Articles of Interest

To: Google
From David Johnson, President

February 28, 2009

The effort Google is making to help solve energy issues are most certainly to be commended. I would like to bring to light an energy efficiency opportunity that continues to go almost totally unnoticed and provides a greater cost benefit than most other solutions combined. My name is David Johnson and I have a small company in Western North Carolina called Electric Solution.

The solution is whole house (or building) Demand Control or Load Control wherein load control equipment installed on the customer's side of the meter transparently maintains demand (kW) to certain programmed limits. The benefit to the customer is a reduction in electricity costs and the satisfaction that they are providing more capacity to the power plant. The benefit to the utility is that they are able to add more customers to an existing power plant and avoid using expensive peaking power generation. The use of whole house load control in 25,000 residences will allow a power plant to serve an additional 14,000 homes. I reduce my residential on-peak demand each month by a minimum of 60% and some months as high as 75%. In a typical residential installation the system monitors all of the electricity coming into the home and controls HVAC compressors, heat strips, air handlers, water heaters and the heating element of the clothes dryer – transparently!

Google can use load control to serve an equivalent number of customers as a coal fired power plant without having to produce the same amount of demand capacity. Here's how: let's say a 1,000 megawatt coal fired power plant can serve 100,000 homes; it would only take a 650 megawatt plant if the 100,000 homes exercise load control. Whether Google's measure of success would consider this type of input is here nor there – I trust the value of load control has been made. However, the costs of 100,000 Load Control Systems would be on the order of plus or minus 200 million and would increase the per megawatt budget for the needed 650 megawatts.

If it cost 2.2 billion to build a 1,000 megawatt coal fired plant then each megawatt represents 2.2 million. If you are now able to accomplish what the coal fired plant does with a 650 megawatt solar, wind, geothermal power plant and the 350 megawatts reduced with load control costs 575,000 per megawatt then you have a new budget of 3 million per megawatt for the 650 megawatts. Obviously the comparison of costs of a coal fired plant and a renewable energy source plant are far more complex than this and involve the operating cost over the life of the plant as well as many other components.

And while I believe load control to be a viable component of Google's task of creating electricity with renewables that are cost competitive with coal, the issue of load control is far larger than this project and certainly far bigger than I am capable of exposing. Load control is a component of energy management that can make an enormous impact globally and deserves far more attention than it is receiving.

I believe demand to be the most misunderstood term in the energy field. In the electricity world there are several types of demand; system demand, instantaneous demand, coincident demand, integrated demand, peak demand and so on, the one we are interested in is the customer's billing demand (kW). Allow me to start by asking the question, what is billing demand? Incidentally, you will not find the definition or any other part of how electricity is billed in an electrical engineering class or any other college class. It is amazing to us how many people we deal with that have electrical engineering backgrounds and are responsible for million dollar annual electric bills that can not define billing demand. Generally speaking demand is the amount of electricity (kWh) consumed in a specified period of time. An electric utility's billing demand is almost always a 15 or 30 minute period. The utility meter measures the amount of kWh's used every 30

minutes literally from 12:00 to 12:30, 12:31 to 1:00 and so on. The customer's billing demand is the 30 minute period that had the largest number of kWh and that kWh is converted to kW. For example, if 20 kWh was the largest 30 minute measure then the kW would be 40; a 15 minute demand period of 10 kWh would also represent 40 kW. A very simple explanation of load control would be to move some of those 20 kWh's to the next 30 minute period where, for discussion sake, we will say only had 10 kWh's. So if we move 5 kWh's to the next 30 minute period we now have 15 kWh's as our highest demand period and we have reduced the billing demand from 40 to 30 kW. With load control equipment the use of electricity is held from one demand period and moved into the next demand period(s) and is done so without the customer knowing its being done.

