Rethinking renewables: A new approach to energy storage for wind and solar

EurekAlert

Troy, N.Y. — Researchers at Rensselaer Polytechnic Institute are leading a new $2 million study to help overcome a key bottleneck slowing the proliferation of large-scale wind and solar power generation.

Funded by a $2 million grant from the U.S. National Science Foundation, the four-year study aims to develop novel ceramic materials for use in a new approach to energy storage. Rather than batteries, the researchers will develop nanostructured capacitors to store energy that is generated and converted by wind turbines and solar panels. With an extremely high power density and the ability to very quickly charge and discharge, these nanoengineered capacitors could be a game-changer impacting a wide range of applications, from energy production to electronics to national defense.

"The transformative nature of capacitive energy storage — a totally new approach to energy storage — will have a tremendous impact on the increased use and efficiency of wind and solar power, as well as conventional coal, nuclear, and hydroelectric generation," said Doug Chrisey, professor in the Department of Materials Science and Engineering at Rensselaer, who is leading the study. "Our proposed capacitors will be smaller, lighter, and more efficient than today's batteries, and with no moving parts the capacitors should last forever. Everyone is looking for a truly innovative material to help meet future energy requirements, and we're confident that our novel ceramic will help advance that conversation."

The grant was awarded through the NSF Emerging Frontiers in Research and Innovation (EFRI) Program, overseen by the NSF Engineering Directorate, which identifies and supports interdisciplinary initiatives at the emerging frontier of engineering research and education. For the study, Chrisey is partnering with renowned glass expert and Rensselaer Professor Minoru Tomozawa, along with nanoscientist and University of Puerto Rico, Río Piedras Professor Ram S. Katiyar.

Unlike a battery, which supplies a continuous level of low power for long periods of time, a capacitor moves large amounts of power very quickly. The ideal solution for electrical energy storage, Chrisey said, will allow fast energy storage and discharge in as small a volume or mass as possible. To achieve this, the researchers will develop a nanostructured capacitor comprising extremely thin layers of a novel composite. The composite is a mix of ferroelectric nanopowder and low-melting, alkali-free glass. The result is a capacitor that can withstand high electric fields and maintain an extremely high dielectric constant — two critical metrics for measuring the effectiveness of energy storage materials.

In addition to optimizing and perfecting the composition of the novel ceramic material, Chrisey and team are tasked with developing new processes to make the material easily and in large quantities.

"Creating a novel ceramic material and developing a cost-effective, scalable method to achieve large-capacitive energy storage could be a big boost to our national economy and increase our global competitiveness," Chrisey said. "What we need is an entirely new approach to energy storage, and we think ferroelectric glass composites could be the answer."

SOURCE [1]

Links:
[1] http://www.eurekalert.org/pub_releases/2010-09/rpi-rra092710.php