ENERGIZE NEW MEXICO

YEAR 5 ANNUAL REPORT

JUNE 1, 2017–MAY 31, 2018

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DESIGNED & CREATED BY
Natalie Rogers
Public Relations Specialist, NM EPSCoR

NM EPSCOR STATE OFFICE

1312 Basehart SE
Albuquerque, NM 87106
P: (505) 814-7500
F: (505) 246-6007
www.nmepscor.org

DISCLAIMER

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NM EPSCOR OFFICE STAFF

William Michener, Program Director & PI
Anne Jakle, Associate Director & Co-PI
Tracy Hart, Program Planning Officer

Dustin Allen, System Administrator
Arman Barsamian, Accountant
Shelby Bazan, Student Employee
Chelsea Chee, Diversity Coordinator
Selena Connealy, Education Coordinator
Melissa Coverdale, Event Coordinator
Andra Kiscaden, Contracts & Grants Administrator
Natalie Rogers, Public Relations Specialist
Isis Serna, Website Administrator

New Mexico EPSCoR

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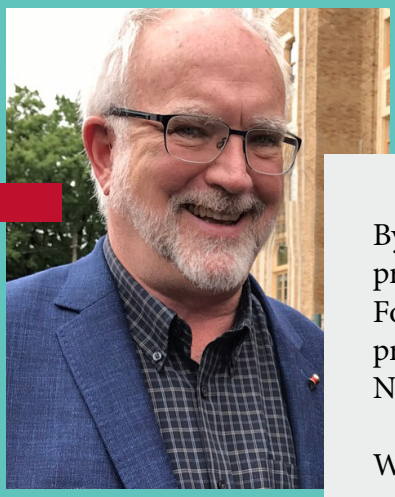
TABLE OF CONTENTS



FROM THE DIRECTORS

By all measures, *Energize New Mexico* has been a highly successful project and has met all of NM EPSCoR and the National Science Foundation (NSF) EPSCoR program core goals and objectives. The project has catalyzed research capability across the state, and 2018 NSF funding equalled or exceeded $50M of the eighth year in a row.

We have significantly supported STEM professional development and involved 278 undergraduate and graduate students from 15 different New Mexico two- and four-year higher education institutions during the project. We have also met a core part of our mission to broaden participation of diverse groups in STEM and exceeded for three years our project goal of having 50% of our project participants be female or from minority groups traditionally underrepresented in STEM.

In part because of NM EPSCoR's success in building research capacity across New Mexico, our state graduated from the NSF EPSCoR program in 2018, joining a handful of states that have fulfilled the EPSCoR mission to build research capacity on par with top performing states in the country. This achievement speaks to the high-quality research and researchers that our relatively small state and its higher education institutions host.

We commend the hard-working faculty, students, and other project participants who have made *Energize New Mexico* such a success and have committed to the teamwork needed to produce the level of achievement we've seen. We look forward to seeing the benefits of this project's investment continue in New Mexico many years in the future!

William Michener, Director
Anne Jakle, Associate Director

ABOUT NM EPSCoR

New Mexico's Established Program to Stimulate Competitive Research (NM EPSCoR) is funded by the National Science Foundation to build the state's capacity to conduct scientific research. Faculty and students from universities and colleges are working to realize New Mexico's potential for sustainable energy development.

Established in 2001, NM EPSCoR also cultivates a diverse, well-qualified Science, Technology, Engineering and Mathematics (STEM) workforce while supporting innovation and inclusion.

Energize New Mexico

Energize New Mexico is a 5-year, $20 million research and human infrastructure grant funded by the National Science Foundation (NSF). The vision of *Energize New Mexico* is to position New Mexico as a national leader in harnessing and promoting energy self-sufficiency and a sustainable culture of innovation. Year 5 encompasses all project activities from June 1, 2017 to May 31, 2018. In Year 5 alone, project participants were awarded $6.6 million in external funding for 19 proposals.

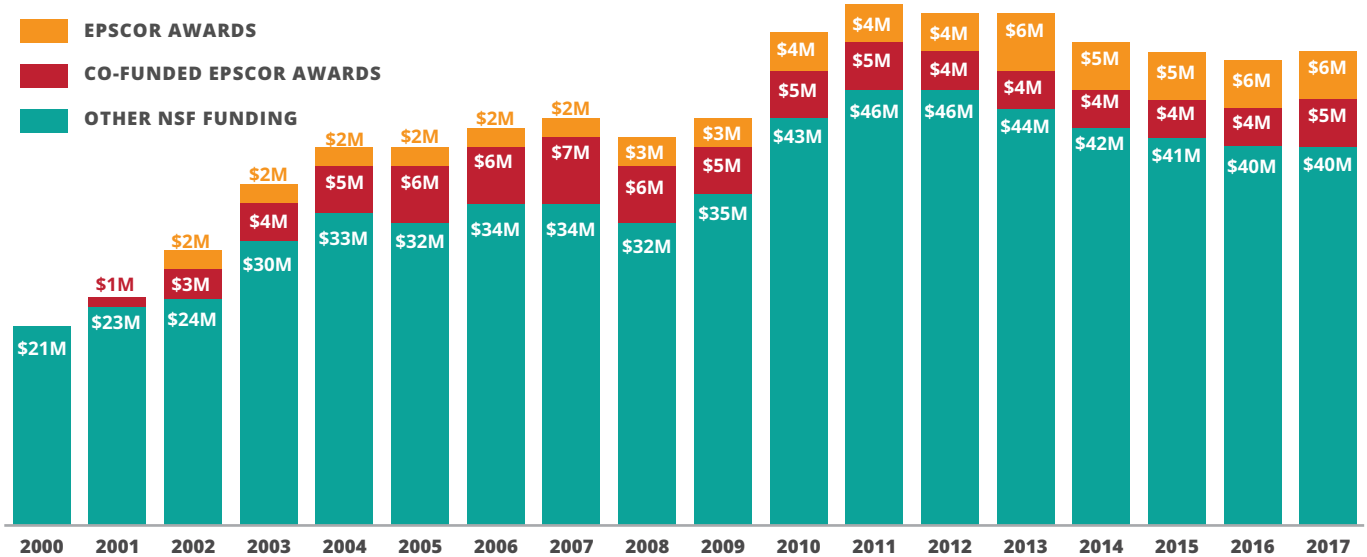
Year 5 By the Numbers

144 PRESENTATIONS

53 PEER-REVIEWED PUBLICATIONS

$6.6M AWARDED PROPOSALS

NSF Funded Awards in New Mexico



NSF EPSCoR

The NSF Established Program to Stimulate Competitive Research supports 25 states, two territories, and one commonwealth in its efforts to build sustainable research and human infrastructure. The mission of EPSCoR is to advance excellence in science and engineering research and education in order to achieve sustainable increases in research, education, and training capacity and competitiveness that will enable EPSCoR jurisdictions to have increased engagement in areas supported by the NSF. Of all NSF EPSCoR faculty hires, 78% remain in their original jurisdictions, creating a return on investment for each jurisdiction.

