Regd No. MC 104

FORTNIGHTLY
ENGINEERING REVIEW
The voice of engineers

Founded by Najam ul Hassan (Marhoom)

Vol.48 No.18 September 16-30, 2023
info@engineeringreview.com.pk
Ph:+92-21-32215961-2

www.engineeringreview.com.pk
www.youtube.com/engineeringreviewER

Can Pakistan extract fullest gains of Thar Coal?

Manzoor Shaikh

Burning Pakistan's locally extracted coal—Thar Coal—for power generation seems to be a possibility not so closer as the imported-coal-fired power plants across Pakistan do not burn even a small fraction of local coal for power generation although they had agreed to mix Thar coal with the imported one up to 10 to 15 percent.

During the PTI government, power sector sources told Engineering Review that the federal government and the power plants had agreed to start mixing Thar Coal with the imported coal for power generation so that they are converted to local coal in a phased manner. The objective, of course, was to save foreign exchange so that the tariff of the electricity should be brought down, an official says. 'Only Jamshoro

Contd on page 2

"A hero is an ordinary individual who finds strength to persevere and endure, in spite of overwhelming obstacles."

- Christopher Reeve

Can Pakistan extract fullest gains of Thar Coal?

Contd from page 1

Power Plant was found to mix Thar coal with the imported one'.

The recent media reports say an investment company—AsiaPak—has agreed to invest in converting the Jamshoro Power Plant from imported to locally extracted Thar coal. The objective is the same as was set by the former government for all imported-coal-fired power plants across Pakistan.

AsiaPak Investments is a private investment firm with operational assets in Pakistan and Hong Kong.

Shehryar Chishti, CEO of AsiaPak Investments was quoted in a report as saying that "the federal government, encouraged by K-Electric and AsiaPak Investments, is now focused on converting this plant to Thar coal so that for the next 30-year life of this project consumes only Thar coal and not imported coal."

Jamshoro Power Plant, financed by the Asian Development Bank (ADB) is almost complete with a total cost of US$545 million but the report says it remains non-operational due to the increasing cost of imported coal. However, the officials privy to the issues of the Jamshoro Power plant say the costs of Thar coal and the imported one have leveled up due to a decrease in the cost of imported coal in the international market. Also, they say the imported coal is available in Pakistan at a spot rate in Pakistani currency. Thus, converting the plant to Thar Coal for which engineering costs are involved that in return will increase the power tariff is not a wise decision at the moment, they suggest.

Concurrently, Shehryar Chishti reportedly said the company would invest in the conversion of the plant, enabling power generation through local coal sourced from Thar at low cost. "We have submitted our plan to the government and soon after approval we will execute our investment plan," he said. The plant would be ready by next year for power generation through local coal.

Information from Jamshoro says a Chinese company has moved a conversion plan which according to AsiaPak Investments cost around $50 million.

Importantly, the plan is in a thought process in Islamabad and no decision has been made so far as various aspects of the conversion are being looked into, says an informed engineer.

He says no matter K-Electric is interested in evacuating power from the power plant which the company believes produces cheaper electricity but the conversion is not so easy at this stage.

He said the transformation of the plant from imported coal to Thar Coal would take not less than one

Contd on page 4

Engineering Bazar

FORTNIGHTLY
ENGINEERING REVIEW
The voice of engineers

Energy trade mechanisms, grid must for regional energy security

Energy experts in a moot in Pakistan said that regional energy security can be achieved by building regional energy trade mechanisms and grid by increasing the share of renewable energy to provide it on affordable rates to the consumers.

Addressing an event titled "Energy Security in South Asia and Transition of Sustainable Sources" organized by Sustainable Development Policy Institute (SDPI) and Friedrich Naumann Foundation for Freedom Pakistan (FNF), Director Pakistan Office FNF, Birgit Lamm remarked that 60 percent of South Asia's energy demand was imported, increasing vulnerability to external shocks like Russian-Ukrainian War and dollar exchange rate fluctuations.

She said that energy was a lifeline for South Asian economies and the issue of high energy bills was a shared regional concern and not limited to Pakistan, adding that structural challenges in the regional energy landscape and combined with demographic shifts hampered sustainable economic growth.

Senior Advisor and Research Fellow SDPI, Dr Hassan Daud Butt said that regional energy challenges were common and collaborative, integrated approach for sustainable, equitable renewable energy transition was the way forward amid rising costs and socio-economic disparities which calls for amplifying efforts for regionally acceptable solutions.

He stressed for bolstering regional co-operation beyond political conflicts, making responsive energy policies to tackle evolving economic challenges and global trends as means to uplift marginalized and vulnerable communities and ensuring inclusive access to clean energy in South Asia.

Head of Energy Unit, SDPI, Ubaid-ur-Rehman said that reliance on imported energy sources had created vulnerability to energy supplies and price fluctuations for South Asian countries, as apparent from the impacts of the ongoing regional turmoil.

Research Fellow (Renewable Energy), Ahsan Javed highlighted the untapped regional energy trade potential which must be leveraged to boost energy security through regional grid. Regional trade of surplus electricity can also increase revenue generation for economic growth, he stressed.

Lead Researcher, Energy Unit, SDPI Dr. Khalid Waleed discussed the energy profiles of South Asian countries and charted the way forward for energy cooperation by overcoming political-economic barriers, removing tariffs, promoting energy networks, exploring joint financing avenues, joint platform for energy planners and sharing energy and water statistics. – APP/ERMD

Pakistan Cable Lunches the Highestest voltage (69kv) CCV line for MV cables in Pakistan

Pakistan Cables launched the nation's first highest voltage (69KV) CCV line for Medium Voltage (MV) cables through world class German technology. As the pioneer in the wires and cables industry in Pakistan, the company has a legacy of breaking barriers. In addition, Pakistan Cables has also set up a High Voltage Testing (HVT) facility at Nooriabad, which enables testing of cables at higher voltage grades.

"This is a significant milestone for the Company during its 70th year anniversary. It reflects 70 years of uncompromised dedication and setting Industry benchmarks. I am thrilled at the outcome and proud of our team, who drove the project with a lot of hard work.", said Fahd K. Chinoy, Chief Executive Officer Pakistan Cables Ltd.

About Pakistan Cables Ltd

About Pakistan Cables Ltd. Founded in 1953, Pakistan Cables is the premiere and most reputable cable manufacturer in Pakistan. Being the only wire and cable manufacturer listed on the PSX since 1955, it is also a member company of the Amir S. Chinoy group. The company has the largest geographical footprint in Pakistan with presence in over 200 cities. It is ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007 certified and various cables type tested by KEMA, Netherlands.■

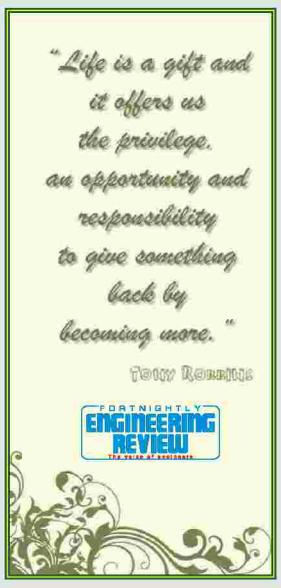
Bijli Ghar

Can Pakistan extract fullest

Contd from page 2

and a half years and it would increase the cost of the project as well as the interest rate which according to the calculation will stand not less than US$ 90 million.

However, Chisti reportedly said the process of conversion would take at least 10 months and electricity generated through local coal would be fed into the national grid. He hoped that power generation through local sources would reduce the country's energy import bill. – With inputs from media reports ■



IEP's 11th OHSE proves to a success by all accounts

Building Code be adopted at all levels to control emergencies

The 11th Occupational Health, Safety & Environment (OHSE) organized by the Institution of Engineers (IEP), Karachi Chapter proved to be a success by all counts—the level of interest and participation and also the overall quality of the papers presented and talks given in the conference.

