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The voice of engineers

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OGDCL, MariEnergies, and Turkish Petroleum to Launch Exploration in Pakistan's Offshore Basins

OGDCL and MariEnergies Acquire 20 pc Stake Each in Eastern Offshore Indus-C Block; Strengthen Pakistan-Türkiye Energy Collaboration

By Manzoor Shaikh
 Oil and Gas Development
 Company Limited
 (OGDCL) and MariEner-
 gies have announced that they have
 entered into a farm-out agreement to
 acquire a 20 percent working interest
 each in the Eastern Offshore Indus-C
 Block from Pakistan Petroleum Lim-
 ited (PPL).
 The agreement also includes Turkish
 Petroleum Overseas Company (TPOC) — a
 wholly owned subsidiary of Türkiye Petrolleri



Anonim Ortaklığı (TPAO), the national oil
 company of Türkiye.
 This strategic partnership stems from
 high-level engagements between the Govern-
 ments of Pakistan and Türkiye, aimed at
 deepening bilateral cooperation in the energy
 sector and encouraging foreign direct invest-
 ment (FDI) to initiate exploration activities in
 Pakistan's underexplored offshore basins.
 Subject to regulatory approvals, the oper-
 atorship of the Indus-C Block will be trans-
 ferred to TPOC, which possesses extensive
 global experience in offshore exploration and
 field development. Following the completion
 of the transaction and receipt of all necessary
Contd on page 2

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OGDCL, MariEnergies, and Turkish Petroleum to Launch Exploration in Pakistan's Offshore Basins

Contd from page 1

approvals, the participating interests in the Block will be as follows:

- TPOC: 25% (Operator)
- PPL: 35%
- OGDCL: 20%
- MariEnergies: 20%

The transaction marks MariEnergies' entry into Pakistan's offshore exploration sector, building upon its strong track record in onshore exploration and development. The company expressed its commitment to an accelerated offshore exploration program, viewing the collaboration as a significant step toward unlocking Pakistan's offshore hydrocarbon potential.

Similarly, OGDCL emphasized that the partnership reaffirms its long-term commitment to advancing offshore exploration. Leveraging its in-house seismic capabilities, technical expertise, and prior experience in offshore programs, OGDCL aims to play a pivotal role in accelerating exploration and development activities across Pakistan's offshore basins.

Both companies underscored that the collaboration with TPOC and PPL represents a milestone in strengthening Pakistan-Türkiye strategic energy cooperation, fostering sustainable exploration growth, and attracting vital international investment to Pakistan's energy sector.

Standing of the companies involved into the agreement

1. Pakistan Petroleum

Limited (PPL)

Ownership: Majority-owned by the Government of Pakistan. The government of Pakistan (through the Ministry of Energy, Petroleum Division) holds around 67.5 percent of shares (directly and via state entities). The

shareholding).

Status: Pakistan's largest E&P company, listed on both PSX and London Stock Exchange (LSE).

Core Role: Leader in oil and gas exploration and production within Pakistan; known for strong financial

Core Role: Brings local expertise, operational efficiency, and strong safety and sustainability standards from onshore experience.

4. Turkish Petroleum Overseas Company (TPOC) Ownership: 100 percent owned by Türkiye Petrolleri

Although the exact value hasn't been released, we can attempt a rough estimate using analogous offshore exploration deal benchmarks based on the data available in media and on companies sources:

Parameter Reasoning /

setup Could raise the cost closer to upper hundreds of millions USD depending on basin complexity

Minimum investment requirements for offshore blocks in Pakistan Some reports say minimum bids or investment thresholds are ~US\$150 million per block for similar offshore bids. Thus this project may be in similar or larger range, perhaps \$200-500 million+ depending on scope

Overview of Eastern Offshore Indus-C Block

Location & Type: The Indus-C Block is an offshore exploration block located in Pakistan's Indus Offshore Basin in the Arabian Sea. It lies within Pakistan's Exclusive Economic Zone (EEZ).

Size & Working Interest Data (Pre-farm-out):

Area: about 748.42 square kilometers. It falls in "Shallow Water," meaning it's not ultra-deep offshore waters. Past cost expended on geology & geophysics (G&G) work was in tens of millions of USD (e.g. ~\$47.7 million by June 2023). Expected hydrocarbons in place for the block are estimated at 1.5-2 Tcf (trillion cubic feet) of natural gas.

Play Type & Prospectivity: The block is of structural/stratigraphic play type. That means the potential hydrocarbon traps are associated with structural formations (folds, faults) and stratigraphic variations (changes in sedimentary layers). ■



remaining shares are publicly traded on the Pakistan Stock Exchange (PSX).

