Chinese researchers develop algorithms for smart energy grid

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A fallen tree, a lightning strike—it doesn't take much to disrupt the electrical grid. An outage could last just a few minutes, but restoring electricity to millions of people typically takes hours, days or even weeks. The outdated system, developed a century ago, is due for an overhaul.

Enter the energy internet. It's based on the idea that electricity could be distributed similarly to the actual internet. The energy internet isn't yet reality, but scientists at Northeastern University in Shenyang, China, have proposed a way to actualize the theory.

"[The energy internet] brings new challenges to the study of some basic problems in power systems, one of which is... energy management," wrote Huaguang Zhang, the director of the Electrical Automation Institute at Northeastern University. Zhang and his team published their proposal in *IEEE/CAA Journal of Automatica Sinica* (*JAS*). "Unlike conventional power systems, the upcoming energy internet emphasizes comprehensive utilization of energy in the whole power system by coordinating multi-microgrids."

A main power grid could partner with decentralized generators, including fuel, wind turbines and solar power, to delegate energy to multiple microgrids within each designated network.

"Each microgrid can either inject spare power (if working in low loads) into or absorb lacking power (if working in high loads) from other

microgrids or the main grid," wrote Zhang.

In their paper, Zhang and his team determined how best to optimize this power exchange between the main grid and the multiple microgrids using computer science algorithms.

The algorithms are consensus based, meaning the decentralized generators within the system agree that one of them will represent their ideal state. This leader communicates with the main grid and collects the power costs of each generator to set the price of electricity within the network.

The next algorithm allows for precise calculation by each generator based on their local needs compared to the global supply and demand by collecting information from their networked microgrids. Based on this information, they can request more energy, or sell surplus energy to the main grid to be sent to a different generator.

The researchers simulated their proposed management method between seven separate systems under different time constraints and energy loads. Every time, the algorithms proved effective.

"The proposed approach is implemented in a distributed fashion, which only requires local communication among neighbors," wrote Zhang. "Thus, it is more cost-effective, reliable, and robust compared to the centralized approaches."

More information: Distributed Optimal Co-multi-microgrids Energy Management for Energy Internet: ieeexplore.ieee.org/stamp/stam … jsp?arnumber=7589482