The moot was graced by Engr. Najeeb Haroon, Chairman of Pakistan Engineering Council (PEC) as the chief guest, and Willian P. Bahnfleth, Professor of Architectural Engineering

from Pennsylvania State University as the keynote speaker.

The conference had three technical sessions followed by a panel discussion.

The conference framed the following recommendations.

1. The Building Code of Pakistan be adopted at all levels to control any fire or other such emergency situations
2. Training on OHSE be included in the curriculums at least at the secondary school level.
3. National Health, Safety & Environment Policy be formulated
4. Occupation Health, Safety, and Environment Standards, code of practices, and guidelines be formulated in accordance with local OHS Laws.
5. Both Print and Electronic Media be requested to allocate a compulsory timeslot for OSH to bring awareness among the general public, and concerned stakeholders
6. Advisory Council having representation from all stakeholders be established at the federal, provincial & local levels, and NGOs, like IEP be made part of such forums
7. OSH authorities at the federal as well as provincial levels be established.
8. Environmental social management system be adopted
9. IEP should establish a separate desk for the promotion of OHSE. Other than seminars, workshops, and conferences, social visits may also be arranged
10. Pakistan Engineering Council may establish a comprehensive data bank regarding OHSE and record accidents also
11. Pakistan Medical and Dental Council or College of Physicians and Surgeons of Pakistan be asked to start specialized courses on Occupational Diseases that are very common in the Pakistani Work Environment
12. Emphasis should be placed on workers' training besides management representatives.■

TEP warns against withdrawal of electric units for power sector engineers

Engr. Jawed Salim Qureshi holds TEP Core Committee moot, Engr Amir Zamir to monitor govt move

The Engineers Pakistan, led by the former chairman, Pakistan Engineering Council (PEC) Engr. Jawed Salim Qureshi has warned against any move to withdraw limited electric units allowed to the power sector engineers in Pakistan.

TEP which held its Core Committee meeting this month said a limited supply of electricity units is a part of the salary package attached to the appointment of engineers.

The meeting which was held in Lahore had on its agenda the current issues faced by power sector engineers.

Core Committee affirmed the full support and unity of engineers working with WAPDA, NTDC, and DISCOs, public sector organizations, semi-government organizations, autonomous bodies, private sector industry, and academia.

They emphasized that the limited supply of electricity units is a part of the salary package of engineers. It's not a facility or allowance which can be withdrawn at any time.

The attempt to withdraw these electricity units will be a breach of the appointment letter which will be resisted by engineers across Pakistan.

They urged the government to withdraw the following taxes from the electricity bills of consumers which will give them relief by 28 percent and ask respective departments to collect it from the consumers directly if it is required. They include I-Tax, TV Fee, GS-Tax and FC-SUR.

Also, the meeting demanded the engineers be given 1.5 times technical allowance of their basic salary so that they meet the hardships and inflation.

The government should ask all Deputy Commissioners and SSPs to take strict action against the theft of electricity. It can further reduce the electricity bill of consumers by 10 percent, increasing total relief by 38 percent to consumers.

The moot warned that the government should avoid taking any such decision that is illegal and against the service rules of Pakistan, failing to which, engineers hold the right to go for complete shutdown on all engineering sectors.

A committee has been formed to work out a strategy to protect the interests of WAPDA, DISCO & NTDC engineers.

Engr Amir Zamir was appointed as Convener of the committee by Chairman TEP to look after all the issues of power engineers. -- Engr Malik Saleem Ullah Saeed, SG, TEP■

NESPAK
Ranked on US-Based ENR Magazine Top Global Firms list

NESPAK, under the leadership of Acting Managing Director Zargham Eshaq Khan, has been ranked for the fifth consecutive year on ENR (Engineering News-Record) Magazine Top International/Global Construction Management/Program Management Firms list, published as part of the ENR Top International/Global Contractors feature in the August 2023 issue of ENR, a US-based ranking magazine.

The ranking has been published in the latest issue of the magazine and NESPAK has been ranked 19 this year among the top 20 Non-US firms in total global construction management and program management.

NESPAK was envisioned by its founders as an organisation free from foreign dependence and capable of delivering the highest quality in the field of engineering consultancy. It was envisaged as an institution which had to lead the consultancy market of Pakistan and compete abroad with excellence. Time has proved that NESPAK has succeeded in fulfilling its objectives to a large extent owing to the unprecedented struggle offered by its professional brigade who left no stone unturned to achieve their stated aims. At present, NESPAK is not only playing a lead role in the consultancy services for the construction of two mega hydropower projects i.e., Mohmand Dam and Diamer Basha Dam Projects. Till to date, NESPAK has provided consultancy services in 39 countries and has proved itself as an international player in the engineering consultancy world. – PR


ENR THE TOP 250

16	SABBOUR CONSULTING, Cairo, Egypt	105.3	0.0	105.3
17	KEO INTERNATIONAL CONSULTANTS, Kuwait City, Kuwait	73.3	30.7	104.0
18	HEERIM ARCHITECTS & PLANNERS CO. LTD., Seoul, South Korea	94.1	0.0	94.1
19	NATIONAL ENG'G SERVICES PAKISTAN (NESPAK), Lahore, Pakistan	51.1	41.6	92.7
20	SKANSKA AB, Stockholm, Sweden	0.0	89.2	89.2

11	STANTEC INC., Edmonton, Alberta, Canada	101.4	83.0	184.4
12	POSCO ENGINEERING & CONSTRUCTION, Incheon, South Korea	126.4	0.0	126.4
13	INGENIERIA Y ECON. DEL TRANSPORTE SA (INECO), Madrid, Spain	123.2	0.0	123.2
14	PM GROUP, Dublin, Ireland	123.1	0.0	123.1
15	AURECON, Melbourne, Australia	47.6	67.7	115.3
16	SABBOUR CONSULTING, Cairo, Egypt	105.3	0.0	105.3
17	KEO INTERNATIONAL CONSULTANTS, Kuwait City, Kuwait	73.3	30.7	104.0
18	HEERIM ARCHITECTS & PLANNERS CO. LTD., Seoul, South Korea	94.1	0.0	94.1
19	NATIONAL ENG'G SERVICES PAKISTAN (NESPAK), Lahore, Pakistan	51.1	41.6	92.7
20	SKANSKA AB, Stockholm, Sweden	0.0	89.2	89.2

* BASED ON FEES FOR MANAGEMENT SERVICES PROVIDED ON A FEE-ONLY BASIS FOR ALL PROJECTS, DOMESTIC AND INTERNATIONAL

Ukraine-related upheavals have only compounded growing inflation and supply chain challenges that began with the COVID-19 pandemic, says Sacyr's López. "Some administrations and clients have not acknowledged this increase in costs or have taken too long to do it, which has taken a toll in sector activity and is an issue that must be addressed," he says.

The rising cost of raw materials continue to be an issue affecting international and domestic markets for global contracting firms, says COMSA Corp's Guillermo Lorenzo, CEO of infrastructure, engineering and services.

MoU between Top Universities

A tri-party Memorandum of Understanding (MoU) was signed between Ghulam Ishaq Khan Institute of Engineering Sciences and Technology (GIKI), National University of Technology (NUTECH), and NED University of Engineering & Technology. The signing ceremony took place on Friday, August 25, 2023, and was graced by Prof. Dr. Fazal A. Khalid, SI, Rector of GIK Institute; Lieutenant General (R) Moazzam Ejaz, Rector of NUTECH; and Prof. Dr. Sarosh Hashmat Lodhi, Vice-Chancellor of NED University, who inked the MoU.

The collaboration aims to jointly advance academic, research, and development activities in line with local and global educational and research challenges. Further bolstered by the sponsorship of HEC and PEC, this alliance will focus on strengthening inter-provincial harmony, academic collaboration, and student and faculty exchanges. The three heads of the institutions recognized the value of student & faculty exchange and mutual development to benefit national interests.

