Our technical breakdown of industry-specific topics, TechBriefs *provide up-to-date information and insight on some of our world's most compelling issues.*

PUTTING ADVANCED DATA TO WORK

A SOPHISTICATED ALGORITHM BRINGS GREATER BENEFITS TO UTILITIES AND THEIR CUSTOMERS SYSTEMWIDE

Growing network connectivity and maturing capabilities in data collection and analysis are facilitating the adoption of new technologies that further optimize operation of the electric distribution grid. Early adopters and pilot projects of one emerging application of this technology aim to realize an immediate 1 to 2 percent energy reduction on a systemwide basis through automated control of distribution services.

"Distribution volt/VAR control (DVVC) is a logical next step to grid optimization once an AMI (advanced metering infrastructure) system is built and network connectivity to distribution assets is established," says Brad Jensen, a senior electrical engineer at Burns & McDonnell. "DVVC improves system value, saves money for customers and the utility, and enables the utility to further improve its operations and planning for the next-generation grid."

ELIMINATING CONFLICT

AMI has enabled utilities to enhance systemwide control of voltage levels through proven and established volt/VAR optimization (VVO) and conservation voltage reduction (CVR) concepts. VVO is the practice of controlling power flows of an entire system to reduce energy loss and, where permitted, reduce peak demand. CVR is the reduction of voltage levels from the substation to customer connections to further reduce energy usage. DVVC is a way of combining these two concepts and looking for the best operating configuration from a variety of factors.

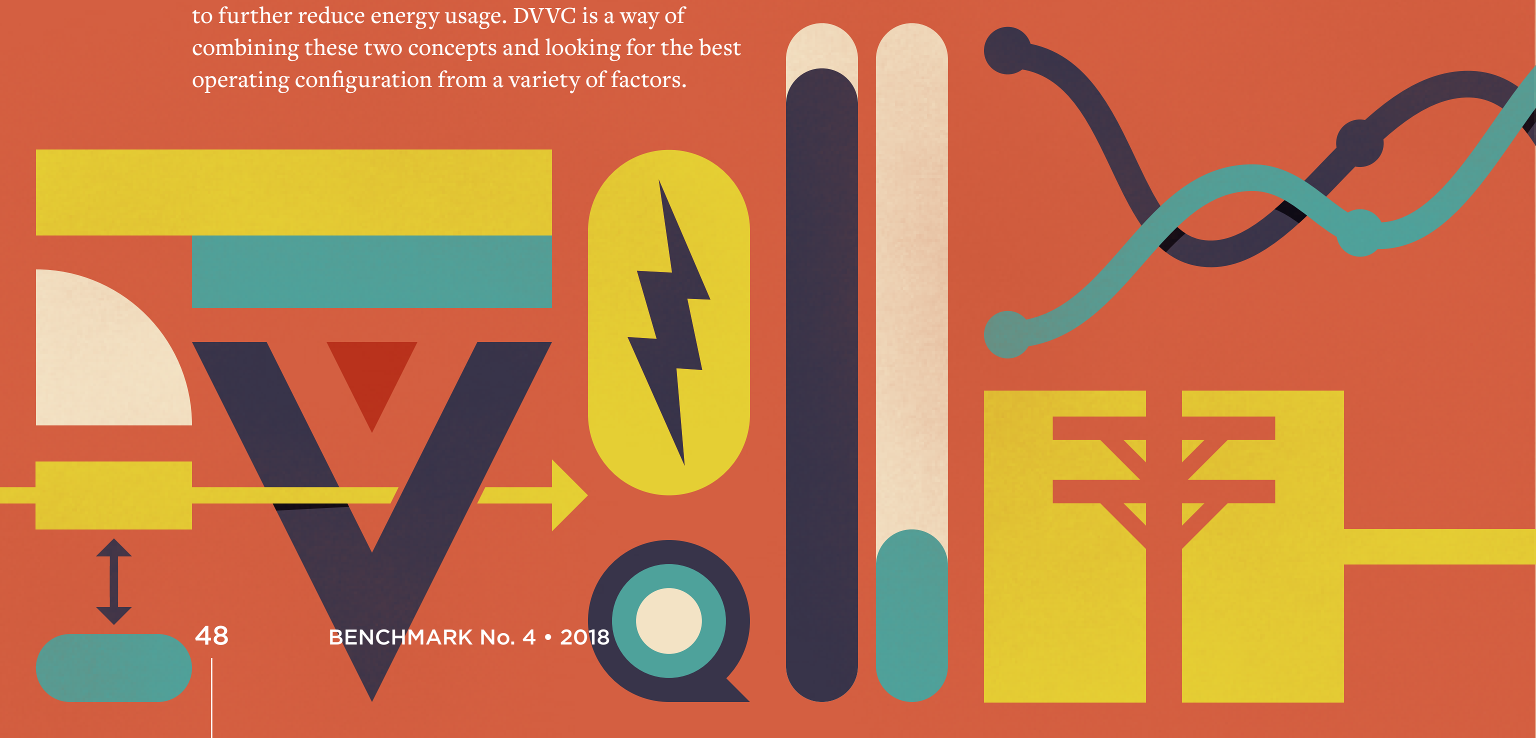
"Many utilities have implemented VVO and/or CVR," Jensen says. "This presents a critical challenge. During peak demand periods, these concepts can conflict with each other, which can significantly reduce the desired benefit of each.

