ENGINEERING REVIEW
GOLDEN JUBILEE
Founded by: Najam ul Hasan
Engineers' trusted voice for 50 years and beyond
November 1-15, 2026
Vol. 51 No. 21
info@engineeringreview.com.pk
www.engineeringreview.com.pk
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Diamer-Bhasha Dam: A Major Step Towards Pakistan's Water and Energy Security

By Manzoor Shaikh

The Rs133.18 billion hydro-mechanical contract marks another milestone in the construction of one of Pakistan's largest water and hydropower projects, but its long-term benefits will depend on effective water management, sediment control and timely completion.

The construction of the Diamer-Bhasha Dam has reached another important milestone with the signing of a Rs133.18 billion contract for its hydro-mechanical equipment and hydraulic steel structures. The agreement, signed by WAPDA with the Power China–IKAN Joint Venture, covers an essential component of the project that will eventually enable the dam to regulate water flows and operate its power generation system.

The agreement was signed at a ceremony held at WAPDA House. Chief Engineer/Project Director Diamer-Bhasha Dam Arif Ali signed on behalf of WAPDA, while Ling Jianke represented the joint venture. Chairman WAPDA Lt Gen Muhammad Saeed (Retd), WAPDA's Member Finance, Member Water and Member Power, the CEO of Diamer Basha Development Company, a delegation headed by the Chairman of Power China International Group Limited and representatives of the consultants also attended the ceremony.



The HM-1 contract covers the manufacturing, supply and installation of gates and hydraulic steel structures required to control water flows at different sections of the dam. These include flushing tunnels on both the left and right banks, power intakes and dam outlets. The contract also includes steel lining, hoisting and pumping systems and associated electrical works.

These installations are essential for the safe and efficient operation of the project. The gates and associated structures will regulate the movement and discharge of water, while the flushing tunnels will play an important role in managing sediment accumulation in the reservoir. The power intakes will supply water to the turbines for electricity generation. In other words, the contract is not merely about installing steel structures; it concerns some of the most important operating systems of the dam.

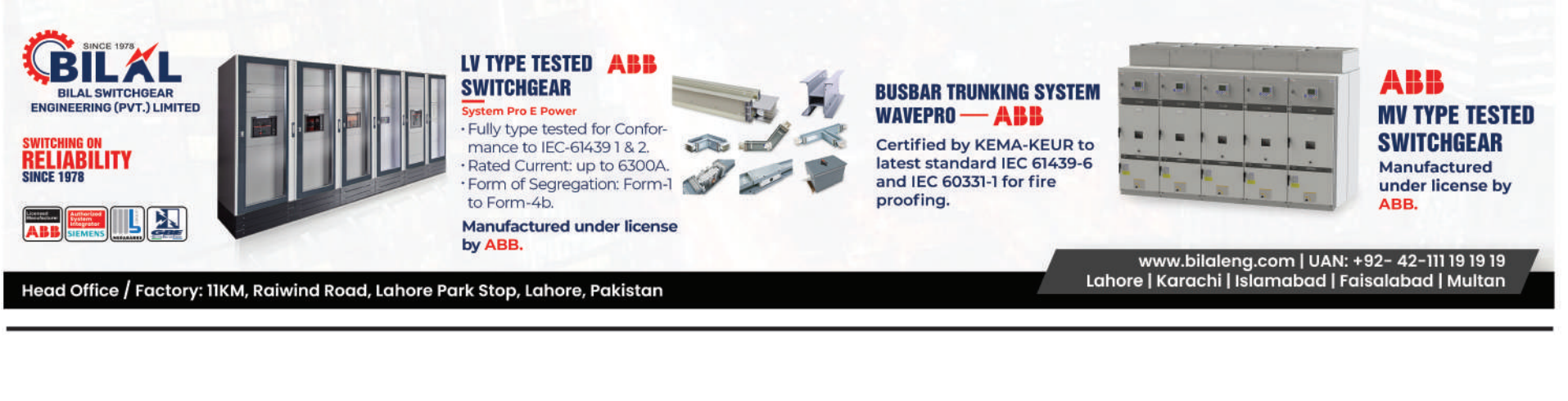
Located across the River Indus, approximately 40 kilometers downstream of Chilas,

Contd on page 4









HIMEL Sees Strong Growth Opportunities in Pakistan Amid Rising Energy Demand and Infrastructure Development

HIMEL, a leading provider of reliable and accessible electrical solutions, has reaffirmed its long-term commitment to Pakistan through a series of strategic industry engagements held across Karachi and Lahore in partnership with its authorized distributor, Powerhouse Pvt. Ltd.

The week-long visit brought together key stakeholders from across the electrical ecosystem and underscored HIMEL's confidence in Pakistan as a high-potential growth market driven by rising energy demand, infrastructure expansion, and industrial development.

As part of the initiative, HIMEL hosted two large-scale customer engagement events attended by more than 750 industry professionals, including over 400 participants in Karachi and 350 participants in Lahore. The events welcomed dealers, consultants, retailers, contractors, panel builders, and industry decision-makers, providing a platform to exchange market insights, strengthen partnerships, and showcase HIMEL's latest solutions designed to meet the evolving needs of Pakistan's electrical sector.

Beyond the events, HIMEL's senior leadership undertook an extensive programme of market engagement activities, including meetings with leading consultants, panel builders, project stakeholders, and channel partners. The delegation also conducted multiple market visits to gain firsthand insights into customer requirements, industry trends, and opportunities emerging across Pakistan's rapidly developing electrical landscape.

Pakistan continues to present significant opportunities for the electrical industry as growing urbanization, increasing electrification requirements, industrial expansion, and ongoing infrastructure investments drive demand for reliable power distribution and electrical protection solutions. With the country's energy requirements continuing to rise, the need for dependable, high-quality electrical products has never been more critical.

Against this backdrop, HIMEL is expanding its focus on the market through closer customer engagement, stronger channel partnerships, and the introduction of innovative products tailored to local requirements. The company's growing presence reflects its commitment to supporting customers with solutions that combine reliability, accessibility, and performance while contributing to the modernization of Pakistan's electrical infrastructure.









Koon San Ang, Vice President, International Sales, HIMEL, said: "Pakistan remains one of the most promising markets within our international growth strategy. The country's expanding infrastructure, increasing energy demand, and ongoing industrial development are creating significant opportunities for the electrical sector. Our engagements across Karachi and Lahore allowed us to connect directly with customers, consultants, panel builders, and partners, providing valuable insights into the market's evolving needs. The strong participation and positive response we received further reinforce our confidence in Pakistan's growth potential. Through our partnership with Powerhouse, we remain committed to delivering reliable, accessible, and innovative electrical solutions that support the country's development ambitions and create long-term value for our customers."

The visit also highlighted the strength of HIMEL's collaboration with Powerhouse Pvt. Ltd., a key partner in expanding the brand's reach and supporting customers across Pakistan.

Pervez Madraswala, CEO, Powerhouse Pvt. Ltd., commented: "Pakistan's electrical industry is evolving rapidly, driven by increasing investments across residential, commercial, and industrial sectors. Customers are seeking trusted solutions that deliver quality, reliability, and value, and we have seen growing demand for the HIMEL portfolio across the market. The excellent turnout and engagement at both events demonstrate the confidence customers have in the brand and its long-term commitment to Pakistan. Together with HIMEL, we look forward to further expanding our presence, supporting industry stakeholders, and helping meet the country's growing electrical infrastructure requirements."

Throughout the engagements, attendees were introduced to HIMEL's latest product innovations and strategic priorities, while participating in discussions focused on industry trends, project requirements, and opportunities shaping the future of the electrical sector. The strong response from customers and industry professionals reflects both the momentum behind the HIMEL brand and the increasing demand for reliable electrical solutions across Pakistan.

As the country continues to invest in infrastructure and address rising energy requirements, HIMEL and Powerhouse Pvt. Ltd. remain committed to supporting the market with products and solutions that enable safer, more efficient, and more dependable electrical installations. The successful engagements in Karachi and Lahore mark another important milestone in HIMEL's growth journey in Pakistan and further strengthen the company's position as a trusted partner for electrical professionals across the country.

ABOUT HIMEL

HIMEL is a trusted global electrical brand committed to making reliable electrical solutions accessible to professionals and businesses worldwide. With a presence across Asia, the Middle East, Africa, and Latin America, HIMEL offers a broad portfolio of low-voltage electrical products designed to meet the needs of residential, commercial, industrial, and infrastructure projects. Through continuous innovation, strong local partnerships, and customer-centric solutions, HIMEL is helping power the development of fast-growing economies and supporting the transition towards safer and more efficient electrical systems.