Status: Public sector exploration and production (E&P) company.

Core Role: Operator of several onshore and offshore blocks; a key upstream player in Pakistan's energy sector.

2. Oil & Gas Development Company Limited (OGDCL)

Ownership: Government of Pakistan owns about 74.9 percent (direct and indirect

base and seismic capability.

3. MariEnergies Limited Ownership: A subsidiary of Mari Petroleum Company Limited (MPCL), which is a publicly listed company on PSX. MPCL's major shareholders include the Fauji Foundation (a large industrial and welfare conglomerate), the Government of Pakistan, and the general public.

Status: Emerging upstream company focusing on expanding from onshore to offshore exploration.

Anonim Ortaklığı (TPAO) — the national oil company of Türkiye.

Status: TPAO is a state-owned enterprise under the Republic of Türkiye's Ministry of Energy and Natural Resources.

Core Role: Brings international offshore exploration and development experience — especially from the Mediterranean and Black Sea regions.

Estimation Based on Similar Deals

Similar Example Estimated Investment Range

Exploration block size & depth Offshore projects generally cost more due to infrastructure, drilling, rigs, seismic surveys, etc.

Likely in the range of hundreds of millions USD (for initial exploration + development planning)

Regulatory incentives & risk If regions are underexplored, companies often anticipate higher cost for geological work, logistical

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Punjab to Establish Four New Industrial Estates for Foreign Investors

ER Report
Punjab Chief Minister Maryam Nawaz Sharif has announced the establishment of four new industrial estates across the province to attract foreign investors, marking a major step toward revitalizing Punjab's industrial and manufacturing landscape.

Chairing a high-level meeting to review the performance and development of industrial estates, the chief minister said the initiative aims to create new opportunities for global investors and strengthen local production capacity. She also revealed that Saudi investors are actively considering potential investments in the existing

industrial estates at Bhalwal, Vehari, and Bahawalpur.

In a significant policy decision, Maryam Nawaz approved the establishment of a new industrial estate in Sialkot, to be developed on 400 acres near Sialkot International Airport, which will cater to the region's expanding export-oriented manufacturing sector. She also approved the transfer of the Chunian Industrial Estate to the Fisheries Department, allowing the area to be utilized for specialized aquaculture and allied industries.

During the meeting, the Chief Minister was presented with audit reports of the Faisalabad Industrial Estate Development and Management Company (FIEDMC) and the Punjab Industrial Estates Develop-

ment and Management Company (PIEDMC). The reports revealed financial irregularities and administrative lapses. Taking serious notice, she directed immediate action against those responsible and

and no one bothered to intervene," she said. "It is our foremost duty to safeguard every inch of government land in the province."

Punjab currently hosts more than 48,000 industrial

Sialkot, Multan, and Sheikhupura — contributes the largest share to Pakistan's industrial GDP, with an estimated annual economic activity exceeding Rs 3 trillion.

The province's industries produce a wide range of goods that are both exported globally and consumed locally. Textiles and garments dominate production, with Faisalabad known as the "Manchester of Pakistan" for its textile exports. Sialkot leads in sports goods, surgical instruments, leather products, and cutlery, while Gujranwala specializes in ceramics, fan manufacturing, and sanitary fittings. Sheikhupura and Lahore are major centers for engineering, chemicals, and processed food products, whereas Multan and Bahawalpur contribute signif-

icantly to cotton processing, fertilizer, and agro-based industries.

The Chief Minister emphasized that industrial development must align with sustainability and competitiveness in global markets. She directed departments to restructure the industrial estate policy framework, making it more transparent, investor-friendly, and results-oriented. The new framework, she said, should promote modern infrastructure, digitized estate management, environmental compliance, and a strong focus on renewable energy integration.

The government also plans to enhance facilities in the existing industrial estates, including Quaid-e-Azam Business Park (Sheikhupura), Multan Industrial Estate, Rahim Yar Khan Industrial



called for strict financial discipline and governance reforms.

"Fraud was being committed right under the nose of the previous administration,

units, ranging from small and medium enterprises to large-scale manufacturing facilities. The province's industrial sector — concentrated in Faisal-

abad, Lahore, Gujranwala, Bahawalpur contribute signif-

Contd on page 4

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Megaplus Pakistan Implements H3C WiFi 7 Solution at Pakistan Stock Exchange

Megaplus Pakistan, in collaboration with H3C Technologies, has successfully implemented the H3C WiFi 7 Solution at the Pakistan Stock Exchange (PSX) — marking a major milestone in the advancement of Pakistan's digital infrastructure.

