quarter of the 2009 calendar year. Retail rates vary depending on charges put in place by each power distributor. There are parallel directly served rate schedules that set out standard rate billing for directly served customers. TVA's Billing Analysis Department currently provides all its wholesale and directly served customers with information on energy usage, price, and other charges on a monthly basis (Tennessee Valley Authority, 2008b, Appendix K4).

Time-of-Use Rates

As part of its current wholesale rate schedule, TVA also makes available optional time-of-day rates that can be utilized by local distributors to offer their customers' optional retail time-of-use pricing. This pricing is also updated from time to time through wholesale Adjustment Addendum and Statement of Amounts documents that are supplied to distributors and directly served customers when pricing for these products changes.

Hourly Pricing Products

TVA has considerable experience in the offering of hourly priced products to directly served customers and also to distributors for their retail customers that wish to participate in such arrangements. TVA has a web-based Real Time Pricing system which provides participating customers and the distributors that serve them with price information on hourly products.

The Real Time Pricing system provides price information within the following time frames for Variable Price Interruptible (VPI), the most commonly used hourly pricing program:

- Monthly average price estimates 12 months out
- Hourly price estimates one week out
- Next day prices updated on an hourly basis

Customer Usage Information

TVA provides its customers with usage information on a monthly basis. Interval demand data is available to customers after the monthly billing process has been completed in electronic form. TVA currently does not provide customers with real-time feeds of their hourly usage.

Pricing and Usage Information Currently Provided by Distributors

Standard Rate Billing

Distributors of TVA power have retail rate schedules to which TVA has agreed and which are attached to the wholesale power contract as the retail rates the distributor will apply. These retail rate structures are also subject to adjustment through Adjustment Addendum and Statement of Amount documents. Most distributors have web pages that include their currently effective retail rates.

Time-of-Use Rates

All distributors of TVA power have optional time-of-day rates for customers with electric power demands in excess of 5,000 kW. These currently see limited use.

Distributors also can make available optional time-of-day rates to customers with power demands less than 5,000 kW at their discretion. Twenty-two distributors currently offer time of use rates to such customers.

Where available, such rates are also typically posted on the distributor's website and updated periodically as appropriate, subject to the issuance of new Adjustment Addendum and Statement of Amount documents.

Hourly Pricing Products

TVA and distributors have worked together to make hourly priced products available to distributor-served customers. Distributor customers that participate in hourly pricing products have the same access to TVA's Real Time Pricing System as TVA's directly served customers and see hourly price information on the same basis as described above.

Customer Usage Information

Distributors provide most of their customers with information on overall monthly usage. Interval data is provided on a limited basis by some distributors to their large customers on a post-bill-processing basis.

Smart Grid Pilots in the TVA Service Area

In order to explore how best to provide information to maximize benefits from smart grid technology, TVA is working with TVPPA to implement several pilot programs in the Valley to investigate options. There are a number of choices available, and TVA and the distributors will have to deal with a wide range of legacy systems, all of which makes the implementation of smart grid systems especially challenging. By putting the pilot programs in place, the experience and lessons learned on a small scale can be leveraged if it is decided to expand the smart grid program further. A brief description of some of the programs offered by the distributors is provided in Appendix I.

Price and Usage Information Targeted in the PURPA Standard

1. Purchasers and other interested persons shall be provided with information on time-based electricity prices in the wholesale market and also time-based electricity retail prices or rates that are available to the purchasers.

TVA currently makes information on time-of-day rates available to its customers on a regular basis through rate schedules and rate updates in Adjustment Addendum and Statement of Amount documents. Information on pricing for hourly based products is also made available to customers participating in these optional pricing arrangements via the Real Time Pricing web-based system.

Information on time-based pricing in the wholesale market is more limited. TVA does provide a daily e-mail to its distributors and directly served customers that indicates the published "Into TVA" price index value from the wholesale market for the day. Other information TVA has on the wholesale market is produced through its bilateral bulk power trading operations and is considered competitively sensitive information.

Distributor communication of time-of-use price information will vary depending on what optional time-of-day rates the distributor offers.

2. Usage – Purchasers shall be provided with the number of units of electricity usage in kWh consumed by them.

TVA and distributors both currently provide this information to their customers on a monthly basis through power bill information.

3. Intervals and Projections – updates of information on prices and usage shall be provided on not less than a daily basis, shall include hourly price and use information, where

available, and shall include a day-ahead projection of such price information to the extent available

TVA and distributors currently provide customers that are on hourly pricing products with price updates consistent with the terms of this information item. TVA and distributors currently do not provide usage update information as indicated by this provision.

Providing daily usage update information is technically possible but would involve significant investment in infrastructure and operations to provide on a universal basis. On the other hand, as technology improves this may become more practical in the future. The TVA staff believes the best course of action on providing customers with usage updates is to evaluate the cost-effectiveness of this on an ongoing basis and to focus on those customers that are on time-of-use or hourly pricing or are involved in smart grid activities where such updates would be most useful.

4. Purchasers and other interested persons shall be provided annually with written information on the sources of power provided by the utility including type of generation and also greenhouse gas emissions by type of generation

This type of information is provided routinely by TVA in its Annual Report (10K filing with the U.S. Securities and Exchange Commission). For example, power supply information in 2008 is shown in Table 2, Appendix J. The Annual Report also includes information on emissions (Tennessee Valley Authority, 2008a, pp 27-33, Appendix K4). The report is available online to all interested parties.

TVA also published a 2008 Environmental Policy that outlined its guiding principles for environmental stewardship and renewables development and its intention to reduce greenhouse

gas emissions substantially over the next decade (Tennessee Valley Authority, 2008c, Appendix K4).

While TVA is sharing the information described in Item 4 publicly through certain specific existing communication channels as part of its overall communication activities, the wording of the PURPA standard could be read to indicate that this information should be packaged and provided to customers in a regular, subject-specific annual communication, which TVA and distributors do not do at this time.

Staff Findings and Conclusion

TVA staff believes the Smart Grid Information standard should be implemented in a modified form. There are two major benefits to providing smart grid information. First, it helps customers better manage their usage, which reduces their overall electricity costs and helps TVA reduce its peak demand. Second, the price and usage information provides detailed electric market and system information to the public. Researchers and other interested parties can learn more about demand elasticity, income response, and other factors influencing energy markets over time. This information can also be used by policymakers to make better decisions. While we believe the intent of the standard is consistent with TVA's objective to provide the public power at the lowest feasible rates, we believe adjustments to the specific language of the standard are appropriate. Because TVA does not currently have all the elements of smart grid investments in place, the details regarding how smart grid information will be made available and the timing of its implementation across the Valley cannot be specified but need to evolve as these programs mature. Additionally, we believe it is important that cost-effectiveness tests be applied in making decisions on what information is made available to consumers. The trade-offs between security and ease of providing smart grid information should also be considered.