My background prior to discovering demand control was in electric utility rate work. I am aware of two companies who manufacture load control equipment. The one we believe to have the superior product is of course, the one we are currently using. We have always been baffled as to why companies like Johnson Controls, Siemens, Honeywell and the like rarely if ever do demand control. They may say they do demand control but what they really do is energy control. A few years ago we came across a customer with an installation from Harris Integration that was being used for energy (kWh) control, we bought software ($3,200) from them that allowed us to do demand control with their equipment and saved the customer over $8,000 a year.

For the customer to save money using demand control the electric utility serving the customer must have a rate schedule to provide the incentive to control demand. For example a utility with demand cost of say $2.50 a demand unit (kW) provides very little incentive for demand control. The customer would have to control a lot of (kW) units to save significant money. On the other hand a utility with demand cost of say $15 a demand unit (kW) provides good incentive. But where load control excels is with utilities that offer demand based time-of-use rate schedules. Time-of-use rates only charge for demand during on-peak hours which are the times that utilities experience the highest demands. Specific on-peak hours vary from one utility to another but are generally daytime hours Monday through Friday. This is important for load control because control only needs to occur during on peak hours.

Demand reduction can not occur without the rate schedules in place to provide incentives. Many, if not most, electric utilities do not offer time-of-use rates and many time-of-use rates are obviously put in place to appease some state legislature or public utilities commission because they have no viable application in the real world. In California there are no residential time-of-use demand (kW) rates. There are time-of-use energy (kWh) rates which do not provide incentive to do demand control and rarely provide any financial benefit to the customer. Wouldn't it make sense for every electric utility to offer their customers the incentive to reduce demand? My experience with Duke Energy and Progress Energy is that many of the upper management remain resistant to change and what they perceive is loosing control of their domain. However, there are some, usually the youngest of the group that recognize these changes have to occur.

Rate schedules can be a puzzling part of the load management equation. Take for instance, the residential time-of-use rates offered by Duke Energy and Progress Energy in North and South Carolina. With both companies any residential customer with an average bill of $150 a month or greater will save money by being on their residential time-of-use rate and do nothing different in how they use electricity; simply the rate change will save them money - 100% of them. Why should a customer save anything if they don't do anything to reduce their demand. I have taken this question up with Duke Energy, Progress Energy, and the North Carolina Utilities Commission and have yet to get much of an answer. If a customer is willing to control their demand either through the use of equipment or self imposed control they should be rewarded financially, if not they should not gain any financial reward. This is not much of an issue with regard to marketing load control because the vast majority of customers don't know the rate is available to them. The benefit of the rate combined with the benefit of the load control

equipment can generate enough savings to pay for the system in one to five years. A customer with an average bill of $285 can save over $1,200 a year and pay for a load control system in less than two years. It is a simple process to design a rate structure that is revenue neutral unless the customer makes a change that is mutually beneficial to both parties.

We primarily target commercial customers (office buildings, large retail, and industrial, institutional) because the savings we can generate make them more profitable and residential customers are hard to target. For example, this past week we submitted a proposal to the owners of a twelve story office building in downtown Charlotte; the terms of that proposal are: we guarantee savings of $12,000 annually, guaranteed transparency, and they pay us 78% of the savings for three years. There is a tremendous opportunity in the commercial sector however, as a whole the residential customer has more to offer the electric grid. By nature the residential customer is by far the most inefficient class of customer. It's bad enough that the residential customer uses electricity very sporadically but almost all residential customers are on the same sporadic schedule; heavy early morning use and early evening use. Therefore, the greatest benefit to the electric grid can be obtained from the residential sector.

The way utilities make money is changing and new laws in some states allow electric utilities to file programs wherein the utility can recover cost and make an amortized profit on energy efficiency investments. We have suggested a tariffed residential program wherein Progress Energy would make a financial contribution to a load control system in an attempt to provide incentive to the customer to participate and while the general principal was well received we were told the loss of revenue far outweighed the gain in demand capacity. However, we have been unable to determine, from their perspective, what value they place on demand reduction. Otherwise, they are telling us that their own rates provide too great an incentive for them to be involved in encouraging load control. Under Progress Energy and Duke Energy's current rates their financial contribution is, for the most part, not necessary; a customer with an average monthly bill of $250 can save a thousand dollars a year with a system that retails for $2,500. Ideally we would like to see a program that the utility supports by providing a three to five year loan to customers and invoice the customer on their monthly bill. In this way the customer's payment is more than covered by the savings and they see it all right there on their bill.

