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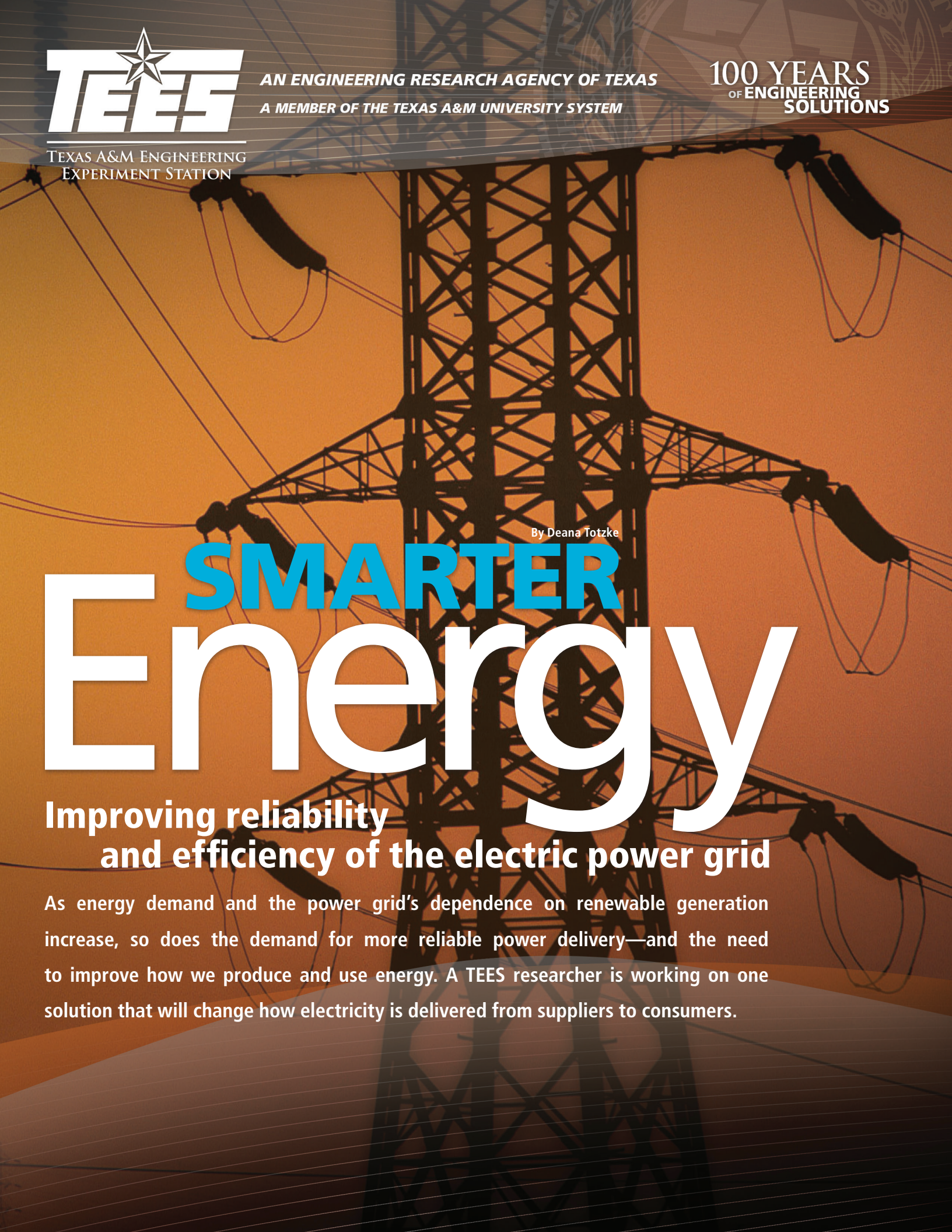

By Deana Totzke

SMARTER Energy

Improving reliability and efficiency of the electric power grid

As energy demand and the power grid's dependence on renewable generation increase, so does the demand for more reliable power delivery—and the need to improve how we produce and use energy. A TEES researcher is working on one solution that will change how electricity is delivered from suppliers to consumers.