In addition, because of the unique structure that TVA has with 158 distributors, TVA's limited oversight in their day-to-day administrative actions, and different stages of implementation of the smart grid information standard for each one, the TVA staff does not believe it is appropriate for TVA to apply a uniform customer information standard to its power distributors.

Conclusion

The earlier sections of this document described AMI and smart grid standards in relationship to the PURPA standards. The intent of this document is to articulate at a high level how TVA plans to deal with each of the four PURPA standards. Detailed supporting information can be found in the appendix section of this document. As AMI and smart grid technologies become ubiquitous, utilities will examine the benefits of installing such solutions. It is clear some aspects of the current approaches will be required to provide additional customer benefits such as demand response, refine the understanding of electricity usage patterns of different end-use loads to perform advanced load research, and explore different demand response/energy efficiency program strategies. TVA and it distributors currently have several pilot projects that will add to the knowledge base of both energy efficiency and demand response.

In many cases, the total benefits of such advanced technologies can only be realized if rate structures reflect utility costs across time and are made available to motivate efficient load-control behavior. TVA is currently working with customers to implement time-of-use rates. This is a complex process that TVA is addressing through several pilot projects.

APPENDICES

The purpose of the following sections in the appendices, in addition to providing references for source material for the report and other background information, is also to provide a greater understanding of TVA's staff recommendation on each PURPA standard. The content of the next several sections also support a longer-term overview of how TVA would implement each standard.

Additional Details on Responses to each Standard

APPENDIX A - TVA Organization

The Tennessee Valley Authority is a federal corporation and the nation's largest public power company. As a regional development agency, TVA supplies reliable, competitively priced power, supports a thriving river system, and stimulates sustainable economic development in the public interest.

Under the TVA Act, TVA's hydroelectric dams and other power generation facilities are designed and operated as part of a multipurpose system to help improve navigation, control floods, meet national defense needs, and promote the development of the Tennessee Valley region. Since 1959, in accordance with the direction of Congress, TVA has operated the power system to be financially self-supporting. Today, power revenues are used to buy fuel, pay wages, service debt, maintain assets, and fund environmental stewardship and economic development activities. In partnership with 158 local utilities, TVA provides reliable, affordable electricity to nine million people and 650,000 businesses in Tennessee and parts of six surrounding states. The 158 local utilities are our wholesale customers. The local utilities purchase TVA power for retail sale to their residential, commercial, and industrial customers. TVA also sells power directly to

about 50 large industrial customers and federal installations, such as Oak Ridge National Laboratory.

TVA operates fossil-fuel, nuclear, and hydroelectric power plants, and also produces energy from renewable sources. It manages the nation's fifth-largest river system to reduce flood damage, produce power, maintain navigation, provide recreational opportunities, and protect water quality in the 41,000-square-mile watershed. TVA also is a catalyst for economic development and job creation throughout its 80,000-square-mile service area, working in partnership with local governments and economic development agencies.

TVA does not report to a public utility commission, but is governed by a nine-member Board of Directors. The Board sets policy and strategy for TVA. The members are nominated by the President and confirmed by the U.S. Senate to serve staggered five-year terms. The Board has the exclusive authority to establish electric prices. It also performs a regulatory role for TVA power distributors and is directed to evaluate PURPA standards with respect to the distributors of TVA power. While the Board must maintain the financial integrity of TVA and operate it in accordance with good business judgment, the TVA power system is not operated with a profit motive. That is, there are no stockholders to receive a share of higher earnings or to be penalized for poor earnings. Therefore, although TVA coordinates with state and regional agencies, the main planning efforts for its electric system are conducted by TVA itself for the seven-state area that it serves.

The Board meets on a regular basis, and notification of time, place, and agenda is publicly posted. The meetings and documentation of proceedings are open and a matter of public record**.**

APPENDIX B- Glossary

Advanced Metering Infrastructure (AMI): Refers to the collection of components that make up a system which measures, collects, and analyzes energy usage from advanced devices. One such example is a electricity meter with the ability to provide, via some telecommunication media, information upon requests based on given thresholds, or on a predefined schedule. The infrastructure includes hardware, software, telecommunications, and customer-associated devices. AMI utilizes smart metering as part of a framework intended to be deployed on a wide scale for all customer classes, including residential and commercial/industrial.

Meter Data Management System (MDMS): A system included in an AMI framework for the storage, analytics, and integration into the utility enterprise application suite (CIS, OMS, GIS, WMS, etc.). Smart meters within an AMI framework are part of a smart grid landscape, but alone do not constitute a smart grid solution.

Automated Meter Reading (AMR): The technology of automatically collecting data from metering devices and transferring that data to a central database for billing purposes. In most cases today this is accomplished by walk-up, drive-by, or one-way communications. A purely one-way solution provides a limited increase in productivity but does eliminate the safety issues associated with manual readings (risk and liability of personnel performing the readings).

Distributed Generation: A generator located (distributed) close to the particular load that it is intended to serve. General, but non-exclusive, characteristics of these generators include an operating strategy that supports the served load and interconnection to a distribution or sub-transmission system.

Demand Response: Programs designed to induce lower electricity use to address system reliability, reflect market conditions and pricing, and support infrastructure optimization or deferral. A variety of technologies, pilots, and programs have been developed and implemented in a collaborative effort with the distributors of TVA power to achieve this objective. An

advanced metering infrastructure strategy utilizing smart meters and direct load control techniques moves TVA toward DOE's smart grid vision.

Fiber-optics: A technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber-optic cable consists of a bundle (two or more) of threads, each of which is capable of transmitting messages via light waves. Fiber-optic cables can carry more data than metal cables and are less susceptible to interference. They are thinner and lighter than metal wires and allow data to be transmitted digitally (the natural form for computer data).

Intelligent Electronic Devices (IEDs): Microprocessor-based controllers of power system equipment such as circuit breakers, transformers, and capacitor banks. IEDs receive data from sensors and power equipment and can issue control commands, such as tripping circuit breakers if they sense anomalies, and raising or lowering voltage levels to maintain a desired level.

Kilowatt (kW): A measure of electrical power equal to 1,000 watts. 1 kW = 3,413 Btu/hr = 1.341 horsepower.

Kilowatt-hour (kWh): A measure of energy equivalent to the expenditure of 1 kilowatt for 1 hour. For example, 1 kWh will light a 100-watt light bulb for 10 hours. 1 kWh = 3,413 Btu.

Megawatt (MW): A measure of electrical power equal to one million watts (1,000 kW).

Mesh Network: A radiofrequency-based self-healing network designed to provide multiple communications paths between devices (e.g., meters) and collectors.