Energize New Mexico Year 5 Honors & Awards

FACULTY

- Bonnie Frey (NM Tech): *New Mexico Network for Women in Science & Engineering Impact! Award*
- Ginger McLemore (NM Tech): *2018 SME Environmental Stewardship Distinguished Service Award*
- José Cerrato (UNM): *NM AMP Faculty Statewide Mentor Award*
- Martin Kirk (UNM): *Humphrey Symposium Lecturer at the University of Vermont*
- Catherine Brewer (NMSU): *University Research Council Winner for Exceptional Achievements in Creative Scholarly Activity*
- Karl Karlstrom (UNM): *2018 Faculty Teaching Award from the UNM Alumni Association*
- Hongmei Luo (NMSU): *Luke Barry Shires Professor in Chemical & Materials Engineering*

STUDENTS

- Allie Arning (NM Tech): *3rd Place Undergraduate Poster at the 2017 NMAS Research Symposium*
- Carmen Velasco (UNM): *1st Place Graduate Poster at the 2017 NMAS Research Symposium*
- Christina Ferguson (UNM): *3rd Place Graduate Poster at the 2017 NMAS Research Symposium*
- Jon Golla (UNM): *2nd Place Graduate Poster at the 2017 NMAS Research Symposium & Geothermal Resources Council Best Presentation Award*
- Eshani Hettiarachchi (NM Tech): *New Mexico Tech Outstanding Graduate Teaching Assistant Award*
- Tom Nakotte (NMSU): *New Mexico Space Grant Consortium Graduate Research Fellowship & NMSU Outstanding Graduate Assistantship*
- Kimberly Pestovich & Stephanie Richins (NMSU): *New Mexico Space Grant Consortium Undergraduate Research Scholarship*

TOP TO BOTTOM: Bonnie Frey; Ginger McLemore; NM EPSCoR 2017 NMAS Poster Winners: Jon Golla, Holly Olivarez, Samantha Ceballes, Allie Arning, and Carmen Velasco. *Not pictured: Christina Ferguson*

PROJECT IN REVIEW

The infrastructure and activities of *Energize New Mexico* were designed to support shared-use equipment, engage new research and community college faculty, and support the STEM pipeline by training teachers, undergraduate and graduate students, and post-doctoral fellows.

Since project inception, *Energize New Mexico* participants have been awarded $55.7 million in extramural funding from federal agencies, state agencies, and private foundations, **representing a 2.5:1 return on investment**. These external funding successes contributed to New Mexico's overall NSF funding total, which for the first time exceeded EPSCoR eligibility criteria, thereby achieving the main goal of the NSF EPSCoR program.

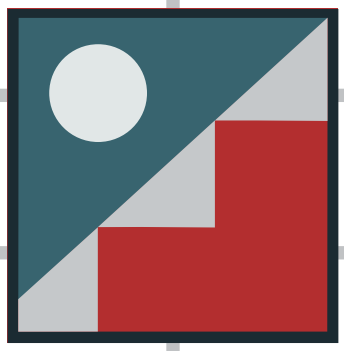
Over 5 years, *Energize New Mexico* involved 459 participants from over 40 institutions statewide, including national labs, community colleges, state universities, informal education facilities, and industry.

Publications

According to a 2003 study by the National Academies of Science, publication of scientific information is the key to moving science forward. Over the five years of *Energize New Mexico*, participants contributed to the growing knowledge of their topics by submitting 275 publications, of which 163 were peer-reviewed.

Funding

The NSF EPSCoR initiative was created to catalyze federal research dollars for smaller states to bring them to a competitive level. By the end of *Energize New Mexico*, participants have been awarded over $55.7 million in extramural funding.



Collaboration

40+ statewide institutions and organizations participated in *Energize New Mexico*. The grant has also catalyzed partnerships among researchers, national labs, tribal communities, and industry that would not have been possible without NM EPSCoR.

People

Energize New Mexico funded over 420 participants over 5 years, including undergraduate students, graduate students, and post-doctoral fellows. The project also supported 49 undergraduate and 47 graduate students through graduation. Over 50% of reporting participants identified as female or under-represented minorities.

Infrastructure

One of the main goals of NM EPSCoR is to support research infrastructure through shared-use equipment. Several higher education institutions across the state will benefit from state-of-the-art equipment purchases by *Energize New Mexico*, including a Zonge Magnetotelluric system, laser-based isotope systems, a gas chromatography system, and more.

Public Outreach

In addition to the over 420 participants over the life of *Energize New Mexico*, grant external engagement activities have reached nearly 10,000 members of the public in New Mexico, including K-12 teachers and students. The museum exhibits funded by NM EPSCoR have a potential to reach over 250,000 people.

SCIENCE & RESEARCH

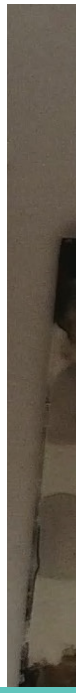
Energize New Mexico utilizes an “all of the above” approach to energy research to ensure multiple pathways to a sustainable energy future for New Mexico

BIOALGAL ENERGY

Bioalgal energy development can play a key role in creating a future that better utilizes alternative fuels and resources. One way that algae will become competitive as a fuel source is to extract co-benefits, such as water treatment, in addition to creating fuel feedstock. The NMSU algal wastewater treatment testbed is pursuing this end at the Las Cruces Wastewater Treatment plant. It is currently the only plant in the country that is treating primary effluent under field conditions to the discharge standards for biological oxygen demand, nitrogen, and phosphorous. In Year 5, *Galdieria sulphuraria* cultures were fed primary-settle wastewater and not only achieved discharge standards for the traditional pollutants in a single step, but reduced bacterial water quality as compared to the existing traditional treatment system.

In a collaboration with SFCC, UNM has been assessing the suitability of high salinity water produced from fracking operations for algae growth, including a mixed algal culture enriched on fracking water and a pure culture of *Duniliella salina*. The team has grown both sources on real fracking water and synthetic media over a range of salinities to determine salinity effects on growth rates, lipid productivity and composition, and community composition (for the mixed culture). Use of fracking water would reduce the need for freshwater for algae cultivation, and also has applications for treatment of these abundant oil and gas wastewaters.