The RATC solution will help prevent future power outages, which account for roughly $80 billion in losses each year for U.S. businesses and consumers. Minimizing the grid's response time to expensive interruptions will also make integrating intermittent renewable energy sources into the grid easier.

Mladen Kezunovic in the Electrical and Computer Engineering Division and his team received a $4.9 million grant from the U.S. Department of Energy's Advanced Research Projects Agency–Energy (ARPA-E) for their research project, Robust Adaptive Topology Control (RATC).

Their grant is part of $156 million that ARPA-E awarded to 60 leading-edge research projects to dramatically improve how the U.S. produces and uses energy. The new ARPA-E selections focus on accelerating innovations in clean technology while increasing U.S. competitiveness in rare-earth alternatives and breakthroughs in biofuels, thermal storage, grid controls and solar-powered electronics.

The electric grid is subject to interruption from cascading faults caused by extreme operating conditions (such as overloads and energy transfer congestion) and malicious external attacks. The grid can also experience intermittent electricity generation from renewable energy sources, including wind and solar power. For instance, when favorable winds cease to blow, energy from wind power decreases and conventional sources of energy must make up the difference.

The grid's susceptibility to such interruptions means that research into more efficient power delivery is especially important, Kezunovic says. He also directs the TEES Smart Grid Center.

The researchers are using a method called topology control—that is, reconfiguring the power system—to improve system operations and manage disruptions within the electric grid.

The RATC solution will be capable of detecting, classifying and responding to grid disturbances by reconfiguring the grid to maintain economically efficient operations while also guaranteeing reliability. This approach would help prevent future power outages, which account for roughly $80 billion in losses each year for U.S. businesses and consumers. Minimizing the grid's response time to expensive interruptions will also make integrating intermittent renewable energy sources into the grid easier.

"The new concept will reduce the time to correctly detect, classify and characterize the contingencies and respond to mitigate problems in the power grid," says Kezunovic, who is a fellow of the Institute for Electrical and Electronics Engineers. "The concept uses a new control strategy. The online problem detection and classification will use advanced data analytics. A decision-making, topology-switching control strategy will define real-time actions for mitigating the grid problems under a variety of undesirable operating conditions."

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The new adaptive controls will help avoid costs from the consequences of blackouts, making the power grid more reliable and resilient.

"Basically, it's a new way to control the grid to mitigate contingencies," Kezunovic says. "The control is through optimization software and does not require costly specialized controllers."

The RATC team includes researchers from Texas A&M; TEES; the University of California, Berkeley; Arizona State University; Lawrence Livermore National Laboratory; Oak Ridge National Laboratory; the Tennessee Valley Authority; the Grid Protection Alliance; and Applied Communication Sciences. The RATC team focuses on several different areas. Kezunovic, the principal investigator, works on the disturbance detection and RATC implementation strategy.

"My part is related to making sure the RATC control strategy is implementable since my group is checking feasibility and offering solutions to harden the control system," he says. "There are multiple partners on the project, each with a role to look into specific aspects of the solution."

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And once the three-year project is complete, Kezunovic says, he hopes their research will play a critical role in the future of the U.S. electric grid and how it produces and uses energy.

"As the results are obtained and verified using field data, we still have a huge task in front of us to make the industry aware of the new solution and help the transition of our solution into the product line," he says. "We are working with the ARPA-E team and TEES Texas Center for Applied Technology on developing the technology-to-market strategy for making the solution widely available for the industry to use."

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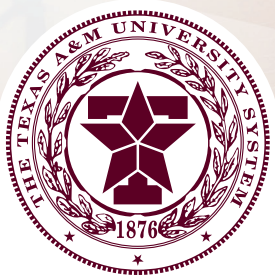

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