Load: The amount of power or energy delivered at a given point or combination of points over a specified time interval.

Smart Meter: An interval meter with two-way communication capability that can relay data from the meter to the utility or vice versa. The technology may be used to transmit simple energy usage data from the meter; to transmit more complex measures of energy recorded in the meter; to implement advanced functionality such as outage detection and remote programming of meters by an authorized party; or to provide other functionality.

Security: The Federal Information Security Management Act (specifically Section 3544(b)(5) of the Act) requires each agency to perform for each system it is responsible for "periodic testing and evaluation of the effectiveness of information security policies, procedures, and practices, to be performed with a frequency depending on risk, but no less than annually. . ." This evaluation will include the testing of management, operational, and technical controls. The National Institute of Standards and Technology develops applicable minimum requirements for standards and guidelines.

APPENDIX C - Acronyms

AMI	Advanced Meter Infrastructure
AMR	Automatic Meter Reading
APPA	American Public Power Association
CFL	Compact Fluorescent Light
CIP	Critical Infrastructure Protection (NERC Initiative)
CPUC	California Public Utilities Commission
CVR	Conservation Voltage Regulation
DLC	Direct Load Control
DOE	Department of Energy
EEI	Edison Electric Institute
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act of 2007
EPA	Environmental Protection Agency
EPAct	Energy Policy Act
EPB	Electric Power Board
EPRI	Electric Power Research Institute
ESCO	Energy Services Company
FISMA	Federal Information Security Management Act
FSR	Final Summary Report
FVR	Final Voltage Report
GSA1	General Power Rate - Schedule GSA Part 1
GPS	Green Power Switch
HUD	Hours Use of Demand
IRP	Integrated Resource Planning
MDMS	Meter Data Management System
NARUC	National Association of Regulatory Utility Commissioners
NEEP	North East Energy Efficiency Partnerships
NERC	North American Electric Reliability Corporation
NESEA	Northeast Sustainable Energy Association
NIST	National Institute of Standards and Technology
NRECA	National Rural Electric Cooperative Association
NYPSC	New York State Public Service Commission
NYSERDA	New York State Energy Research and Development Authority
ORNL	Oak Ridge National Laboratory
PBSR	Power Billing Summary Report
PG&E	Pacific Gas & Electric Company
PSP	Power Supply Plan
PURPA	Public Utility Regulatory Policies Act (PURPA) of 1978 (as amended)
SDE	Seasonal Demand and Energy
STOU	Seasonal Time-of-Use
TD	Time Differentiated
TOU	Time-of-Use
TVPPA	Tennessee Valley Public Power Association
TVSGV	Tennessee Valley Smart Grid Vision
VPI	Variable Price Interruptible

APPENDIX D - Energy Efficiency Programs at TVA

In accordance with its 2007 strategic plan, TVA is working with local power distributors and Valley stakeholders to become a leader in energy efficiency improvements and peak demand reduction (Tennessee Valley Authority, 2007b Appendix K.1). Over the next few years, TVA will phase out its existing energy efficiency programs and transition into a new portfolio of product and service offerings supporting today's peak reduction goal of an incremental 1,400 MW by 2012.

1. Residential Initiatives

TVA and its 158 public power distributors have a long history of residential energy efficiency programs for the Valley. These programs are currently marketed under the brand name *energy right*®. A marketing firm was selected last summer to partner with TVA staff to develop a series of new and repositioned program offerings to be launched in calendar year 2009. TVA held a number of intensive interviews and focus group sessions with customers, trade allies, and distributor staffs at locations throughout the Valley. The purpose was to define concepts and develop initiatives that would best conceptualize how TVA could meet or exceed its goal to lower electricity capacity requirements by nearly 4 % by 2012.

About 153 distributors participate in various initiatives under the *energy right* Program. These initiatives are described below:

a. New Homes Plan

The *New Homes Plan* promotes all-electric, energy efficient new homes. All homes built *energy right* must meet a minimum rating in overall energy efficiency. Homes built at least 7 % better than current energy efficiency code qualify as *energy right* while those built 15 % better qualify

as *energy right* Platinum or *energy right* Platinum Certified. Since the summer of 2005, when TVA began an ENERGY STAR® certification promotion (which equates to *energy right* Platinum Certified), over 1,800 homes have been certified through 22 participating power distributors. FY 2008 installations included 4,606 *energy right* homes, 786 *energy right* Platinum homes, and 599 *energy right* Platinum Certified homes.

TVA was recognized by the Environmental Protection Agency (EPA) with a 2008 ENERGY STAR Leadership in Housing award. This award recognized the contributions TVA had made to energy efficient construction by certifying 391 homes through the *energy right* program. According to the EPA press release, the annual environmental benefits of these 391 homes are equivalent to eliminating the emissions from almost 200 vehicles or planting over 300 acres of trees.

The National Theatre for Children, the largest educational theatre company in the world, is working with TVA and distributors to bring a performance on energy efficiency and clean energy messaging to 700 schools. Programs began in the fall of 2008, and the plays will continue throughout the 2009 and 2010 school years in the service territories of more than 50 distributors.

b. Heat Pump Plan

The *Heat Pump Plan* promotes the installation of high efficiency heat pumps in homes and small businesses. Installation, performance, and weatherization standards have been established to ensure the comfort of the customer and the proper operation of the system. A Quality Contractor Network (QCN) has been established to maintain high installation standards. Through a third-party lender, TVA provides 10-year financing for residential heat pumps with repayment through the consumer's electric bill.

c. Water Heater Plan

The *Water Heater Plan* promotes the installation of energy-efficient electric water heaters in homes and small businesses.

d. New Manufactured Homes Plan

The *New Manufactured Homes Plan* promotes the installation of high-efficiency heat pumps in new manufactured homes. TVA won the Tennessee Manufactured Housing Association's 2008 Non-Industry Partner of the Year Award, which recognizes non-industry organizations that contribute to the overall success of the industry as well as the State association. TVA has won the award for the last two years.

e. In Concert with the Environment Program

In Concert with the Environment (in partnership with Aclara Software) is another TVA energy efficiency promotion program that targets youth participation. It is a comprehensive environmental and energy education program directed at middle school and junior high school students. Student participants receive an energy survey to complete for their households. Results from the survey indicate the home's estimated annual and monthly energy usage by appliance and give a number of energy, environmental, and water-usage recommendations for the student and their family to implement.

f. *energy right*® Home e-Valuation®

The *energy right Home e-Valuation* (in partnership with Aclara Software) focuses on ratepayers. It allows residential customers to play an active role in saving energy in their homes. After completing an online or paper version of the energy survey, customers receive a personalized report that breaks down the home's annual and monthly energy usage by appliance, and gives a number of energy recommendations as well as information about distributor products and

services. TVA began offering free energy efficiency kits to all customers that complete the home energy survey in January 2008. The kit includes tools to help consumers save energy and money on their power bills. More than 55,000 customers have participated in this special promotion in the last 12 months.

g. The In-Home Evaluation Program

The *In-Home Evaluation Program* is targeted to consumers who have a strong desire to make significant energy efficiency improvements in their home. This program is currently in a pilot stage with 22 power distributors participating from around the Valley. With this program, the entire home is evaluated by trained HVAC and weatherization professionals who provide a detailed report on energy efficiency improvements that would reduce the home's energy costs. Incentives, which are paid to the customer based on work performed, can be either a cash rebate or a financing package. If the pilot yields positive results, it will be expanded to the entire Valley in about a year.

