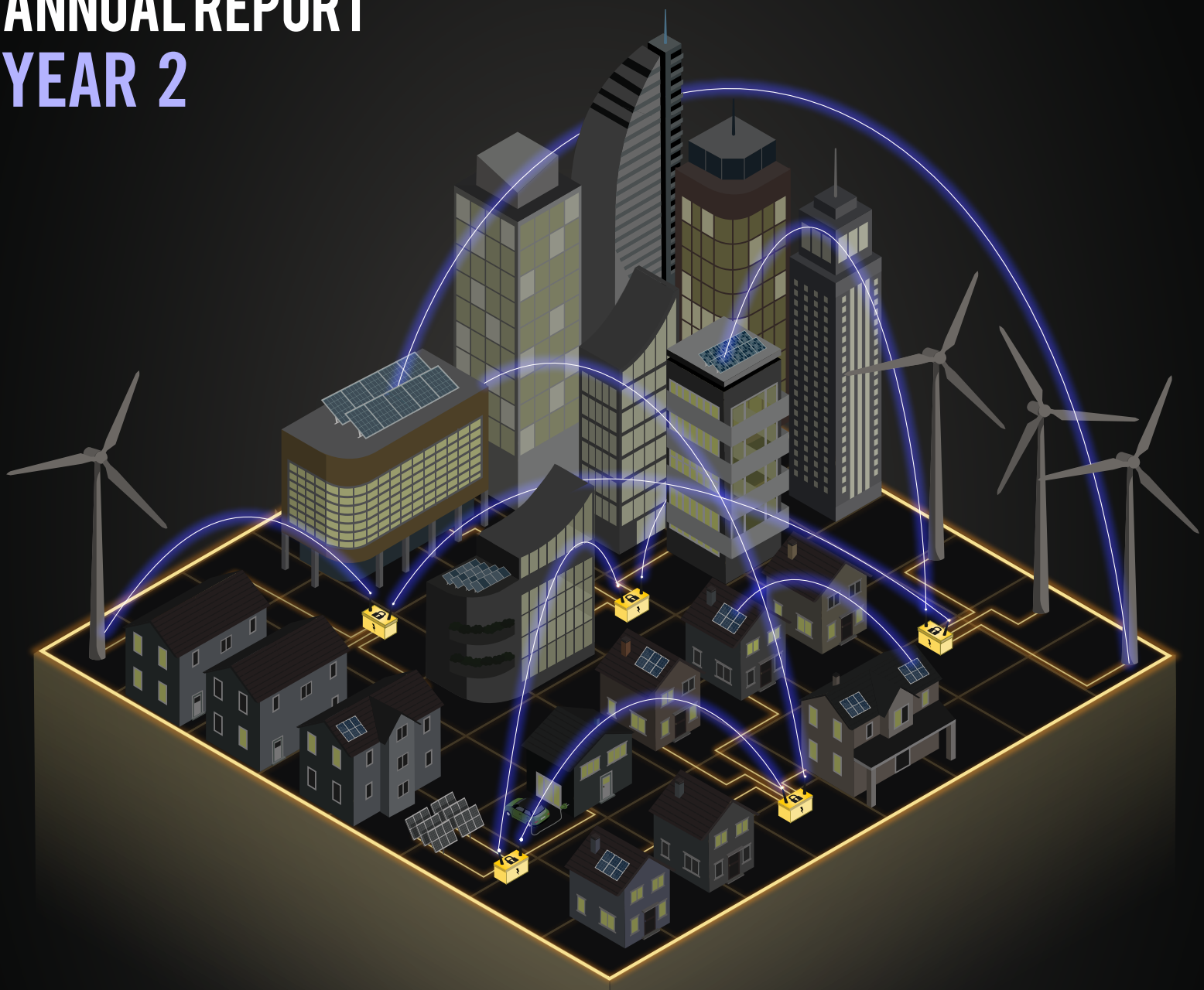
NM SMART Grid Center ANNUAL REPORT YEAR 2