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Construction Sector Reforms: Govt Seeks Consensus but PEC's Role Remains Unclear

By Manzoor Shaikh

October 28 meeting leaves key questions unresolved as government considers a new regulatory structure, contractual reforms and stronger accountability in public projects

The federal government is considering a new institutional and contractual framework for Pakistan's construction industry, but its latest round of discussions has ended without a final decision on the proposed structure or the responsibilities of the institutions that may be involved.

Federal Minister for Economic Affairs and Establishment Division Senator Ahad Cheema chaired a meeting in Islamabad on October 28 to discuss reforms aimed at strengthening the construction sector, improving project delivery and addressing problems faced by contractors and other industry stakeholders.

The meeting considered the proposed Construction Industry Development Authority (CIDA) Bill, but Cheema stressed that the legislation required further examination. One of the central questions was whether Pakistan should establish a single body to regulate and promote the construction industry or create two separate institutions, with one responsible for regulation and the other for industry development.

The minister asked the relevant officials, Minister of State for Finance Bilal Azhar Kayani and representatives of the Constructors Association of Pakistan (CAP) to continue consultations and develop a workable institutional structure. The discussions did not produce a final decision on the proposed arrangement.

The question of institutional responsibility is particularly important because Pakistan already has a statutory body with a mandate covering several areas of engineering and construction: the Pakistan Engineering Council (PEC).

Established under the PEC Act, 1976, the Council registers professional engineers, consulting engineers, constructors and operators. Its statutory functions also include establishing standards for engineering contracts, costs and services, facilitating engineering-sector industries and providing a forum for arbitration in construction and consultancy disputes.



Despite this mandate, PEC was not listed among the participants in the October 28 meeting, according to the official announcement. Its name was also absent from the published attendance details of an earlier government meeting on construction-sector reforms held on August 15.

This raises questions about how the government intends to involve the country's engineering regulator in designing a framework that could directly affect engineers, consulting firms, construction companies and technical standards. The published records do not establish whether PEC was consulted separately, but its absence from the announced participation is notable.

Interestingly, PEC had itself discussed construction-industry reforms at a Management Committee meeting on August 6, 2026. The Council identified construction-sector reforms among its strategic initiatives. However, this was an internal PEC meeting and not part of the federal government's consultation process.

Another important issue discussed on October 28 was the retention money withheld from contractors during the defect liability period. The meeting considered a proposal to place these funds in interest-bearing accounts, allowing contractors to receive both the original amount and the accrued return after the stipulated period.

For contractors, retention money can represent a significant amount of working capital, particularly when payments remain withheld for extended periods. The proposed arrangement could reduce this financial burden, although the mechanism for managing the accounts and releasing funds would require further agreement.

The meeting also examined the introduction of Dispute Avoidance/Adjudication Boards (DAABs) for government projects. These boards are intended to monitor project implementation and help prevent disagreements from escalating into lengthy disputes.

CAP proposed applying the mechanism to projects worth Rs20 billion and above. Cheema, however, called for a lower threshold and further consultations to determine an appropriate limit. The government also wants the forthcoming construction-sector framework to draw upon the rules and standards of the International Federation of Consulting Engineers (FIDIC), whose contract conditions are widely used in international engineering and construction projects.

The duration of the defect liability period was another significant subject. The minister directed the Pakistan Public Procurement Regulatory Authority (PPRA) to begin work on introducing a period of at least three years for major projects, with the measure to be extended to smaller projects in phases.

A longer defect liability period could encourage better construction quality and make contractors more accountable for defects appearing after project completion. However, its effectiveness will depend on clear contractual provisions, proper technical inspections and fair procedures for handling claims.

The October 28 meeting was attended by Minister of State for Finance Bilal Azhar Kayani, Secretary Housing Captain (Retd) Muhammad Mahmood, a Member of the Planning Commission, the Managing Director of PPRA, CAP representatives and other senior officials.

For now, the government appears to be examining several possible reforms rather than implementing an agreed package. The institutional structure of the proposed authority, the treatment of retention money, the threshold for DAABs and the scope of the longer defect liability period all require further consultation.

The next stage will be important. If the government wants a framework that improves the entire construction industry rather than primarily addressing contractors' concerns, consulting engineers, professional bodies, academia and PEC will need a meaningful place in the process. The proposed reforms will have far-reaching implications for the quality, cost and accountability of public infrastructure, making broad-based consultation essential before the legislation moves forward.■

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Diamer-Bhasha Dam: A Major Step Towards Pakistan's Water and Energy Security

Contd from page 1

Diamer-Bhasha is a priority project of the federal government for strengthening Pakistan's water, food and energy security. It is designed as a 272-metre-high roller-compacted concrete (RCC) gravity dam, with gross water storage of 8.1 million acre-feet (MAF) and live storage of approximately 6.4 MAF. Its planned installed electricity generation capacity is 4,500 MW, with estimated annual generation of around 18,097 GWh.

The project is significant because Pakistan faces two interconnected challenges: increasing pressure on its water resources and a growing demand for electricity. However, the benefits of a large dam must be examined not only in terms of its storage capacity and generating potential but also in terms of its impact on agriculture, the environment and the country's energy system.

Implications for agriculture and water security

Agriculture remains the largest consumer of water in Pakistan, and the country's irrigation system depends heavily on the Indus River and its tributaries. Seasonal variations in river flows create difficulties for farmers, particularly during periods of reduced rainfall and limited water availability. Diamer-Bhasha is expected to improve the regulation of river flows by storing water during periods of higher availability and releasing it when irrigation requirements increase.

The reservoir's live storage capacity of approximately 6.4 MAF will provide additional flexibility in managing water supplies. It is expected to support irrigation, improve the reliability of water releases and help reduce pressure on existing reservoirs. WAPDA has also projected that the project will help irrigate an additional 1.23 million acres of land.

Another important advantage is its potential contribution to the management of sediment in the Indus River. The river carries substantial quantities of sediment from its mountainous catchment areas, which gradually accumulate in reservoirs and reduce their storage capacity. By trapping a portion of this sediment upstream, Diamer-Bhasha is expected to help extend the operational life of Tarbela Reservoir, an important component of Pakistan's irrigation and hydropower infrastructure.

However, the project also has limitations. Building additional storage capacity does not automatically resolve Pakistan's agricultural water crisis. Inefficient irrigation practices, water losses in canals, poor drainage, inadequate maintenance and the cultivation of water-intensive crops will continue to affect the productivity of the irrigation system. Unless these issues are addressed alongside the construction of new reservoirs, the expected benefits may not translate into proportional improvements in agricultural output.

Sedimentation is another long-term concern. Although the dam is expected to trap a significant portion of the sediment carried by the Indus, its own reservoir will also gradually lose storage capacity. Effective sediment management and regular monitoring will therefore remain essential throughout its operational life.

A major addition to Pakistan's energy capacity

The energy component is equally important. With an installed capacity of 4,500 MW and estimated annual generation of approximately 18.1 billion units, Diamer-Bhasha will become one of Pakistan's largest hydropower facilities.

Hydropower offers an important advantage over electricity generated through imported fossil fuels. It does not require continuous purchases of imported coal, oil or gas to generate electricity. Once the infrastructure is operational, its generation costs are generally less exposed to international fuel price fluctuations. It can also help reduce dependence on thermal generation and improve the overall composition of Pakistan's energy mix.

The project will have two underground powerhouses, each containing six generating units of 375 MW. Water released through the power intakes will drive turbines connected to generators, converting hydraulic energy into electricity before being dis-

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Bijli Ghar



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From Rock to Reality: Bridging Academia and Industry

By: Dr. Saad Nadeem, Associate Professor, Department of Chemical Engineering, NED University

The Department of Chemical Engineering at NED University of Engineering & Technology, in collaboration with Lucky Cement Limited, successfully hosted a highly anticipated academic seminar titled "From Rock to Reality: The Engineer's Guide to Modern Cement Manufacturing."

The event, held at the NED University Main Auditorium on October 19, 2026, witnessed an overwhelming response, with the required student registrations filling up within just a few hours of its announcement.

The seminar was meticulously coordinated by Dr. Saad Nadeem from Chemical Engineering Dept. NEDUET, alongside Yazdan Ahmed Khan and Ahsan Burney representing Lucky Cement. The program commenced with a warm note of thanks from Prof. Dr. Saud Hashmi, Chairman of the Chemical Engineering Department. In his address, he emphasized the critical need for industry-academia collaboration and urged both sectors to work together to bridge the prevailing gap between theoretical education and practical industrial application.



