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

Newsletter | Fall 2017

Energizer

What's Inside

New startups bring innovative solutions to Pakistan's energy needs

Arizona State University (ASU) organized a three day workshop on Technology Entrepreneurship from September 27-29, 2017 in Islamabad, Pakistan which was facilitated by Professor Kenneth Mulligan–faculty at ASU. This was the eighth in a series of technical workshops conducted by ASU in Pakistan. The workshop was attended by more than 80 participants from NUST, UET Peshawar and Mehran University, including three entrepreneurs as guest speakers. In addition to technical presentations, the participants also worked in groups and developed a business model for their respective startup ideas to address Pakistan's energy crisis.

The participants visited the Technology Incubation Center at NUST where they were briefed on the Center. There they met budding entrepreneurs who already had technology startup experience under their belts. UNIDO, TIE Pakistan and the Innovation and Partnership Unit of USAID also shared their initiatives regarding entrepreneurship and the opportunities they offer for young entrepreneurs. The workshop was very well received by participants and the partner institutions.

Students and faculty come together for Professor Kenneth Mulligan's technology entrepreneurship workshop in Islamabad, Pakistan. Photo credit: Arsal Latif ASU/USPCAS-E

Message from the Project Director

"USPCAS-E is at a turning point in the course of the project. We have begun to see the efforts and results of past cohorts and continue to support our scholars who are graduating, publishing research and are making an impact in academia, industry and within their country. We welcome the latest cohort and cannot wait to see their impact that they will be creating. USPCAS-E continues to make a positive impact and urges all of its scholars to continue to strive for the best."

-**Dr. Sayfe Kiaei,** Project Director, USPCAS-E

Young engineers from UET departed for the U.S.

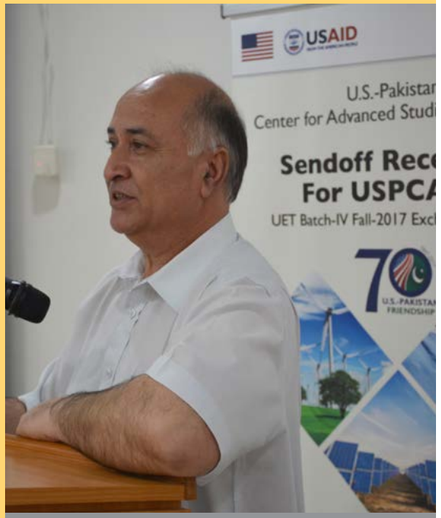
Students and faculty - Part of the exchange program's fourth cohort

A send-off reception was held in Peshawar, Pakistan for 15 students and one faculty member who are currently spending one semester at ASU as part of the exchange program.

The send-off reception was attended by senior officials from University of Engineering and Technology (UET) Peshawar, Khyber Pakhtunkhwa and USPCAS-E management. The exchange program offers promising students an opportunity to enhance their research skills and industry awareness, and provides faculty members the opportunity to upgrade their teaching and corporate-partnership skills.

During their four-month stay, the exchange scholars will engage in experimental research in energy at ASU's labs under the supervision of professors, and are expected to design, execute, and analyze experiments in areas such as batteries and solar panels. They will also take part in industry visits to learn more about power generation mechanisms in the U.S.

Speaking at the occasion, the Vice-Chancellor from the University of Engineering and Technology Peshawar, Dr. Iftikhar Hussain remarked that this exchange program focuses on applied research in energy to serve as another hallmark of the partnership between the U.S. and Pakistan for developing strong educational institutions. He also encouraged the students to make full use of this once-in-a-lifetime opportunity.



Vice-Chancellor, UET Peshawar talks to students during sendoff ceremony.
Photo credit: Arsal Latif ASU/USPCAS-E

Scholars visit National Center for Physics

USPCAS-E scholars at the University of Engineering and Technology (UET) Peshawar had the opportunity to visit Pakistan's National Center for Physics (NCP) on August 29th, 2017.

The Center was inaugurated on May 16th, 2000 with the primary purpose of promoting research in physics and applied disciplines in Pakistan and the region.

USPCAS-E visitors included both faculty and students from UET who visited labs working on experimental high energy physics, nano-technology, atomic and laser plasma physics, vacuum science and technology as well as a center for earthquake studies.

