

# Engineering a Brighter Future



**USAID**  
FROM THE AMERICAN PEOPLE

**ASU** Arizona State University



## U.S.-Pakistan Centers for Advanced Studies in **Energy**

Partnering Universities:



**NUST**  
Defining Futures

# ENERGIZING PAKISTAN

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

## PROJECT GOALS

## Curriculum



## Research



### 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 Peshawar (UET-P) 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.

### CREATE A MODERN, RELEVANT CURRICULUM

ASU is supporting NUST and UET-P to develop new masters and Ph.D. degree programs with 14 new programs developed to date plus more than 140 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.

### 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 36 applied research projects and 12 joint research projects with U.S.-based faculty at ASU and OSU.

## PROJECT PROGRESS AS OF ► SPRING 2019



**14** MASTERS & PH.D. DEGREE PROGRAMS DEVELOPED

**36** APPLIED RESEARCH PROJECTS

**800+**



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

**12**

JOINT RESEARCH PROJECTS WITH U.S. & PAKISTANI RESEARCHERS



**140+** NEW COURSES DEVELOPED

**12** TECHNICAL WORKSHOPS WITH VISITING EXPERTS

The USAID-funded U.S.-Pakistan Centers for Advanced Studies in Energy, USPCAS-E, 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 Peshawar (UET-P) along with partner Oregon State University (OSU).

## Exchange and Scholarships



## Sustainability



## Governance



### FACILITATE LEARNING THROUGH EXCHANGE PROGRAMS

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

### ENSURE LONG-TERM SUSTAINABILITY OF THE CENTERS

USPCAS-E is working to ensure the sustainability of initiatives at NUST and UET-P 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.

### FACILITATE INDUSTRY COLLABORATION AND STAKEHOLDER ENGAGEMENT

USPCAS-E 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, USPCAS-E is working to actively engage 120 stakeholders over the life of the project.

**171** EXCHANGE VISITORS

HAVE COMPLETED THE EXCHANGE PROGRAM IN THE U.S.

MALE **126** FEMALE **45**



SEMESTER-LONG RESEARCH EXPERIENCE




CULTURAL AND ACADEMIC EXCURSIONS



PROFESSIONAL NETWORKING

**70+**

MEETINGS TO BUILD ENGAGEMENT WITH THE PUBLIC/PRIVATE ENERGY SECTOR

**\$1.54**   
**MILLION**  
RAISED IN EXTERNAL FUNDING

 **84**  
INTERNSHIPS

**379**

ATTENDEES ENGAGED

AT STAKEHOLDER MEETINGS



# GLOBAL COMMITMENT

▼ ASU professor Zachary Holman, center, works with participants at an energy materials workshop in Islamabad, Pakistan. Regular workshops bring expert technical training to faculty, staff and stakeholders in Pakistan.



▲ **Dr. Sayfe Kiaei** is the Motorola Chair in Analog and RF Integrated Circuits; Professor, School of Electrical, Computer and Energy Engineering, one of the Ira A. Fulton Schools of Engineering at ASU; Senior Sustainability Scientist, Julie Ann Wrigley Global Institute of Sustainability; and an IEEE Fellow.

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ARIZONA STATE UNIVERSITY

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## Imagine losing power for six to 12 hours a day.

Your connection to the world through the Internet is severed. Your appliances cease to function. The air conditioning keeping your home comfortable cuts off. This is a reality faced by thousands of Pakistanis each day as rolling blackouts sweep through the nation regularly. Not only does this present socioeconomic hurdles for the people of Pakistan, it restricts economic growth and reduces foreign investment.

Together with partner universities National University of Sciences and Technology in Islamabad and University of Engineering and Technology in Peshawar, we at Arizona State University's Ira A. Fulton Schools of Engineering aim to address the energy needs of Pakistan through research, education and collaboration with government and industry.

In doing so, we hope to unlock Pakistan's full economic potential, improve the quality of life nationwide and forge lasting relationships with our partnering universities.”

— USPCAS-E Director, Sayfe Kiaei, Ph.D.

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## Pakistan's energy challenges

For years, the challenge of balancing Pakistan's energy supply against demand has created significant hardships for the Pakistani people. Pakistan suffers from rolling blackouts and is currently in an energy crisis. Based on population and need, the country is quickly outgrowing its already fragile energy system. Pakistan faces significant challenges in revamping its energy sector to meet the supply-demand gap.

Energy shortfalls have stunted the country's economic growth and the increasing reliance on imported fuels to meet the demand has exacerbated the country's trade deficit problems. With 67.1 percent of Pakistan's electricity generated from fossil fuels, the country ranks number 33 globally in oil consumption. But Pakistan has the renewable energy potential to generate approximately 167.7 gigawatts of power, offering a sustainable way to meet the country's energy needs well into the future (M. Mujahid Rafiquea and S. Rehman, 2017).