The session featured distinguished speakers from Lucky Cement. Mazhar Hussain, Director, Sales & Marketing, opened the floor by providing a comprehensive introduction to Lucky Corporation, its diverse ventures, and its pivotal role in making Pakistan a great nation. He motivated the attending students, highlighting their crucial role in an ever-evolving cement industry.

Nohman Mahmud, General Manager, Quality Control at Lucky Cement delivered an insightful presentation on the technical manufacturing processes. He detailed Lucky Cement's impressive operational scale of 15.60 MTPA and the intricate journey from quarrying to dispatch. He elaborated on the raw milling and CF Silo blending, the four dry-process kilns with their specific temperature zones (from preheating to cooling), and the coal-fired system. Highlighting the industry's future, he discussed Lucky Cement's "Road to Net Zero" initiatives—including solar, wind, Waste Heat Recovery, and Battery Energy Storage systems—and the integration of Industry 4.0 through IoT, AI, and digital twins. He also touched upon process safety and rigorous quality control standards.

Atiq Naru, General Manager, Plant Operations at Lucky Cement focused on the "Cement Manufacturing Business Operational Cycle." He provided a macro view of how production plans drive annual budgets, mapping out the various cost centers from mining to dispatch. He discussed the company's major operational KPIs, including equipment run factors, specific thermal and electrical energy consumption, and the integration of renewable resources. Naru also highlighted the role of business automation through SAP and the critical importance of process safety, encompassing Process Safety Information, Hazard Analysis, Management of Change, and LOTO systems.



The event concluded with closing remarks by Dean CPE, Prof. Dr. Zahoor ul Hussain Awan, who commended the speakers for their informative sessions. To honor their contributions, shields were distributed to the speakers and coordinators. The AIChE and ACI student chapters played a vital role in all arrangements under the supervision of Dr. Fahim Uddin, Faculty Advisor, AIChE NED Chapter.

The students were ecstatic with the highly informative sessions. The seminar concluded on a high note, with both the Department and Lucky Cement agreeing to continue their engagement and knowledge sharing, ensuring that the bond between NEDUET and the cement industry continues to flourish.■





Dr Zahid Hussain Khand Gets Four-Year Extension as Aror University Vice Chancellor

Prof. Dr. Engr. Zahid Hussain Khand has been granted another four-year term as Vice Chancellor of Aror University of Art, Architecture, Design and Heritage, Sukkur, by the Government of Sindh.

The extension will allow Dr Khand to continue leading the public-sector university, which focuses on art, architecture, design and the preservation of cultural heritage.



The decision was approved in September 2026. According to media reports, the extension followed a recommendation by Sindh Assembly Speaker Owais Qadir Shah, reversing an earlier proposal to advertise the position and appoint a new vice chancellor through a selection process.

Reports also stated that Sindh Chief Secretary Asif Hyder Shah had initially recommended advertising the position and considering Dr Khand for reappointment if no suitable candidate emerged through the selection process. The subsequent approval granted him another four-year tenure.

Dr Khand's extension comes at a significant stage in the development of Aror University, which aims to promote higher education in creative disciplines while connecting the region's cultural heritage with contemporary academic and professional opportunities.

Who is Prof. Dr. Engr. Zahid Hussain Khand

Prof. Dr. Engr. Zahid Hussain Khand is an academic and university administrator currently serving as Vice Chancellor of Aror University of Art, Architecture, Design and Heritage, Sukkur.

As head of the university, he has been associated with its institutional development, academic expansion, administrative strengthening and efforts to promote art, architecture, design and heritage education.

At the university's fourth Senate meeting, held on March 11, 2026, Dr Khand presented an overview of progress during 36 months of institutional transformation. The presentation covered developments in administration, academics, digital transformation, infrastructure and the promotion and preservation of art and cultural heritage.

His stated academic vision emphasizes merit, analytical and creative thinking, leadership skills and entrepreneurship among young people.

With his reappointment for another four years, Dr Khand will continue to lead the institution's efforts to strengthen its academic standing and contribute to the development of creative education in Sindh. - ER

HVACR Trends 6.0 Draws 3,283 Visitors to Karachi as ASHRAE President Joins Pakistan's Cooling Industry



ASHRAE Pakistan Chapter's sixth edition puts VRF technology at the centre of a two-day conference and exhibition

The ASHRAE Pakistan Chapter concluded HVACR Trends 6.0, its sixth conference and exhibition, on 16–17 October in Karachi. Themed "VRF: Evolution, Innovation & the Future", the event welcomed 3,283 visitors and 37 sponsors and exhibitors.



HVACR Trends exists to bring together the people who design, supply, install and operate heating, ventilation, air conditioning and refrigeration systems, and to connect them with ASHRAE's technical knowledge. Its purpose is to promote energy-efficient, sustainable and technically sound HVACR practice in Pakistan under the motto "Innovate. Sustain. Connect."

ASHRAE Society President Sarah E. Maston, P.E., BCxP, LEED AP, delivered the Presidential Address at the inauguration on 16 October. Her theme, "Changing the Game: Retrofitting for Resilience", spoke directly to the opportunity in Pakistan's existing building stock.

A new feature this year was a Networking Breakfast, "An Intimate Morning Conversation with the ASHRAE President", held on 17 October. Chapter members, young engineers, students and industry professionals met Ms. Maston in a personal setting. The session ran beyond its scheduled close as questions kept coming. The format was conceived by Faraz Khan, Co-Chair of the Chapter's ECC Committee for 2026–27.

Seven technical papers examined VRF from design to long-term performance, from intelligent HVAC and coastal corrosion protection to new refrigerants and VRF flow design. Speakers included ASHRAE Distinguished Lecturers Luke Leung and Dr Hesham Safwat. A closing panel, "Chillers vs VRFs", moderated by Mohsin ul Haq, urged choosing systems on whole-building performance and lifecycle cost.

The exhibition covered VRF, chillers, controls, piping, insulation, coatings and fire protection. Cosmix Engineering was the exclusive Titanium Sponsor. AMCON and AICOM General were the Platinum Sponsors, and Midea was the Diamond Sponsor. The Gold sponsors were MM Steel, Bharmal Traders, Airnest, Echelon Industries, Powermech and Greaves Air-conditioning; Silver Sponsors were Heresite, AVS, Crescent Corporation and Eurocon. Other major participants were Forte Pakistan, H&M Supply, Khan Brothers, 3Tech, IDEAS Associates, The Engineering, AIREX, Saeed Sons, United Insulation, SWI, Burhani Enterprises, Al-Karimjee and Pivot. Sponsors and exhibitors were happy with the outcome: the event met, and went beyond, the expectations and goals they brought to Karachi.

The Chapter credits the success of HVACR Trends 6.0 to the leadership of Ibad Hasan, President of ASHRAE Pakistan Chapter, and Omer Khan, Chairman of the Organising Committee, and above all to Engr. Abbas Sajid, whose mentorship guided the event from start to finish.

The event was endorsed by The Institution of Engineers Pakistan, CESS Pakistan, ACEP, PSPP, IWA Young Water Professionals Pakistan, Pakistan Businesses Forum and REAP.

About ASHRAE Pakistan Chapter

ASHRAE Pakistan Chapter is part of ASHRAE, the global society advancing HVACR to serve humanity and promote a sustainable world.■



Agriculture Review

China-Pakistan Agricultural Cooperation Trains 885 Professionals, Supports 15 Startups

Program focuses on AI, seed technology, livestock disease surveillance, genomics and water-efficient farming, with more than 50,000 farmers and professionals reportedly reached

A bilateral agricultural cooperation program between Pakistan and China has trained 885 Pakistani agricultural professionals, supported the establishment of 15 startups and reached more than 50,000 farmers and agricultural professionals, according to a report published on October 30.

The program, which aims to strengthen Pakistan's agricultural research and technological capabilities through cooperation with Chinese institutions, covers a wide range of emerging fields, including artificial intelligence (AI), seed production, livestock disease surveillance, genomics, aquaculture, high-efficiency irrigation and food processing.

The latest progress was highlighted at the China-Pakistan Agricultural Science and Technology Exchange Event held in Yangling, China, on October 27. Meanwhile, another 107 Pakistani participants are attending the third batch of the training program at Northwest A&F University.