Research collaboration opportunities were discussed and it was agreed that both USPCAS-E and NCP may sign a research collaboration Memoradum of Understanding to develop future partnerships.

Class Notes: Where are our scholars now?

Nafeesa Irshad, has returned to ASU after completing her master's degree in Pakistan. She will be studying under Dr. Clark Miller in order to pursue her PhD.

Farah Qazi, won a gold medal at National University of Science and Technology (NUST) in Nanoengineering. Currently she is in Japan for a fully-funded internship and is doing research at the Okinawa Institute of Science and Technology.

Pakistani students publish paper on solar cell coatings

Asad Ali and Waqar Ali, both graduate students from University of Engineering and Technology (UET) Peshawar, recently published a seven-page research paper in the scientific journal called, *Solar Energy Materials and Solar Cells*, on the effects of certain types of coatings on solar cells.

Asad and Waqar are Pakistani's who were part of the U.S.- Pakistan Centers for Advanced Studies in Energy, (USPCAS-E).

The basis of Asad's and Waqar's publication encompassed research on a new coating on the surface of solar cells that reduces reflection losses and traps more light. Typically, solar cells are covered in 'Anti Reflective Coatings' which are not as renewable as the new coating. Asad and Waqar, as well as the rest of their ASU collaborators, worked to fabricate the layers of the cells with different textures that they hoped would create optimal results. The difference between Asad's and Waqar's research was the testing of the final product; Asad's work focused more on electrical properties while Waqar concentrated on optical properties.

Asad remarked in regards to the improved solar cell that, "It is significant in that it has improved the efficiency of those solar cells by 10% relative value without increasing their cost." With their research, Asad and Waqar concluded that there will be new manufacturing techniques involved to create such solar cells.

Their ongoing research, that took approximately half a year to publish, will be beneficial to the solar industry in Pakistan, specifically for the Pakistan Council for Renewable Energy Technology, because its research advances the study of solar energy.

"Solar cells are a very hot topic for research in our country and after getting in depth knowledge, we will be able to work on research in a similar field as well as continue the same research," Waqar remarked. Pakistan is currently in the midst of one of the worst energy crises in history, with many of the villages suffering over twelve hours of outages daily.

Asad and Waqar worked alongside USPCAS-E researcher, Dr. Zachary Holman, who is Assistant Professor at the Energy Materials School of Electrical Computer and Energy Engineering at ASU. Asad noted that, "Holman is the most intelligent, sincere, cooperative and efficient supervisor." Waqar agreed by also adding, "He not only transferred his academic knowledge to us but acted as a mentor in our life. It was a great privilege to work under his supervision."

Looking ahead, Asad hopes to work in the solar industry, continue researching solar technology as a PhD scholar, and one day establish his own solar company in Pakistan. "USPCAS-E has provided me a path to meet such tremendous people and end up in this research work," Asad emphasized.

Meanwhile, Waqar hopes to start a small setup of solar related materials that can be utilized by other solar companies. His dream is that his startup will become so substantial, it produces economical, reliable and long lasting solar panels. While reflecting on his research at ASU, Waqar remarked, "I had always been interested in renewable energy as I am a big advocate of clean and green energy. This research will help people adopt cleaner energy."

(Above) Asad Ali, a Pakistani exchange scholar from the U.S.-Pakistan Centers for Advanced Studies in Energy.
(Below) Waqar Ali at the ASU Research Park.

Picture this: Pakistani scholar brings illustrative twist to thesis

If a picture is worth a thousand words then Syeda Qudsia's master's thesis must be worth at least 40,000 words. In March, she successfully defended her thesis at the National University of Sciences and Technology in Islamabad, Pakistan on the applications of graphene oxide for solar cells, using cartoons.

Syeda Qudsia attended Arizona State University last year as part of an exchange program with the U.S.-Pakistan Centers for Advanced Studies in Energy, better known as USPCAS-E, that seeks to brighten the lives of her fellow compatriots and be part of the solution for Pakistan's energy crisis by developing skilled energy professionals.

"I chose a comic strip format because it is a great medium for storytelling and it makes everything so much more interesting," Qudsia explained.

