

ASU technical innovation enables more reliable and less expensive electricity

Utility bills for demo site reduced by up to 40%; electrical performance improved 22% during mock grid outages

By Gary Werner, ASU News
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Growing demand for electricity is pushing the energy sector to innovate faster and deploy more resources to keep the lights on and costs low.

Clean energy is being pursued with greater fervor, but expanding the use of renewable technologies within the complex system that already powers our grid presents big challenges. And those challenges raise big questions.

Will the grid still be reliable if we add more renewables? Or could these additions make it even more reliable? Can we afford this transition? Or could it make electricity even cheaper?

Research just completed by Arizona State University indicates the answer to all of these questions is yes.

The project was called Providing Energy Resilience With an ROI, and it demonstrated a very clear return on investment.

Utility bills for the demonstration site were reduced by 26% to 40%, saving about \$1,000 a month. Results also showed a 22% improvement in electrical system performance during mock grid outages. That meant power stayed on for a full day longer than would have been the case if relying solely on backup generators.

In terms of efficiency, resiliency and responsible use of taxpayer dollars, we couldn't ask for more.

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Randall Handorf

Utilities engineering supervisor at the Arizona Department of Emergency and Military Affairs, the demo site for a new ASU technology that coordinates electrical energy from multiple sources

The new technology behind this success — called Adaptive Control of Energy Systems, or ACES — was developed by ASU's Laboratory for Energy And Power Solutions, or [LEAPS](#), and it was deployed in collaboration with the Arizona Department of Emergency and Military Affairs, or AZ DEMA, which offered its Papago Park Military Reservation in Phoenix for the work.

“ACES is a supervisory software with smart energy controls to monitor and manage when and how energy is used or stored by the existing systems or network at a site,” says James Nelson, director of technology and innovation for LEAPS and the leader of the research and demonstration project. “It also includes wiring, sensors and communication tools to connect everything.

“Think of it as a brain that tells different energy systems how to work together.”

Better integration

Those different systems are known as distributed energy resources, or DERs. They are smaller power sources that can produce or store electricity right where it's used. Examples of DERs include solar panels, batteries and backup generators. Unlike large power plants that send electricity over long distances, DERs work at or near homes, businesses or military facilities.

AZ DEMA was selected as the project demonstration site because of its existing building automation system and its existing set of DERs — called a microgrid. ASU integrated these elements together and used predictive analytics to automate operation to reduce cost and improve resilience.

(Video: <https://www.youtube.com/watch?v=wmyzMaKembA>)

According to Randall Handorf, the utilities engineering supervisor at AZ DEMA who offered installation guidance for the project, the results were a complete success.

“In terms of efficiency, resiliency and responsible use of taxpayer dollars, we couldn't ask for more,” Handorf says. “This is a solution designed to integrate seamlessly with a system that is already in place. It's highly tailored to our application, giving us the best possible reduction in total energy consumption. But it can also inform design choices regarding the scope and sizing of future systems. We may be able to use a smaller, less expensive system to accomplish our goals.”

The nearly three-year effort finished in February 2025 and was funded by almost \$600,000 from the U.S. Department of Defense [Environmental Security Technology Certification Program](#), which supports the development of new means to strengthen defense infrastructure. However, the

benefits extend beyond military applications.

Broader impact

The growing threat of devastating wildfires and extreme weather events increases the risk of power outages for everyone, and that risk is driving interest in microgrids and their installation by many businesses, institutions and communities.

Recognizing the potential of this adoption led Salt River Project to assist the LEAPS project.

“ASU’s work helps SRP better understand how microgrids interact with our distribution system and what capabilities could benefit the rest of our customers,” says Joel Dickinson, senior manager of distribution integration for SRP. “For example, this project was able to demonstrate that their microgrid controller could reduce peak usage at the customer’s location upon SRP’s request, thereby reducing demand on our distribution system. We can apply lessons like these to other research under way at SRP’s new microgrid lab.”

Lessons from the project also extended to ASU students. Among them is Arnel Garcesa, who just completed his PhD in systems engineering and is graduating this May. Garcesa served as the point person for software development specific to AZ DEMA’s heating, ventilation and air-conditioning systems. His work included site visits for commissioning, data retrieval and analysis.

“You quickly learn that you can model as much as you want in a static, sanitized, you-know-the-status-of-everything-at-all-times environment,” Garcesa says. “But once you deploy outside of pure simulation, constants become variables, and you have to process why you see behaviors and patterns you didn’t expect to see.”

Working through the unexpected, Garcesa says the LEAPS team was able to diagnose issues and integrate their novel controls by maintaining data communication between the various on-site systems — even with those components being managed by different vendors. He says this means any microgrid consumers who install ACES can get better performance and savings with minimal additions to what they already have in place.

According to Nathan Johnson, director of ASU’s LEAPS, the return on investment for this project is clear: The cost of adding controller technology like ACES can be recouped in two years, or even less depending on site characteristics. From that point forward, the benefits of electrical system resilience and efficiency are delivered with significant savings.

Johnson also says these efforts in applied research and commercial demonstration deliver ROI in the form of talent development.

“It’s commonplace for a PhD program to overemphasize the creation of the dissertation, which is usually a combination of journal articles or other academic works,” he says.

“But practical experiences such as this effort enable students to collaborate with the government or an industry partner, turn theory into practice, lead through uncertainty, file a patent, copyright code, budget and manage projects, and other aspects of what is needed to become a successful professional. It’s all incredibly valuable.”

About this story

There's a reason research matters. It creates technologies, medicines and other solutions to the biggest challenges we face. It touches your life in numerous ways every day, from the roads you drive on to the phone in your pocket.

The ASU research in this article was possible only because of the longstanding agreement between the U.S. government and America's research universities. That compact provides that universities would not only undertake the research but would also build the necessary infrastructure in exchange for grants from the government.

That agreement and all the economic and societal benefits that come from such research have recently been put at risk.

Learn about more solutions to come out of ASU research at news.asu.edu/research-matters.

This story originally appeared on [ASU News](#).

Main image



ASU graduate student Arnel Garcesa celebrates a mission accomplished in front of an electrical controller and generator at the Arizona Department of Emergency and Military Affairs' Papago Park facility in Phoenix. Garcesa's efforts were crucial to successful demonstration of novel technology developed by ASU's Laboratory for Energy And Power Solutions to improve the reliability and reduce the cost of electricity almost anywhere using microgrids. Photo by Alexander Mobley/ASU

Text image(s)



ASU student Arnel Garcesa works to correct on-site power system communications from the mechanical room at the Arizona Department of Emergency and Military Affairs' Papago Park facility in Phoenix. Photo by Arjun Hati/ASU