Through this successful implementation, Megaplus Pakistan has positioned PSX among the pioneers in Pakistan to adopt next-generation WiFi 7 technology,

delivering ultra-fast, reliable, and intelligent enterprise connectivity.

The newly deployed system ensures



lightning-fast wireless speeds for enhanced business operations, seamless connectivity across critical PSX facilities, and a future-ready network foundation built for scalability, security, and innovation.

This achievement underscores Megaplus Pakistan's commitment to delivering cutting-edge networking solutions that empower organizations across Pakistan to embrace digital transformation with confidence.

The company expressed appreciation to the PSX Management and IT Team for their support and cooperation throughout the project, calling the deployment a landmark step in strengthening Pakistan's digital ecosystem. - ERMD ■

6th World ESG Summit: Windmason Arabia's IDEC Technology Draws Global Attention

The 6th edition of the World ESG Summit served as a global platform bringing together leaders, innovators, and organizations committed to advancing

and collaboration.

Engineer Javeria Asad, HVAC Project Manager at Windmason Arabia Co., presented on IDEC Technology and its contribution to sustainable cooling solutions. She highlighted that traditional air conditioning systems are among the largest contributors to carbon emissions

impact while meeting the growing demand for cooling, this innovation directly supports the achievement of ESG objectives.

Through her participation, Engineer Javeria Asad represented Windmason Arabia's commitment to sustainability and emphasized the



Environmental, Social, and Governance (ESG) goals. The summit emphasized sustainable practices, reducing carbon footprints, and building resilient economies through responsible innovation

and energy consumption, particularly in warm regions such as the Middle East.

Her presentation demonstrated how IDEC technology is driving a shift toward energy-efficient, eco-friendly, and future-ready cooling systems. By reducing environmental

HVAC industry's vital role in advancing ESG-aligned practices. She also noted that the summit provided a valuable opportunity to engage with global leaders, exchange insights, and contribute to shaping a more sustainable future. RIYADH ■

Punjab to Establish Four New Industrial Estates

Contd from page 3

Estate, Vehari Industrial Estate, Bhalwal Industrial Zone, and the Bahawalpur Industrial Estate. These estates already accommodate hundreds of operational industries employing thousands of workers and generating significant export revenue.

Maryam Nawaz underscored the need to restore investor confidence through good governance and efficient management, saying Punjab's industrial transformation could play a decisive role in reviving the national economy.

"Industrial estates are not just plots of land; they are engines of economic growth," she said. "We are determined to make Punjab

the preferred destination for both local and international investors by ensuring transparency, quality infrastructure, and ease of doing business."

The Chief Minister also directed a comprehensive review of the administrative structures of FIEDMC and PIEDMC, recommending amendments to rules and regulations to enhance efficiency, accountability, and transparency.

With four new estates on the horizon and a renewed focus on governance and modernization, Punjab's industrial future appears set for a major transformation — one that could significantly strengthen Pakistan's economic backbone and attract long-term foreign investment. ■

IEEEEP Karachi Centre Announces 40th Multi-Topic International Symposium 2026

The Institute of Electrical & Electronics Engineers Pakistan (IEEEEP), Karachi Centre, has announced its 40th Multi-Topic International Symposium 2026, to be held on 23rd and 24th April 2026 at Pearl-Continental Hotel, Karachi.

Recognized as one of Pakistan's leading engineering forums, the IEEEEP Multi-Topic Symposium serves as a dynamic platform for engineers, researchers, technologists, and industry leaders to present their innovative research, case studies, and indigenous solutions in the fields of electrical, electronics, and allied engineering disciplines.

This year's symposium is themed around "Transforming Ideas into Innovation," encouraging participants to bring forward research that not only addresses national challenges but also contributes toward sustainable technological advancement. Call for Papers

The institution has invited professionals, academics, and industry experts to submit their abstracts under a diverse range of focus areas, including but not limited to:

1. Sustainable Energy Solutions & Microgrids
2. Power Sector Challenges & Localization (Make in Pakistan)
3. Smart Infrastructure & Resilient Systems
4. Digital Transformation, AI, Robotics & Intelligent Systems
5. Communications, Data Centers & Cybersecurity
6. Biomedical Innovations & Healthcare Engineering
7. Climate Change & Infrastructure Resilience

The communication states that abstracts should be submitted by 10th January 2026.

Abstracts can be submitted via the official Google Form link: <https://forms.gle/qu3prpfN71qnKRk6>

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The Edge That Sets S.M. Jaffar Apart from Rest

Kaiser Kasim Ali, Director of S.M. Jaffar & Co., recalls, “My father and uncle founded this company in 1948.