## Energy leadership at ASU

ASU is helping to facilitate a transition to a future powered increasingly by renewable energy. Its expertise in developing knowledge leaders in order to transform energy systems is driven by strong training and implementation initiatives in Arizona and abroad. USPCAS-E is benefiting from the expertise and research of ASU's multidisciplinary energy centers as well as capabilities in training and stakeholder engagement.

## USAID and the Centers for Advanced Study program

USAID is the lead U.S. Government agency that works to end extreme global poverty and enable resilient, democratic societies to realize their potential. To create and strengthen a culture of applied research, USAID launched the U.S.-Pakistan Centers for Advanced Studies in 2015.

With significant expertise in power systems, photovoltaics and renewable energy, policy and related energy engineering, ASU was selected to lead the energy centers.



# LASTING IMPACT

## Fostering Partnerships, Ensuring Sustainability

Stakeholder engagement is key to the sustainability of Pakistan's higher education institutions' ability to:

- Contribute solutions to Pakistan's energy challenges
- Drive private sector innovation
- Promote modernization
- Strengthen government policy
- Stimulate economic growth

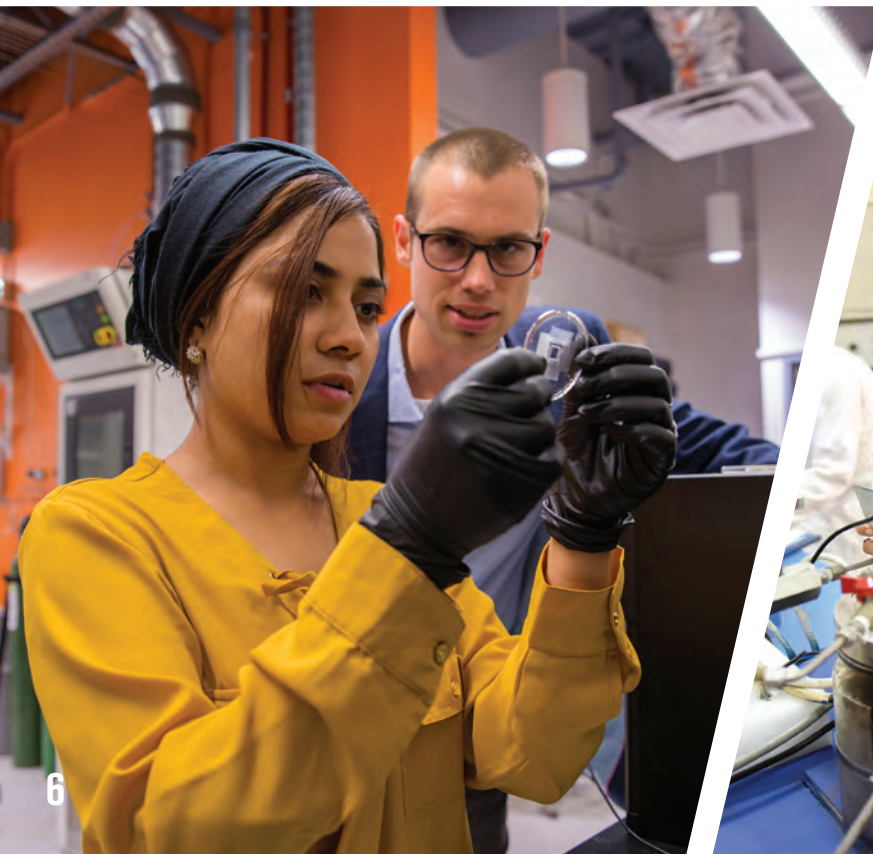
Through early and frequent engagement with stakeholders, USPCAS-E is ensuring relevant curricula and the development of research agendas that respond to private sector needs for the long term.

### Opportunities for collaboration include:

- Sponsorship of research projects
- Developing joint research proposals
- Internships and recruitment
- Student scholarships
- Knowledge sharing
- Feedback on curriculum and research
- Testing and training services



▲ As of spring 2019, seven cohorts of faculty and students from NUST and UET-P have visited ASU and OSU for an intensive research and cultural experience.





## Toolbox for Change

Applied research projects, workshops and courses focus on:

- Power systems
- Electric grid and distribution systems
- Solar photovoltaic systems
- Renewable energy (solar, biomass)
- Thermal energy
- Energy materials
- Energy policy



## Game-Changing Outcomes

The efforts of USPCAS-E can help bring about a stable and prosperous Pakistan through research, education and innovation. This long-term investment in human lives echoes throughout the careers of the students, global relationships and advances in the field of energy research.