New Mexico EPSCoR

September 2019–August 2020

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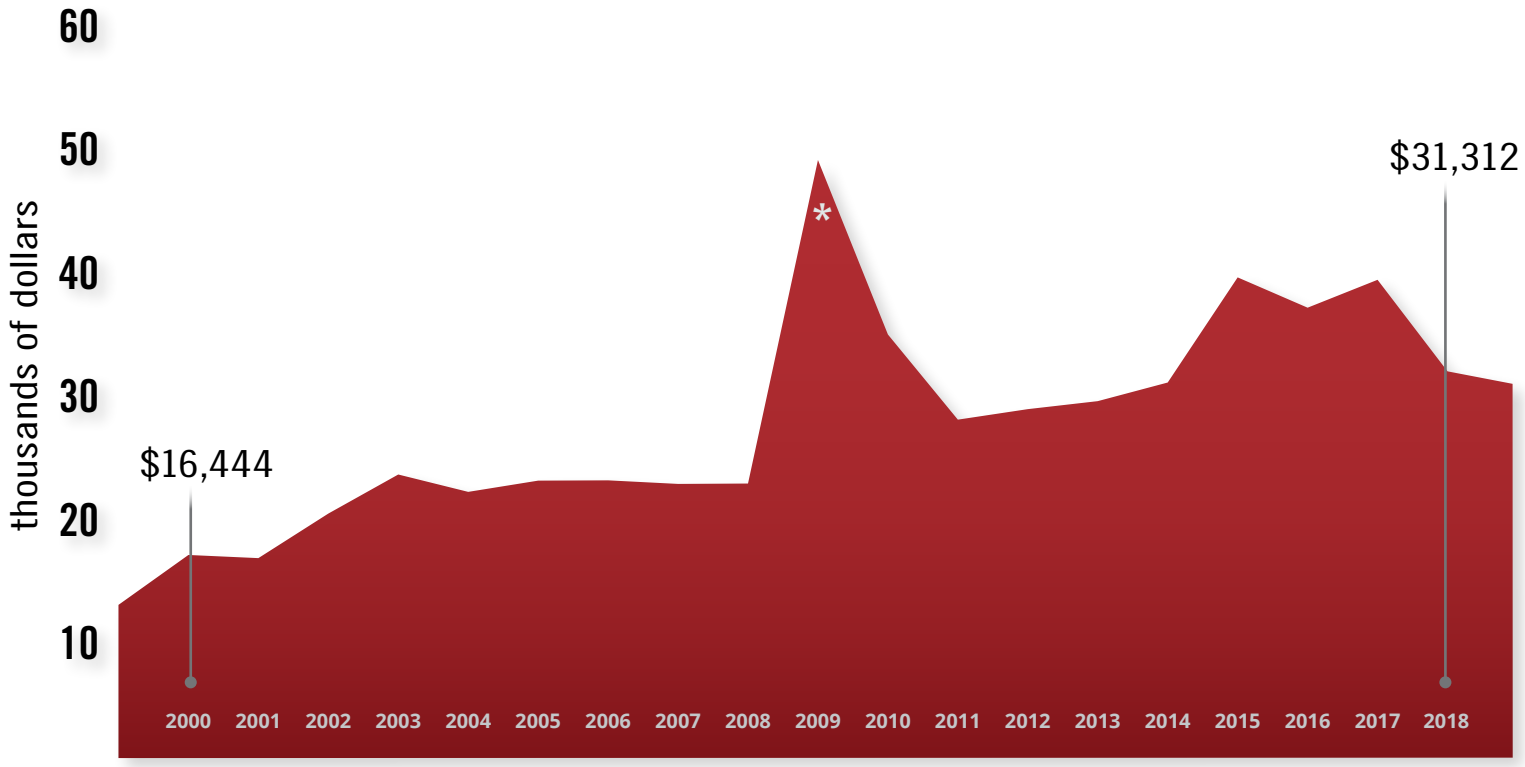
New Mexico
SMART Grid Center

NM EPSCoR OVERVIEW

New Mexico's Established Program to Stimulate Competitive Research (NM EPSCoR) was established in 2000 and is funded by the National Science Foundation (NSF) to build the state's capacity to conduct scientific research while cultivating a diverse, well-qualified STEM workforce.