I represent the second generation of our family business.”

In an interview with ER, he shared his views on Pakistan's economy, the future of emerging technologies in the country, and what makes his company stand out from others.

Pakistan's Economy

First of all, we should look at things positively — because positive thinking brings dividends for everyone.

Our economy is growing, even if the base isn't as strong as we'd like yet. It is performing reasonably well and, more importantly, is poised to do better in the future. There are several reasons for this optimism, but I would like to stipulate a few key ones.

Pakistan has finally assumed a positive global outlook. The world is beginning to see Pakistan through a more confident and forward-looking lens. Our expanding partnerships and contracts with GCC countries, Europe, and North America are making a real difference. This positive perception will continue to bring tangible benefits to Pakistan in the years ahead.

Does Data Support Our Positive Outlook?

S.M. Jaffar & Co. has been serving the industrial, banking, and commercial sectors for the past 76 years. This company is just two years younger than Pakistan — the nation was born in 1947, and S.M. Jaffar in 1949.

As an engineering company, we provide solutions

that help industries stretch their energy capacity efficiently. We guide them on how to buy the most cost-effective energy and how to reduce production costs.

Our long-standing engagement across sectors has shown us one thing clearly — things only improve when companies introduce new technologies.

And that is precisely why I believe our economy is improving: people are investing.

Right now, if you look at the renewable sector — particularly solar — Pakistan has already crossed 25 GW of installed capacity. We are now among the top five countries in the world in terms of solar installations.

Beyond solar, investment in wind energy is also growing, as businesses recognize the potential of producing affordable energy that keeps their products competitive in the global market.

Now, as renewables become the primary source of power, we will need battery energy storage systems (BSS) to ensure stability. Pakistan must embrace this technology — and we are offering it to all our clients. People are ready and willing to invest in it because they understand that affordable, reliable energy is key to global competitiveness.

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able after-sales support. Similarly, we have built a strong reputation for excellence in services. Our team is well-trained, and they are the true assets of our company.

Our services distinguish us from competitors. We don't just sell products — we sell services — because anyone can make a product. Products can come from anywhere, but running and maintaining them effectively requires expertise.

Our people are trained professionals who ensure quality support.

I always tell our engineers and teams to keep updating their skills with the latest technologies. Unless you bring innovation to the table, how will you know whether you're keeping pace with the world?

When everyone else was only talking about solar, we were already advising our clients to install BSS (Battery Storage Systems) alongside it. We explained that if you rely solely on solar, what happens when there's a dip in sunlight?

And now, since 2022–23, people have started listening and investing in battery solutions.

Look at the evolution in battery technology — from NiMH to Li-Po, lithium-ion, and now lithium iron phosphate (LFP). Each step brought progress, and this evolution continues.

Technology never stands still — and neither do we. We continuously train our engineers and service teams so they can provide the best technical support in Pakistan.

That's why our service division keeps us ahead of the competition.

Climate Change and New Technologies

Today, every exporter — whether in textiles, pharmaceuticals, or food — is being urged to use green

energy. Products made using fossil fuels are increasingly being deprioritized in the global market, where countries prefer greener supply chains — whether from India, Bangladesh, or elsewhere.

This is why Pakistani exporters are now actively investing in renewable energy.

Let me share another promising solution — Hydrogen (H₂).

It's quite simple. In water (H₂O), you separate oxygen from hydrogen and use hydrogen to generate clean energy. The key is to use renewable power for the separation process. That makes it green hydrogen, a sustainable energy source.

Right now, most generators being sold in Pakistan are hydrogen-capable. Previously, they could operate on just 10% hydrogen; today, they can run on 100%.

All technologies are moving toward green solutions — it's the only way forward. Many new technologies are already emerging. Hydrogen investment is happening — slowly but



steadily — not only in Pakistan but worldwide.

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All of these technologies will soon become part of Pakistan's energy landscape, helping shape a cleaner, smarter, and more sustainable future. ■

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Pakistan, UAE to Enhance Cooperation in Digital Innovation and AI: Shaza Fatima

On the sidelines of GITEX 2025, Federal Minister for IT and Telecom Shaza Fatima Khawaja held a series of high-level meetings aimed at

AI innovation, data infrastructure, and startup ecosystem development.

Minister Shaza Fatima highlighted key Pakistani initiatives, including the Digital Nation Pakistan Act, National Data Exchange Layer, and programs promoting a cashless economy, smart govern-

innovation, and building cross-border technology partnerships.

In a separate meeting with Mr. Muneeb Anjum, CEO of AHAD, discussions centered on advancing Pakistan's cybersecurity framework. The dialogue focused on enhancing digital trust, implementing



strengthening Pakistan's collaboration in digital transformation, artificial intelligence, and technology-driven investment.