Like her cartoon alter-ego featured in her thesis, Qudsia is known for wearing her traditional hijab and veil hijab but also dons her trademark Converse sneakers. The "cartoon Qudsia" illustrates the complexities of chemical bonds with a superhero graphene molecule.

"We modified graphene oxide with a chemical compound, believing that it would change the electrical properties of the material. And it did," she discovered.

The work she conducted in electrical engineering Assistant Professor Zachary Holman's lab in the Ira A. Fulton Schools of Engineering at ASU was on silicon nanoparticles, aimed at improving the efficiency of silicon solar cells. This experience polished her skills and helped her complete her research on graphene oxide's role in similar solar cell applications back in Pakistan.

Qudsia believed that most science presentations were tedious and dull, and although she felt like she was breaking the rules of traditional science presentations, her thesis was well-received amongst her peers and advisors.

"Sometimes people cannot cover the gap-of-knowledge between the audience and the presenter," she said, but her project certainly bridged that gap and made technical concepts more approachable.

In the spring of 2017 she graduated from NUST in Pakistan with a masters of science in nanoscience and engineering. Currently, Qudsia is in the process of applying for a doctoral position in solar cell research with the hope of contributing to energy research.

Qudsia was grateful for the USPCAS-E program and the many opportunities availed for her to grow personally and professionally. She credits ASU's research facilities as an integral part of her success.

(Above) Syeda Qudsia during her 16-week exchange visit to Arizona State University.
Photo credit: Erika Gronek ASU/USPCAS-E

USPCAS-E draws Fulton Schools' grad back to ASU

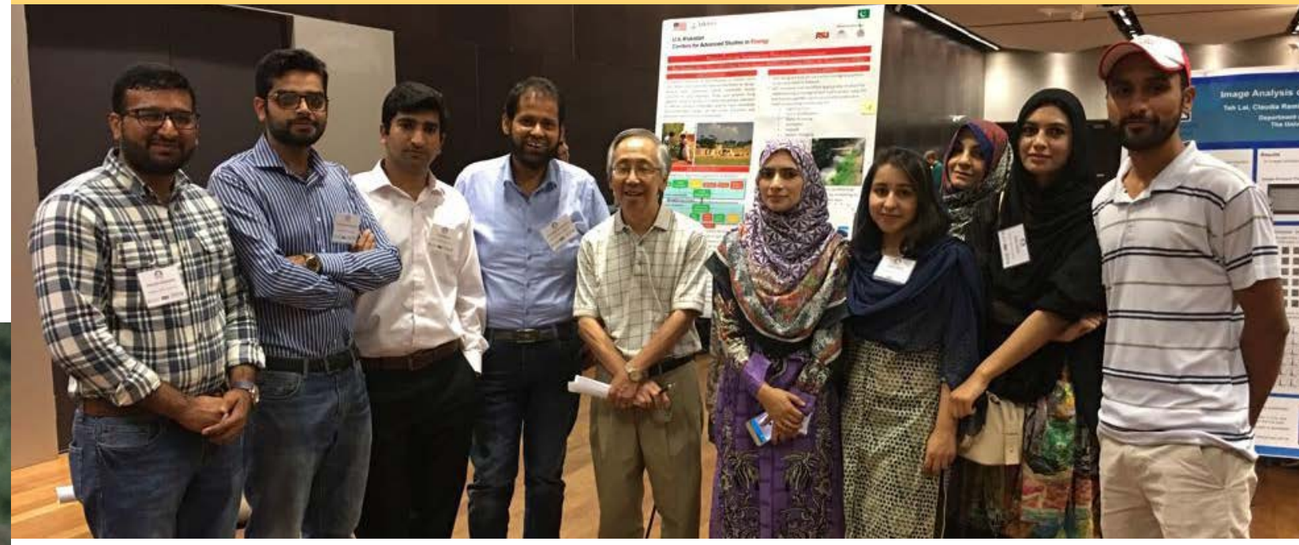
Photo credit: Arsal Latif ASU/USPCAS-E

Edward J. William Jr. graduated from the Ira A. Fulton Schools of Engineering and has returned to ASU as the technical advisor to USPCAS-E in Islamabad, Pakistan. His work will include inspiring new ideas to create innovative energy solutions at the National University of Sciences and Technology, Pakistan.