2. Commercial Initiatives

In cooperation with the distributors of TVA power, energy efficiency programs are being offered to the commercial and industrial market sectors. The Commercial Efficiency Advice and Incentive program is being developed and targeted to large commercial customers with a demand greater than 250 kW. The purpose of the program is to provide commercial customers with reliable, unbiased, fact-based assistance and information to help them make sound energy-saving investment decisions and to provide incentives that will help in reducing the project payback period.

In addition to helping commercial customers manage their energy use more efficiently, TVA's energy efficiency programs are designed to achieve maximum peak reduction benefits during the

highest periods of demand on the TVA system. Past growth in the use of electricity in the Valley has required TVA to increase power purchases from other suppliers to meet summer peak power demand. Energy efficiency programs like the Commercial Efficiency Advice and Incentive program can help reduce the amount of power TVA purchases from more costly sources, which helps keep energy costs lower for all Valley consumers.

3. Industrial Initiatives

The TVA Energy Efficiency (EE) Program Design staff is currently developing a program for the large industrial sector. The program takes a holistic approach to identifying plant energy efficiency opportunities for industrial customers who have a contract demand greater than 5 MW. They can be either distributor-served or directly-served by TVA.

This program leverages the Department of Energy (DOE) funded Save Energy Now (SEN) assessments, which are offered at no cost to large manufacturers who consume 0.3 TBTUs of annual energy. When needed, TVA provides consultants to support industrial customers in identifying EE opportunities. Incentives are provided for customers who implement the recommendations.

A pilot of this program was conducted at Mahle, Inc., in Morristown, TN, a manufacturer of die cast pistons that supports the automotive and truck industries. TVA and Morristown Utilities offered Mahle electric-process heating and chiller assessments at no cost, while DOE provided gas-process heating and compressed air assessments through the SEN program. The estimated peak demand savings calculated showed that Mahle could reduce its current facility demand by 618 kW. After implementation of the recommendations, measurement and verification showed an actual demand savings of 800 kW, and over 5 MWh per year was achieved.

Additional programs will be developed to cover all segments of the C&I market sector. New construction and re-commissioning programs will be developed as well.

4. Energy Services Company (ESCO)

Since 1997, TVA's Energy Services Company has worked with customers to achieve energy efficiency savings and peak demand reduction through performance contracting projects. More than $50 million in improvements have been made at military installations, state-owned buildings, and school systems in the Valley. Under these performance contracts, the equipment cost is funded through the resulting savings on the energy bills.

In 2008, Fort Campbell, Kentucky, received the 30th Annual Secretary of the Army Energy and Conservation Award for Energy Efficiency/Energy Management based on work done with TVA's ESCO and the Pennyrile Rural Electric Cooperative Corporation. Fort Campbell invested $16.7 million in building projects on lighting replacement/retrofit, energy management control systems, hot water modifications, HVAC improvements, and architectural modifications. Fort Campbell was able to secure annual savings of over $2.3 million, resulting in a simple payback of just over seven years.

APPENDIX E- Rationale for Energy Efficiency/Challenges and Risks

1. Ease Upward Pressure on Electricity Costs

Moderate expected increases in average customer bills. With customers taking control of their demand, they will better be able to reduce their monthly kWh usage and their peak kW demand over what it would have otherwise been. TVA and the power distributors want to become partners with customers to help them implement energy efficiency projects. By becoming informed about how they use electricity, how their homes can become better insulated, and how their appliances can be upgraded, residential customers can take an active role in reducing their average bills. This same improvement is possible for businesses in the Valley; by active involvement in energy efficiency initiatives, they can also reduce their average bill.

Slow increases in anticipated growth in TVA's energy costs. As capacity requirements increase with growth in population, new industry, and increases in average electricity demand in the Valley, TVA needs to plan for ways to meet those requirements. Investment in generating plants is becoming increasingly expensive, and their addition is elevating TVA's average costs rather than lowering them. Internal studies have indicated that over the long run, energy efficiency improvements will reduce TVA's costs by levels greater than the revenue reductions that can be expected to accompany the loss of sales (TVA, 2008c Appendix K.1). These cost savings have been identified by other studies as well, such as those conducted by California, Connecticut, Iowa, Massachusetts, New York, Vermont, and Washington State (Hurley et al., 2008, p. 12 Appendix K.1).

Enhance system reliability and reduce transmission congestion. Energy efficiency investments have the potential to reduce stress and congestion on the transmission and distribution system, thereby improving system reliability (Union of Concerned Scientists, 2003, and Nadel *et al*., 2000 Appendix K.1). Therefore, through reductions in the rate of electrical growth on the system, investments in energy efficiency will enhance the ability of the system to perform within acceptable standards, delivering power when and where consumers need it.

Lower emission levels, reducing system costs. To the extent that a kWh of electricity can be saved through energy efficiency by not generating it at a fossil fuel plant, TVA realizes savings in emission costs. Today, those savings are the equivalent value of emission allowances for sulfur dioxide (SO2) and nitrogen oxide (NOx), as regulated under the Clean Air Act by the U.S. Environmental Protection Agency (USEPA, 2001 Appendix K.1). The value of these savings varies as market prices for allowances vary. One estimate put the value of NOx emissions alone at $0.70/MWh (Burtraw *et al.*, 2005, p. 44 Appendix K.1). With the anticipated addition of regulations on emissions for mercury and carbon dioxide, these costs are expected to increase, as are the potential savings from energy efficiency.

2. Additional Customer/Society Benefits

Create a stronger energy security system. Using energy efficiency as a resource reduces TVA's need to purchase electricity on the market or generate electricity. Either way, it reduces TVA's need for purchasing fossil fuel resources on the market or competing for electricity imports. Although TVA does not depend on imported oil for electricity production, some of the purchased power TVA obtains and some of the market prices TVA pays are influenced by the prices for imported oil. Currently, oil prices are at moderate levels, but oil prices spiked above $140 per

barrel during the summer of 2008. Reducing TVA's exposure to those markets can help reduce TVA's risk (Hurley *et al.* 2008, p. 5 Appendix K.1).