LEFT: A shake-table with various algae cultures in Dr. David Hansen's lab at UNM; ***RIGHT:*** Dr. Omar Holguin with the pilot testbed at the Las Cruces Wastewater Treatment facility

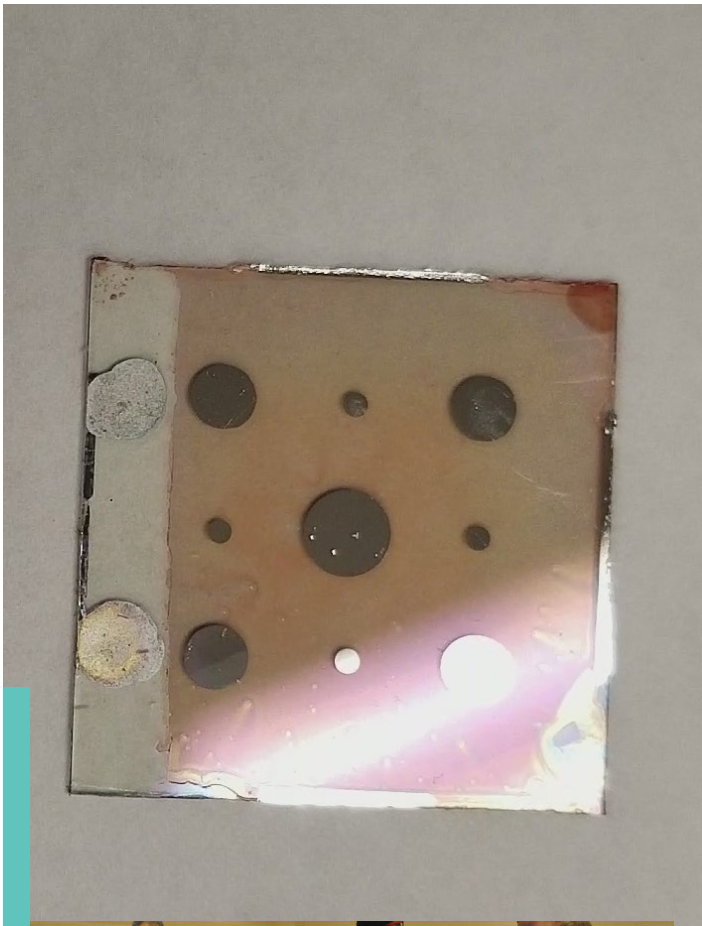


SOLAR ENERGY

The *Energize New Mexico* Solar Energy team formed to address challenges involved in making solar energy a sustainable and practical investment. The team focused on the efficiency and effectiveness of solar cells, and the feasibility of alternatives to fossil fuels by using solar power to convert carbon dioxide into methanol.

Polymer cells have the potential to change commerical solar panels in the future because they are more affordable, and can be made to fit any shape, but their efficiency and resiliency must be improved before they can become commercially viable. Equipment purchased through NM EPSCoR by the UNM team at the Center for High Tech Materials measures photoluminescence of polymer solar cells, and researchers in the Chemistry Department continue their work on improving the efficiency of polymer solar cells. In addition, researchers on the NMSU team have turned to materials science and have increased their understanding of these processes at the molecular level, called excited state lifetimes. This has the potential to provide long-lasting, high-energy processes that boost the efficiency of solar cells for consumers.

As the most abundant greenhouse gas, efforts at NM Tech and NMSU focused on conversion of CO_2 to value-added chemicals or automotive fuels such as formate or methanol. In Year 5 at NM Tech, silver nanoparticle-copper oxide nanocomposites (Ag/Cu_2O) were characterized for the first time as a useful catalyst for converting bicarbonate to formate.



TOP: Polymer solar cell crafted at the UNM Department of Chemistry; ***BOTTOM:*** Solar Energy team leads Michael Heagy (NM Tech), Hongmei Luo (NMSU), and Martin Kirk (UNM)

OSMOTIC POWER DEVELOPMENT

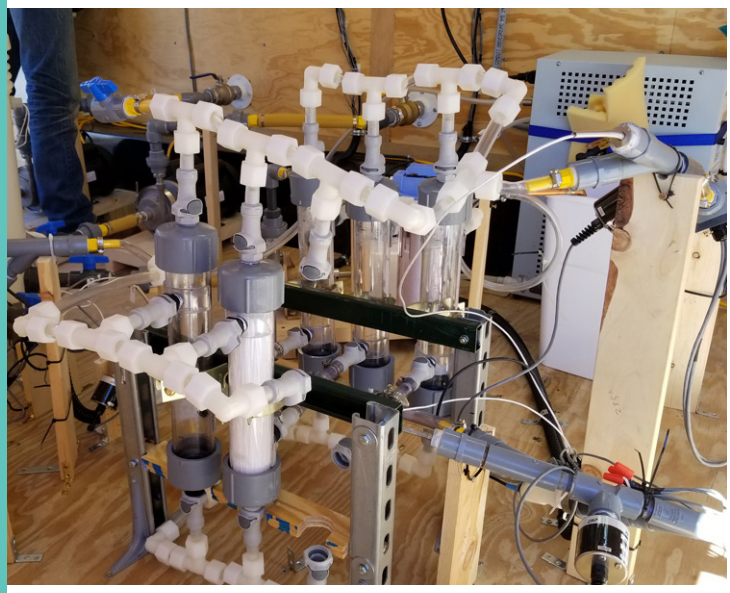
The Osmotic Power Development team is housed at NM Tech in Socorro, and a team of undergraduate and graduate students is led by Dr. Frank Huang of the Chemistry department. They have partnered with Masson Farms of New Mexico, a local geothermal greenhouse, to work toward meeting its demand for irrigation at a lower cost while conserving existing fresh-water resources. In order to do this, the team has spent the last 4 years working on filtration through membrane fabrication, and designing a geothermal membrane distillation (GMD) system to clean the brackish water for reuse.

Highlights:

As part of the *Energize New Mexico* project, the Osmotic Power Development team developed from scratch a geothermal membrane distillation system that has the potential to clean brackish geothermal waters to be used for irrigation. The success of the system allowed the team to bridge the gap between real-world applications and the lab by installing the system in a research trailer at a local geothermal greenhouse north of Las Cruces, Masson Farms of New Mexico.

The team's membrane characterization process is revolutionary; membrane desalinization will become increasingly popular in New Mexico as water becomes scarce. Results are promising, and the team intends to continue their work by optimizing the membrane fabrication process to improve performance for commercialization.

Water scarcity is an issue in the desert Southwest, and this system may allow for industries that rely on irrigation or agriculture to use brackish, abundant sources of water rather than freshwater sources such as groundwater that communities rely on. Membrane distillation of this type may also help local businesses such as Masson remain competitive in a changing economic and environmental climate.