The initiative reflects growing efforts by the two countries to extend their cooperation beyond conventional agricultural trade and investment towards research, technology transfer and the development of skilled human resources.

The program's areas of focus are particularly relevant to Pakistan, where agriculture faces persistent challenges involving low productivity, water scarcity, crop diseases, livestock health, poor seed quality and post-harvest losses.

Artificial intelligence and digital technologies, for example, can support precision farming, crop monitoring and more efficient use of irrigation water and fertilizers. Similarly, advances in genomics and seed production could help develop crop varieties better suited to local environmental conditions, including heat, drought and disease resistance.

Livestock disease surveillance is another important area. Improved monitoring and early detection systems can help farmers and veterinary authorities respond to outbreaks more effectively, reducing economic losses and strengthening food security.

The program has also encouraged entrepreneurial activity. According to the report, 15 startups have emerged from the wider training and cooperation initiative, suggesting that some participants are attempting to translate their exposure to Chinese technologies and research practices into commercial ventures.

One example is NanoDrop, a Pakistani startup whose founder described work on membrane-based water filtration technology with potential applications in agriculture.

Water treatment and filtration technologies could have particular relevance in Pakistan, where farmers in several regions face problems associated with poor-quality irrigation water, salinity and limited freshwater availability. Membrane-based systems can be used for different filtration and water-treatment applications, although their suitability for agricultural use depends on factors such as operating costs, energy requirements, water quality and the scale of deployment.

The reported training of more than 50,000 farmers and agricultural professionals is another important component of the initiative. Technology transfer cannot produce meaningful results if it remains confined to universities and research institutions. Farmers, extension workers and agricultural businesses need access to practical knowledge, equipment and technical support to adopt new methods.

However, the real measure of the program's success will be its impact on agricultural productivity and the ability of Pakistani institutions and businesses to sustain the technologies introduced through the cooperation.

The establishment of 15 startups is an encouraging development, but their commercial progress, investment requirements, locally developed products and market reach will need to be assessed. Similarly, the number of people trained does not necessarily indicate how many have adopted new technologies or achieved improvements in production.

For Pakistan, the next challenge is to build stronger links between agricultural universities, research centres, technology companies, government departments and farmers. Such collaboration could help convert research and training into locally manufactured equipment, affordable digital solutions and commercially viable agricultural technologies.

China's experience in agricultural mechanization, research-led farming and technology adoption offers opportunities for cooperation. But successful transfer will require adapting technologies to Pakistan's soil conditions, climate, farm sizes, water availability and economic realities.

The training initiative provides a platform for that cooperation. Its long-term value, however, will depend on whether the knowledge acquired in China leads to stronger domestic research capabilities, viable agricultural enterprises and measurable improvements in the livelihoods of Pakistani farmers. - ERMD



Pakistan HVACR Society, Lahore Chapter Signs MOU with UMT Lahore

A delegation of the Pakistan HVACR Society, Lahore Chapter led by Chairman Jafar Raza Haidery visited the University of Management and Technology, Lahore, for the formal signing of a Memorandum of Understanding.

The delegation included Muhammad Tanseer Hussain, Engr. Waqas Arshad Farooqi, Amina Abdul Ghafoor and Athar Shahzad Amir.

The delegation was welcomed by Dr. Muhammad Farhat Kaleem, Dean, School of Engineering, along with Dr. Zeshan Ahmad, Chairperson, Mechanical Engineering, Iqra Ramzan, Lecturer and other distinguished faculty members.



The MOU aims to strengthen industry–academia collaboration, technical knowledge sharing, professional development, and student engagement.

The Pakistan HVACR Society appreciates UMT's warm hospitality and looks forward to a productive and lasting partnership.■

STEVTA organizes Technical Training Workshop on Good Servicing Practices for RAC Sector

The three-day Training Workshop on "Good Servicing Practices for Servicing Technicians in the RAC Sector" was held on 15-17, October.

The workshop was organized by Sindh Technical Education & Vocational Training Authority (STEVTA), Sukkur, with the support of the National Ozone Unit (NOU), Ministry of Climate Change & Environmental Coordination, Government of Pakistan, and funded by the UN Environment Programme (UNEP) under the Montreal Protocol.

30 trainees participated in the workshop, comprising STEVTA pass-outs, skilled RAC Technicians from Sukkur and Khairpur districts, and faculty members of the Government Vocational Training Center, Khairpur. The training workshop was completed with the coordination & support of the Regional Directorate, STEVTA Sukkur & CCPC Team, GVTC Khairpur Team and Staff Training Institute (STI), Sukkur at Khairpur Team.





The servicing sector of refrigeration and air conditioning sector plays an important part in the depletion of the Ozone Layer. The National Ozone Unit, under the guidance of the United Nations Environment Programme (UNEP), imparts training on good practices for maintenance of air-conditioning and refrigeration appliances.

New natural refrigerants are now emerging in the local markets which are both environmentally and ozone-friendly. It is extremely important to train servicing sector technicians to be familiar with these natural refrigerants and ways of their handling.

About the Trainer:

Muhammad Muslim, RAC Master Trainer of the National Ozone unit is also a certified National TVET Management Trainer & Assessor and holds a Master's degree in Business Administration from Mohammad Ali Jinnah University and an Engineering Graduate from NED University, currently working the Head of Technical Center Al-Khair Technical Training Center.

He also takes part in a variety of consulting projects, including planning national programs, setting up institutions, developing technical training courses, and managing projects. He also has a strong background in HVACR and Mechanical Engineering. Awarded the Training Course "Strengthening TVET Instructional Management System" by CPSC, Master Assessor training on competency based on Good Servicing Practice in HC Refrigerants, Kula Lumpur, Malaysia, and the Ministry of Commerce are training exchanges for vocational technology for Pakistan and China's Ningbo Polytechnic and Member of the of Pakistan HVACR Society in Karachi Chapter.■

Diamer-Bhasha Dam: A Major Step Towards Pakistan's Water and Energy Security

Contd from page 4

charged downstream.

However, hydropower generation is directly linked to water availability. Seasonal variations in river flows, changing climatic conditions and competing irrigation requirements can influence the amount of electricity generated. Although the dam will provide greater flexibility in water management, its installed capacity of 4,500 MW should not be confused with continuous electricity production at that level throughout the year.

There are also/ substantial financial and environmental considerations. Large dams require enormous investments, long construction periods and complex engineering arrangements. Geological conditions, seismic risks, sedimentation and the relocation of affected communities are among the issues that require careful management. The environmental consequences of altering river flows and trapping sediment also need to be considered, particularly for downstream ecosystems and communities.

Looking beyond construction

The signing of the HM-1 contract represents an important step in advancing the construction of Diamer-Bhasha Dam. The installation of hydro-mechanical equipment and hydraulic steel structures will be essential for completing the infrastructure required for water regulation and power generation.

Nevertheless, the real measure of the project's success will be its ability to deliver the promised benefits after completion. Pakistan needs better coordination between water storage, irrigation management, hydropower generation and environmental protection. Investment in dams must go hand in hand with improvements in canal efficiency, agricultural practices, transmission infrastructure and the management of existing water resources.

Diamer-Bhasha has the potential to become a major asset for Pakistan's water and energy infrastructure. But its contribution to national development will ultimately depend not only on how effectively the dam is constructed but also on how wisely the stored water and generated electricity are managed.■

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Entrepreneurial Engineering Strategies for Emerging Technologies

Engr. Dr. Muhammad Nawaz Iqbal

Entrepreneurial engineering approaches to emerging technologies must be dynamic and have a blend of technical innovation, business intelligence and strategic risk management.

The introduction of technologies like artificial intelligence, quantum computing, biotechnology, robotics and cutting-edge materials is continuing to revolutionize industry, and entrepreneurs need to find strategies to convert scientific discoveries into commercial products. The process includes the following: determining the market need, determining the feasibility of the technology and designing products that provide measurable value to the market. Entrepreneurial engineers need to be more focused on creating innovations that solve real-world problems, enhance the efficiency of operations and provide a sustainable competitive advantage, rather than just focusing on technologies. Bringing the principles of engineering and entrepreneurial thinking together allows companies that wish to do more than just follow traditional approaches to create new markets in fast-evolving technological worlds.