Facilitate the creation of clean energy jobs. In order to meet increasingly aggressive goals for reducing energy consumption through energy efficiency improvements, there is a need for dramatic improvements in the insulation and energy-using features of residential households. As Van Johnson points out, most of these improvements are not difficult to accomplish, but are time-consuming and need an army of trained "green-collar" workers to make them happen (Jones, Van, 2008 Appendix K.1). Johnson believes that this developing niche can be served by the blue-collar workers who are currently losing jobs in industries that have seen contraction (such as automobiles) through retraining.

Enhance occupant comfort and improve indoor air quality. One of the ways investments in energy efficiency provide benefits is in providing quality improvements, moving customers up to a higher standard of living. For example, if they invest in insulation or improved ductwork in their homes, they don't suffer from drafts and unequal heating zones. If the ventilation-systems are not designed efficiently, it is likely that they will not correctly circulate air or allow for adequate ventilation. If the energy envelope and delivery system is improved, the house itself becomes more livable (Meier, 1994 Appendix K.1).

Generate higher worker productivity. With improvements in lighting, better control over heating and cooling environments, and improvements in ventilation and indoor air quality worker productivity increases. Therefore, these investments not only reduce a company's energy bill – the direct effect – they also have the indirect effect of making its workforce more productive (Lobash, 2005 Appendix K.1). Besides increasing the productivity of the hours the staff are at

the work location, such improvements also reduce the number of days employees are absent from work (Philips Lighting Electronics, 2008 Appendix K.1).

Save other resources, such as water. One of the synergistic features of energy efficiency investments is that such upgrades can also provide other benefits. For example, energy efficient washers often reduce water consumption over earlier models (PG&E, 2008 Appendix K.1).

Lower emission levels, improving resident health and reducing carbon footprint. There are less financially quantifiable benefits associated with reduced emission levels. To the extent that emission levels may be associated with increased risk of respiratory distress, reductions in emission levels should reduce the probability that the population will be exposed to these risks. In addition, there is a growing recognition that a national greenhouse gas program is likely to be enacted. This legislation recognizes the national concern with climate change risks, and TVA is interested in implementing energy efficiency programs that reduce the risk of adverse effects of climate change without adding other risk factors (Hurley, 2008, pp. 5-6 Appendix K.1).

Challenges/Risks

1. Identification of Program Costs/Benefits

One challenge is measuring the value of energy efficiency programs to TVA, its distributors, its end-use customers, and the Valley as a whole. In order to address this issue, TVA is evaluating programs based on a set of cost-effectiveness metrics such as total resource cost and ratepayer impact tests. One of the goals of using these tests is to identify those energy efficiency programs that will return more value in terms of societal benefits than they cost to implement. Not all energy efficiency programs are equal. Some provide a higher return in terms of energy saved per dollar invested, while others may be more valuable from a capacity standpoint.

Demand Side Management benefits typically include the avoided costs of building additional power plants and the avoided costs of energy. TVA uses its most recent bimonthly forecast of market prices to represent the opportunity cost of power for screening evaluation

The Total Resource Cost (TRC) test calculates the net value to the Tennessee Valley as a whole. The benefits result from the reduction in the cost of producing electricity by implementing the next-best resource option. The costs include all incremental utility and customer costs for implementing an efficiency program. Any costs from incentives are disregarded in this test, as if they do not impact the value to the Valley. It is often a challenge to determine customer costs as part of this test. This test is sometimes expanded to include external societal costs and benefits, such as a change in air or water quality caused by the program.

The Rate Impact Measure (RIM) test calculates the bottom line gain or loss to TVA's cash flow and therefore has implications for TVA's electric rates. Unlike the TRC measure, the RIM test includes revenue loss and incentive costs. Programs that do not pass this test put upward pressure on TVA's rates, however small. Nonetheless, small increases in rates as a result of energy efficiency programs are often considered acceptable because of their other benefits (as shown by the TRC). Programs that pass TRC but do not pass RIM often create subsidization from non-participants to participants. If programs are made available to all customer types, this issue can be mitigated to an extent. Programs that reduce rates (so that even non-participating customers benefit) would pass the test and support investment in the program (State of California, 2002 Appendix K.1).

2. Loss in Margin

Energy efficiency is an unusual "supply" resource in that it is actually a reduction in demand. As electricity sales are reduced, so are the associated margins to cover fixed costs. Because utilities are a high-fixed-cost industry, there is generally a disincentive to make investments in energy efficiency because of the negative impact on sales and revenues.

One of the solutions that has been put forth to address this disincentive toward investment in energy efficiency is the advent of more smart grid technologies. As consumers are provided more information and clear pricing signals, it is anticipated that reductions will be increased during the hours that cost the utility the most to produce power, thus decreasing costs. It is further anticipated that the greatest changes in energy efficiency and demand-side management with smart-grid technologies will be made in the early implementation of these technologies. The effects of demand loss will be overtaken with gradual growth in overall demand that is more economically suited to the needs of the electric system as a whole. The growth in electricity-using devices (televisions, data servers supporting computer applications, electric vehicles, etc.) is expected to continue to be strong, even with advances in electric efficiency. Energy prices are not expected to decline, which should aid margins as peaks are rebalanced (Energy Information Administration, 2009 Appendix K.1). Energy efficiency and smart grid technology will be some of the features in a portfolio of strategies to meet the changing needs of customers' electricity demands over the long run.

3. Increased Variability in Achieving Energy Efficiency Reductions

One of the features of many of the estimates of energy efficiency savings is that they are based on behavioral assumptions (such as those associated with reactions to time-of-use rates or incentives) or assumptions regarding new technology savings over time (Hurley *et al.,* 2008, p. 10 Appendix K.1). These values are very difficult to estimate and tend to vary over time as circumstances change (the economy, relative prices, speed of new home formation, government incentives, the

culture's emphasis on "green," and a host of other factors). So it is difficult to rely on all energy efficiency savings in the same way as contracting for power or building a new generating plant. One example is a customer's response to time-of-use rates. It is difficult for the utility to know how much of a reduction in load the introduction of such rates will deliver. In addition, the picture is not a static one. The reductions achieved during one critical peak event may not be the same as the next, since each event has different features that affect how customers may react. There are also issues regarding how automatic the time-of-use energy efficiency changes can be made, how the impacts on customers can be affected, and how much the energy efficiency changes will affect comfort levels (Loeff, 2009 Appendix K.1).

Such variability does not mean energy efficiency is not a valuable resource; it just means that it may present more uncertainty than traditional resources. As more information becomes available about energy efficient options and performance, the planning and integration of energy efficiency into resource planning will become more robust and better developed.

