BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

ACT 129 PHASE II ENERGY EFFICIENCY AND CONSERVATION PROGRAM

DOCKET NO. M-2012-2289411

COMMENTS ON THE TENTATIVE IMPLEMENTATION ORDER

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Table of Contents

Executive Overview

The Pennsylvania Public Utility Commission (Commission) has done excellent work with Act 129, and it is appreciated that the Commission is allowing interested parties to comment on the Act 129 Phase II Energy Efficiency and Conservation (EE&C) Program Tentative Implementation Order (Order).

Upon review of the Docket, there is no mention of energy efficiency improvements in the delivery of power or mention of ensuring Power Quality, both of which can result in lower overhead costs and have a significant impact on power generation capacities.

It is a known and accepted practice that people will do what they are incentivized to do. Some of the most common solutions are handled in billing as opposed to rebates. Rebates are generally used to encourage technologies that the end user has a long-term investment in to see a financial gain. For example, currently LED lighting takes about ten (10) years to pay for itself. This is a large upfront cost as the LED lasts about ten (10) years. Rebates encourage the end user to use the more energy efficient technology by offering a short-term incentive.)

Utilities might also charge a penalty, such as a Reactive Power Charge or a Power Factor Penalty in tariffs. This is a form of negative reinforcement to obtain the desired goal. The least aggressive types of billing that effectively incentivize the end user to prevent poor energy consumption practices include billing a KVA charge in place of or in addition to KW charges. Although this practice may be less aggressive, it encourages end users to improve the efficiency of electrical devices and places less demand and inefficiencies on the grid. These inefficiencies are generated by end users and have a negative impact on responsible users. Utilities are generally concerned with running out of capacity. This is the basis for a demand charge. Billing a KVA demand is typically an incentive to the end user to correct phase shift and harmonics as these will make for higher demand charges. When the end user corrects these power quality issues, it in turn offers more grid capacity to the Utility. In addition, losses in the infrastructure (relays, switching devices, transformers, overhead wiring capacity, etc.) are minimized offering more effective power delivery and network efficiency.

In conclusion, billing policies can be an incentive that should be strongly considered as an option for large scale energy efficiency of a power system. This allows more monies to be available for other technologies that should be incentivized such as lighting, upgrades, higher efficiency loads, alternative energy incentives, etc.

As a minimum, a policy to change demand charges from KW to KVA should be enacted over a period of time to empower end users to police themselves to become more responsible for their energy usage practices and to work with the Utility in a synergistic approach.

Comments on Docket M-2012-2289411

Upon reading the docket and the related documents, it became apparent that there were no mentions to improve Power Quality or initiatives to improve power distribution efficiencies which would put the responsibility of efficient use of energy from the point of generation all throughout the system and to the end user. Having programs to get end users to pursue new and efficient technologies is great, but a consideration must be made encompassing the system as a whole.

One of the problems with programs today is that technologies have been "auto approved" solely based on the technology and unscrupulous individuals have marketed and sold the technology even in applications where it does not apply. The concern was not about being responsible and reducing consumption, but instead it was about what qualifies for rebates and grants. To prevent this, some agencies have required proof of savings as a means to prevent such abuse.

Power Factor

The issue of Power Quality is typically a problem generated by an end user that the utility has to handle, which actually passes the costs on to all other users in the form of higher operating costs from lost capacity and delivery inefficiencies. The most common issues are related to power factor, either from a phase shift inefficiency, as a result of using an induction motor, or from harmonics, which are typically cased by converting AC power to DC power as in the case of computers, Variable Frequency Drives and other electronics. The result is that more total energy is required to be present in the system than is necessary for the work being done.

An example of something equivalent is if there were twenty percent (20%) more cars on the road that did not actually have to go anywhere. They were not delivering anything or picking anything up. This would be particularly bad during rush hour when the system is being overused already. This is actually what happens on the grid during peak demand times. In this example, KW would be a measurement of the cars (energy) that is on the road (grid) that is actually doing work such as delivering people or resources (work is taking place) and KVA is a measurement of the total number of cars (energy). The end user is where these inefficiencies (more cars) comes from. If this were actually cars just driving around, we would put a stop to it. This is relatively simple and inexpensive to correct, and it can help add capacity and lower the total demand placed on a utility. This excess energy can be penalized or the end user can simply be billed for total use (KVA) instead of just the part that is actually producing work (KW).