Since 2000, NSF research & development funding to New Mexico universities and colleges has increased 90%



*ARRA funding

NSF Research & Development Funding to New Mexico

THE DETAILS

The amount EPSCoR has contributed to New Mexico in direct and co-funded awards since 2001

$189 million

By the Numbers

1,855
project participants

$7,200,000
scientific & computing equipment purchased

33
university faculty hires supported

25
NM higher education institutions directly involved

2.6:1
return on investment in the last five years

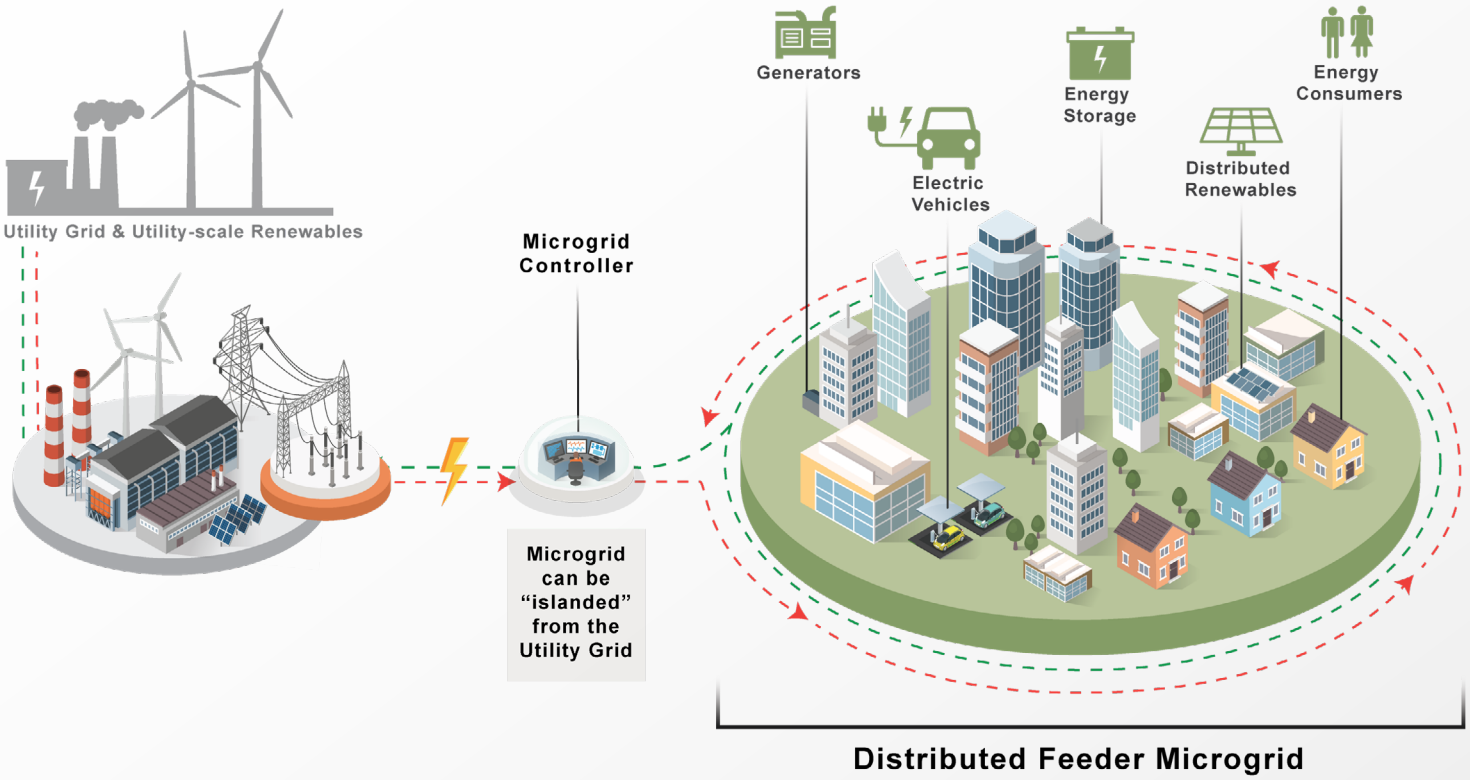
3,665
hours of educational media watched online

NM SMART GRID CENTER OVERVIEW

The *NM SMART Grid Center* is a 5-year, $20-million research and human infrastructure project investigating the fundamental challenges to transition existing electricity transmission and distributed energy infrastructure into a SMART (Sustainable, Modular, Adaptive, Resilient, Transactive) grid.

Our mission is accomplished by developing research capacity and education programs to support a modern electric grid building on the principles of **Distribution Feeder Microgrids (DFMs)** with a focus on architecture, networking, decision-support, and deployment, and by empowering a future workforce through industry partnerships, education, and public outreach.