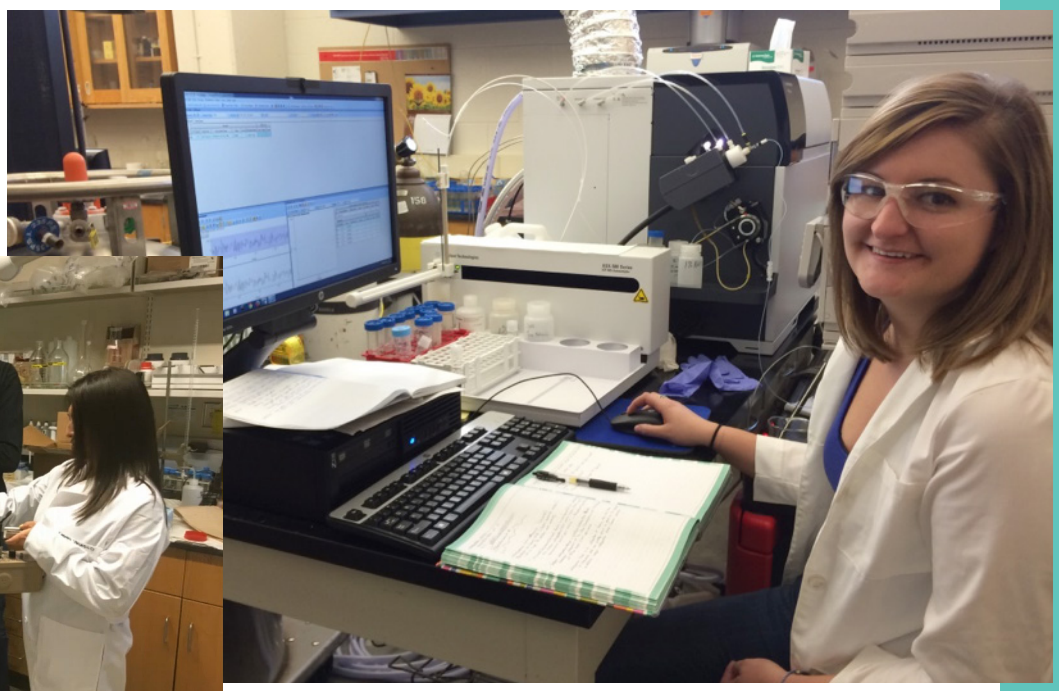


TOP: The Direct Contact Membrane Distillation (DCMD) system; ***BOTTOM:*** The Osmotic Power Development team with their pilot-scale DCMD system trailer at Masson Farms

URANIUM TRANSPORT AND SITE REMEDIATION

Through research over the last five years, the team at UNM discovered that the dissolution of Uranium and Vanadium (U-V)-bearing minerals similar to carnotite is a key process affecting the transport of U and V from Uranium mine wastes in the Navajo Nation. Results of this study were published by Sumant Avasarala in *Environmental Science & Technology*.

The team at NM Tech has tackled understanding the movement of uranium through different pathways. Research shows compelling results that suggest increasingly acidic and basic conditions promote uranium leaching from mine waste. Liliya Frolova submitted a paper to the *Journal of Hazardous Materials* with co-authors that include students Samantha Saville and Chase Kicker. The paper is based on some of the findings that supported Frolova's uranium filter patent application—which was published publicly on May 2017—and is currently under review.



LEFT: UNM team members Sumant Avasarala and Carmen Rivera test new lab equipment; ***RIGHT:*** Samantha Saville (NM Tech) analyzes soil and water samples with the ICP Mass Spectrometer purchased with NM EPSCoR funding; ***OPPOSITE:*** STEMAP students work with grad student Marisa Repasch in the Jemez Mountains

GEOTHERMAL ENERGY

The Geothermal team continued their statewide collaborative efforts for the project on geothermal sites and prospects in Year 5 through novel approaches and collaboration. South of Jemez Pueblo in San Ysidro, the topography is challenging, so the team combined magnetotelluric (MT) and electromagnetic surveys by the NM Tech team with geochemical data previously collected by the UNM team to begin to reveal and map the geothermal systems of the area, all the way down to the mantle. This research also resulted in a successful IWG proposal to plan further research activities. The UNM team also completed a report and final presentation on the the dramatic degradation of surface water quality by geothermal inputs, especially at times of low river stage to landowners and stakeholders in the Rio Ojo watershed.

Another surprising development in 2017 was a meeting set up by geothermal experts from LANL and a company from Sweden who are pioneering new technologies to generate electricity in combination with small direct-use geothermal sites that have great potential in New Mexico. A successful pilot follow-up is now ongoing between the Swedish company, SFCC, and the Jemez Pueblo surrounding the Indian Well site that may lead to both a geothermal greenhouse and accompanying modest power generation.

Highlights:

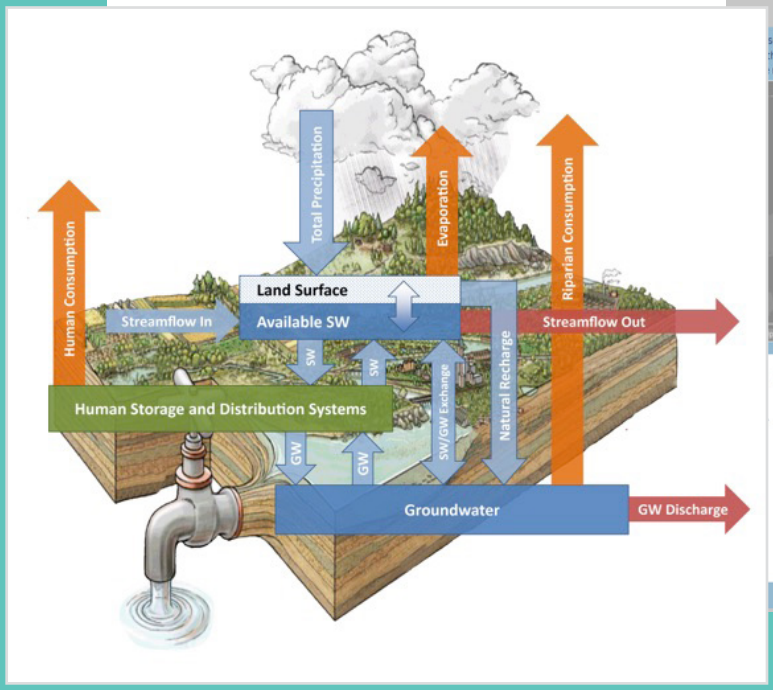
Using NM EPSCoR funding, the Geothermal Energy team purchased and deployed a magnetotelluric (MT) system in northern and southern New Mexico. The team discovered that MT survey results can detect permeability variations within deep hydrothermal systems, allowing researchers to predict salinity, temperature, and resistivity patterns for different types of permeable rock.