A new approach would be to put in place an opportunity-driven innovation process where new technological opportunities are linked with unmet customer needs. Entrepreneurs can research industry inefficiencies, shifting consumer trends and new regulations to find potential areas where technology can be applied. Artificial intelligence (AI) and predictive maintenance are two areas where AI can be utilized. For instance, AI can be used to predict when equipment is likely to malfunction and alert the relevant team, which can save manufacturing companies from the costs of unexpected downtime. Likewise, the combination of sensor networks and agricultural technologies can enhance irrigation efficiency and crop monitoring. The difference lies in starting with a well-defined problem and not in developing technology without any market value. When engineering research is tied to customer demand, entrepreneurs can enhance product relevance, decrease commercialization risks and boost the chances of products being accepted in the market in the long term.



The other key approach is to use rapid prototyping and experimentation throughout the product development process. New technologies tend to have performance requirements that evolve quickly, uncertain development processes and unforeseeable costs. These problems can be overcome by entrepreneurial engineers by developing minimum viable products, conducting experimental tests and asking for feedback from potential users before moving on to large-scale production. Using digital twins, computer-aided simulations, additive manufacturing and virtual testing environments can speed up this process while also minimizing the amount of waste materials and development costs. The information gained from each development cycle can be beneficial in understanding technical performance, usability, reliability and customer expectations. Unsuccessful trials can be seen as learning opportunities, enabling technology-based enterprises to improve their designs more efficiently and quickly adapt to changing market conditions.

Another powerful strategy for commercializing emerging technologies is to work strategically with others. There are many innovations that require specialized knowledge, advanced infrastructure and a good amount of capital, which individual startups may not have the luxury of possessing. Entrepreneurial engineers can then form alliances and collaborations with universities, research labs, existing corporations, government agencies and technology incubators. These collaborations allow for the transfer of knowledge, access to specialized equipment and opportunities for joint research and development. Open innovation networks can also facilitate startups in bringing together different specialist skills to develop solutions that would otherwise be challenging to design on their own. A biotechnology company can partner with artificial intelligence experts to speed up the process of drug discovery, for example, or a clean-energy company can work with materials scientists to enhance battery performance. To ensure successful partnerships, they must be well designed, distributing risks, building technical capacity and connecting the lab to the market.

Being financially flexible and efficient in resource utilization is also crucial when creating businesses based on new technologies. Startups in industries with long research cycles, variable demand and high overheads might require a funding structure that is different from the traditional approach. An alternative approach is to adopt staged investment strategies where



investment funds are allocated in a manner that is in line with technical and commercial milestones. Initial investments can be used for feasibility analysis and prototype development, and later investments can be made for testing and certification, manufacturing and scaling up. Different stages of development can involve VC funding, research grants, strategic corporate investment, licensing agreements and other alternative financing options. Moreover, engineers can lower expenses through the use of a modular approach to product architecture, shared research facilities, cloud computing and scalable manufacturing processes. By allocating resources in this way, emerging technology businesses can maintain their ability to innovate while keeping their finances healthy.

Entrepreneurs should also make responsible innovation and sustainable engineering core tenets of their

Contd on page 11

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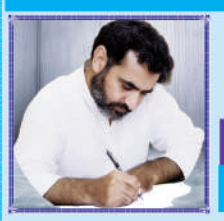
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In Allah's wisdom, in His sacred design,
Two souls are brought together, their destinies intertwined.

Of love and mercy, friendship and care,
Of mutual rights and duties to share.

A bond of faith, for this life and the next,
Where hearts find comfort, affection and rest.

For peace and tranquillity, two hearts unite,
Each other's garment, in love's sacred light.

Live with fairness, with kindness and grace,
Let mutual respect have a permanent place.

The husband bears responsibility to lead and provide,
With justice and compassion, and love by her side.

Win over your wife, not through power or pride,
But with patience and tenderness, with love as your guide.

Stand by each other, through sunshine and rain,
In faith and devotion, through pleasure and pain.

Encourage what's virtuous, let evil depart,
Let goodness and kindness govern each heart.

When mindful of Allah, His guidance will show,
A way through difficulties, wherever you go.

As Surah At-Talaq promises, with Taqwa as your guide,
Provision will come from where none is implied.

Live together in Taqwa, in word and in deed,
For Allah makes easy the life of those who believe.

He pardons our wrongs, our good deeds He will raise,
And multiplies blessings in countless ways.

Together grow stronger, through struggle and strife,
Let love be the warmth that sustains you through life.

The best among men, as the Prophet made clear,
Is he who treats his wife with kindness sincere.

And she, through devotion, with faith held above,
May enter through any gate of Paradise, by Allah's love.

When differences arise, as they sometimes may,
Let patience and wisdom help light the way.

Choose words that heal, let forgiveness prevail,
For love is the anchor when tempers may fail.

Do not let your differences tear love apart,
Let mercy and reason reconnect every heart.

And when life's journey brings trials to bear,
Turn first towards reconciliation, with patience and care.

For marriage is precious, a blessing divine,
A partnership of two, by Allah's design.

So cherish each other, in all that you do,
For Allah created us in pairs — to love, to honour, and to remain true.

Entrepreneurial Engineering Strategies for Emerging Technologies

Contd from page 10

entrepreneurial strategy. With the increasing influence of emerging technologies, entrepreneurs need to think about how their technologies will impact the environment, society and the economy, as well as consider ethical issues, from the outset. Care must be taken to ensure that privacy concerns, algorithmic bias, cybersecurity and transparency are all considered when using artificial intelligence systems. In the same way, energy efficiency, material recovery and product life should be considered in the design of advanced manufacturing processes and electronic devices. Businesses can address these challenges, build public confidence and carve out their niche in highly competitive markets by including sustainability evaluations and ethical design in their product development processes. Responsibility can be a driver for innovation and not just something done to comply with the law, opening entrepreneurs up to new possibilities in renewable energy, circular manufacturing, assistive technologies and resource-efficient infrastructure.

Another new approach is the creation of "adaptive business models" that adapt to technological advancements as they occur. New technology is continually evolving, and it is important not to develop a product, pricing or distribution strategy that cannot be adapted to future changes. For instance, an automation company may offer cutting-edge equipment as part of a subscription service that incorporates upkeep, software updates and performance monitoring, making top-of-the-range automation available to smaller companies. Likewise, an AI-powered industrial company may have the ability to provide analytics and optimization services to customers on a recurring basis, as opposed to simply offering a software licence. Such flexible models can help businesses adapt to evolving customer needs, create a steady revenue stream and foster long-term customer relationships. Technical modularity, coupled with commercial adaptability, can assist entrepreneurial ventures in being able to withstand changes in markets and technologies.

The key to successful entrepreneurial engineering is establishing an organizational culture that encourages growth, strategic thinking, multidisciplinary approaches and value generation. Entrepreneurs face the challenges of tracking technological trends, assessing new competition, building a team of qualified people and deciding on performance metrics that will not only track engineering performance but also account for business success. Technology roadmapping and scenario planning can enable companies to get a better handle on what disruptive developments might take place and to plan for different scenarios before conditions in the market start to shift dramatically. Meanwhile, it is important to encourage employees to challenge assumptions, share information between departments and try out new ideas and solutions that might be different from the norm. Entrepreneurial engineers can leverage these practices to create a holistic innovation approach that can develop new technology into a scalable, responsible and economically viable business.■







چینی کمپنی K-4 پائپ لائن کی تعمیر پر آمادہ، کام جلد شروع کیا جائے، وزیرِ اعلیٰ سندھ

ووہان میں چینی کمپنی HBSZ کا دورہ، سکھر بیراج کی بحالی اور جدید کاری کیلیے تیار کیے جانیوالے دروازوں کا معائنہ کیا

چن گفا ہی شینگ ایگریکلچر ڈیولپمنٹ کے نمائندوں سے بھی ملاقات، ہواوے و دیگر کمپنیوں کے ساتھ شراکت داری کی تجاویز

وزیراعلیٰ سندھ سید مراد علی شاہ نے چینی کمپنیوں کو سندھ کے آبی وسائل، زراعت اور بنیادی ڈھانچے کے شعبوں میں سرمایہ کاری کی دعوت دیتے ہوئے کراچی کیلیے 100 کلومیٹر طویل کے۔فور پائپ لائن کی تعمیر، سکھر بیراج کی بحالی اور موسمیاتی تبدیلیوں کا مقابلہ کرنے والی فصلوں کی اقسام تیار کرنے میں تعاون کی خواہش ظاہر کی ہے۔