Phase Shift and KVA vs KW

When an induction motor is turned on, it requires amps to make a magnetic field strong enough to magnetically couple to the shaft, and spin the shaft from a magnetic force. The motor also draws amps to provide a force, horsepower (HP, for the actual work being done. The amps that make the magnetic field can actually be "recycled" with the use of capacitor technology. The reason it can be recycled is that it is not being consumed in work other than by heating wires, transformers and other infrastructure. The generator from the Utility must produce those Amps and it must terminate them (consume) when they could be recycled. This results in lower capacity from the generator and additional capacity stressed through the delivery network (grid). Depending on the size of the electrical network and the distance from the generation plant to the end user, this loss in system capacity can be significant. This unused energy is billed to every customer in the form of greater losses and inefficiencies in the Utility.

Harmonics

In the 1980's and 1990's, as personal computers came into popular use, a great change came to businesses. One change was that now the productivity of workers could increase as more flexibility and opportunity came by the ease of making changes and calculating became simpler. Another thing that it brought was the first time so many harmonic loads appeared on the electrical systems of office buildings. The result is that the rules changed. Unfortunately, a significant number of building electrical fires resulted before the problem was recognized. These unfortunate overloading conditions had actually caused over current (amp) conditions to appear in the neutral lines of the facility, to the point that the wire insulation caught on fire.

Since then, oversized neutrals are required on a computer circuit and regulations have been passed to reduce the harmonics in computer power supplies. As we improve technology, this problem becomes more significant because we turn to electronics more and more. As a matter of fact, this is often how we get the efficiencies that we can obtain. Again, this can show up in the KVA vs KW evaluation. As more harmonics are present, it increases the KVA to KW ratio.

Another example is compact florescent lamps (CFLs), which use less watts (about 12 to 14 watts to produce the same light as a 60 Watt incandescent), but they generate harmonics. This is similar to Variable Frequency Drives (VFD's). A VFD running at about 80% is typically offering no energy reduction. There are many applications where the VFD is running at 10% to 40% most of the time and less of the time at 80% or more capacity. This can be an energy savings solution, however, this is also a place where sales firms convince people to switch to VFDs without re-engineering the system so that the motor runs at a more efficient level. This has resulted in sales of VFDs through rebates and grants that have actually resulted in the energy consumption (KW) to go up not down. This is an example of why proof of savings should be required on each case. There are even instances where people were buying CFLs that instead of drawing 12 to 14 watts for 60 watts of light, they were drawing 20 to 30 watts, which is some savings, but if there are going to be rebates for a technology, a certain savings ratio should be required for a rebate to take place. This prevents less than reputable sales groups to prey on unsuspecting end users.

Solutions

Power Quality should be part of any energy strategy. People need to be incentivized in order to act. There are several solutions. Typically this is from either imposing penalties and fines on the individuals with the bad habits, or dispersing the costs among the populace so the good and the bad pay for it (Example: not having any consequences for littering might encourage more people to litter), or by making the cost of doing business automatically reward those that have optimized the costs and uses (Example: If water were 25 cents per gallon. Use your own jug or buy one for two (2) dollars would reward recyclers).

Demand Charges

The purpose of a demand charge is that a generation device has a limit on how much energy it can produce at any given moment. When the generation capacity is reached, we have rolling blackouts and other negative consequences. Typically, trying to best represent the end users, commissions like to see the Utilities bill everything in KW because it is the lower number between KW and KVA. In reality, most all of the devices in the grid are really limited by KVA as opposed to KW. Wire is Amp limited which is the same with fuses. Transformers are KVA rated; not KW rated. Generators are rated in KW to present a power factor that the generator can operate while maintaining regulation.