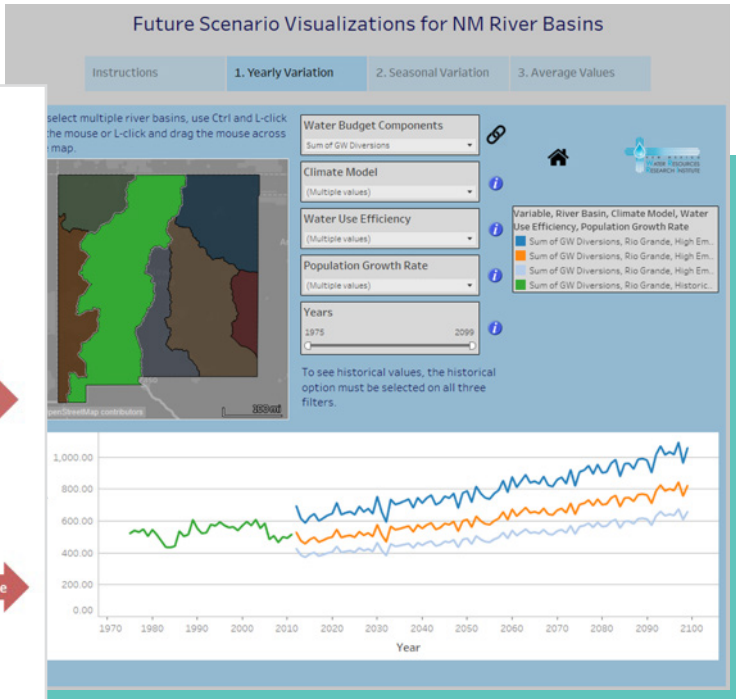
Since underground hydrothermal systems remain hidden, the ability to visualize those systems through modeling can transform our knowledge of the Earth itself, including mapping blind systems to find groundwater paths, predicting the degree of difficulty of drilling by locating certain types of rock, and taking the temperature of hydrothermal systems to determine geothermal energy potential of a specific area.

SOCIAL & NATURAL SCIENCE NEXUS

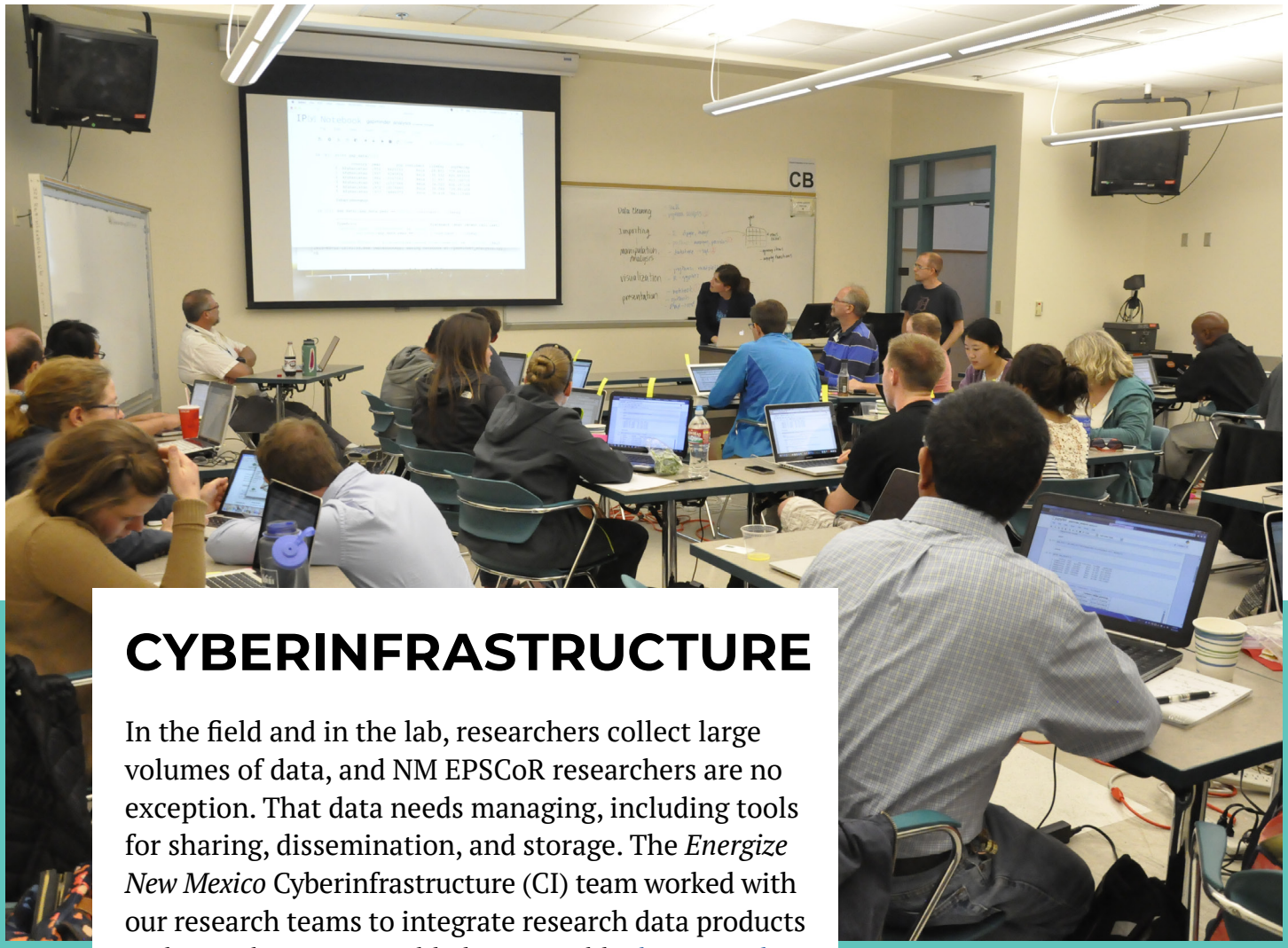
Substantial progress has been made on the completion of components for the System Dynamics (SD) model in Year 5, with module additions in the last year including: energy trade-offs for water associated with energy production, siting criteria for new renewable generation installation in the state, trade-off analysis between generation types by location that are both economic and environmental, and energy emissions health tradeoffs.

The New Mexico Dynamic State Water Budget (NMDSWB) SD model continues to be refined and expanded. In Year 5, the initial future scenario portion of the model was completed, and a link (currently private) to the NMDSWB online visualization tool is up and running. Currently, the NMDSWB incorporates three future scenario options: climate models, water use efficiency, and population growth rates. The implementation of future scenario options within the model allows users to forecast New Mexico's water budget for a range of potential scenarios and to compare these future projections to the historical trends.





LEFT: Schematic of the NMDSWB system dynamics model. Thirteen different inputs/outputs form the core water budget terms; ***RIGHT:*** Historical and future projections of groundwater diversions from the NMDSWB



Software Carpentry Training at UNM

CYBERINFRASTRUCTURE

In the field and in the lab, researchers collect large volumes of data, and NM EPSCoR researchers are no exception. That data needs managing, including tools for sharing, dissemination, and storage. The *Energize New Mexico* Cyberinfrastructure (CI) team worked with our research teams to integrate research data products and metadata into a publicly-accessible data portal. Over 167 new research datasets were added in Year 5, and the portal currently holds over 894 datasets that represent all *Energize New Mexico* research areas.

The CI Team made enhancements in automation of data documentation, submission, and review process for new project datasets developed by the research components. This has resulted in a workflow in which any issues identified with submitted datasets and associated metadata are quickly turned around for resolution with the submitting researchers. To enhance discoverability, NM EPSCoR data continues to feed to the DataONE network and transfer all project data to UNM's long-term institutional data repository (DigitalCommons) for data preservation.

