



Smart grid solutions

Johnson City's Enhanced Systems Consulting snags \$1 million federal grant to continue development of energy-saving software

A Johnson City company, East Tennessee State University and Bristol Tennessee Essential Services are expanding their groundbreaking work on electricity load management and peak shaving technologies with the help of a \$1 million Small Business Innovation Research Grant from the U.S. Department of Energy. The results could bring huge benefits to both pocketbooks and the planet.

The grant, awarded to Enhanced Systems Consulting (ESC) of Johnson City, results from a fruitful three-way partnership that leverages BTES's long history of load management as well as the East Tennessee State University College of Business and Technology's ongoing work helping area businesses solve real-world problems.

The partnership has produced software technology that takes load management – managing a utility's power usage without compromising end customers' consumption choices – to a level that could reduce load by 8 to 12 percent. The DOE is interested because that, in turn, could forestall the need to build new power plants, typically at a cost of around \$1 billion.

The Phase II SBIR grant is to help ESC “pursue next steps in bringing the technologies to market,” a recent DOE news release stated. It follows completion in the past year of Phase I, which was funded at \$150,000 and which ESC President Matthew Bolton said proved highly successful.

Those next steps will include expanding the model to other utilities that, like BTES, purchase power from the Tennessee Valley Authority.

The ESC software worked in concert with BTES programmable water heaters and with about 70 capacitor banks installed by the utility. The combination helped BTES shave about 8-12 percent off its “peak load” last year.

“We think that with water heaters, you can probably take 4 or 5 percent of the peak load off, and with voltage capacitors maybe also that much,” BTES CEO Mike Browder said. “If you're taking 8 to 12 percent of the load off, that means that instead of needing 11 power plants, you'd only need 10, and that sort of thing makes a difference.”

The race to find technologies that help reduce electricity consumption has been a furious one. Concerns about climate change, spikes in commodity prices (the raw fuels for production) and recent global economic difficulties all have contributed to a sense of urgency. As Browder noted, as a system such as

TVA gets toward its peak load (say on a very hot day), it typically begins using more power from plants that cost more to operate and aren't as environmentally friendly.

ESC's Bolton said the local partnership has some distinct advantages. BTES has spent years managing load, and ETSU has spent more than a decade partnering with local companies to help them do more with less. It's a combination that excites ETSU's Dr. Andy Czuchry, particularly with respect to the ESC/BTES project.

"I think it's a triple bottom line issue here," said Czuchry, who oversees graduate student teams that work with local businesses. "On this project our students addressed complex energy issues with large-scale financial impacts, resulting in lower cost electricity for consumers, and cleaner energy generation with positive environmental influence."

Browder agreed, saying that a 12 percent reduction in peak load across TVA's system would equate to about 5 years' worth of growth. "One 500 megawatt power plant is about a billion dollars, and there is also a tremendous amount of energy use that goes into building those," he said.

The BTES/ETSU connection goes back about a decade, and BTES's efforts to shave peak demand go back even further. That "peak shaving" was all done manually for years, but a BTES/ETSU project that started about a decade ago paved the way for the current effort. BTES employees who were also attending graduate school at ETSU came up with a project that ultimately resulted in the utility running fiber optic cable throughout its system, including to customers' homes.

The fiber brought a high-profile foray into providing Internet, TV and phone service, but it also enhanced BTES's system internally.

"Our load management efforts before had a limited amount of feedback from what's going on in the field," Browder said. The fiber installation gave us a technological infrastructure that could be automated and made a lot more effective than doing it manually. ESC developed a system that made the pieces talk to each other at extremely fast speeds and with lots of real data, which has allowed us to make decisions on how to operate it closer to the limits and wring a lot more value out of it."

Further, Bolton said, ETSU has played a major role in helping ESC – a business solutions software firm more familiar with distribution and manufacturing challenges – work toward a software solution for the vexing problem of energy savings. Teams led by Czuchry have provided additional expertise and analysis, along with coaching and partnership definition.

"We're excited to be part of this, but none of it would have happened without the foresight of Dr. Browder and Dr. Czuchry," Bolton said.

The next step is rolling out the "Dynamically Controlled Electric Demand Management System" to a broader clientele, starting with more of TVA's local power systems and possibly TVA itself.

If most local utilities in TVA's network get on board, savings could run into the hundreds of millions for the utilities combined, and into the billions for TVA.

The huge numbers are possible because electricity costs are becoming as much about when power is used as they are about how much is used. Power companies are trying to reduce peak and shift loads where

possible to non-peak times. Many are also charging based on “time of use.” Customers get a price break for using power when overall demand is low, and pay a premium during high or peak demand times.

ESC's software helps smooth out the peaks and valleys of usage, and it also shifts load with the water heater program.

The bottom line to whether the system can scale up without government help is, well, the bottom line, and on that account Bolton reckons the odds are looking good.

“TVA has looked at our results and is watching them very carefully,” Bolton said. “If their estimates of system wide savings can be proven during our Phase II Program the possibility of avoiding several new generating plants becomes very real.”