Part of his time will be spent in Pakistan and the rest will be at ASU. Having come back to Arizona, he says, "I have to admit, it feels like coming home. When it's home it becomes your obligation as alumni to make the university transcend to the next level.".

UET students at ASU present poster at the Arizona Student Energy Conference

On October 20th, 2017, several scholars presented a poster at the Arizona Student Energy Conference, (AzSEC), and won the, 'Distinguished Poster Award'. AzSEC is a conference where Arizona's top universities come together to focus on development in the field of renewable energy science, technology and policy.
It hosts panel discussions, seminars and presentations where scholars are provided with the opportunity for discussion and networking. The scholars included students representing the U.S.- Pakistan Centers for Advanced Studies in Energy, (USPCAS-E), the U.S. Agency for International Development, (USAID), and the University of Engineering and Technology (UET), in Pakistan. The scholars are very proud of their accomplishments as the award is highly prestigious.



Where will solar go next?

This past semester ASU organized a virtual seminar for both partner universities, NUST and UET, on the topic, "Where will solar go next?"

The seminar was delivered by Prof. Dr. Zachary Holman from ASU. This hour-long session highlighted the importance of different types of solar material. Module efficiency is a primary cost driver in today's flat-plate PV industry because the module cost now accounts for less than half of the total installed system cost. Consequently, in the past five years, commercial cell and module efficiencies have improved dramatically.

Following an introduction to silicon's impending efficiency plateau, the talk motivated silicon-based tandems with a discussion of their value proposition and likely points of market entry. Next, Dr. Holman reviewed the most promising materials and device designs, including monolithically integrated III-V/Si, II-VI/Si, and perovskite/Si solar cells, and optically coupled tandems.

Finally, he introduced a new tandem concept that relieves some of the constraints of previous tandems and promises high efficiencies.

The seminar concluded with a discussion by faculty and students of the practical challenges of utilizing latest applications and how to mitigate some of these.

(Above) USPCAS-E faculty and students participate in the virtual seminar conducted by Prof. Dr. Zachary Holman. Photo credit: Arsal Latif ASU/USPCAS-E

U.S.-sponsored energy conference brings together experts to find solutions to Pakistan's energy needs

The U.S.-Pakistan Center for Advanced Studies in Energy (USPCAS-E), University of Engineering and Technology (UET) Peshawar organized an international conference in Islamabad, Pakistan from September 12-13, 2017.

U.S. Deputy Chief of Mission (DCM) to Pakistan John Hoover inaugurated the International Conference on Sustainable Energy Technologies.

The conference brought together energy professionals and policymakers from academia, government, electric power companies and manufacturing industries to exchange information and share ideas related to sustainable energy technologies.

Speaking at the inaugural ceremony, DCM Hoover said, "Our collaboration with the Higher Education Commission and the University of Engineering and Technology, Peshawar to advance higher education is guided by a shared conviction that a well-informed and educated Pakistani workforce can better address these challenges and opportunities in Pakistan and in a globalized world."

The Deputy Chairman of Planning Commission of Pakistan, Mr. Sartaj Aziz, emphasized the need to involve academia in creating sustainable solutions to address the energy crisis and expressed appreciation to the U.S. Government for its support in establishing the Centers for Advanced Studies.

The USAID-funded USPCAS-E is a joint initiative between the National University of Sciences and Technology (NUST), UET Peshawar, and Arizona State University focused on building Pakistan's expertise to conduct applied research to meet Pakistan's energy needs.

As part of USAID's $127 million U.S.-Pakistan Centers for Advanced Studies program, approximately 200 graduate students and faculty members from UET Peshawar and NUST will conduct applied research on energy at Arizona State University by 2019. The partnership has also developed curricula, established new laboratories at NUST and Technology and UET Peshawar, and initiated exchange programs.

Chief guest Mr. Sartaj Aziz, Deputy Chairman – Planning Commission, presiding over the International Conference on Sustainable Energy Technologies in Islamabad along with Mr. John Hoover, Deputy Chief of Mission U.S. Embassy, Islamabad. Photo credit: UET/USPCAS-E

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