Both parties have agreed to exchange scientific, academic, and technical information, identify opportunities for student and faculty exchanges, and cooperate in joint research and development in disciplines of mutual interest. Moreover, the agreement covers collaboration to conduct joint training, research centers, laboratory use, and collaborative initiatives in delivering courses and academic programs. The institutions will also collaborate to organize conferences, seminars, symposiums, and workshops. The MoU may be reviewed, amended, modified, or extended anytime by mutual written consent of the three parties.■

Efficiency and Uses of Thermoelectric Generator

Engr. Dr. Muhammad Nawaz Iqbal

Like automotive thermoelectric generators (ATGs), thermoelectric generators can be utilized in vehicles to improve fuel efficiency as well as in power plants to transform waste heat into additional electrical power. To create the necessary temperature differential to power space probes, radioisotope thermoelectric generators use radioisotopes.

Around 5 to 8% of thermoelectric generators are typically efficient. Older devices were large and used bimetallic connections. Depending on the temperature of the application, more contemporary devices use highly doped semiconductors produced from bismuth telluride (Bi_2Te_3), lead telluride (PbTe), calcium manganese oxide ($Ca_2Mn_3O_8$), or mixtures of these materials. There are no moving elements in these solid-state devices, unlike dynamos, with the odd exception of a fan or pump to enhance heat transfer. It is possible for TEGs to compete with some heat engine efficiencies if the hot area is at 1273K and the ZT values of 3–4 are used.

Thermoelectric materials turn temperature differences into electric voltage to provide electricity directly from heat. To be effective thermoelectric materials, these substances must have both high electrical conductivity and low thermal conductivity. A large voltage can be produced while there is a temperature gradient thanks to limited thermal conductivity, which makes sure that when one side gets hot, the other side stays cool. Due to their all-solid-state construction and lack of orientation dependence, thermoelectric generators can be used in deep-sea or zero-gravity applications because they don't need any fluids for cooling or fuel. Operating in harsh settings is possible thanks to the solid-state design. The absence of moving components in thermoelectric generators makes them more dependable and reduces the need for ongoing maintenance.

Many thermopiles, each built of numerous thermocouples constructed of a linked n-type and p-type material, are used to create thermoelectric generators. The thermocouples are normally arranged in one of three primary configurations: planar, vertical, or mixed. Thermocouples are laid out horizontally on a substrate between the heat source and the cold side in a planar design, allowing for the creation of longer and thinner thermocouples, increasing thermal resistance and temperature gradient, and ultimately increasing voltage output.

A thermoelectric system produces power by absorbing heat from a source, such as a hot exhaust flue, using thermoelectric modules. The system requires a significant temperature differential to function, which is challenging in practical implementation. Air or water must be used to cool the cold side. For this heating and cooling, heat exchangers are employed on both sides of the modules. There are several uses for thermoelectric generators. Thermoelectric generators are frequently employed for low power remote applications or in places where Stirling

engines, which are bulkier but more effective heat engines, are impractical. The solid state electrical components that are commonly employed to perform thermal to electric energy conversion do not have moving parts, in contrast to heat engines. Components that don't need any maintenance, have a high level of intrinsic reliability, and can be used to build generators with extended service lives can be used to convert thermal energy into electric energy.

In addition to raising the figure of merit, there is a growing emphasis on creating novel materials with higher electrical power production, lower costs, and greater environmental friendliness. For instance, the cost per watt is solely controlled by the power per unit area and the operating period when the fuel cost is low or virtually free, like in waste heat recovery. As a result, rather than focusing on conversion efficiency, it has started to look for materials with high power output.■

إنا للہ وانا الیہ راجعون

انجینئر ثاقب منور

کی سات سالہ بیٹی

مریم ثاقب

اندھی گولی کی زد میں آ کر شہید ہوگئی

اللہ تعالیٰ والدین اور دیگر لواحقین کو صبر جمیل عطا فرمائے۔ آمین

ہم اس معصوم بچی کی وفات پر انکے خاندان کے غم میں برابر کے شریک ہیں۔

FORTNIGHTLY ENGINEERING REVIEW
The voice of engineers

BISMILLAH HIR REHMAN NIR RAHEEM

THE STORY OF THE PEOPLE OF CAVE (ASHAAB E KAHF)

By Muhammad Tariq Haq

To save their faith
The young believers took shelter in a cave

Five, six, seven or eight
How many were they, even to-date we speculate

To the God they prayed
"be merciful and compassionate

and in every matter
show us the path which is straight"

There was a dog too,
one of their associates

For three hundred and nine years, they remained in the cave
While at it's gate, the dog stayed, always awake

God saved them from the sun rays as they laid in the open space
Turning them both ways, so that their bodies are not decayed

When they woke up after three centuries and almost a decade
"we slept only a little", they declared

The only food they ate
had to be clean and legitimate

They sent one of their associates to the marketplace
he was told to talk gently and in vain debate not to engage

The money they had, was out of date
Not able to fetch anything or purchase

They were honoured and highly praised
people remembered them long after they met their ultimate fate

Those who believed they will not again be raised
"life after death", they could no longer negate

Another lesson which has been conveyed
it is our strong faith that makes us truly great

Neither for money nor for a future, about which, we are afraid
mainly for sake of faith, we should immigrate

The best is to migrate from a sinful state to that of good deeds and faith
whether we live in a big city or in a poor village

Wherever you live, death will overtake
Make no mistake, for eternal life, be prepared

MoU Singing Ceremony

MoU signing ceremony between Aror University of Art, Architecture, Design & Heritage and the Sukkur Chamber of Commerce and Industry.

Professional Club — Engineering Review

MUET, SSUET, BUITEMS, NUTECH delegates attend ACTIVE project moot

The ICT Appli-Cations for susTaInable enVironmental protEction (ACTIVE) Project is a unique initiative ERASMUS+ Capacity Building in the Field of Higher Education (CBHE) funded by EACEA aimed at bridging the gap between ICT engineering and environmental sciences in Pakistan. The project is centered around capacity building and interdisciplinary training to leverage ICT to address pressing environmental and climatic challenges that urban and rural areas face in Pakistan. By collaborating with partner universities located across the country, we are uniquely positioned to address the diverse environmental concerns specific to each region.

Prof BS Chowdhry (SI), Project Principal Contact and coordinator from MUET mentioned that the ACTIVE project addresses a critical need in today's education and industry - the convergence of ICT and environmental sciences. While many programs focus on ICT engineering or environmental sciences, they often operate in silos, limiting the scope and effectiveness of their solutions. ACTIVE seeks to integrate these areas, training ICT engineers with a strong understanding of environmental science to create more impactful and sustainable solutions for environmental and climatic issues.

Prof Dr Mohammad Aamir, Project Principal Contact and coordinator from SSUET presented that our primary objective is to cultivate highly qualified ICT engineers who possess in-depth knowledge of environmental science. This will be accomplished through:

- Capacity-building activities to enhance ICT engineers' understanding of environmental issues.
- Establishing a master's degree and expert courses on advanced technologies like machine learning, artificial intelligence, remote sensing, IoT and sensor networks, wireless communication, and embedded systems, applied to environmental issues and climate change.
- Creating four research centers focusing on local problems, providing practical training and contributing to environmental challenge mitigation.

Prof Enrique Nava, Lead Coordinator from the university of Malaga, Spain informed us that we anticipate several outcomes from the ACTIVE project:

- The emergence of a new cadre of ICT engineers equipped with knowledge of environmental science, ready to design and implement innovative solutions for environmental challenges.
- An expanded curriculum across our partner universities, featuring advanced courses that intersect ICT and environmental sciences.
- The establishment of research centers, acting as hubs for practical training and research on local environmental issues. These centers will play a pivotal role in formulating localized solutions to mitigate environmental challenges.
- An increased use of advanced ICT in environmental management across Pakistan, leads to more effective and sustainable solutions.