APPENDIX F - Industry Example of Grid Enablement and Future Direction

Southern California Edison (SCE) has been a leader in smart grid technology for some time. It has been very visible with its Circuit of the Future project and especially with its advanced metering infrastructure (AMI) Smart Connect project. It plans is to deploy 5.3 million smart meters from 2009 to 2012. SCE has been instrumental in refining the approach for conducting a smart metering project and based its entire $1.7 billion plan on the results. It has documented its use of a defined methodology in a case study available at the SCE website. The case study provides significant insight into the benefits of this approach which is also being used at TVA. www.edison.com/pressroom/pr.asp?id=7110

A Distribution Management System (DMS) platform is under development by the University of Hawaii that will feature advanced functions for home energy management by consumers and improved distribution system operations by utilities. This platform will integrate AMI as a home portal for demand response; home automation for energy conservation; optimal dispatch of distributed generation, storage, and loads in the distribution system; and controls to make the distribution system a dispatchable entity to collaborate with other entities in the bulk grid. Home energy management of this type will enable consumers to take control, automating energy conservation and demand response practices based on their personal preferences.

In West Virginia a "super circuit" project is under way by Allegheny Energy. It is designed to demonstrate an advanced distribution circuit with improved reliability and security through the integration of distributed resources and advanced monitoring, control, and protection technologies. This circuit will integrate biodiesel generation and energy storage with the AMI and a mesh-based wireless communications network for rapid fault anticipation, location, and

restoration with minimal impact to customers. The super circuit will demonstrate an ability to dynamically reconfigure the circuit to allow isolation of the faulted segment, transfer uninterrupted services to "unfaulted" segments, and tap surplus capacity from adjacent feeders to optimize consumer service. www.businesswire.com/portal/site/alleghenyenergy/?ndmViewid=news_view&newsid=20080902005782&newsLang=en

Boulder, Colorado has been chosen as the site for Smart Grid City, the nation's first fully integrated smart grid community. It has an ideal mix of residential and commercial customers and will have the largest and densest concentration of these emerging smart grid technologies. Implementation of the Smart Grid City was planned to occur in two phases, March 2008 to August 2008 and September 2008 to December 2009. By the end of August 2008, significant progress had been made. The first smart meters are active, and two-way communication between the customer and the utility company is established. Sensors and high-speed communications have been installed on approximately 82 miles of fiber-optic cable. By the end of 2008, more than 13,000 homes were expected to be outfitted with smart meters, and by mid-2009, another 10,000 will be available for installation at a customer's request. Two substations have been upgraded with smart technology. The local utility can now automatically detect and isolate non-catastrophic outages, restore load for downstream customers, and reduce the duration of the outage event. Two additional substations will be upgraded with smart grid enabled technologies by mid-2009. http://smartgridcity.xcelenergy.com/

Prepaid metering can be a conservation tool capable of helping people monitor energy use and perhaps cut back on it. Several utilities across the United States have implemented prepayment programs and found that they have several unforeseen benefits. When consumers are in control

of what they perceive as a resource they can manage, they tend act differently toward it. Many people who have taken part in these programs tend to reduce overall consumption of electricity because they are more aware of what they have used and what they have left to use. Prepay technologies generally give customers an in-home display that shows how their actions affect their electric bills. Such knowledge usually makes people more careful about turning on the lights and air conditioner. Several utilities have seen this conservation effect in action. For instance, Phoenix-based Salt River Project (SRP) has the largest prepay deployment in North America, with 59,000 of the utility's 935,000 electric customers enrolled in the utility's prepay option. According to SRP, those customers use an average of 12 %, or 1,750 kWh less than customers in similar households. https://www.srpnet.com

American Recovery and Reinvestment Act (ARRA)

In early 2009, the American Recovery and Reinvestment Act (ARRA) was enacted. ARRA provides over $70 billion to Federal agencies to fund energy-related programs. Over the next several months, Federal agencies will be gearing up to allocate the funds, but it is not entirely clear at this point how the funds will be allocated and distributed.

The Department of Energy released a notice of intent to issue a funding opportunity announcement (FOA) concerning smart grid demonstration projects, part of the agency's work under the smart grid provisions of the Stimulus Act. Falling under the DOE's Office of Electricity Delivery and Energy Reliability, the FOA will be available online at Grants.gov and at the DOE's Industry Interactive Procurement System at http://e-center.doe.gov. TVA and the distributors will be evaluating how to access these funds to leverage smart grid investment efforts.

APPENDIX G- Demand Response Programs at TVA

Residential Water Heater Pilot

TVA and its 158 public power distributors have a long history of creating residential energy-efficiency programs for the Valley. The Residential Water Heater Pilot promotes the installation of energy-efficient electric water heaters in homes and small businesses. Today's advanced control and communication technologies make it possible to control water heaters and other home appliances using a two-way load control device. This device activates a curtailment of the water heater, providing validation back to the utility that the water heater was indeed turned off. The device can also send a signal when the water temperature has fallen below a certain set point, which provides for better delivery of reliable hot water service compared with what is possible under one-way communication and control. The heater can be turned off and on based on the water-use pattern of the homeowner, thereby maintaining customer comfort and averting a spike in the utility load demand.

Direct Load Control Initiatives

Current direct load control (DLC) programs are based on a series of phone calls and actions taken at the affected site to reduce the load. During peak demand periods, TVA has a rate structure that provides transmission operators with the option of reducing energy consumption by participants in order to maintain power system reliability. Industrial customers reduce energy consumption through a series of local actions and receive a bill credit from TVA for each event. Customers of TVA distributors with the ability to vary their energy usage do not have this option based on their current rate structure with distributors. An aggregator was solicited to profile potential customers and outline the response measures necessary to develop a Tennessee Valley DLC solution.

Demand Response Load Aggregation Initiative

EnerNOC, of Boston was selected under a pilot program. As a third-party load aggregator, EnerNOC recruited large customers in the Valley that were willing to curtail usage during peak periods and then orchestrate the shedding of load on requests made by TVA. EnerNOC has installed equipment and software to activate and monitor demand events successfully. In FY 2008, EnerNOC signed up 11 MW of load to be reduced under the program.