ووہان کے علاقے بانیانگ میں واقع ایچ بی ایس زیڈ (HBSZ) کمپنی کے دورے کے دوران وزیراعلیٰ سندھ نے کے فور پائپ لائن منصوبے پر تبادلہ خیال کیا اور سکھر بیراج کی بحالی اور جدید کاری کے لیے تیار کیے جانے والے دروازوں کا معائنہ کیا، حکام کے مطابق ایچ بی ایس زیڈ نے 100 کلومیٹر طویل پائپ لائن کی تعمیر پر آمادگی ظاہر کی ہے جبکہ وزیراعلیٰ سندھ سید مراد علی شاہ نے ہدایت کی کہ منصوبے پر جلد از جلد کام شروع کیا جائے۔

وزیراعلیٰ سندھ کو سکھر بیراج بہتری منصوبے پر ہونے والی پیش رفت کے بارے میں بریفنگ دی گئی، یہ منصوبہ چائنا وڈ اینڈ برج کارپوریشن اور ایچ بی ایس زیڈ کے مشترکہ منصوبے کے تحت جاری ہے، حکام کے مطابق سکھر بیراج کے دریائی پانی کے بہاؤ کو کنٹرول کرنے والے 54 دروازوں میں سے 44 اور ان کے آپریٹنگ سسٹم تبدیل کر کے فعال کر دیے گئے ہیں جبکہ متعلقہ مقامات پر تعمیراتی مرمت کا کام بھی مکمل ہو چکا ہے، باقی 10 دروازے تیار کر لیے گئے ہیں اور انھیں جلد چین سے پاکستان منتقل کیا جائے گا، وزیراعلیٰ سندھ سید مراد علی شاہ نے کہا کہ سکھر بیراج میرے لیے انتہائی اہمیت رکھتا ہے یہ سندھ کی معاشی شہ رگ ہے، وزیراعلیٰ سندھ سید مراد علی شاہ نے دوہان میں قائم جدید ٹیکنالوجی کے ذریعے بیج تیار کرنے والی کمپنی چن گفا ہی شینگ ایگریکلچر ڈیولپمنٹ کمپنی لمیٹڈ کے نمائندوں سے بھی ملاقات کی اور سندھ میں زیادہ پیداوار دینے والی اور موسمیاتی تبدیلیوں کا مقابلہ کرنے والی فصلوں کی اقسام تیار کرنے، مقامی سطح پر بیجوں کی پیداوار بڑھانے اور جدید زرعی ٹیکنالوجی منتقل کرنے کیلیے تعاون کو وسعت دینے کی دعوت دی۔

چن گفا ہی شینگ ایگریکلچر ڈیولپمنٹ کمپنی کے چیئرمین وانگ شی کائی اور اعلیٰ حکام سے ملاقات کے دوران وزیراعلیٰ سندھ سید مراد علی شاہ نے مشترکہ تحقیق، ٹیکنالوجی کی منتقلی، ہاریوں کی تربیت اور سندھ کے زرعی اضافے کے لیے ڈیٹا، مصنوعی ذہانت اور ڈیجیٹل پلیٹ فارمز کے استعمال سے متعلق چین کے تجربات سے فائدہ اٹھانا چاہتا ہے، وزیراعلیٰ سندھ نے کراچی میں ایک آزمائشی منصوبہ شروع کرنے کی تجویز پیش کی جس کا محور سیلاب سے پیشگی آگاہی اور شہر کے انتظامی امور کی نگرانی ہوگا،



ابتدائی مرحلے میں اس منصوبے کا دائرہ ایک ضلع تک محدود رکھا جائے گا جس کے بعد اسے شہر کے دیگر علاقوں تک توسیع دی جا سکے گی، انھوں نے سندھ حکومت کے افسران کے لیے دوہان سٹی آپریشن سینٹر کے حالات سے مطابقت رکھنے والے جدید بیجوں کی پیداوار کے نظام کی تیاری پر تبادلہ خیال کیا، سید مراد علی شاہ نے سندھ میں مشترکہ تحقیقی مراکز قائم کرنے کی تجویز دی جہاں بیجوں کی اقسام کو بڑے پیمانے پر تیار کرنے اور ہاریوں میں تقسیم کرنے سے پہلے ان کی تیاری اور جانچ کی جا سکے، وزیراعلیٰ سندھ نے یہ تجاویز چین کے شہر ووہان میں ہواوے کے ڈیجیٹل ٹیکنالوجی کے ذریعے شہری انتظام کے عالمی ماڈل مرکز، ووہان مصنوعی ذہانت کمپیوٹنگ سینٹر اور ہیومن ویل ہیلتھ کیئر گروپ کے ہیڈ کوارٹرز کے دوروں کے دوران پیش کیں، ہیومن ویل ہیلتھ کیئر گروپ کو ریینفو فارماسیوٹیکل گروپ کے نام سے بھی جانا جاتا ہے،

چین کے سرکاری دورے پر اعلیٰ سطح کے وفد کی قیادت کرتے ہوئے وزیراعلیٰ سید مراد علی شاہ نے کہا کہ سندھ حکومت عوامی خدمات کو بہتر بنانے، بڑھتے ہوئے شہروں کا انتظام سنبھالنے اور صنعتی صلاحیت میں مطالعاتی دوروں اور ہواوے، سندھ کی جامعات و تکنیکی اداروں کے درمیان زیادہ تعاون کی بھی تجویز پیش کی، انھوں نے کراچی ایجوکیشن سٹی کو اعلیٰ تعلیم، تحقیق، جدت اور جدید ٹیکنالوجیز کے مرکز کے طور پر ترقی دینے کے سندھ حکومت کے منصوبوں کو بھی اجاگر کیا۔

وزیراعلیٰ سندھ سید مراد علی شاہ نے ہیومن ویل ہیلتھ کیئر گروپ کو پاکستان اور علاقائی منڈیوں کی ضروریات پوری کرنے کے لیے سندھ میں ادویات کی تیاری کے کارخانے قائم کرنے کی دعوت دی، ووہان کے ایسٹ لیک ہائی ٹیک ڈیولپمنٹ زون میں کمپنی کے ہیڈ کوارٹرز کے دورے کے موقع پر سید مراد علی شاہ کو کمپنی کے کاروباری آپریشنز، تحقیقی صلاحیت، عالمی توسیعی حکمت عملی اور ادویہ سازی کے شعبے میں اس کے کردار پر بریفنگ دی گئی، وزیراعلیٰ سندھ نے ہیومن ویل کو چین کے معروف دوا ساز گروپس میں سے ایک قرار دیتے ہوئے خصوصاً بے ہوشی کی ادویات، درد کے علاج اور انتہائی نگہداشت کے شعبوں میں اس کی مہارت کو سراہا، سید مراد علی شاہ نے چینی کمپنی کی قیادت کو آگاہ کیا کہ دھانیچی، بن قاسم اور خیر پور میں قائم اسپیشل اکنامک زونز ٹیکس میں چھوٹ اور کسٹم ڈیوٹی میں رعایت سمیت مالی مراعات فراہم کرتے ہیں۔■



کوہاٹ میں ملکی تاریخ کی سب سے بڑی تیل و گیس کی دریافت

یومیہ 15,005 بیرل تیل اور 45.36 ملین مکعب کیوبک فٹ گیس حاصل ہو رہی، تیل، گیس کی سب سے بڑی دریافت تاریخی لمحہ ہے، وفاقی وزیر توانائی علی پرویز

آئل اینڈ گیس ڈویلپمنٹ کمپنی لمیٹڈ نے صوبہ خیبر پختونخوا کے ضلع کوہاٹ میں براگزئی ایکس 1 - کنواں سے ملکی تاریخ کی سب سے بڑی تیل و گیس کی دریافت کا اعلان کیا ہے، جو پاکستان کی مجموعی خام تیل کی کل پیداوار کا تقریباً 10 فیصد ہے۔

اس کنویں کے پانچ مختلف زونز سے ہائیڈرو کاربن کے ذخائر حاصل ہوئے ہیں، براگزئی ایکس 1 - کنواں سے یومیہ 15,005 بیرل تیل اور 45.36 ملین مکعب اسٹینڈرڈ کیوبک فٹ گیس حاصل ہو رہی ہے، او جی ڈی سی کے ماہرین نے ریکارڈ



وقت میں 8 کلومیٹر لمبی پائپ لائن مکمل کر کے براگزئی کو میلہ اور ن شپا فیلڈز سے منسلک کر دیا ہے، اس منصوبے سے یومیہ 156 ملین روپے، ماہانہ 4.7 ارب اور سالانہ 57 ارب روپے کی آمدن متوقع ہے، جس سے تقریباً 329 ملین ڈالر کی زرمبادلہ کی بچت بھی ممکن ہوگی۔

ترجمان او جی ڈی سی کا مزید کہنا ہے کہ مذکورہ کنویں سے 2028 تک تیل کی پیداوار 25 ہزار بیرل، گیس کی 60 ملین مکعب اسٹینڈرڈ کیوبک فٹ اور ایل پی جی 200 میٹرک ٹن یومیہ تک بڑھانے کا ہدف مقرر کیا گیا ہے، وفاقی وزیر توانائی (پیٹرولیم ڈویژن) علی پرویز ملک نے اس دریافت کو قومی توانائی سیکورٹی کیلئے تاریخی قرار دیا۔■



New AI-powered mosquito trap could help curb dengue outbreaks

As Florida continues to face one of its worst dengue outbreaks in nearly a century, a mosquito trap created by USF startup Digitomy is helping curb the spread of the virus and other mosquito-borne diseases.