Prof Mihai Ciuc – Project Principal Contact from UPB, Romania presented work package 7 which focuses on project management and the project progress regarding budget control (optimal utilization of various budget heads), use of resources including HR and space management, execution of specific activities to achieve short term and long term results and outcomes, and the management of potential risks of different levels. To achieve the wide and specific objectives of the project, the core members of the team will collect and analyze the relevant information about the project progress in a systematic and effective manner. Regular reviews and control mechanisms will not only ensure the effective monitoring of the progress of the project but it also assure the quality of the content of progress reports. Continuous communication is the most critical factor for efficient and effective leadership.

During the meeting Dr Marium Jalal, Project Principal Contact from NUTECH gave precentation about the identification of needs from different target groups in order to define the requirements and contents of the academic programs and capacity building activities in addition to Curriculum Development for proposed Master's Degree Program "MS in Sustainable integration of environmental development with ICT" for addressing climate change related challenges of Pakistan.

Prof Dr Anayaullah Principal Contact from BUITEMS presented the equipment list needed Development of ICT Environmental Research Centers at BUITEMS, SSUET, MUET and NUTECH to address the learning and research needs for the Master's Program.

Dr Kapal Dev Principal Contact from Munster Technological university suggested to have

International summer schools to provide specialized training in related topics and strengthen collaboration and group working abilities related to ICT applications in July 2024 qt MTU, Ireland.

The associate partner Alfoze Technologies Pakistan for helping in website development and conduct of survey was greatly appreciated.

In addition, another associate partner Pakistn Engineering Council would be requested to provide help in Organizing short courses for capacity building of staff and students of partner HEIs related to the project objectives.

In concluding remarks Prof Enrique Nava thanked to Prof Mihai Cuic for hosting the event at UPB, Bucharest, Romania. Prof Nava also emphasized that Regulating Bodies related to Engineering Profession and Education in Pakistan, Environmental protection agencies of Pakistan and Industry and Non-governmental Organizations such as Industrial Zones of Pakistan, Agriculture sector of Pakistan, ICT and Software Industry, National Disaster Management Authority Local and regional governance may also be approached by Pakistani partners.

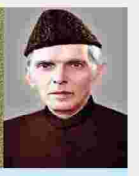
During the meetings several visits of innovation centres and laboratories were carried out at UPB, Bucharest for future collaboration.■

آوازِ اقبال

اقبال کا ترانہ بانگِ درا ہے گویا
ہوتا ہے جادہ پیما پھر کارواں ہمارا

تیری عمر رفتہ کی اک آن ہے عہد کہن
وادیوں میں ہیں تیری کالی گھٹائیں خیمہ زن
چوٹیاں تیری ثریا سے ہیں سرگرم سخن
تو زمیں پر اور پہنائے فلک تیرا وطن
چشمہ دامن ترا آئینہ سیال ہے
دامن موج ہوا جس کے لئے رومال ہے
ابر کے ہاتھوں میں رہوار ہوا کے واسطے
تازیانہ دے دیا برق سر کوہسار نے

اے ہمالہ کوئی بازی گاہ ہے تو بھی جسے
دست قدرت نے بنایا ہے عناصر کے لئے
ہائے کیا فرط طرب میں جھومتا جاتا ہے ابر
فیل بے زنجیر کی صورت اڑا جاتا ہے ابر



فرمانِ قائداعظمؒ

ایمان ، اتحاد ، تنظیم

اصول اور تفصیلات

گاندھی جی کہتے ہیں: "ہندوستان کو جیتے جی ٹکڑے ٹکڑے کیا جارہا ہے۔"
راج گوپال اچاریہ کہتے ہیں: "بچے کے ٹکڑے کیے جارہے ہیں۔"
قدرت نے پہلے ہی سے ہندوستان کو تقسیم کر رکھا ہے اور اس کے ٹکڑے ٹکڑے کر رکھے ہیں۔ ہندوستان کے نقشہ پر مسلم ہندوستان اور ہندو ہندوستان پہلے ہی سے موجود ہیں' نہ معلوم اس کے متعلق اتنا واویلا کیوں کیا جاتا ہے۔ وہ ملک ہے کہاں جس کے ٹکڑے ٹکڑے کیے جائیں گے؟ اور وہ قوم کہاں ہے جس کی قومیت فنا کی جانے کو ہے؟
وہ طاقت جس کے قبضہ قدرت میں آج ہندوستان ہے' وہ انگریزوں کی طاقت ہے اور یہ جو ایک خیال دماغوں میں بیٹھ گیا ہے کہ ہندوستان ایک متحدہ ملک ہے اور اس کی اپنی حکومت ہے' وہ صرف اس وجہ سے ہے کہ انگریز اس سارے ملک پر حکمران ہیں۔
(مسلم لیگ کانفرس' بمبئی۔ 26 مئی 1940ء)

آئی ٹی سیکٹر کا فروغ، نئی نسل کا مستقبل تابناک

ہمارے ملک کے ذہین نوجوان باہمت اور محنتی ہیں، ان نوجوانوں نے فری لانسرز، اسٹارٹ اپس سمیت دیگر کاروبار کے ذریعے ترقی کی ہے۔ سب سے بہترین بات یہ ہے کہ پاکستان کا آئی ٹی سیکٹر بلین آف ڈالرز کی مارکیٹ کی کی کیپٹلائزیشن کے ساتھ ابھر رہا ہے۔ بزنس کمیونٹی کو خوب سمجھنا چاہیے کہ انویسٹمنٹ صرف رئیل اسٹیٹ پر نہیں ہوتی، انویسٹمنٹ آئی ٹی پر بھی ہوتی ہے۔ موجودہ دور میں پالیسی کے لحاظ سے بہت مثبت پیش رفت ہوئی ہے، تاہم گروتھ کے رجحان کو برقرار رکھنے کے لیے ضروری ہے کہ پالیسی میں تسلسل ہونا چاہیے۔ پاکستان میں صنعتی، کاروباری، تجارتی سرگرمیوں میں اضافہ کے لیے آئی ٹی کو فروغ دے کر ترقی کے زینے طے کیے جاسکتے ہیں۔ آئی ٹی سیکٹر کے فروغ سے برآمدات بڑھانے کے مواقع ملیں گے، جب کہ آئی ٹی میں پالیسیوں کے تسلسل سے برآمدات بڑھانے کی ضرورت ہے، کیونکہ صنعتی کاروباری اور تجارتی سرگرمیوں میں اضافہ کے لیے انفارمیشن ٹیکنالوجی کا استعمال ناگزیر ہے۔ آج دنیا بھر میں 26 ہزار سے زائد کمپنیاں اینڈرائیڈ کا سافٹ ویئر استعمال کررہی ہیں۔ دنیا میں تیزی سے بدلتے ہوئے کارپوریٹ ماحول میں انفارمیشن ٹیکنالوجی ایک اہم سہولت کار ہے۔ آئی ٹی انقلاب کے نتیجے میں پوری دنیا میں لوگوں کا طرز زندگی بدل گیا ہے۔