Conservation Voltage Regulation Pilot

This program will use conservation voltage regulation (CVR) with TVA's distributors to take advantage of year-round energy savings that are realized by operating distribution feeders in the lower portion of the ANSI service voltage requirement range. A pilot program with Ripley Power and Light, a TVA distributor, will demonstrate the effectiveness of this on its entire power system. The program seeks to achieve an understanding of the energy savings that are possible using CVR. The program objective is to run a year-round pilot to reduce both energy consumption and overall demand**.**

APPENDIX H- Wholesale Power Rates

Table 1 Wholesale Rates, January to March, 2009						
Rate Class	**Application**	**Wholesale Base [1]**	**Wholesale Environmental Adjustment [2]**	**Wholesale Adjustment Addendum [3]**	**Wholesale Fuel Cost Adjustment [4]**	**Wholesale Effective [5]**
Residential						
Residential Rate - Schedule RS						
	All kWh	$0.04745	$0.00283	$0.01253	$0.01329	$0.07610
GSA1						
General Power Rate - Schedule GSA - Part 1						
Small, Non-residential						
< 50 KW						
	All kWh	$0.05440	$0.00333	$0.01439	$0.01329	$0.08541
GSA2						
General Power Rate - Schedule GSA - Part 2						
Large Commercial						
51 to 1,000 KW						
	1st 15,000 kWh	$0.05440	$0.00333	$0.01439	$0.01329	$0.08541
	Additional kWh	$0.03108	$0.00191	$0.00822	$0.01329	$0.05450
	kW, 51-1,000	$7.530	$0.460	$1.99		$9.98
GSA3						
General Power Rate - Schedule GSA - Part 3						
Very Large Commercial						
1,001 to 5,000 KW						
	All kWh	$0.03108	$0.00191	$0.00822	$0.01329	$0.05450
	kW, 0-1,000	$7.95	$0.48	$2.10		$10.53
	kW,1,001 - 5,000	$9.38	$0.58	$2.49		$12.45
GSB						
General Power Rate - Schedule GSB						
Industrial						
(1st 620 Hours Use of Demand (HUD))						
	First 620 HUD	$0.02777	$0.00170	$0.00734	$0.01329	$0.05010
	Additional HUD	$0.02	$0.00	$0.01	$0.01	$0.04
	All kW	$9.67	$0.59	$2.55		$12.81
GSC						
General Power Rate - Schedule GSC						
(1st 620 Hours Use of Demand (HUD))						
Industrial						
	First 620 HUD	$0.02777	$0.00170	$0.00734	$0.01329	$0.05010
	Additional HUD	$0.02	$0.00	$0.01	$0.01	$0.04
	All kW	$9.67	$0.59	$2.55		$12.81
GSD						
General Power Rate - Schedule GSD						

Industrial						
	All kWh	$0.02226	$0.00136	$0.00589	$0.01329	$0.04280
	All kW	$11.99	$0.73	$3.17		$15.89
MSB Part 1						
Manufacturing Service Rate - Schedule MSB Part 1						
< 5,000 KW						
Classified in SIC 20 to 39						
(1st 620 Hours Use of Demand (HUD))						
	First 620 HUD	$0.02364	$0.00145	$0.00625	$0.01329	$0.04463
	Additional HUD	$0.01929	$0.00118	$0.00510	$0.01329	$0.03886
	All kW	$8.23	$0.50	$2.18		$10.91
MSB Part 2						
Manufacturing Service Rate - Schedule MSB Part 2						
5,001 to 15,000 KW						
Classified in SIC 20 to 39						
(1st 620 Hours Use of Demand (HUD))						
	First 620 HUD	$0.02245	$0.00138	$0.00593	$0.01329	$0.04305
	Additional HUD	$0.01833	$0.00112	$0.00485	$0.01329	$0.03759
	All kW	$7.77	$0.48	$2.05		$10.30
MSC						
Manufacturing Service Rate - Schedule MSC						
15,001 to 25,000 KW						
Classified in SIC 20 to 39						
(1st 620 Hours Use of Demand (HUD))						
	First 620 HUD	$0.02245	$0.00138	$0.00593	$0.01329	$0.04305
	Additional HUD	$0.01833	$0.00112	$0.00485	$0.01329	$0.03759
	All kW	$7.77	$0.48	$2.05		$10.30
MSD						
Manufacturing Service Rate - Schedule MSD						
> 25,000 KW						
Classified in SIC 20 to 39						
	All kWh	$0.01800	$0.00110	$0.00476	$0.01329	$0.03715
	All kW	$9.67	$0.59	$2.55		$12.81
Outdoor Lighting						
All KW						
	All kWh	$0.03108	$0.00191	$0.00822	$0.01329	$0.05450
Drainage Pumping						
All KW						
	All kWh	$0.03108	$0.00191	$0.00822	$0.01329	$0.05450
TRS						
Time-of-Use Residential Rate - Schedule RS						
All Customers						
	Onpeak kWh	$0.08075	$0.00481	$0.02131	$0.01329	$0.12016
	Offpeak kWh	$0.02625	$0.00156	$0.00694	$0.01329	$0.04804
TGSA1						
Time-of-Use General Power Rate - Schedule TGSA Part 1						
Small, Non-residential						
< 50 KW						
	Onpeak kWh	$0.09666	$0.00592	$0.02556	$0.01329	$0.14143
	Offpeak kWh	$0.02551	$0.00156	$0.00676	$0.01329	$0.04712

TGSA2						
Time-of-Use General Power Rate - Schedule TGSA Part 2						
Large Commercial						
51 to 1,000 KW						
	Onpeak kWh	$0.04076	$0.00250	$0.01078	$0.01329	$0.06733
	Offpeak kWh	$0.02488	$0.00153	$0.00659	$0.01329	$0.04629
	Onpeak kW	$7.48	$0.46	$1.99		$9.93
	Offpeak Excess kW	$0.91	$0.06	$0.24		$1.21
TGSA3						
Time-of-Use General Power Rate - Schedule TGSA Part 3						
Very Large Commercial						
1,001 to 5,000 KW						
	Onpeak kWh	$0.04076	$0.00250	$0.01078	$0.01329	$0.06733
	Offpeak kWh	$0.02488	$0.00153	$0.00659	$0.01329	$0.04629
	Onpeak kW	$8.74	$0.54	$2.31		$11.59
	Offpeak Excess kW	$0.90	$0.06	$0.24		$1.20
TGSB						
Time-of-Use General Power Rate - Schedule TGSB						
Industrial						
	Onpeak kWh	$0.03740	$0.00229	$0.00990	$0.01329	$0.06288
	Offpeak kWh	$0.02208	$0.00135	$0.00584	$0.01329	$0.04256
	Onpeak kW	$9.67000	$0.59000	$2.55000		$12.81000
	Offpeak Excess kW	$0.86	$0.05	$0.23		$1.14
TGSC						
Time-of-Use General Power Rate - Schedule TGSC						
Industrial						
	Onpeak kWh	$0.03740	$0.00229	$0.00990	$0.01329	$0.06288
	Offpeak kWh	$0.02208	$0.00135	$0.00584	$0.01329	$0.04256
	Onpeak kW	$9.67000	$0.59000	$2.55000		$12.81000
	Offpeak Excess kW	$0.86	$0.05	$0.23		$1.14
TGSD						
Time-of-Use General Power Rate - Schedule TGSD						
Industrial						
	Onpeak kWh	$0.02326	$0.00143	$0.00616	$0.01329	$0.04414
	Offpeak kWh	$0.02172	$0.00133	$0.00574	$0.01329	$0.04208
	Onpeak kW	$12.09000	$0.74000	$3.19000		$16.02000
	Offpeak Excess kW	$1.45	$0.09	$0.39		$1.93
TMSB Part 1						
Time-of-Use Manufacturing Service - Schedule TMSB Part 1						
< 5,000 KW						
Classified in SIC 20 to 39						
	Onpeak kWh	$0.03184	$0.00195	$0.00841	$0.01329	$0.05549
	Offpeak kWh	$0.01879	$0.00115	$0.00497	$0.01329	$0.03820
	Onpeak kW	$8.23	$0.50	$2.18		$10.91
	Offpeak Excess kW	$0.73	$0.04	$0.19		$0.96
TMSB Part 2						
Time-of-Use Manufacturing Service - Schedule TMSB Part 2						
5,001 to 15,000 KW						
Classified in SIC 20 to 39						
	Onpeak kWh	$0.03025	$0.00185	$0.00799	$0.01329	$0.05338