The smart trap contains patented AI technology and has achieved more than 98% accuracy in identifying mosquito species during laboratory testing.

Research behind Digitomy has been underway at USF since 2018. The technology, created by Associate Professor Ryan Carney and Professor Sriram Chellappan, uses artificial intelligence to identify mosquito species, gender and whether they have fed on blood. Paired with cloud computing and a mapping dashboard, the system aims to help public health officials track disease-carrying mosquitoes for more timely, targeted control.

"The mosquito is the deadliest animal on the planet. While there are 3,500 mosquito species, it's primarily only one, Aedes aegypti, that is spreading dengue in Florida. We can use the data from our smart traps to construct a habitat model, as well as to monitor the species' presence and abundance in real time, to strategically mitigate its spread," said Carney.

Creating an effective trap

Digitomy's trap works when hung on a low tree branch or placed on the ground. Either a light or bait at the top can be used to attract mosquitoes, while a fan draws them inside. Once captured on a sticky pad, two built-in cameras photograph the insects, allowing the AI technology to identify their species using a vast database of mosquito images.

"Traditional mosquito surveillance requires a long manual approach by specialists, which can take two to three days under a microscope," Chellappan said. "The AI in our trap speeds up the process and can lead to more targeted disease interventions, while still being human-led."

While smartphones can be used to help identify a mosquito by its physical characteristics, laboratory testing calculations suggest the Digitomy trap is highly efficient, requiring less energy to identify an entire sticky pad of mosquitoes than sharing a single Instagram post.

Testing at USF and the research team's partnership with St. Johns County's Anastasia Mosquito Control District, which includes St. Augustine, has helped advance the technology.

"Collaborating with Digitomy and USF will benefit our programs by helping us explore and adopt new artificial intelligence technology. We will then be able to greatly monitor vector mosquito populations and promote future public participation in mosquito surveillance," said Rui-De Xue, Anastasia Mosquito Control District executive director.

Surveillance and public education

Beyond identifying mosquitoes, Digitomy could help public health officials pinpoint where disease-carrying species are concentrated and direct control efforts more effectively. The technology could also complement Carney's earlier DYCAST early warning system for dengue and West Nile virus outbreaks.

The team has also integrated trap data into a private layer of its Global Mosquito Observations Dashboard, combining trap information with more than half a million citizen science reports. The system could eventually help mosquito control districts monitor populations across different locations and respond more quickly during outbreaks.

Digitomy is also developing a cloud-based education platform for mosquito control professionals and the public. Users can examine mosquito images, identify species and receive AI-generated feedback to improve their identification skills without attending in-person training sessions.

"Education is our secondary line of defense," Carney said. "While our smart traps provide the macro-level data, the public should practice the three D's: Drain standing water, Dress to cover skin and wear DEET. Pairing automated AI data with mosquito control and engaged communities can help us conquer these outbreaks."

The researchers hope to work with mosquito control districts, including Anastasia and Hillsborough, to incorporate the platform into professional training and public education programs.

Scaling smart tech to global markets

As Digitomy moves closer to consumer sales, the researchers are preparing for field validation with Hillsborough County while working to bring the technology to market.

Carney and Chellappan are now working with the USF Technology Transfer office to license Digitomy to established mosquito trap manufacturers who can combine their existing equipment with USF's AI identification system.

"Mosquito-control programs wait days to learn what is in their traps," said Diana Shapiro, chief operations officer of Digitomy and operator for several USF ventures in USF Technology Transfer's Launch Program. "Our technology is built to tell them the same day, and to reach the places with the least to spend and the most at stake." - TX



The unexpected key to extending EV battery life found in 'oxygen release'

What if a battery could become more powerful as it ages? Much like wine developing a deeper flavor over time, researchers in Korea have uncovered the mechanism behind a battery material that can deliver greater usable capacity after repeated charging and discharging.

A research team led by professor Jihyun Hong (Department of Battery Engineering at POSTECH) with Dr. Gukhyeon Lim and a team led by professor Kyu-Young Park (Department of Battery Engineering & Materials Science and Engineering at POSTECH) with doctoral student Hojun Lee have identified the origins of performance degradation in manganese-based cathode materials, which are considered promising candidates for next-generation electric vehicle batteries.

The team proposed a new strategy for turning what has traditionally been regarded as a weakness of the material into a potential performance advantage.

The study was published in Energy & Environmental Science.

Lower costs, persistent degradation

The electric vehicle industry is actively searching for cost-effective next-generation battery materials capable of competing with inexpensive lithium iron phosphate (LFP) batteries manufactured in China. One of the most promising candidates is the lithium- and manganese-rich layered oxide (LMRO) cathode.

LMROs require less expensive nickel and cobalt while storing approximately 20% more energy than conventional nickel-based cathode materials, making them attractive for batteries that could be both less expensive and capable of longer driving ranges.

However, LMROs have a critical drawback. Their capacity gradually decreases with repeated charging and discharging, while their operating voltage also declines. Previous studies attempting to identify the cause have reported different final structures inside the cathode, leaving the fundamental mechanism governing these structural changes unresolved.

Oxygen loss drives structural disorder

The POSTECH team examined how the internal structure of the cathode evolved over hundreds of charge-discharge cycles. Initially, lithium and transition-metal atoms are neatly arranged in separate layers, resembling bricks stacked in an orderly wall. As charging continues, however, some of the oxygen atoms that stabilize this framework gradually escape from the material. This is similar to a well-organized drawer whose contents gradually become jumbled over time.

As these oxygen atoms are removed, lithium and transition-metal atoms begin to migrate across their original layers and mix with one another. Eventually, the highly ordered layered structure transforms into a disordered rocksalt structure, in which the cations no longer follow their original long-range ordering.

The researchers discovered that the amount of oxygen lost from the material acts as a key trigger determining how extensively the internal structure becomes disordered. They further demonstrated that oxygen loss can be controlled by how deeply the battery is charged—in other words, by how high the charging voltage is raised. Deeper charging led to greater oxygen loss, while the resulting oxygen vacancies progressively accumulated and drove structural rearrangement within the cathode.

Turning disorder into usable capacity

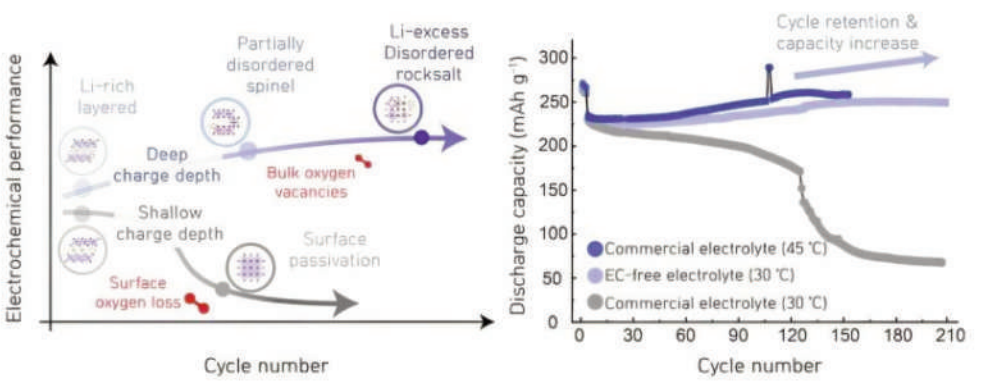
The most surprising finding came afterward. Oxygen loss would normally be regarded as a clear sign of battery degradation. However, as the cathode became disordered and transformed into a new structure, additional pathways through which lithium ions could move were created. As a result, usable capacity increased.