پاکستانی حکومت نے ملک میں آئی ٹی سرمایہ کاروں کو کئی فوائد فراہم کیے ہیں، جس کے نتیجے میں آئی ٹی سیکٹر کی ترقی ہوئی ہے۔ دنیا میں چوتھا صنعتی انقلاب جاری ہے، جس میں روبوٹس، مصنوعی ذہانت، نیوٹیکنالوجی، کوان نم کمپیوٹنگ، بائیو ٹیکنالوجی، انٹرنیٹ آف تھنگز، (آئی او ٹی) 3D پرنٹنگ، اور خودمختار گاڑیاں جیسے شعبوں میں ملازمین کی ضرورت ہوتی ہے اور یہیں روزگار کی اگلی لہر ہے۔ حکومت اسکالرشپ اور کورسز کے ذریعے موجودہ مہارتوں کو فروغ دینے پر توجہ دے رہی ہے تاکہ نوجوانوں کو آمدنی اور کاروبار کے لحاظ سے خودکفیل بنایا جاسکے۔ ریگولیٹری قوانین مختلف طریقوں سے آئی ٹی سیکٹر کی ترقی کی راہ میں رکاوٹوں میں سے ایک ہیں۔ اسٹارٹ اپ ہولڈرز، فری لانسرز کے لیے بینک اکاؤنٹ حاصل کرنا ایک مشکل کام ہے۔ دوسرا، غیرملکی کرنسی کے کنٹرول کے طریقہ کار فری لانسرز کو غیرملکی کرنسی کو آزادانہ طور پر منتقل کرنے سے روکتے ہیں۔ گورنمنٹ کے اقدامات کے باوجود اس طرح کے معاملات آئی ٹی سیکٹر کے لیے مشکلات پیدا کرتے ہیں، جس کے نتیجے میں آئی ٹی کمپنیوں اور فری لانسرز کی اکثریت نے متحدہ عرب امارات، سنگاپور اور امریکا میں بینک اکاؤنٹس کھولے ہیں۔ وفاقی وزیر امین الحق کہتے ہیں کہ پالیسی سازی اور فری لانسرز کو سہولیات کی فراہمی کے لیے وزارت آئی ٹی اقدامات کررہی ہے۔ ان کے مطابق پاکستان میں فری لانسرز کو ایک اکاؤنٹ کھولنے سے لے کر ایف بی آر کے نوٹسز تک کئی مسائل کو ترجیحی بنیادوں پر حل کیا گیا ہے۔

ضرورت اس امر کی ہے کہ پاکستان کی بزنس کمیونٹی میں یہ شعور بیدار کیا جائے کہ کاروبار جتنا آئی ٹی سے ہم آہنگ ہوگا، وہ کلاؤڈ کی طاقت کو استعمال کرسکتا ہے۔ عنقریب ایسا ہونے جارہا ہے کہ پاکستان میں بینکنگ سیکٹر کے اندر شفٹ آئے گا۔ جہاں جہاں آئی ٹی سیکٹر موجود ہے اور سب کرے گا، جابز کٹ ڈاؤن ہوں گی۔ بینکس اپنے پاس کلاؤڈ کو اپلائی کریں گے۔ بینکنگ سیکٹر کے بعد یہ سلسلہ گورنمنٹ کے اداروں میں جائے گا۔ اسی طرح ٹیلی کمیونیکیشن جن کے ملین آف ڈالرز انفرااسٹرکچر پر لگے ہوئے ہیں، وہ اپنے آپ کو رڈیوس کریں گے۔ یونیورسٹیز اور ہوسٹنگ کمپنیز اب اس جانب رخ کررہی ہیں۔ کلاؤڈ پر منتقل ہونے کے براہ راست دو فائدے ہیں۔ کے پکس بھی رڈیوس ہوگا، ریونیو ایک سپینڈ بچر بھی رڈیوس ہوگا۔ پاکستان سمیت دنیا بھر میں گرتی معاشی صورت حال نے یہ عندیہ دے دیا ہے کہ بے روزگاری بڑھے گی اور اس کے حل کے طور پر ٹیکنالوجی کے ذریعے چھوٹے بڑے کاروبار اور تجارت کو فروغ دینا ہوگا۔ آئی ٹی کی خدمات کی ڈیمانڈ اتنی زیادہ بڑھی ہوئی ہے کہ ہم اسے پورا ہی نہیں کرپا رہے، پاکستان میں ہر سال ایک لاکھ آئی ٹی گریجویٹس کی ضرورت ہے لیکن تعلیمی اداروں سے صرف 25 ہزار لوگ ہی نکل رہے ہیں، اگر 25 ہزار طلباء تعلیمی اداروں سے پاس آؤٹ ہو بھی رہے ہیں تو ان میں سے صرف 2500 ایسے ہیں کہ جن کے اندر وہ مہارت اور ہنر ہے جو کہ آئی ٹی کے شعبے میں درکار ہوتی ہے۔ اس شعبے میں طلب اتنی زیادہ ہے کہ ایک لاکھ قابل گریجویٹس دو مہینوں میں ملازمتوں پر لگے ہوں گے۔ دراصل اس شعبے کو انفرااسٹرا کچر کی نہیں بلکہ پالیسی کی ضرورت اور اسے حکومت کی ترجیحات میں زیادہ جگہ ملنی چاہیے جیسے کہ حکومت ٹیکسٹائل کے شعبے کو دیتی ہے، اگر اس شعبے کو ترجیحی بنیادوں پر ترقی دی جائے تو یہ پاکستان کو قرضوں کے بوجھ سے نکال سکتا ہے۔ اس شعبے کو انفرااسٹرکچر کی ضرورت نہیں بلکہ صرف پالیسی کی ضرورت ہے جس میں کاروبار میں آسانی جیسے مسائل شامل ہیں، اگر حکومت کی جانب سے موجودہ پالیسی جاری رہتی ہے اور مزید معاونت ملتی ہے تو اس شعبے کی ہر آمدات 2025 تک مطلوبہ اہداف تک پہنچ سکتی ہیں۔

ٹیکنالوجی کی بنیاد پر لوگوں کی ضروری اشیاء، کپڑے، جوتے، سبزیاں، فاسٹ فوڈ، ٹرانسپورٹ سروس، بائیک ڈیلیوری سمیت کئی کاروبار آن لائن جاری ہیں اور وقت کے ساتھ ان میں اضافہ ہورہا ہے۔ بڑے شہروں کے ساتھ چھوٹے شہر اور قصبوں میں بھی موبائل فون اور انٹرنیٹ کے ذریعے ٹیکنالوجی سے استفادہ کیا جارہا ہے، ٹیکسی، بائیک ایئرٹریول، پبلک ٹرانسپورٹ کی سہولت عام شہری آن لائن بکنگ سروس سے باآسانی حاصل کررہا ہے، ان سروسز سے بلواسطہ اور بلاواسطہ لاکھوں لوگ روزگار بھی حاصل کررہے ہیں۔ عام لوگ بلوں کی ادائیگی، پیسوں کی منتقلی اور فیسوں کی ادائیگی کے لیے بھی آن لائن سروسز سے استفادہ کررہے ہیں، سفر، سڑکوں پر رش اور طویل قطاروں سے بچنے کے لیے ٹیکنالوجی کا استعمال تیزی سے بڑھ رہا ہے۔ انفارمیشن ٹیکنالوجی کے شعبے میں پاکستان کو مزید افرادی قوت کی ضرورت ہے۔ آئی ٹی سیکٹر کے فروغ کے لیے سرکاری سطح پر توجہ دی جارہی ہے لیکن ابھی شعبہ تعلیم نے اس پر زیادہ توجہ نہیں دی ہے، ملک اور بیرون ملک کمپیوٹر سائنس، سافٹ اور ہارڈ ویئر انجینئرز کی مانگ میں اضافہ ہوا ہے لیکن ساتھ اس سے منسلک سرٹیفکیٹ اور ڈپلومہ کورسز کرنے والے افراد بھی بہتر روزگار حاصل کررہے ہیں۔ شعبہ طب، تعلیم، ٹرانسپورٹ ٹیکنالوجی سے منسلک کئی کاروبار چلانے کے لیے باقاعدہ کال سینٹرز اور کنٹرول روم 24 گھنٹے کام کرتے ہیں جہاں سیکڑوں نوجوان مختلف شفٹوں میں امور انجام دے رہے ہیں۔ ٹیکنالوجی کی بنیاد پر کام کرنے والی کمپنیاں عام آدمی کو کاروبار اور باعزت روزگار دینے کے لیے بڑے پلیٹ فارمز فراہم کررہی ہیں جب کہ دوسری جانب صارفین کے مسائل میں کمی بھی ہورہی ہے کہ انھیں دروازے پر سہولیات فراہم کی جارہی ہیں۔

