Augmenting microgrid technology: A new way for reliable power

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A group of American and Chinese researchers has designed and tested a microgrid system that is both robust and reliable—and therefore capable of delivering energy safely and without interruptions. This is particularly

important during harsh weather conditions and times of peak consumption and is critical for economic growth.

The research was published in the March issue of *IEEE/CAA Journal of Automatica Sinica* (*JAS*), a joint publication of the IEEE and the Chinese Association of Automation.

A microgrid, or small-scale electric grid, is a network of nodes that provide, store and use energy. Electricity moves from each of the locations within the microgrid in the form of electric current, which can travel in two modes—either in just one direction, in which case it is called direct current (DC) or in several different directions that change periodically, also referred to as alternating current (AC). However, electrical sources that deliver electricity in just one direction are vulnerable to sudden changes, such as changes in load that can result in a voltage overload.

"In order to create parallel DC microgrids that function safely and efficiently, focus should be placed on two things. One is the regulation of voltage and one is the amount of electricity that is shared among users in a network," says Wenxin Liu, Ph.D., corresponding author and Associate Professor with the Department of Electrical and Computer Engineering, Lehigh University, Bethlehem, PA.

Specific to this paper, the researchers have enhanced a microgrid with a single-DC source in such a way that it functions as a safe and reliable electricity source by aligning several energy sources in parallel and basing the microgrid on a decentralized control algorithm. Decentralized control—also called distributed control—means that there is not a single point within the grid where the decision is made. Rather, each point within the grid makes a decision on its own and the resulting output is the aggregate response of all of the nodes.

With this setup, the researchers have designed a microgrid that delivers a large amount of electricity while overcoming the aforementioned burdens of system overload and shutdown. Put simply, they have found a way to
deliver a constant and uninterrupted stream of high amounts of electricity safely.

"The parallel operation of distribution generators offers several advantages including expandability, reliability, efficiency, and ease of maintenance. This single-energy-source topology has a wide range of applications within electrical power systems of avionics, automotive, telecom, marine, and rural areas," says Liu.

More information: Jiangkai Peng et al. Adaptive decentralized output-constrained control of single-bus DC microgrids, *IEEE/CAA Journal of Automatica Sinica* (2019). DOI: 10.1109/JAS.2019.1911387

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