

U.S.-PAKISTAN CENTERS FOR ADVANCED STUDIES IN ENERGY

ENERGIZER



THE POWER OF EXCHANGE

USPCASE IS CHANGING MINDS
AND LIVES THROUGH ITS
EXCHANGE SCHOLARS PROGRAM

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ASU Prof. Zachary Holman facilitated a three-day workshop on the state-of-the-art in materials used in photovoltaic modules and the art of proposal storyboarding.

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Securing research funding is key to a sustainable research center. International proposal development expert Alan Paul led a hands-on workshop for faculty in Pakistan.

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USAID
FROM THE AMERICAN PEOPLE

ASU Arizona State University



THE POWER OF EXCHANGE

PROXIMITY OPENS POSSIBILITIES

Exchange programs are a critical part of the knowledge transfer that is taking place among the partner institutions that make up the U.S.-Pakistan Centers for Advanced Studies in Energy. More than 200 students and faculty from NUST and UET will visit the United States for a semester-long research and cultural exchange experience during the life of the project.

Imagine being an engineer who couldn't conduct research, a scientist who couldn't perform vital experiments in a lab. That's the reality for some of Pakistan's brightest science and technology scholars, but not for those who come to the U.S. to study at Arizona State University as part of the U.S.-Pakistan Centers for Advanced Studies in Energy.

Through USPCASE, a few dozen Pakistani scholars spend a semester hitting the books in their chosen fields at ASU, learning about U.S. culture and – to the delight of people like thermal engineering student Muhammad Zia Ullah Khan – gaining hands-on experience in a university laboratory. Khan called working in the lab “the main opportunity” he enjoyed as an exchange student. Back home, students often aren't allowed to use university lab equipment.

Khan also called learning the culture very important, and that's a key component to the USPCASE exchange program. Participants do more than expand their technical proficiency. They also acquire perspective and skills that will help them meet some of the pressing

electricity shortages that now plague the Pakistani people.

FROM LACK TO LEADERSHIP

“Pakistan has 200 million people in a relatively small country that's super-densely populated and has an insecure supply of electricity,” notes Zachary Holman, assistant professor in ASU's School of Electrical, Computer and Energy Engineering. Although the government has added electricity generation capacity in recent years, population growth has outpaced that capacity, and the nation still endures rolling power outages throughout areas beyond big-city limits.

“When you don't have access to regular electricity, there are a lot of things you can't do,” Holman says. Adverse effects to industry, refrigeration and hospital operations are a few of the outcomes he mentions, adding that, “you can't have a productive society,” which impacts societal prosperity and stability.

“The students who come through the USPCASE program are supposed to be the next generation of engineers in Pakistan. They need to know a lot more than just how solar cells work.” Much of that extra learning comes from studying abroad.

“There are three components to the exchange program,” says Andrew Sarracino, international visits coordinator for USPCASE. “The first is training, the second is professional development, and the third is cross-cultural activity.”

In the USPCASE program, that cross-cultural exchange involves Pakistani students studying in the U.S., Pakistani faculty conducting research here, as well, plus there is a series of workshops in which ASU professors go to Pakistan to teach in-country.

Why are such cross-cultural activities important? In part, because they solidify relationships. “There is much and repeated interaction between the students and the faculty in Pakistan and ASU,” Holman says. “There also are opportunities for research and education collaboration that can take place between ASU and the Pakistani universities funded by USAID,” the government agency backing the USPCASE program. “It's hard to start something with someone you don't know.”



“HOW DO YOU DRIVE ECONOMIC GROWTH? YOU DRIVE IT THROUGH ENTREPRENEURSHIP AND INNOVATION.”

CHANGING MINDS

As Sarracino notes, professional development is a big part of the USPCASE program. To that end, students must take classes in energy policy and entrepreneurship. “They’re supposed to be learning things beyond book and lab skills,” says Holman. “They’re gaining skills that will help them go back to Pakistan and really have impact.”

Ken Mulligan teaches classes on entrepreneurship at ASU and is among the instructors imparting such skills.

“One of the challenges in Pakistan is that they are a nation of job seekers, not a nation of job creators,” Mulligan says. “How do you drive economic growth? You drive it through entrepreneurship and innovation.”

According to Mulligan, changing mindsets is a major challenge for Pakistan. “Engineers are trained as problem solvers. They use the waterfall analytic method for problem solving. It’s all formulaic. They look at a problem and they just apply principles and formulas to solve it,” he says. But, he adds that entrepreneurship is about value creation, the act of producing “real value for real people. You and I as individual consumers: What things will make our lives better in terms of convenience, comfort and basic economics?”