EDUCATION & OUTREACH

Energize New Mexico provides activities that engage and support learners at all educational levels, leading to a diverse workforce in STEM fields

STEM ADVANCEMENT PROGRAM

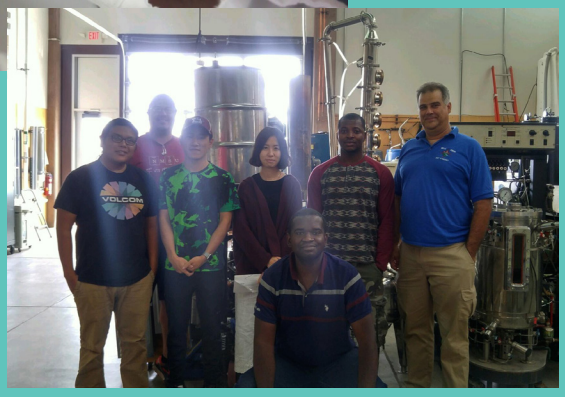
The Science, Technology, Engineering, and Math Advancement Program (STEMAP) undergraduate research experience has provided transformative academic opportunities to underrepresented students across New Mexico, contributing to a strengthened and diverse STEM workforce and community in the State. STEMAP gives undergraduate students from non-research universities and two-year colleges the opportunity to spend eight weeks working with faculty at a research university. Often, this is the first formal research experience of their academic careers. Because mentorship is strongly associated with future STEM success of underrepresented minorities and women, an important element of STEMAP was the fostering of mentoring relationships for participating students—with with faculty at research universities, near-peers (undergraduate and graduate students engaged in research teams), and with faculty mentors at their home institutions.

In its entirety, the STEMAP program welcomed 50 undergraduates (92% female or underrepresented minority) from 14 primarily undergraduate institutions (93% minority-serving) across New Mexico in the summers of 2014–2017. Of these students, 15 have transferred to 4-year universities, 20 have graduated or will graduate by May 2018, two are in graduate school, and five are in the workforce. Eight STEMAP students have presented their research at conferences, including the national SACNAS and AISES conferences, five students have recieved poster presentation awards, and one is a co-author on a peer-reviewed paper published in the American Chemical Society journal *Sustainable Chemistry & Engineering*.

STEMAP Summer Cohorts
TOP TO BOTTOM: 2017, 2016, 2015, 2014

EXTERNSHIPS

The externship program is a research opportunity allowing graduate students to spend a semester (or summer) at a partnering New Mexico university, research facility, or industry partner. Nine graduate students, four individuals plus a team of five students, participated in the Year 5 externship program from the Solar and Bioalgal research components. The externships involved students from UNM, NMSU, and NMT, who visited SFCC, Los Alamos National Laboratory, the New Mexico Consortium, and the National Renewable Energy Laboratory. The New Mexico Consortium externship resulted in Taylor Britton (UNM) receiving funding for the remainder of his PhD.



TOP: Hanqing Pan in the lab with lasers at the Solar Research Facility at NREL; ***MIDDLE:*** Taylor Britton at the New Mexico Consortium; ***BOTTOM:*** Meshack Audu (2nd from right) with his summer research team at SFCC

GUTC Alumni Mini Showcase

GROWING UP THINKING COMPUTATIONALLY (GUTC)

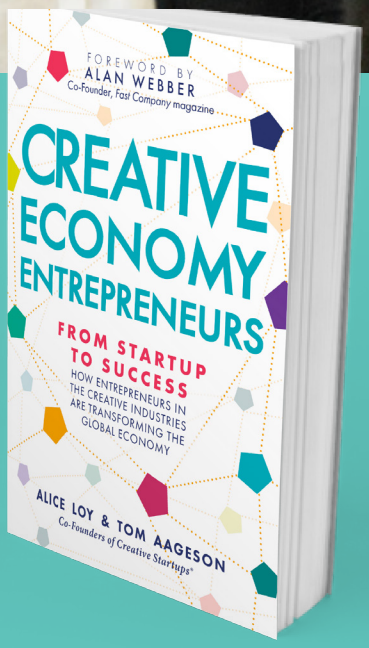
In Year 5, GUTC focused on providing teacher training, support for in-school implementation of computational thinking modules, and a week-long summer camp for middle-school students. Twenty middle-school teachers from two southern New Mexico school districts (Las Cruces and Gadsden) participated in a week-long teacher workshop in Summer 2017 and learned how to integrate computer science modules into Earth, Physical, and Life Science courses. Sixteen high school teachers participated in two days of training on Computational Thinking and tools including ozobots, BoeBots, SCRATCH, and Python programming.

Overall, this program will increase the number and diversity of middle and high school teachers who successfully implement computer science concepts into their classes and produce students who are better prepared to enter into computer science pathways in college.

FACULTY LEADERSHIP PROFESSIONAL DEVELOPMENT INSTITUTE

The Faculty Leadership & Professional Development Institute (FLPDI) comprises opportunities for faculty from primarily undergraduate universities to support STEM learning, especially among under-represented minorities. Through the program, participants gain skills and strategies to support student success in STEM with a focus on support and retention. In Year 5, 26 faculty from 12 primarily undergraduate institutions participated in two day-long workshops facilitiated by NM EPSCoR staff, the first on promoting undergraduate research experiences and the second on Project and Problem Based Learning. Participants gained valuable skills and strategies and explored ways to incorporate those strategies into their own teaching. FLPDI also helped establish a network of PUI faculty and program administrators who are familiar with the project mission and are committed to disseminating project information and opportunities.

Selena Connealy of NM EPSCoR facilitates the February 2018 FLPDI



TOP: Creative Startups co-founder Alice Loy gives a lecture on the importance of diversity in entreprenuership; ***BOTTOM:*** New book released by Creative Startups founders Alice Loy and Tom Aageson

CREATIVE STARTUPS

The Creative Startups Accelerator was launched in 2014 with seed funding from NM EPSCoR and now is located in three sites domestically (Albuquerque; Winston-Salem, NC; Baltimore, MD) and internationally in Kuwait and Malaysia. They have graduated 65 startups from 7 international Accelerator cohorts, and 40 startups from the New Mexico Accelerator program. Creative Startups has close to 100 local and international mentors and experts. To date, the startup companies that participated in the Accelerator have raised $11 million in private investment, generated $10 million in new revenues, and created over 160 new jobs in New Mexico and 210 jobs globally. Seventy percent of these startups are women- or minority-owned. Additional accomplishments can be viewed in their 2018 Impact Report.

In 2017, Creative Startups launched their new Creative Startups LABS program to address the needs of early stage startups and entrepreneurs and prepare them for a full Accelerator program. Sixteen New Mexico–based startups participated in the inaugural LABS cohort. The LABS program will be expanded in 2018 with the development of "Libraries as Launchpads" in six public libraries throughout New Mexico. This program will connect entrepreneurs in rural and tribal communities to the educational resources needed to expand their businesses.