ان ہائی ٹیک بزنس کمپنیز کو اپنے کاروبار کو چلانے کے لیے بڑی تعداد میں آئی ٹی ماہرین کی خدمات بھی درکار ہیں جس کی بناء پر انفارمیشن ٹیکنالوجی کی تعلیم انتہائی اہمیت اختیار کیے ہوئے ہے۔ ملک بھر میں یہ ضرورت بھی محسوس کی جارہی ہے کہ نوجوانوں کو ٹیکنالوجی کے استعمال سے منسلک کاروبار کی جانب راغب کیا جائے اور ساتھ ہی نہیں آئی ٹی کی تعلیم کی اہمیت سے آگاہ کیا جائے۔■

Founder
Najamul Hasan (Marhoom)

Funding Editor
Riazul Hasan (Marhoom)

Publisher / Managing Editer
Muhammad Salahuddin

Editor
Manzoor Shaikh

Honorary Consulting Editors

Prof. B. S. Chaudhry	Education
Engr. Farhat Adil	Civil Engg.
Engr. Khalid Pervaiz	Elect. Engg.
Engr. Sohail P. Ahmed	Industry
Dr. Moh. Nawaz Iqbal	

Graphic Designer
Shaikh Muhammad Raza ur Rehman

Page & Web Designer
Waheed Ahmed

Branch Manager (Lahore)
Hamza Idrees

Regional Manager (Islamabad & North)
Muhammad Arif

Annual Subscription
1200

Printer
Aslam Zaki, Ayisha Printers,
Eveready Chambers,
Off: Chundrigar Road, Karachi.

FORTNIGHTLY ENGINEERING REVIEW
The voice of engineers

Member All Pakistan Newspapers Society

Head Office
305, Spotlit Chambers, Dr. Billimoria Street,
Off: Chundrigar Road, GPO Box 807,
Karachi-74200, Pakistan.
Ph: 021-3221-5961-62
0334-2668581
Email: info@engineeringreview.com.pk
engineeringreview@yahoo.com

Lahore
Room # 29, 6th Floor
Goldmine Plaza
105-Ferozepur Road Lahore.
Ph: 042-3540-4622; Mobile: 0322-4881881
Email: engineeringreview_lahore@yahoo.com

Islamabad
3-B, Basement Tripple One Plaza,
Fazle Haq Road, Blue Area, Islamabad.
Ph: 051-2348-6200 Mobile: 0300-9202824
Email: engineeringreview isb@gmail.com

www.engineeringreview.com.pk

پندرہ روزہ

انجینئرنگ ریویو

بانی: نجم الحسن بانی ایڈیٹر: ریاض الحسن

جلد نمبر: 48 • شمارہ نمبر: 18 • ستمبر: 16-30, 2023 • فون: +92-21-32215961-2, 32632567
ویب سائٹ: www.engineeringreview.com.pk • ای میل: info@engineeringreview.com.pk

www.engineeringreview.com.pk www.youtube.com/engineeringreviewER

آئی ٹی ایکسپورٹ 10 ارب ڈالر تک بڑھانے کے لیے کوشاں ہیں، یونس ڈھاکہ

صوبائی حکومت مالیاتی اور زرعی شعبے میں آئی ٹی اپیلی کیشنز متعارف کرانے کی منصوبہ بندی کر رہی ہے، نگران وزیر

3 روزہ آئی ٹی سی این ایشیا 2023 اختتام پزیر، مقامی اور غیر ملکی کمپنیوں کے ساتھ 11 کروڑ ڈالر کی ڈیلز طے کی گئیں

ایکسپوسینٹر میں جاری 3 روزہ آئی ٹی ٹیلی کام نمائش آئی ٹی سی این ایشیا 2023 اختتام پزیر ہوگئی، نمائش میں پاکستانی آئی ٹی فرمز کی مقامی اور غیر ملکی کمپنیوں کے ساتھ 11 کروڑ ڈالر کی ڈیلز طے کی گئی ہیں، نمائش کے آخری روز سندھ کے نگراں وزیر خزانہ یونس ڈھاگا نے شرکت کی اور نمائش کے کامیاب انعقاد پر منتظمین کو مبارکباد پیش کی، انھوں نے کہا کہ پاکستان انفارمیشن کمیونی کیشن ٹیکنالوجی کا علاقائی مرکز ہے، نگراں وفاقی اور صوبائی حکومتیں اسپیشل فیسیلیٹیشن انویسٹمنٹ کونسل (ایس ایف آئی سی) کے ویژن کو سپورٹ کرتے ہوئے ملک بھر میں آئی ٹی سیکٹر کی ترقی کیلیے پرعزم ہے۔

انھوں نے مزید کہا کہ صوبائی حکومت مالیاتی اور زرعی شعبے میں آئی ٹی اپیلی کیشنز متعارف کرانے کی منصوبہ بندی کر رہی ہے تاکہ مالیاتی شمولیت کا دائرہ وسیع کرنے کے ساتھ سندھ میں فصلوں کی فی ایکڑ پیداوار میں اضافہ کیا جاسکے، انھوں نے کہا کہ

حکومت سندھ وفاقی حکومت کے قریبی تعاون اور اشتراک سے آئی ٹی کی ایکسپورٹ 10 ارب ڈالر تک بڑھانے کیلیے کوشاں ہے، اس مقصد کیلیے کمپنیوں کے آئی ٹی کمپنیوں کے سیلز ٹیکس کا مسئلہ ترجیحی بنیادوں پر حل کیا جائے گا۔

نمائش کے منتظم نائب صدر ای کامرس گیٹ وے عمیر نظام نے کہا کہ آئی ٹی سی این ایشیا نے ملک کی اہم معاشی سرگرمی بن چکا ہے جس میں آئی ٹی کے شعبے میں 11 کروڑ ڈالر مالیت کے کاروباری سودے طے کیے گئے ہیں، انھوں نے کہا کہ نمائش میں 57 ہزار افراد نے شرکت کی جن میں 13 ملکوں کے 100 وفود شامل ہیں جبکہ اس ایونٹ سے تجربہ کار پروفیشنلز اور نئے گریجویٹیس کے لیے روزگار کے مواقع پیدا ہوئے ہیں۔

آئی ٹی سی این ایشیا کا انعقاد وزارت انفارمیشن ٹیکنالوجی اور ٹیلی کمیونی کیشن اتھارٹی، پاکستان سافٹ ویئر ہاؤس ایکسپورٹ بورڈ اور پاکستان آئی ٹی انڈسٹری ایسوسی ایشن کی معاونت سے کیا گیا جس میں 450 کمپنیوں نے شرکت کی۔■