	Offpeak kWh	$0.01785	$0.00109	$0.00472	$0.01329	$0.03695
	Onpeak kW	$7.77	$0.48	$2.05		$10.30
	Offpeak Excess kW	$0.65	$0.04	$0.16		$0.85
TMSC						
Time-of-Use Manufacturing Service - Schedule TMSC						
15,001 to 25,000 KW						
Classified in SIC 20 to 39						
	Onpeak kWh	$0.03025	$0.00185	$0.00799	$0.01329	$0.05338
	Offpeak kWh	$0.01785	$0.00109	$0.00472	$0.01329	$0.03695
	Onpeak kW	$7.79	$0.48	$2.05		$10.32
	Offpeak Excess kW	$0.68	$0.04	$0.18		$0.90
TMSD						
Time-of-Use Manufacturing Service - Schedule TMSD						
> 25,000 KW						
Classified in SIC 20 to 39						
	Onpeak kWh	$0.01942	$0.00119	$0.00513	$0.01329	$0.03903
	Offpeak kWh	$0.01813	$0.00111	$0.00480	$0.01329	$0.03733
	Onpeak kW	$10.07	$0.62	$2.65		$13.34
	Offpeak Excess kW	$1.18	$0.07	$0.30		$1.55

APPENDIX I- Data and Information Program at TVA

Seasonal Time-of-Use Rates

TVA and TVPPA are in the process of making seasonal time-of-use rates available to end-use customers on a voluntary basis by October 2010. In order to facilitate appropriate customer response, the power distributors will need to link those households and businesses onto the smart grid framework to track their usage. At this time, with the limited rollout this voluntary program would likely have, the plan is to supply pricing and usage information in real time not through the Internet but through a hand-held device such as the PowerCost monitor, which retails for $119 each (BlueLine Innovations, 2009 Appendix K.4). This kind of device can provide continuous readouts of how much energy is being used in a home and calculate the cost using the prices keyed in to reflect the seasonal demand and energy rate schedule.

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Smart Water Heater Program

As discussed under the standard on Smart Grid Investments, the Smart Water Heater Program will result in the installation of smart, two-way demand response load control switches on residential customer water heaters in coordination with the Bristol Tennessee Essential Services system. Through this pilot program, data will be collected at 10-minute intervals and sent to TVA and the Electric Power Research Institute (EPRI) for analysis. The goal of tracking energy usage is to gain better load profiles and evaluate response system benefits. Although sharing the usage information with households in real time is not currently an integral component of this pilot, information obtained by TVA and EPRI through the course of the study will identify what information is useful to better identify the next phase of information dissemination (Tennessee Valley Authority 2009c Appendix K.4).

Residential Direct Load Control Pilot

The Residential Direct Load Control pilot will have more direct provisions for providing real-time information to consumers. An advanced meter infrastructure system will retrieve energy usage information in intervals of between 15 and 60 minutes (the exact duration has not yet been determined). The consumers participating in the pilot will be provided with in-home display devices to tell them the level of their household energy consumption and how much it costs. In addition, the current average cost per kWh will be estimated, along with the value of the average cost per kWh for the next hour, so the consumers can evaluate how much it will cost or save them to delay their energy use for an hour. In addition to having this information, the pilot will evaluate how alternative incentives will affect usage, including automatic devices to reduce demand, voluntary demand response, and the use of prepaid accounts (Tennessee Valley Authority, 2009e Appendix K.4).

Smart Thermostat Pilot

The Smart Thermostat Pilot is being initiated at Glasgow Electric Plant Board (EPB). Like the Residential Direct Load Control pilot, it will involve investigations into automatic devices to reduce demand and the development of better individual usage profiles. Glasgow EPB is enthusiastic about being one of the first in the region to experiment with the smart grid technology and give its customers the opportunity to evaluate how it can help them save money (Glasgow EPB, 2009 Appendix K.4).

APPENDIX J- Operated Generation Facilities

Table.2
Power Supply from TVA-Operated Generation Facilities
For the years ended September 30
(Millions of kWh)

	2008		2007		2006		2005		2004	
Coal-fired	98,752	62 %	100,169	64 %	99,598	64 %	98,361	62 %	94,618	61%
Nuclear	51,371	33 %	46,441	30 %	45,313	29 %	45,156	28 %	46,003	30%
Hydroelectric	6,685	4 %	9,047	6 %	9,961	6 %	15,723	10 %	13,916	9%
Combustion turbine and diesel generators	1,386	1 %	705	<1 %	613	<1 %	595	<1 %	278	<1%
Renewable resources *	39	<1 %	27	<1 %	36	<1 %	47	<1 %	35	<1%
Total	158,233	100 %	156,389	100 %	155,521	100 %	159,882	100 %	154,850	100%

Source: Tennessee Valley Authority, 2008a, p. 12.

* Renewable resources for years 2004 through 2006 have been adjusted to remove renewable resources amounts that were acquired under purchased power agreements and included in this table in TVA's 2006 Annual Report on Forms 10-K as amended. These adjustments resulted in reductions in the amount of renewable resources by 13 million kWh for 2004, 14 million kWh for 2005, and 15 million kWh for 2006. Also, for years 2004 through 2006 the following amounts related to TVA's digester gas cofiring site have been reclassified from Coal-fired to Renewable resources: 30 million kWh for 2004, 43 million kWh for 2005, and 32 million kWh for 2006. Renewable resource facilities include a digester gas cofiring site, a biomass cofiring site, a wind energy site, and solar energy sites.

APPENDIX K-Reference Sources and Information Citations

This section of the appendix contains references for the materials used in the preparation of this report.

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