This is a key question Mulligan brings to his classrooms at ASU and workshops in Pakistan. “It’s a hard lesson for engineers,” he says. “There are a lot of vagaries and uncertainties attached to advancing an idea from a napkin sketch to a finished product. People who are attracted to engineering tend to like well-defined answers. They like the formula that gives them the same answer every single time. They’re curious, they like to investigate, but they don’t like uncertainty, and entrepreneurship has a lot of it.”

Still, Mulligan is determined to help his students move from problem solvers to solution and job creators. “My mission is to empower the students to have a vision for value creation and understand that their role is to do good from their knowledge base,” he says.

“I tell them, ‘Why not you? Why shouldn’t you be the person who leads the way to a new and better Pakistan?’”



LEARNING TO SPEAK UP

After teaching Pakistani students both abroad and in ASU classrooms, Holman says that one of the biggest benefits exchange offers is “seeing a different way of doing things.”

As noted at the beginning of this article, lab work is a new experience for most exchange students. “They always tell me when they leave that the most valuable thing for them was being given the freedom and responsibility to use pieces of equipment on their own,” Holman says.

Some of those pieces of equipment are worth more than \$1 million. “To the students, this is a complete revelation because even when they have equipment, often students aren’t allowed to use it. Sometimes that’s about resources, but a lot of it is about a different system and culture.”

Hands-on experiences present a different learning mechanism than book and classroom learning. Maria Kanwal, an exchange student from Pakistan’s National University of Sciences and Technology (NUST), says her time in the materials science lab enhances her research proficiency. “I have learned quite a few techniques that I had previously been introduced to only theoretically,” she says.

In addition, lab work expanded Kanwal’s knowledge of materials science. That’s Holman’s research area, and he explains that it’s all about finding new materials to use, putting them together to make solar cells, then “finding out how they perform in real-world conditions. You need to do those things to improve efficiency and reliability.”

“I TELL THEM, ‘WHY NOT YOU? WHY SHOULDN’T YOU BE THE PERSON WHO LEADS THE WAY TO A NEW AND BETTER PAKISTAN?’”



EMPOWERED BY EXCHANGE

Exchange scholars do research, learn about energy policy and build their entrepreneurial toolbox during their exchange visits to the U.S. – they also learn a lot about American culture

Kanwal describes the work in the energy materials lab as a place “where novel solar cell technologies are being developed. Exposure to this facility has broadened my horizons about the room for improvement in the current technology,” she notes.

UP AND OUT

Lab work isn't the only way Pakistani students are educated and empowered by the exchange program. In the classroom, they're taught to speak up and expected to do so in weekly presentations. Although many students begin this requirement with considerable shyness, Mulligan teaches his students that it's “an opportunity.” Here's what he tells them: “If you can get over this fear and learn how to package your ideas in a way that people understand and respond to, you'll create more opportunity for yourself and you'll do more good.”

Another learning experience comes from stateside travel. Each semester, Sarracino arranges and chaperones a week-long trek across the Western U.S. in which exchange students visit places like the Hoover Dam,



the Grand Canyon and Disneyland. “The purpose of this is for students to realize the potential that they could implement through tourism, land conservation and economic development in their home country,” Sarracino says.

“For instance, going to the Grand Canyon, students were able to see how the Hualapai Tribe, a Native American entity, was able to leverage natural resources and turn that into a tourism enterprise.”

Some of the eye-openers exchange students experience relate more to culture than commercialism.

Sarracino recalls the person who needed shampoo and was stunned to discover Walmart offered up a whole aisle of options. Another couldn't get over how many cars exist in the U.S.

**RESPECT FOR OTHERS IS
ANOTHER BY-PRODUCT OF
THE EXCHANGE PROGRAM.**

136 EXCHANGE SCHOLARS ... AND COUNTING!

Since 2016, five cohorts of exchange scholars have visited the U.S. for research, entrepreneurial training and cultural experiences.

The sixth cohort arriving in fall 2018 is shaping up to be the largest cohort yet.

*NUST and UET faculty and students from
the fifth cohort, spring 2018 >*





“I WISH FOR PAKISTAN TO MAKE USE OF THE HUGE SOLAR POTENTIAL THAT IT HAS.”

Maria Kanwal

“One day we were driving by a six-story parking garage and I said to the student, ‘See that building? That is for parking cars,’ Sarracino recalls. “It blew his mind.”

Many students, including Muhammad Khan, report astonishment at the number of well-managed festivals they were able to attend while at ASU. “They’re surprised at how the festivals are run in the U.S.,” Sarracino notes. “One individual pointed out that waste management gets involved. There are trash cans all around, there are ATMs and food trucks ... it’s all so organized.”