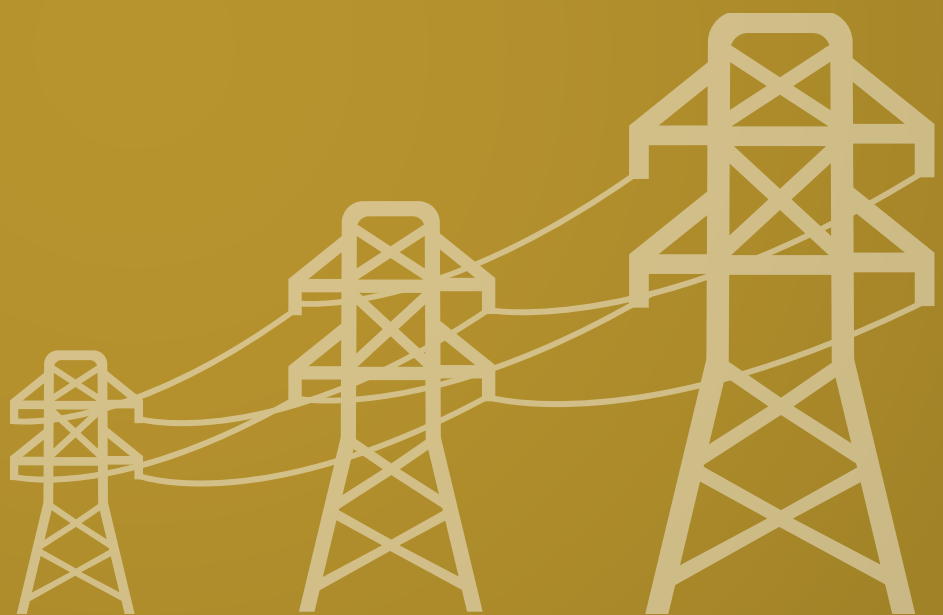
Distribution Feeder Microgrid



THE DETAILS

	project participants	peer-reviewed papers published or accepted	additional extramural funding awarded to project participants
YEAR 2	171	73	$30 MILLION
YEAR 1	120	19	$7.9 MILLION

> Distribution Feeder Microgrids will enable us to retrofit existing utility infrastructure in a way that allows entire sections of a city to operate with or without power supplied by a central utility.



RESEARCH TEAMS

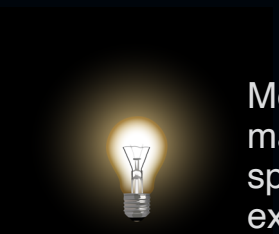
Architecture Team

The Architecture Team is creating a comprehensive framework for distribution feeders to evolve into managed microgrids. In Year 2, team economists shed light on consumers' willingness to participate in utility-run energy conservation/ management programs, while team engineers improved power system evaluation software, developed novel fault detection models, and advanced microgrid protection technology research.

Networking Team

The Networking Team is building scalable and secure communication systems for Distributed Feeder Microgrid (DFM) frameworks developed by the Architecture Team. This year, team computer scientists developed system "traffic controls" attuned to information priority and introduced device authentication security protection schemes requiring less energy and communication resources.

YEAR 2 HIGHLIGHTS



Members of the Networking Team made significant improvements to the performance of Low-Density Parity-Check codes (a code used in most modern high-speed digital communications) which will enable devices, like smart phones, to exchange data more efficiently while using less power.

Pioneering cybersecurity schemes developed by members of the Architecture team are capable of accurately distinguishing cyberattacks from legitimate events and rapidly mitigating attacks on a distributed control DC microgrid.

Decision Support Team

Harnessing the power of machine learning, data mining, and artificial intelligence, the Decision Support Team is designing robust automatic and computer-aided decision-making tools for DFM systems. In Year 2, the team began processing datasets for research use and created two data repositories. Researchers also made significant advancements in data classification, anomaly detection, and automated data interpretation.

Deployment Team

The primary focus of the Deployment Team is to test the models and technologies developed in simulations at diverse testbeds. In Year 2, team members made repairs and installed new equipment at UNM and NMSU testbed sites, which will allow researchers to conduct the real-time geographically-distributed simulations important to demonstrate actual DFM operation.