کنسٹرکٹرز ایسوسی ایشن آف پاکستان

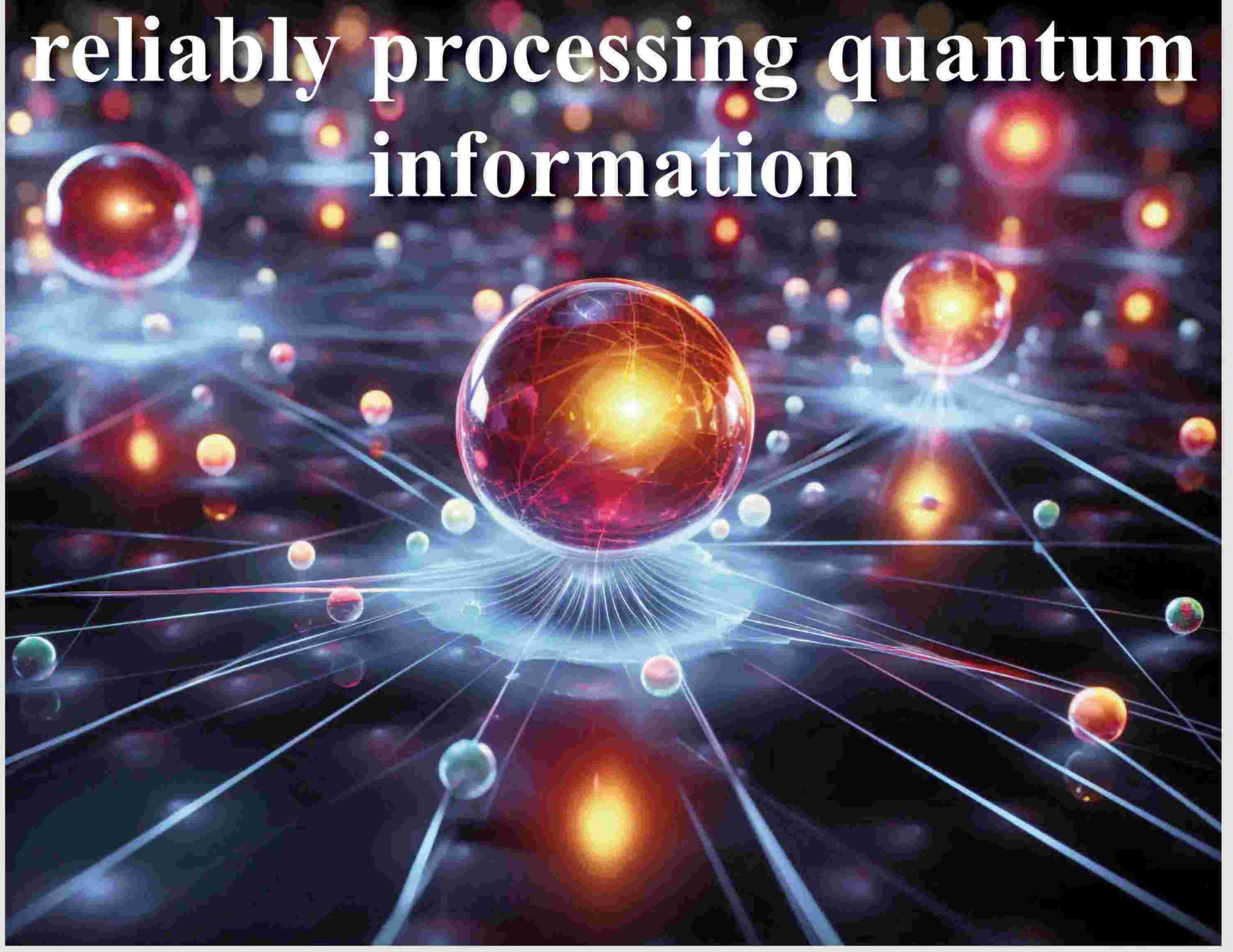
کراچی واٹر اینڈ سیوریج بورڈ میں کی جانے والی پری کوالیفیکیشن غیر قانونی قرار

کنسٹرکٹرز ایسوسی ایشن آف پاکستان سندھ کی کور کمیٹی کا ہنگامی اجلاس کراچی واٹر اینڈ سیوریج بورڈ میں کی جانے والی پری کوالیفیکیشن سے متعلق کنٹریکٹرز کی جانب سے ملنے والی شکایات سے متعلق تھا جو ایسوسی کے وائس چیرمین سندھ نعیم کاظمی کی صدارت منعقد ہوا اس اجلاس میں کمیٹی کے ممبران میں چیف آرگنائزر سندھ سعید مغل، ممبر ایگزیکٹو کمیٹی رضاء عابدی، انجینیر عبدالجبار شیخ، سابق چیرمین کیپ افضال الرحمن، نعیم الدین صدیقی، میڈیا منیجر اسلم مغل، حیدر کاظمی کے علاوہ دیگر عہدیداروں نے شرکت کی۔

اجلاس میں فیصلہ کیا گیا کہ ریگولیٹری اتھارٹی کے رولز، اور پاکستان انجینئرنگ کونسل کے بائی لاز کی کھلی خلاف ورزی کرتے ہوئے متعلقہ اداروں کی آنکھوں میں دھول جھونکتے ہوئے واٹر اینڈ سیوریج بورڈ کے تعمیر و مرمت کے عام نوعیت کے کاموں کے لیے دو کیٹیگری میں کنٹریکٹرز کی پری کوالیفیکشن کے نام سے کنٹریکٹرز کو شارٹ لسٹ کیا جارہا ہے ان دونوں میں ایک پری کوالیفیکشن کا نتیجہ دیکھ کر یہاں کے افسران کے مزاج اور عزائم کا اندازہ کیا جاسکتا ہے اجلاس میں قرارداد منظور کی گئی کہ آج کا اجلاس مکمل طور سے واٹر اینڈ سیوریج بورڈ کی غیر قانونی پری کوالیفیکشن کی مذمت کرتا ہے اور اس کے لے ہر قانونی راستہ اپنایا جائے گا۔

واضع رہے کہ اس سے قبل لیاری ڈویلپمنٹ اتھارٹی نے اس ہی قسم کی پری کوالیفیکشن کی تھی جسے سندھ ہائی کورٹ نے اس پری کوالیفیکشن کو منسوخ کرنے کے علاوہ اس پری کوالیفیکشن کے تحت طلب کردہ کاموں کو بھی منسوخ کر دیا تھا جبکا اسے بڑے نقصان کا سامنا کرنا پڑا تھا۔ متعلقہ اداروں کو اس شکایت سے آگاہی کے لیے خط لکھ دیئے، اس کے علاوہ قانون مشاورت کی ٹیم تشکیل دے دی گئی ہے۔ جو جلد عدالت سے رجوع کرنے کے اقدامات کرے گی۔■

A significant step towards reliably processing quantum information



Using laser light, researchers have developed the most robust method currently known to control individual qubits made of the chemical element barium. The ability to reliably control a qubit is an important achievement for realizing future functional quantum computers.

This new method, developed at the University of Waterloo's Institute for Quantum Computing (IQC), uses a small glass waveguide to separate laser beams and focus them four microns apart, about four-hundredths of the width of a single human hair. The precision and extent to which each focused laser beam on its target qubit can be controlled in parallel is unmatched by previous research.

"Our design limits the amount of crosstalk-the amount of light falling on neighbouring ions-to the very small relative intensity of 0.01 per cent, which is among the best in the quantum community," said Dr. K. Rajibul Islam, a professor at IQC and Waterloo's Department of Physics and Astronomy. "Unlike previous methods to create agile controls over individual ions, the fibre-based modulators do not affect each other.

"This means we can talk to any ion without affecting its neighbours while also retaining the capability to control each individual ion to the maximum possible extent. This is the most flexible ion qubit control system with this high precision that we know of anywhere, in both academia and industry."

The researchers targeted barium ions, which are becoming increasingly popular in the field of trapped ion quantum computation. Barium ions have convenient energy states that can be used as the zero and one levels of a qubit and be manipulated with visible green light, unlike the higher energy ultraviolet light needed for other atom types for the same manipulation. This allows the researchers to use commercially available optical technologies that are not available for ultraviolet wavelengths.

The researchers created a waveguide chip that divides a single laser beam into 16 different channels of light. Each channel is then directed into individual optical fibre-based modulators which independently provide agile control over each laser beam's intensity, frequency, and phase. The laser beams are then focused down to their small spacing using a series of optical lenses similar to a telescope. The researchers confirmed each laser beam's focus and control by measuring them with precise camera sensors.

"This work is part of our effort at the University of Waterloo to build barium ion quantum processors using atomic systems," said Dr. Crystal Senko, Islam's co-principal investigator and a faculty member at IQC and Waterloo's Department of Physics and Astronomy. "We use ions because they are identical, nature-made qubits, so we don't need to fabricate them. Our task is to find ways to control them."

The new waveguide method demonstrates a simple and precise method of control, showing promise for manipulating ions to encode and process quantum data and for implementation in quantum simulation and computing.■

New battery holds promise for green energy

Jimmy Jiang envisions a future where every house is powered by renewable energy stored in batteries.