Respect for others is another by-product of the exchange. “I have found that persons in the U.S.A. are hard working,” Khan says. “During the working day, I hardly notice anyone moving around freely. They stick to their work. On the weekend, they enjoy themselves. They value time.”

Khan and Kanwal – both from NUST – were selected for the exchange program through a competitive process that brought only 15 of 90 potential travelers to the U.S. Each of these students will leave ASU with renewed commitment to apply their knowledge to help their country.

Kanwal reports this goal: “I wish for Pakistan to make use of the huge solar potential that it has.”

Khan has similar service-oriented ambitions. “The job I’m aiming to pursue in Pakistan is related to research and development,” he says. “I could implement my knowledge to help eradicate Pakistan’s energy crisis.”

BY BETSY LOEFF

MESSAGE FROM THE DIRECTOR

We bid farewell to our fifth cohort of exchange faculty, and graduate student scholars from NUST and UET. The faculty and graduate students spend a term in research labs at ASU and OSU working on the latest in power systems, electric grid and distribution systems, thermal energy, renewable energy, including—solar energy and biomass—and energy policy.

We are working diligently on a roadmap for the centers that ensures they remain sustainable after the project concludes. Engaging stakeholders and forming partnerships are key to our efforts to ensure the sustainability of the centers. It is important to be responsive to industry and Pakistan’s energy sector needs and we benefit from stakeholder ideas and feedback: it serves as a compass to keep us on track. We hope to position the centers as a critical resource for both the research and workforce needs for Pakistan’s energy sector.

Creating this bandwidth of ideas, innovation and talent is critical to conquering Pakistan’s energy crisis.

DR. SAYFE KIAEI
PROJECT DIRECTOR, USPCASE



ENERGIZING PAKISTAN

Leveraging ASU expertise in energy engineering to create capacity and find solutions to close Pakistan's energy gap

PROJECT GOALS

BUILD NEW CENTERS OF ADVANCED STUDIES IN ENERGY

New buildings at the National University of Sciences and Technology (NUST) and the University of Engineering and Technology (UET) Peshawar have created a catalyst for change in energy education in Pakistan. These modern facilities feature new labs and libraries and the tools, environment and mindset needed for transformative change.

Curriculum



CREATE A MODERN, RELEVANT CURRICULUM

ASU is supporting NUST and UET to develop new masters and Ph.D. degree programs with 11 new programs to date plus more than 80 new courses. These new degree programs translate work in the classroom and lab into the public and private sector in a pragmatic and applied manner with a focus on immediate real-world applications.

Research



FOCUS ON HIGH-IMPACT APPLIED RESEARCH

The centers are focused on energy research that directly relates to ongoing and future energy challenges that affect the lives of ordinary Pakistanis and impede economic growth. These efforts include 30 applied research projects and 10 joint research projects with U.S.-based faculty at ASU and OSU.

PROJECT PROGRESS AS OF ► SPRING 2018



11 NEW
MASTERS &
PH.D. DEGREE
PROGRAMS

18 APPLIED
RESEARCH
PROJECTS

600
M.S./PH.D.
STUDENTS
ENROLLED
TO DATE

9 
JOINT RESEARCH
PROJECTS WITH U.S. &
PAKISTANI RESEARCHERS

 **80+**
NEW COURSES
DEVELOPED

11 
TECHNICAL
WORKSHOPS
WITH VISITING EXPERTS

The USAID-funded U.S.-Pakistan Centers for Advanced Studies in Energy, USPCASE, is a partnership between Arizona State University (ASU) and two leading Pakistani universities: National University of Sciences and Technology (NUST) and University of Engineering and Technology (UET) Peshawar along with partner Oregon State University (OSU).

data snapshot

Exchange and Scholarships



FACILITATE LEARNING THROUGH EXCHANGE PROGRAMS

USPCASE supports the academic and research advancement of Pakistani students and faculty by hosting more than 200 exchange students and faculty at ASU and OSU — 30 each semester — to conduct cutting-edge energy research in state-of-the-art labs.

Sustainability



ENSURE LONG-TERM SUSTAINABILITY OF THE CENTERS

USPCASE is working to ensure the sustainability of initiatives at NUST and UET through fundraising strategies and the cultivation of six public-private partnerships with the goal of raising \$2M in funding, creating 20 new labs and two libraries, and securing 100 internships.