We use an average monthly bill of $250 as a guideline for customers who can pay for the system with three years or less of the savings however, the benefit to the utility is almost as great with much smaller customers. For instance, I have an all electric 4,200 square foot home, a wife and 3 kids and my demands in the winter can be as high as 28 and I can control to a 9. At an installation we did on a modular home, occupied by two adults had high winter demands of 22 and we control to a 6. Clearly the benefit to the utility is almost as great as with a home less than half the size however, the ROI may be as much as seven years.

It is easy to confuse energy (kWh) and demand (kW). The impact to the electric grid for a reduction in energy (kWh) often times isn't as great as the energy world makes it out to be. Don't misunderstand me energy reduction is an enormous component to a prudent energy policy. There is a direct correlation between energy reduction and the fuel used to produce the energy but, the impact on demand (the ability for the power plant to serve more customers) is often negligible or even negative. For instance, most school systems wait until the last moment to start up electric heating systems to minimize the amount of energy used; in fact the more sophisticated programmable thermostats have the ability to observe the outside temperature and calculate the shortest amount of time it takes to achieve the set temperature. Operating electric heating systems in this manner certainly reduces kWh but the impact on demand is grossly negative. Most utilities experience their highest winter demand from 6am to 8am. It takes a tremendous amount of energy to bring a school building's temperature up from 62 to 68 degrees however it only takes a fraction of that amount to maintain 68 degrees. Schools systems can save a surprising amount of money and do a great service to the electric grid by bringing up electric heating systems prior to

6am. This same analogy applies to residential customers; the utilities might suggest by doing this you will eventually just move the peak back to 5am. In the perfect world you would only want half of the customer base to preheat and if we ever got to that point we have done our job.

As I have been writing this piece I began to ask myself what is it that I am asking of organizations like Google and CNET?

First, I would like to see Google's and CNET's energy personnel become educated about demand control. I apologize if that sounds insulting but I have to think if you did understand demand control the way we do you would be involved in its development. It's understandable you would not be aware of this industry in that there are no other companies anywhere engaged in this type of work (other than a few mom and pop dealers for Brayden and Dencor that are almost exclusively marketing to residential customers). Also, I would think organizations like Google and CNET would rather engage in activities from the customer's side of the meter verses from the utility side.

Second, I would like to see a lobbying effort directed at Federal and State Legislatures, Utilities, and Utility Commissions to educate and support the development of rates and tariffs that encourage the use of demand control.

As to my company Electric Solution specifically, we could use a loan program for our residential customers. The private investor we use is not interested in residential customers. If we had a loan package with reasonable interest rates and up to five year terms we could offer residential installations whereby the customer's monthly savings would exceed their monthly payment. Being able to offer a package like that would open up residential sales in an enormous way.

As it stands right now Electric Solution's growth will be limited by our cash flow. With an influx of capital we would be able to expand at a rate fifty times as fast as we are able to presently. In January 2009 I solicited for a Director of Sales and Marketing on a couple of web sites. I found Peter Zomick in Charlotte. Peter and I came to an equity arrangement and Peter has begun developing sales teams in the Winston-Salem, Greensboro, Charlotte, Greenville-Spartanburg, Asheville and the Raleigh-Durham markets. Peter has been able to bring in more work in three weeks than has come into this company in the previous six months. Largely because of the quality of people that have responded to us. In three days we had over 400 resumes of incredibly qualified people who are excited to learn more about what we do. We would relish the opportunity to discuss with someone a capital investment for the rapid expansion of the business.

I have recognized for some time that what we have here is far larger and far more important than me. I could keep a low profile and develop this business into a very nice living for myself, but I believe the growth of this technology needs to happen at a much greater pace than I have resources.

Best regards,

David Johnson
President

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