In his chemistry lab, Jiang and his students at the University of Cincinnati have created a new battery that could have profound implications for the large-scale energy storage needed by wind and solar farms.

Innovations such as UC's will have profound effects on green energy, Jiang said. Batteries store renewable energy for when it's needed, not just when it's produced. This is crucial for getting the most out of wind and solar power, he said.

"Energy generation and energy consumption is always mismatched," he said. "That's why it's important to have a device that can store that energy temporarily and release it when it's needed."

They described their novel design in the journal Nature Communications.

Traditional car batteries contain a mix of sulfuric acid and water. And while they are inexpensive and made from readily available materials, they have severe drawbacks for industrial or large-scale use. They have a very low energy density, which isn't useful for storing megawatts of power needed to power a city.

And they have a low threshold for electrochemical stability. Jiang said that means they can blow up.

"Water has a voltage limit. Once the voltage of an aqueous battery exceeds the stability window of 1.5 volts, the water can decompose or be split into hydrogen and oxygen, which is explosive," he said.

"Membranes are super expensive," Jiang said. "We developed a new type of energy storage material that improves performance at a lower cost."

Likewise, membranes are inefficient, he said.

"They can't separate the positive and negative sides completely, so there is always crossover," he said.

The group has submitted provisional patent applications, he said.

"There is still a long way to go," Jiang said.

But he said we are hurtling toward a battery revolution in the next 20 years.

"I am confident about that. There is a lot of intense research going into pushing the boundaries of battery performance," he said.

His students are equally enthusiastic. Doctoral student and study co-author Rabin Siwakoti said the battery offers higher energy density.

"So even a small battery can give you more energy," he said.

"We've managed to eliminate the membrane in a battery, which is a huge component of upfront costs. It's as much as 30% of the cost of the battery," co-author and doctoral student Jack McGrath said.

Co-author Soumalya Sinha, a visiting professor at UC, said countries are racing to develop cheaper, more efficient batteries.

"This design significantly decreases material costs," he said. "We're trying to achieve the same performance at a cheaper cost."

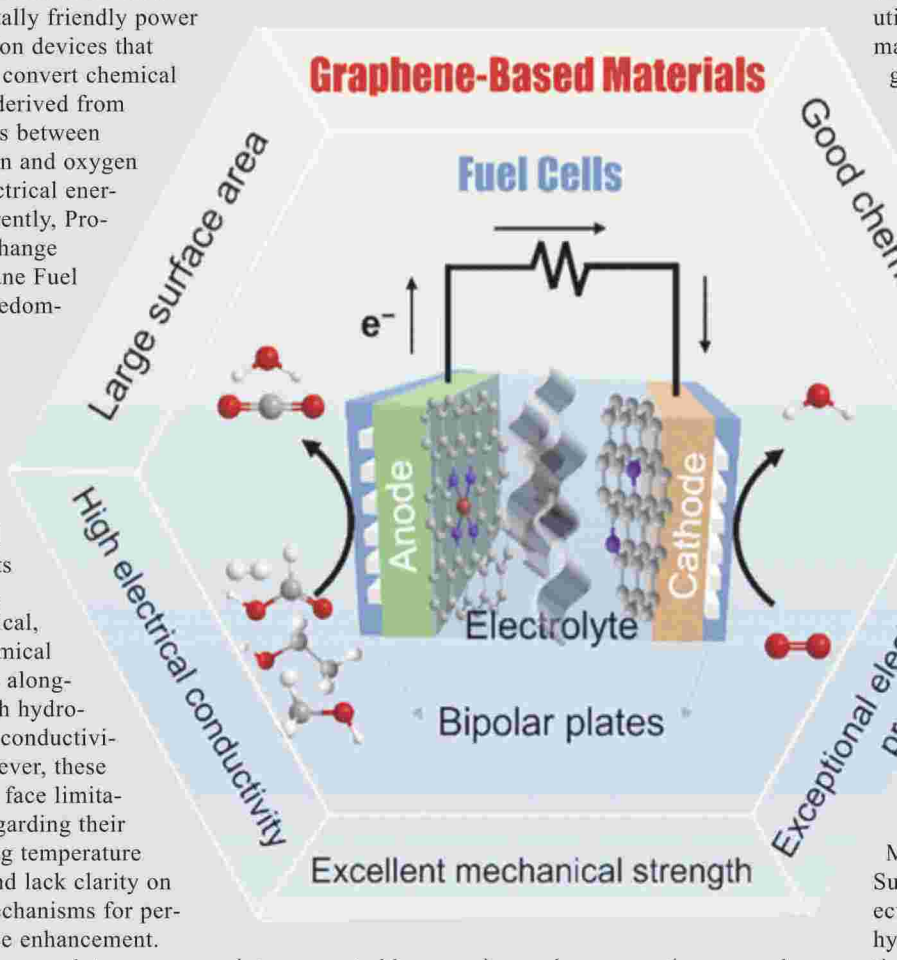
Other contributors include lead author and UC postdoctoral researcher Rajeev Gautam, doctoral student Xiao Wang and UC doctoral graduate Amir Lashgari. -- SD ■

New ionic materials boost hydrogen fuel cell efficiency!

A team of researchers, affiliated with UNIST has made a groundbreaking advancement in improving the efficiency of hydrogen fuel cells, which are gaining significant attention as eco-friendly next-generation energy sources.

Led by Professor Myoung Soo Lah in the Department of Chemistry at UNIST, the team successfully developed solid electrolyte materials utilizing metal-organic frameworks (MOFs). This innovative approach significantly enhances the conductivity of hydrogen ions within the solid electrolyte employed in hydrogen fuel cells. Furthermore, the research team introduced guest molecules with low acidity -- marking a pioneering achievement among intermediaries used for this purpose. By implementing a novel methodology that increases the number of guest molecules inside MOF pores, they achieved improved hydrogen ion conductivity.

Hydrogen fuel cells are highly efficient and environmentally friendly power generation devices that directly convert chemical energy derived from reactions between hydrogen and oxygen into electrical energy. Currently, Proton-Exchange Membrane Fuel Cells predominantly employ Nafion as an electrolyte material due to its thermal, mechanical, and chemical stability alongside high hydrogen ion conductivity. However, these systems face limitations regarding their operating temperature range and lack clarity on their mechanisms for performance enhancement.



The research team turned their attention to MOFs as potential alternatives. MOFs are materials composed of metal clusters interconnected by organic ligands to form a porous structure. With excellent chemical and thermal stability properties, MOFs have recently garnered considerable interest for use in fuel cell applications. Moreover, when generated, MOFs possess pores of varying sizes that can be utilized for developing materials with high hydrogen ion conductivity by introducing guest molecules through these channels.

In this study conducted by the research team at UNIST led by Professor Myoung Soo Lah's group members, zwitterionic sulfamic acid -- a low-acidity amphoteric ionic substance possessing both positive and negative charges -- was introduced as guest molecules into two types of MOFs, namely MOF-808 and MIL-101. Sulfamic acid, a guest molecule with exceptional hydrogen bonding capabilities in various forms, effectively operates as a medium for transferring hydrogen ions. By increasing the amount of sulfamic acid within the pores of MOFs, the team successfully developed materials demonstrating high hydrogen ion conductivity (achieving levels of 10-1 Scm-1 or higher). Moreover, these materials exhibited remarkable durability as they maintained hydrogen ion conductivity over an extended period.

The research findings hold immense promise for advancing the efficiency and performance of hydrogen fuel cells through the utilization of metal-organic frameworks. This breakthrough contributes to accelerating progress toward sustainable energy solutions in line with global efforts towards decarbonization.

The study findings have been published ahead of their official publication in the online version of Angewandte Chemie International Edition on March 26, 2023. This work was selected for the back cover of the journal and was subsequently published on June 20, 2023. -- SD■