ABOVE: The NM EPSCoR Uranium Exhibit Science Team in front of the new Uranium exhibit at the Nuclear Museum, led by Bonnie Frey (front, right)
OPPOSITE: The NM EPSCoR-Explora solar energy exhibit

NEW MEXICO INFORMAL SCIENCE EDUCATION NETWORK

NM EPSCoR understands the need to communicate scientific concepts to the public to increase science literacy, especially for future generations. The New Mexico Informal Science Education Network (NM ISE Net) increases the ability of informal educators, such as museum staff and citizen scientists, to support STEM learning and education. Year 5 activities included an exhibit evaluation training in a collaboration between Explora and *Energize New Mexico*'s external museum evaluator, and a lecture series about sustainable energy research at the Farmington Museum that featured three NM EPSCoR researchers.

The final Network meeting was held in conjunction with a two-day training on the state's science standards. New Mexico's largest celebration of science, the NM Science

Museum Exhibits

Two museum exhibits funded by NM EPSCoR opened to the public in Year 5. The Solar Exhibit at Explora explains the difference between organic and conventional solar cells and short videos showcase NM EPSCoR's solar energy research. The Uranium Exhibit,"What's Up with U?", is housed at the National Museum of Nuclear Science and History and highlights research of the Uranium team. Museum staff and Uranium team researchers have collaborated closely on the content and structure.

Additionally, the computer game from our Year 4 exhibit at the NM Museum of Natural History and Science Bioalgae exhibit has been launched as a web-based application, which allows it to be remotely accessed and used at outreach events like family science nights and school-based programs. The NM EPSCoR office has used it at Navajo STEM events at Chapterhouses across the Navajo Nation and at "UNM Day" at the New Mexico Legislature.

In sum, these museum exhibits provide a vehicle for NM EPSCoR research to be shared with hundreds of thousands of members of the general public, on a much larger scale than could be accomplished through traditional outreach activities.

Fiesta, took place the week of May 14–21, 2018, with participation by all NM EPSCoR research components and many NM ISE Net organizations, and attracted over 5000 visitors.

NM ISE Net also worked closely with NM EPSCoR scientists to communicate *Energize New Mexico* research to the public by providing mini-grants with funding up to $3000 for events and programming. Two were awarded in Year 5: one to support the NM Science Fiesta and one to support professional development for two ISE Net members around K-12 science. A mini-grant awarded in Year 4 to the Albuquerque Biopark to develop algae education materials for Tingley Beach, a city-owned facility used for public recreation, completed its scope of work in Year 5 by unveiling new educational material developed in conjunction with Bioalgal Research co-lead Becky Bixby and hosting a public event.

TEACHER PROFESSIONAL DEVELOPMENT INSTITUTE

NM ISE Net members provide a week-long energy institute for upper elementary and middle school teachers, plus two follow-up workshops, that provide all the necessary ingredients for building a scientific way of thinking in teachers and students. The final Teacher Institute for *Energize New Mexico* was conducted in Northern New Mexico in Taos; follow-up workshops occurred at the state science teacher conference in the fall and Santa Fe in the spring. A total of 23 teachers from 11 schools across eight school districts participated in the Teacher Institute that was facilitated by instructors from ISE Net members and the New Mexico Public Education Department.

The large majority (78%) of the teachers showed substantial gains in energy knowledge as measured by a pre- and post-test assessment. Additionally, they rated the Institute very high as compared to other professional learning experiences, with more than 68% reporting it as the best professional development they had ever experienced. The Teacher Professional Development Institute model will be sustained through the Public Education Department, which has adopted this model of teacher professional development and has committed to fund science teacher institutes for up to 600 teachers per year.

ABOVE: The Summer 2017 Teacher Professional Development Institute participants

Participants in the Strengthening Higher Education and Tomorrow's Workforce Town Hall review their work

Credit: New Mexico First

STATEWIDE TOWN HALL

Strengthening Higher Education and Tomorrow's Workforce

In partnership with New Mexico First, NM EPSCoR co-convened a Town Hall on April 10–11, 2018, on higher education reform and workforce development. NM EPSCoR sponsored the Energy Workforce Development track which addressed challenges related to New Mexico's energy workforce and streamlining the state's training pipeline. Higher educational institutions grapple with how to efficiently produce the graduates needed to fill industry demand despite considerable workforce pipeline barriers. Town Hall participants started with data-driven analyses and informed resident deliberations, then developed consensus recommendations. By the end of the event, the Town Hall generated consensus-supported direction and actionable policy recommendations for education, community, business and policy leaders seeking optimal alignment of education and the workforce, as well as statewide economic prosperity.

INTERDISCIPLINARY INNOVATION WORKING GROUPS

Interdisciplinary Innovation Working Groups (I-IWGs) provide a venue for researchers, educators, and nationally-recognized experts to address grand challenges that require an interdisciplinary approach to transform science. IWG support (up to $7500) is aimed at working groups that emphasize the collaborative development and testing of important ideas and theories, cutting-edge analysis of recent or existing data and information, the use of sound science policy and management decisions, and investigation of social issues that pertain to energy development that minimizes impacts on water and the environment. In Year 5, NM EPSCoR funded the following I-IWGs:

New Mexico Computational Science Pathway: An Integral Part of New Mexico's Cyberinfrastructure for Research and Education: This I-IWG convened computer scientists, educators, and policy advocates from eight institutions. The group created a vision for computer science in New Mexico and a pathway for completing that vision. Among the outcomes were new collaborations among universities and national laboratories to create specialized mid-level computational science courses.

Water Resilience in the Intermountain West through Coordinated Research and Innovation: This I-IWG builds upon success of the Social & Natural Science Nexus team's New Mexico Dynamic Statewide Water Budget to explore a region-wide water budget approach to identify western trends in changing hydrology. The three-day event hosted representatives from water managers and universities across 11 states to tackle the grand challenge of water scarcity and management in the Western U.S.

TOP: Participants from the Water Resilience in the Intermountain West I-IWG visit a water quality field site; ***BOTTOM:*** Participants in the NM Computational Science Pathway I-IWG

DIVERSITY & INCLUSION INITIATIVES

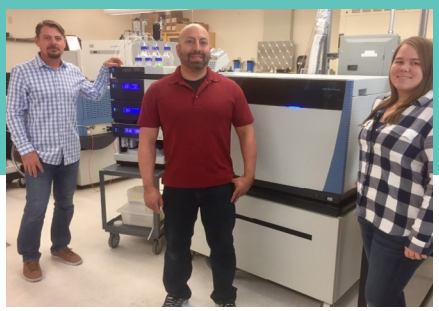
Diversity and inclusion are a key component of *Energize New Mexico*'s success. In Year 5, one of the main goals—50% representation by women and underrepresented minorities in all supported programs—was exceeded, with 65% female or underrepresented minority participants. Diversity-specific programs such as Natives in STEM leveraged external funding to host nine hands-on Family STEM Nights at Navajo Nation chapter houses.