By carefully controlling the degree of oxygen loss and the resulting structural evolution, the researchers demonstrated that the cathode retained 98.4% of its initial performance even after more than 200 charge-discharge cycles, showing long-term durability.

Structural disorder in battery materials has traditionally been regarded as an undesirable aging phenomenon that should be avoided. This study, however, demonstrates that when such structural evolution is precisely controlled, it can instead become a design tool for improving battery performance.

Hong said, "From an industrial perspective, our study shows that battery degradation can be delayed and battery lifetime extended simply by controlling parameters such as operating temperature and the surface environment." He added, "By regulating oxygen loss and thereby either promoting or suppressing structural disorder, it may become possible to design next-generation electric vehicle batteries optimized for different applications."

Park, a co-corresponding author of the study, said, "By integrating precise materials characterization with computational materials science, we were able to address a problem that had remained unresolved for nearly two decades. The collaborative research environment within POSTECH's Department of Battery Engineering, which encourages interaction and cooperation among researchers through the Specialized Graduate School Program, played a decisive role in making this work possible." - TX



Improving Battery Energy Density and Cycle Life by Controlling Oxygen-Vacancy Concentration

Semiconductors could sidestep a key solar-energy trade-off through a newly identified mechanism

A study led by the University of Oxford has identified a novel semiconductor that overcomes a key limitation of light-harvesting materials. The results, published today (Oct. 28) in Nature, could enable more efficient solar panels with higher outputs.

The trade-off limiting solar cells

Solar energy currently faces a critical limitation: Materials that absorb light more strongly also tend to be less efficient at turning captured light into electricity.

Solar cells rely on materials called semiconductors, which absorb sunlight and use its energy to free tiny negatively charged particles called electrons, leaving behind positively charged gaps known as holes. To produce electricity, these charges must be collected before an electron and a hole meet and cancel each other out, wasting the energy they carry.

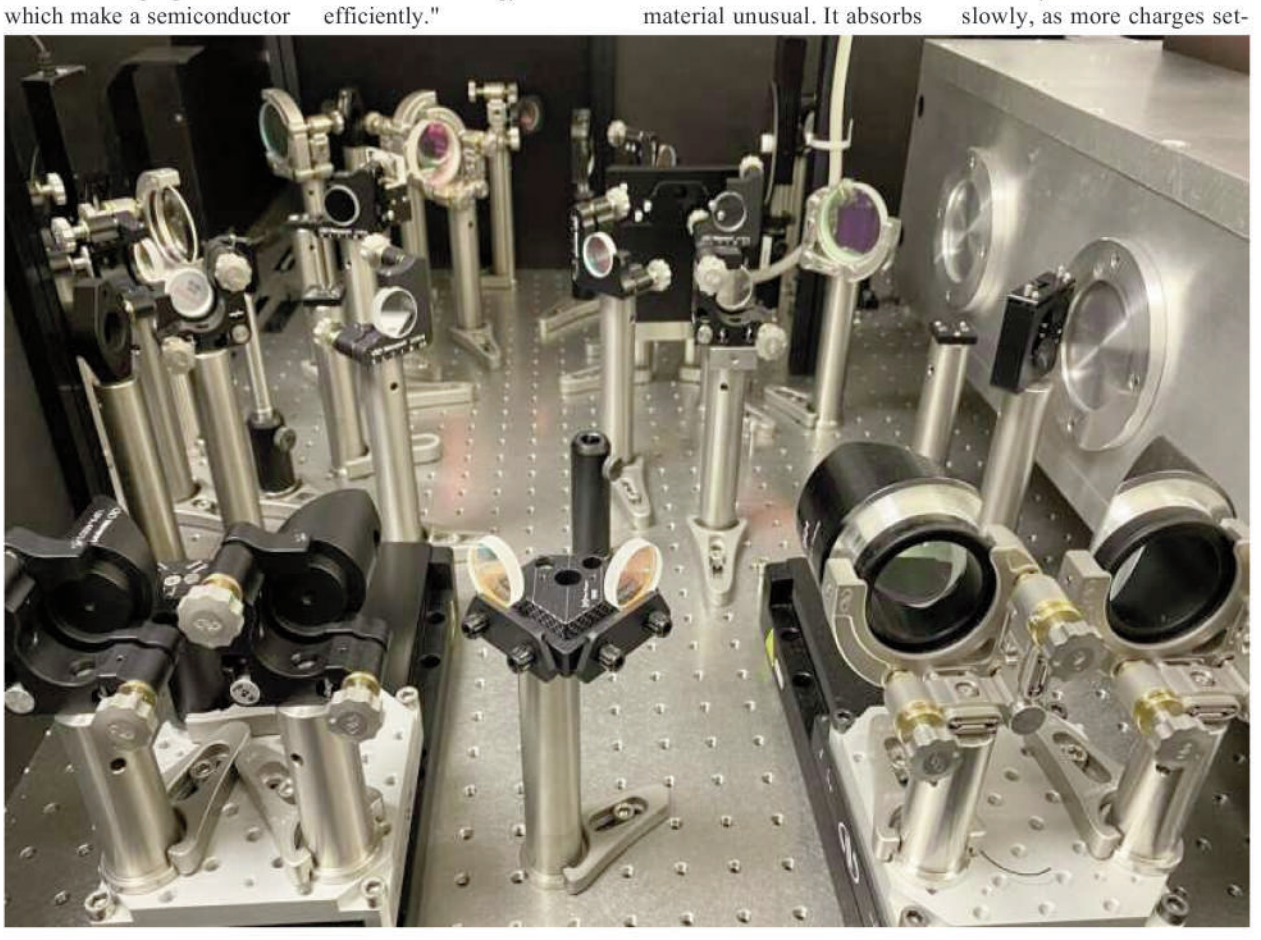
This creates a fundamental challenge. Semiconductors that absorb light more strongly also tend to lose their charges more quickly. This trade-off limits how efficiently solar cells can turn sunlight into electricity.

Bismuth sulfide breaks the pattern

In the new study, the researchers discovered that bismuth sulfide appears to sidestep this trade-off. This is because it has an unusual arrangement of energy levels that allows it to absorb light strongly while losing its electrical charges more slowly, pointing to a new way to design more efficient solar cells.

"One of the longstanding challenges in developing efficient solar-energy materials is that the properties which make a semiconductor very good at absorbing sunlight also tend to make the resulting electrical charges disappear quickly," said corresponding author professor Laura Herz (Department of Physics, University of Oxford).

"Our work shows that this trade-off is not inevitable. By uncovering how an unusual electronic structure can combine strong light absorption with much slower recombination, we have identified a new principle for designing semiconductors that could help us harvest solar energy more efficiently."



A reservoir that slows charge loss

The team excited thin films of bismuth sulfide with extremely short laser pulses and then measured how quickly the resulting charges disappeared, using a technique called ultrafast terahertz spectroscopy. They carried out the measurements at temperatures ranging from room temperature to just above absolute zero.

Electronic structure calculations by professor Marina Filip's group in the Department of Physics revealed what makes the material unusual. It absorbs light mainly through one strong route between energy levels, but just below this in energy lies a second, much weaker route, through which charges are lost only slowly. The two are so close in energy that charges spend much of their time in these lower-energy states, which act as a temporary "reservoir" and slow their loss.

The experiments confirmed this picture. In most semiconductors, charges are lost faster as the material is cooled, but in bismuth sulfide they were lost more slowly, as more charges settled into the reservoir. This matched the team's model of what physicists call a pseudo-direct semiconductor.

The team estimates that, at room temperature, this arrangement cuts the rate at which charges are lost by about 75% compared with conventional materials that absorb light as strongly.

"What makes this discovery particularly exciting is that we are not simply improving an existing semiconductor property but identifying a different way in which semiconductors can behave," said Herz. "Understanding this mechanism gives us a roadmap for discovering and potentially engineering other materials with similarly advantageous properties."

From longer-lived charges to solar technologies

For solar energy, this could matter in two ways. Charges that last longer have a greater chance of being collected, which could reduce one of the fundamental energy losses in solar cells without sacrificing strong light absorption. Longer-lived charges could also allow more time for the chemical reactions needed to turn sunlight into fuels.

The team's calculations suggest that other materials with the same property could be found by screening materials databases or could be engineered. The researchers stress that the study demonstrates a physical mechanism rather than a finished solar cell. Further work is now needed to translate these findings into improved solar cell technologies.

The research was an international collaboration between the University of Oxford and Wuhan University in China. - TX