Governance



FACILITATE INDUSTRY COLLABORATION AND STAKEHOLDER ENGAGEMENT

USPCASE is focused on the collaboration needed to develop world-class centers of energy engineering that will serve as Pakistan's go-to think tanks with the technical expertise to close the energy gap. As part of this effort, USPCASE is working to actively engage 120 stakeholders over the life of the project.

130+ EXCHANGE VISITORS



FEMALE **30%**



SEMESTER-LONG RESEARCH EXPERIENCE



CULTURAL AND ACADEMIC EXCURSIONS



OUTREACH OPPORTUNITIES

50

MEETINGS TO BUILD ENGAGEMENT WITH THE PUBLIC/PRIVATE ENERGY SECTOR

\$1.5 MILLION

RAISED IN EXTERNAL FUNDING



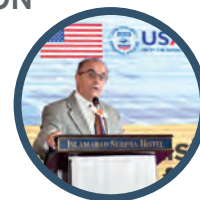
50

INTERNSHIPS

100

STAKEHOLDERS AND FACULTY

ATTENDED MOST RECENT MEETING; PARTICIPATION HAS NEARLY DOUBLED EACH YEAR



THE CENTERS ORGANIZED TWO CONFERENCES WITH

200+

ATTENDEES EACH

WORKSHOPS



ADVICE FROM OUR EXCHANGE SCHOLARS



"Don't be rigid, always have a positive attitude ... be adaptive according to your situation."

— Usman Hameed



"Do hard work and enhance your skill level in order to make your self viable for any other place."

— Ahmed Hassan



"If someone is trying to acclimate to a new place always remember to socialize as much as possible."

— Rehan Anwar

ENERGY MATERIALS

Professor Zachary Holman of Arizona State University led a three-day workshop, February 7-9, on the state-of-the-art in materials used in photovoltaic modules, including absorbers such as silicon, perovskites, CdTe, and III-V materials; contacts such as high- and low-work-function metal oxides and transparent conductive oxides; and metallization and module packaging materials.

Photovoltaics (PV), long a minor contributor to the global energy mix, has arrived at a market inflection point. In 2016, PV was the dominant source of new electricity generation capacity in the U.S.—beating out gas and coal—and similar crossovers are occurring around the world. Despite this market growth, commercial PV modules still convert only 20 percent of incident solar power into electricity.

The workshop also focused on a different, though complementary topic: preparing publication-quality research manuscripts. Workshop participants practiced generating storyboards, graphical outlines, of a proposed research problem and its hypothesized solution.

As part of the workshop, guest lecturers presented on the state of the PV market globally and in Pakistan, and the Pakistani industry's role in these markets.

The workshop included tours of the Pakistan Council of Renewable Energy Technologies (PCRET) photovoltaics laboratory and NUST characterization facilities, as well as presentations from Asma Shamim and Asad Ali, graduates of previous USPCASE exchange scholar cohorts.



USAID VISIT TO ASU

Erica Rounsefell, USAID/Pakistan Office of Education Deputy Director, visited ASU March 14-15 to meet the scholars and U.S.-based project team and visit USPCASE labs.

RAMPING UP RESEARCH



Proposal expert Alan Paul shared strategies for success during a hands-on proposal writing workshop in Pakistan

USPCASE organized a Strategic Proposal Writing Training in Islamabad, Pakistan, February 6-8, 2018. The training was facilitated by Dr. Alan Paul, an international expert in grants making and proposal writing. Thirty-three faculty members and research associates from NUST and UET Peshawar participated in this training. These workshops are key to strengthening the capacity building efforts of the centers and ensuring their sustainability into the future.

Research funding can transform an organization and it is key to long-term sustainability of the Centers for Advanced Studies in Energy. Getting funding means getting noticed by grants-making

organizations, and the key to standing out among a sea of funding seekers is an outstanding proposal.

This three-day training workshop offered strategies to identify the right sponsors, the design projects that interest them, and the strategies to convince these sponsors to support your work. Paul demystified the proposal development process, showing participants how to manage relationships with sponsors, university administration and collaborators. Participants had the opportunity to practice techniques for persuasive writing and heard directly from key Pakistani government sponsors on their funding priorities.



LOOK ONLINE FOR MORE

FIND LINKS TO VIDEOS, PHOTOS, EVENT INFORMATION AND MORE ON OUR WEBSITE, USPCASE.ASU.EDU

VIRTUAL SEMINAR SOCIAL DRIVERS, DYNAMICS AND OUTCOMES OF ENERGY INNOVATION REMAKE THE WORLD

Meeting the challenges faced by world's energy systems requires technology innovation, but technology innovation cannot occur with simultaneous social, institutional, market, and policy innovation.