"For example, a VVO algorithm typically regulates power factor and VAR demands at a substation bus by being able to switch a substation capacitor on and off. However, at certain points, regulating power factor at the bus means you might not be able to regulate the voltage — so during periods of peak demand, when utilities need to conserve energy, the VVO algorithm is increasing voltage instead of decreasing system voltage."

Both VVO and CVR help under some circumstances, and not everyone can afford or manage implementation of both. DVVC is helping overcome that, maximizing the benefits of both concepts by eliminating the potential conflicts through customization at individual buses.

SMOOTHING THE VOLTAGE PROFILE

Typically implemented as an automation control algorithm, DVVC can be run as a third-party application that interfaces with a distribution



management system (DMS) or is embedded into many automation systems. The DVVC algorithm enables system owners to finely adjust the average system voltage and distribution bus voltage to more quickly and reliably react to system changes. This reduced voltage on electrical loads, including motors, air conditioners and some lighting, can reduce electricity demand ever so slightly to reduce overall system losses. However, voltage reductions along the line increase the risk of low voltage for customers at end-of-line (EOL). To mitigate this, engineers use capacitors or regulators to boost the voltage, ultimately smoothing the profile to try to get a flat voltage profile.

"With voltage, the farther a customer is from the substation, particularly those near the EOL, the more prone they are to voltage dips," Jensen says. "The DVVC system tries to find the optimal capacitor configuration to reduce the voltage drop from the substation to the EOL under a variety of loading scenarios."

CONTINUOUS OPTIMIZATION

While initial costs might seem challenging, the primary benefit to customers — and the main driver for DVVC implementation — is cost savings as a result of reduced losses and reduced energy consumption. Utilities also have the opportunity to realize significant operational cost savings through improved asset management, maintenance and asset utilization.

"DVVC improves asset utilization by identifying new operating configurations and tracking operation frequency," Jensen says. "The more distribution system assets used to support VVO and CVR control schemes, the greater the value to the utility and customer — and the value will grow as utilities continue to improve their data capture and analysis capabilities."

Learn more about the barriers, opportunities and potential benefits of implementing DVVC at **burnsmcd.com/OptimizedGrid**.

Jensen notes that ongoing DVVC programs, such as continuing work with Southern California Edison, use AMI data to develop, refine and customize the application within the system, but do not typically use real-time data. This means as data capabilities improve, so, too, will grid controls.

"The exciting aspect of DVVC is that it is the realization of many concepts the national labs, such as Pacific Northwest National Laboratory (PNNL) and Electric Power Research Institute (EPRI), have been studying for decades," Jensen says. "The technical and financial aspects are proven. While DVVC is challenging to implement, we know that there are savings to be realized. DVVC puts the data to work to deliver real benefits to the customer and utility. As the data improves, so do the benefits. The application will grow with and help inform continuous grid optimization and modernization efforts."