### USPCAS-E outcomes include:

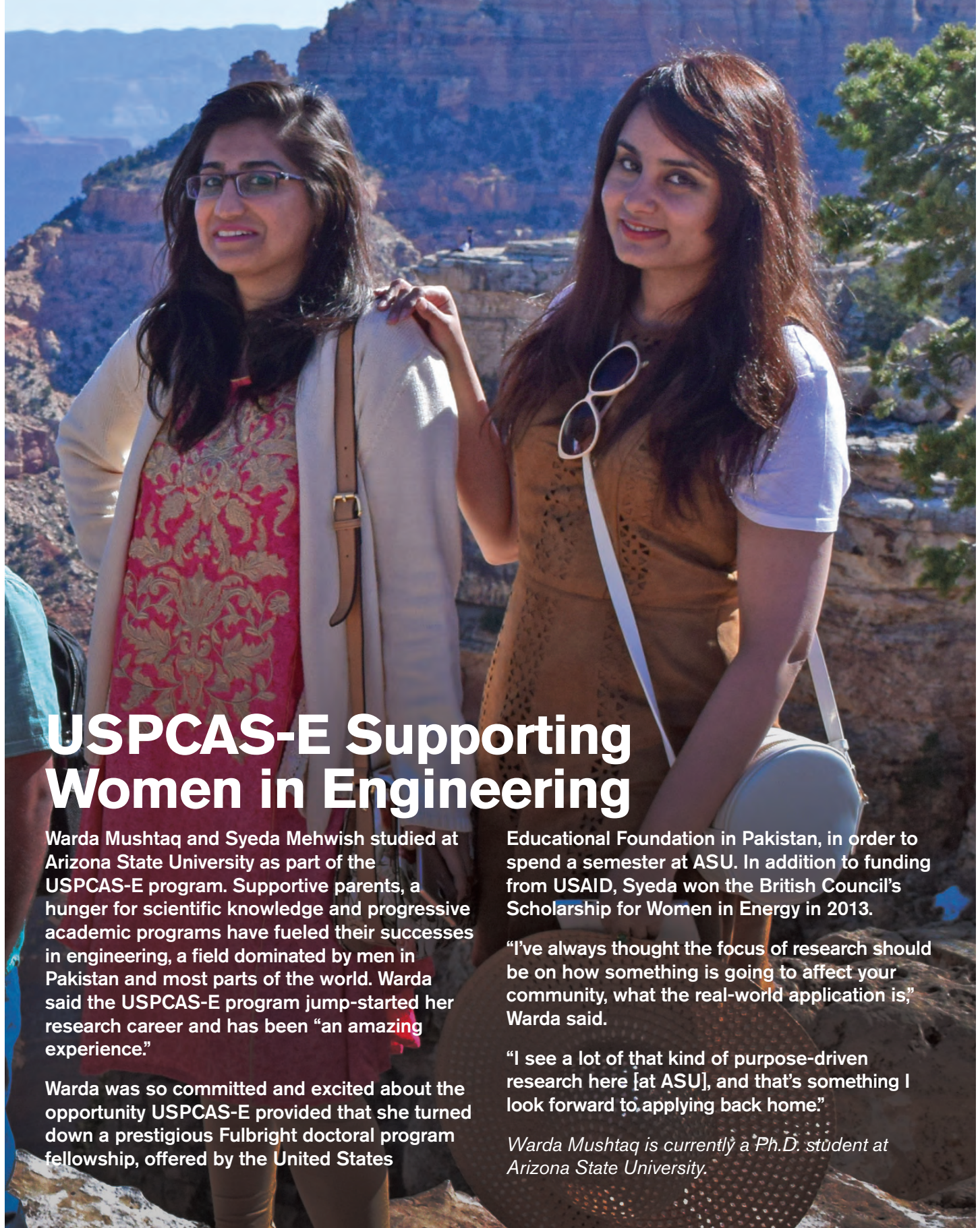
- Robust student and faculty exchange programs between U.S. and Pakistani universities
- Strengthened university capacity to deliver quality applied research in energy
- Regular policy dialogues between public and private energy stakeholders
- Modernized curricula and teaching methods
- Establishing channels to facilitate local and international networking in the energy sector
- Increasing access to energy-related professions for women and economically disadvantaged students



The networking opportunities provided through national stakeholder meetings with like-minded professionals has been a very attractive feature. It is incredible to see the best brains in Pakistan coming together to discuss common issues and a way forward.

— Muhammad Raziuddin  
Stakeholder and CEO, KPOGCL





# USPCAS-E Supporting Women in Engineering

Warda Mushtaq and Syeda Mehwish studied at Arizona State University as part of the USPCAS-E program. Supportive parents, a hunger for scientific knowledge and progressive academic programs have fueled their successes in engineering, a field dominated by men in Pakistan and most parts of the world. Warda said the USPCAS-E program jump-started her research career and has been “an amazing experience.”

Warda was so committed and excited about the opportunity USPCAS-E provided that she turned down a prestigious Fulbright doctoral program fellowship, offered by the United States

Educational Foundation in Pakistan, in order to spend a semester at ASU. In addition to funding from USAID, Syeda won the British Council's Scholarship for Women in Energy in 2013.

“I’ve always thought the focus of research should be on how something is going to affect your community, what the real-world application is,” Warda said.

“I see a lot of that kind of purpose-driven research here [at ASU], and that’s something I look forward to applying back home.”

*Warda Mushtaq is currently a Ph.D. student at Arizona State University.*

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