Dr. Clark Miller, Director of the Center for Energy and Society at Arizona State University, led a virtual seminar on the topic of energy innovation for

faculty and students from both NUST and UET Peshawar.

Dr. Miller discussed in detail the social, economic and political drivers, as well as the dynamics and outcomes of energy innovation and identified strategies that can be used to enhance them for delivering positive results.





ERADICATING POVERTY THROUGH ENERGY INNOVATION

A key idea motivated the Eradicating Poverty through Energy Innovation conference, held February 12-14 at ASU, noted co-organizer Clark Miller, director of ASU's Center for Energy and Society: "Energy innovation can help end poverty in remote and rural communities if projects can deliver high levels of social and economic value for energy users."

Conference sponsors included ASU's QESST Engineering Research Center, USPCASE,

ASU International Development, the Partnership for Transborder Communities, LightWorks, the Global Institute of Sustainability, and conference host School for the Future of Innovation in Society.

Participants with diverse expertise from five continents and 11 countries, including USPCASE exchange students, gathered to share research and experiences and deliberate on strategies for creating pathways to full energy access.



OPENING DOORS TO UNDERSTANDING

ASU's annual Open Door outreach event is an opportunity for the public to visit and get a behind the scenes look at university life. It's a chance to talk with faculty and students and learn more about the importance of research and the passion that drives their work.

The USPCASE scholars talked with visitors about their work and shared a little bit of Pakistani culture.

It was a great opportunity to practice public speaking skills while conveying the importance of ongoing renewable energy research.

Visit the USPCASE website to check out the photos on ASU Now and the Fulton Schools of Engineering Full Circle site. And don't miss ASU's highlight video from the event.

"THIS TRIP HAS GIVEN ME A CHANCE TO LOOK DEEPLY INTO AMERICA AND ITS CULTURE. PEOPLE HERE ARE INDEPENDENT, HARDWORKING AND INCREDIBLY INNOVATIVE."

- AFSHAN QAMAR

Road Trip

During ASU's spring break, the USPCASE scholars take an extended tour of educational, engineering and cultural destinations in the Western United States. In March 2018, they visited the Grand Canyon, Hoover Dam, Ivanpah Solar Electric Generating System, a concentrated solar thermal plant, Disneyland and Griffith Observatory.

CULTURAL EXCURSIONS ROUND OUT THE EXCHANGE EXPERIENCE

"AT EVERY PLACE AMERICANS TREATED US WITH SMILES AND KINDHEARTEDNESS WHICH MAKES ME FEEL VERY GOOD AND IT SHOWS THE AFFECTION AND LOVE FOR OTHER PEOPLE."
- MUHAMMAD JUNAID AFZAL

"ONE OF THE INTERESTING PLACE WAS THE IVANPAH SOLAR THERMAL POWER GENERATION FACILITY ... IN PAKISTAN VERY LITTLE ATTENTION IS BEING PAID TO SOLAR THERMAL POWER GENERATION. I AM PLANNING TO EXPLORE THE SOLAR THERMAL POTENTIAL IN VARIOUS LOCATIONS OF PAKISTAN, WITH THE HELP OF MY RESEARCH TEAM BACK IN PAKISTAN."

-KHURSHID AHMAD



"THE SPRING BREAK EXCURSION ORGANIZED BY ARIZONA STATE UNIVERSITY FOR THE EXCHANGE COHORT FROM PAKISTAN PROVIDED A GREAT OPPORTUNITY TO EXPLORE THIS BEAUTIFUL COUNTRY AND CULTURE."

THERE ARE MANY PLACES TO GO IN THE WORLD, MANY PEOPLE TO MEET, AND FANTASTIC MEMORIES TO MAKE. BUT FRANKLY, YOU CAN'T GO WRONG, WHEREVER YOU END UP."

- MUHAMMAD ZUBAIR

ABOUT USPCASE

The U.S.-Pakistan Centers for Advanced Studies in Energy (USPCASE) is a five-year program implemented by partners National University of Sciences and Technology (NUST), University of Engineering and Technology (UET) Peshawar and Arizona State University (ASU).

The project focuses on applied research relevant to Pakistan's energy needs. The program has multiple goals including curriculum development, applied research, the establishment of new laboratories, and international visitor programs.

Partnering Universities:



ARIZONA STATE UNIVERSITY
USPCASE.ASU.EDU

QUESTIONS AND MEDIA INQUIRIES:

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IN THE NEXT ISSUE

National Stakeholders Meeting and Research Expo Recap



NUST CELEBRATES ITS GRADUATES WITH FIRST CONVOCATION