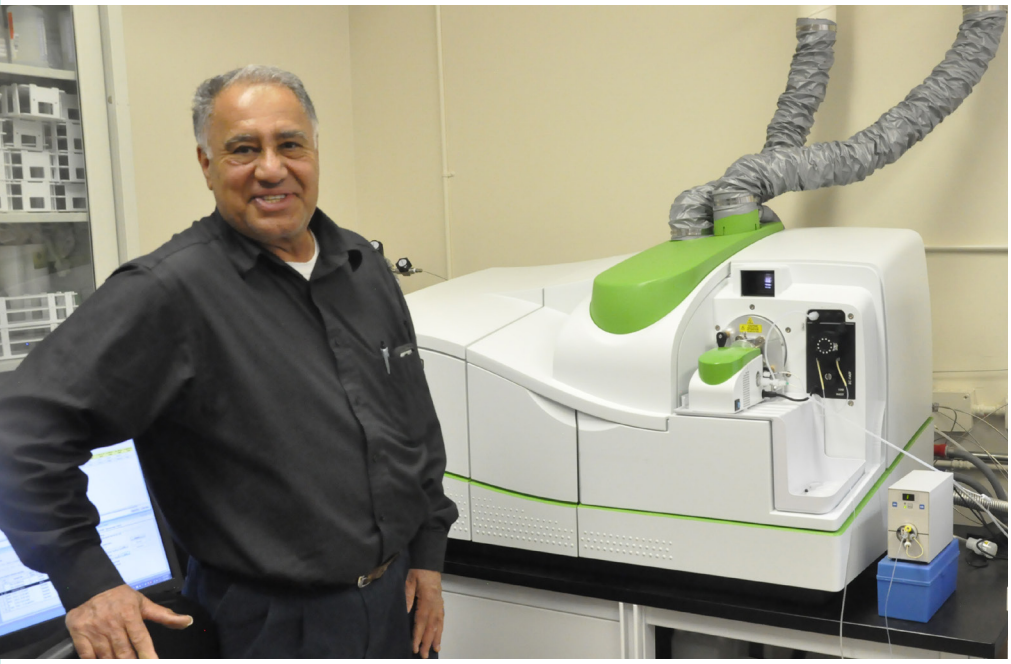
NM EPSCoR believes mentors are not only vital to student growth and development, but also essential to the retention of students in STEM fields. In May 2018, NM EPSCoR awarded its second Mentoring Excellence Awards to three outstanding *Energize New Mexico* faculty participants: Dr. Catherine Brewer (NMSU), Dr. Martin Kirk (UNM), and Dr. Juchao Yan (ENMU). The Award recognizes NM EPSCoR participants who not only build relationships with students and support their academic, research, and career endeavors, but also work to create inclusive environments for students with diverse backgrounds. More information on these excellent mentors can be found at www.nmepscor.org.

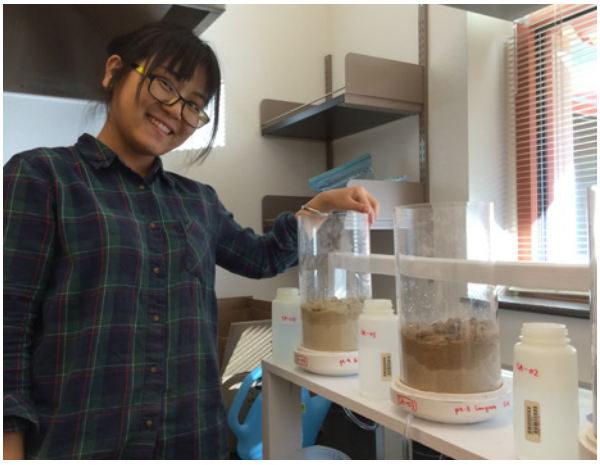
2018 MENTORING EXCELLENCE AWARD WINNERS, LEFT TO RIGHT: Dr. Catherine Brewer (NMSU); Dr. Martin Kirk (UNM); Dr. Juchao Yan (ENMU)

A LOOK BACK

Energize New Mexico officially ends on November 30, 2018.
Here's a look back at our project over the last five years.
We are proud of our positive impacts on New Mexico!





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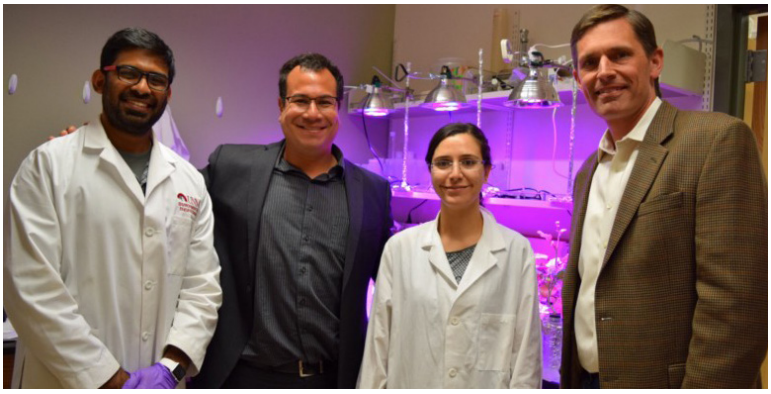


NEW MEXICO TECH
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Credits & Acknowledgments

Thank you to everyone who contributed to this report, and to our project participants and students over the last five years! Thanks to Isis Serna and Dustin Allen for their work on the Year 5 Annual Report website. Thank you to all participants who submitted photos or allowed Natalie to tag along in your lab and at your field sites. Thank you to William Michener and Selena Connealy for providing editing assistance with this report.

Acronyms

AISES	American Indian Science and Engineering Society
CI	Cyberinfrastructure
CNM	Central New Mexico Community College
CO_2	Carbon dioxide
ENMU	Eastern New Mexico University
EPSCoR	Established Program to Stimulate Competitive Research
GUTC	Growing Up Thinking Computationally
I-IWG	Interdisciplinary Innovation Working Group
ISA	Infrastructure Seed Award
LANL	Los Alamos National Laboratories
MT	Magnetotelluric
NM AMP	New Mexico Alliance for Minority Participation
NMAS	New Mexico Academy of Science
NM EPSCoR	New Mexico Established Program to Stimulate Competitive Research
NMHU	New Mexico Highlands University
NM ISE Net	New Mexico Informal Science Education Network
NMSU	New Mexico State University
NMDSWB	New Mexico Dynamic State Water Budget
NM Tech	New Mexico Tech
NNMC	Northern New Mexico College
NSF	National Science Foundation
PUI	Primarily Undergraduate Institution
SACNAS	Society for the Advancement of Chicanos and Native Americans in Science
SFCC	Santa Fe Community College
STEM	Science, Technology, Engineering & Math
STEMAP	Science, Technology, Engineering & Math Advancement Program
UNM	University of New Mexico
USGS	United States Geological Survey