Many Utilities acknowledge that for every amp they can save from making magnetic current (reactive amps), it is another amp they can use as KW amps. This expands the capacity of the generation stations. Demand charges are made because it determines when new generation plants need to be deployed. Demand charges are a great way to incentivize a responsible use at the right time. By making the demand charge based on KVA instead of KW rewards responsible people and incentivizes those that are not being efficient.

Policies

Agencies are responsible for establishing policies for the state to operate under. This is a great responsibility and a great challenge. It is important to make it fair to everyone and encourage collaboration among the constituents. Typically, in energy this means that the residential users are given a certain latitude and encouraged to make smaller improvement and look for industry standard "high efficiency" products, such as the SEER rating on HVAC systems, and other Energy Star approvals. It is usually up to commercial and industrial companies to identify their own needs and best practices for their industry. Some places allow for certain concessions to allow certain industries to exist as they look for the best interest (i.e. jobs) for the community they govern.

It is important that consideration be made to applying rules that create proximate goals and strategies for improving the future. This can come in the form of incentives, positive or negative, or even the metric that billing policy takes. Making a change of how we move to a more accurate billing policy for energy is part of the solution. In provinces of Canada, there are utilities that bill for KVA Demand and KVAh (instead of KWh) because of evaluations and calculations wherein they have determined that KVA is the true cost of power. Demand charges are the first obstacle to approach as it determines when new generation plants are required. Switching Demand charges to KVA in the future will result in more capacity. It is a responsible step to take as part of an energy program.

Conclusion

The EE&C Program proposed by the Commission offers an ambitious goal for energy consumption for the Utilities to undertake with their customer base. The Order does not specifically spell out how this will be accomplished although references to other documents are made. This is very good as it allows for creative thinking and for the advent of any new technological breakthrough to be adopted. It also allows us to think outside the proverbial box for other solutions. The reference documents are primarily targeted to what end users can do and what types of technologies should be incentivized.

The strong opinion being offered is that the Commission has a responsibility in this effort by establishing acceptable policy. This can also inspire conservation methods by affecting the acceptable practices for billing practices in the tariffs by allowing or recommending that KVA be used as a measure of Demand charges.

The result will inspire end users to pursue technologies that result in lower maximum demand for the utilities and also reduce overhead costs that each consumer pays for energy delivery losses. This will improve Power Quality and prevent new technologies from creating other side effects to the system, as both KWh and KVA are considered as viable solutions.

By adopting a program for minimum savings a project should deliver for rebates and incentives, assurances are made that practical solutions are used and that there is not rampant abuse of these programs.

Good job and congratulations on being future sighted for your energy consumption needs.

Appendix A: Qualifications of Commenters

Theron Colbert, PE, MSEE is a retired U.S. Naval Commander with over 27 years of active duty military service and a licensed Professional Engineer with two Masters degrees in engineering specializing in the areas of energy management, renewable energy and construction management. He has traveled to over 30 countries including two recent tours in the war theatre of Iraq.

From 2006 to 2007, Mr. Colbert served as the Officer-in-Charge-of-Construction for the U.S. Army Corps of Engineers in Al Anbar Province, Iraq where he led a team in executing over $600M in Iraqi reconstruction efforts throughout western Iraq, which included building electric power generation stations and completely rebuilding the Iraqi national electrical transmission and distribution grid. In 1995 and 1996, Mr. Colbert was the Utilities & Energy Programs Officer at Naval Base Point Mugu, CA where he led a team to earn two consecutive Secretary of the Navy Energy Conservation Awards by reducing base energy and water consumption by 40% and coordinating with Southern California Edison on a $6M solar energy project at Santa Cruz Island.

Currently, Mr. Colbert is the Vice President of Business Operations at KVAR Energy Savings, Inc. (KES), a company that focuses on energy efficiency technologies.

David Wise has a degree in Electronics Engineering Technology, AS. Mr. Wise has seven (7) U.S. Patents in which he listed as inventor. Mr. Wise's experience is from manufacturing, product development, telecommunications, and product representation for energy saving solutions. These include solar, lighting and development of energy reduction technologies.

Appendix B: References and Links

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