Cyberinfrastructure

In Year 2, the Cyberinfrastructure Team expanded existing high performance computer resources to include EPSCoR nodes and connected over 700TB of storage to the system for project researchers. Additionally, team data experts established a system user guide, conducted multiple trainings, and set-up virtual machines to facilitate data transfer and use by researchers geographically separated from the primary data repository.

HUMAN INFRASTRUCTURE

Developing the human resources needed to create, maintain, and build future electrical infrastructure requires a multi-pronged approach—one that reaches diverse students, faculty, teachers, industry, and entrepreneurs. Here is what NM EPSCoR did in Year 2 to build New Mexico's human infrastructure.

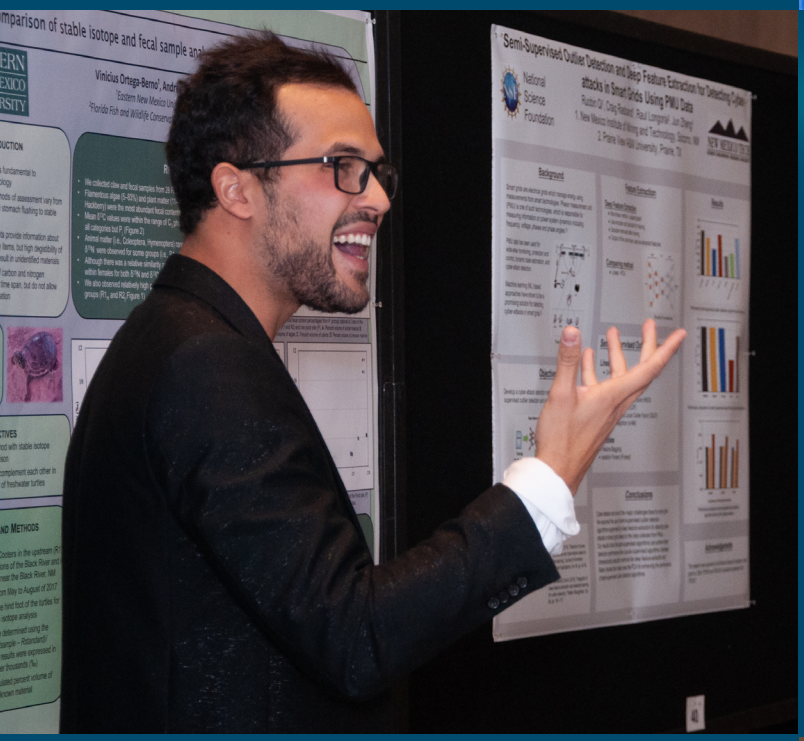
1 SUPPORT WORKFORCE DEVELOPMENT

2 INCREASE DIVERSITY IN STEM

3 COMMUNICATE THE RESEARCH

SUPPORT WORKFORCE DEVELOPMENT

In Year 2, the NM SMART Grid Center supported the hiring of six new faculty, hosted a multi-day Early Career Leadership Workshop for post-docs and new assistant professors, and conducted a Team Science Leadership Workshop for mid- and senior-career faculty. Two Collaborative Innovation Working Group Workshops fostered interdisciplinary collaborations to address challenges in modernizing the electricity grid, and four $50,000 Infrastructure Seed Awards were funded to support pioneering smart grid research at UNM, NMT, and SFCC.



INCREASE DIVERSITY IN STEM

This year, the project's undergraduate summer research program (STEMAP) went virtual with 12 students, 75% of whom were female or from an under-represented minority (URM) group. Additionally, of the 83 individuals who attended the six project Software and Data Carpentries workshops, 70% were female or URM. Retention initiatives, like mentoring, are one proven method for increasing diversity in STEM, and this year the NM EPSCoR Excellence in Mentoring Award recipients were Dr. Olga Lavrova (NMSU) and Dr. Ali Bidram (UNM), selected for their inclusivity and superior mentee support.

COMMUNICATE THE RESEARCH

In project Year 2, student researchers from 19 institutions across the state honed their communication skills at the New Mexico Research Symposium, hosted by NM EPSCoR, through oral and poster presentations delivered to over 100 conference attendees. This year outreach partner, Explora Museum, also began their "Meet A Scientist" series, which virtually connects the public with scientists while challenging traditional stereotypes and promoting diversity in STEM.

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