During a meeting with H.E. Omar Suwaina Al Suwaidi, Undersecretary at the UAE Ministry of Industry and Advanced Technology, the two sides discussed joint efforts in digital governance,

nance, and AI integration. Both parties expressed their commitment to deepening cooperation in advanced technologies, data innovation, and cross-border startup investment.

The Minister also met Mr. Massimo Falcioni, Chief Competitiveness Officer at the Abu Dhabi Investment Office, to explore avenues for expanding UAE-Pakistan collaboration in digital investment, fostering

robust security solutions, and strengthening public-private partnerships to bolster national cyber resilience and support the country's innovation ecosystem.

Minister Shaza Fatima underscored Pakistan's commitment to positioning itself as a regional hub for digital innovation and secure technology growth through strategic global collaborations. — ER News Desk

BF Biosciences Launches Zetide® for Diabetes and Obesity Treatment

BF Biosciences Limited, a leading biopharmaceutical company, has announced the launch of its innovative product Zeptide® (Tirzepatide) in an easy-to-use pre-filled syringe format, marking a major step forward in the fight against diabetes and obesity in Pakistan.

In a disclosure to the Pakistan Stock Exchange (PSX) under Sections 96 and 131 of the Securities Act, 2015 and Clause 5.6.1(a) of the PSX Rule Book, the company said Tirzepatide is a synthetic polypeptide that acts as a dual agonist for the GLP-1 and

GIP receptors, targeting key pathways for blood sugar and metabolic control. The drug is approved by the US Food and Drug Administration (FDA) for treating Type 2 diabetes mellitus (T2DM) and obesity.

Zeptide® is produced at BF Biosciences' state-of-the-art European prefilled syringe



facility. The pre-filled format aims to enhance patient safety and convenience by reducing dosing errors. The product's quality, structure, and potency have been verified by a leading biological mass spectrometry laboratory in the US and a national university in Pakistan. The company noted that

Pakistan has one of the highest diabetes prevalence rates globally, with 9 million undiagnosed patients and alarming rates of overweight and obesity—affecting 57% of women and 41% of men, according to the World Health Organization (WHO).

As Pakistan's first biopharmaceutical plant, BF Biosciences has been producing essential medicines for HCV, cancer, cardiology, diabetes, nephrology, and other therapeutic areas for over a decade. The company said the launch of Zeptide® represents an important milestone in its mission to address critical unmet medical needs and is expected to positively impact future growth. — ER News Desk ■

Pakistan Oilfields Brings Razgir-1 Well Onstream

Pakistan Oilfields Limited (POL) announced that the Razgir-1 well, located in the TAL Block, has been successfully brought onstream on October 12, 2025, after obtaining all necessary regulatory approvals.

According to the compa-

ny's disclosure to the Pakistan Stock Exchange (PSX),



the development follows earlier communications regarding the testing results of the

Lumshiwal, Kawagarh, and Lockhart formations at the well.

As per information received from MOL, the operator of the TAL Block, production from Razgir-1 is being gradually increased and is expected to achieve a flow rate of 25.1 million cubic feet per day (MMCFD) of gas and 333 barrels per day of condensate.

Contd on page 11

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Powering Reliability: ABB's UPS Solutions Redefine Industrial Resilience with SMJ

By Asif Hasnain

The dependability of electrical power systems has a direct impact on system reliability, considering the current global state and the role of power in it.

Even slight power outages can result in system failures, subsequently resulting in substantial operational losses. To mitigate such hazards, many companies rely on Uninterruptible Power Supply (UPS) systems,

which provide a constant and consistent power supply. ABB happens to be a global pioneer in this field, with a good reputation for providing UPS systems that combine efficiency, dependability, and intelligent control. SMJ's offer of ABB UPS technology demonstrates its dedication to operational resilience in the same field.

These UPS are meticulously engineered to provide unhindered power protection by bridging the gap between utility supply and backup generation. Their double-conversion topology ensures consistent voltage and frequency regulation, protecting sensitive equipment from surges, fluctuations, and outages. The system's design minimizes energy loss, making it both environmentally and economically sustainable. For sectors like textile, food, and pharma, where uninterrupted operations are critical, ABB's UPS provides the stability necessary to maintain performance even under adverse power conditions.

SMJ a leading power solutions providing company, has one of the distinguishing features of ABB's UPS portfolio is its modular architec-

ture. This allows organizations to scale their systems accordingly and also provides companies with changing load requirements without significant infrastructure changes.

With a super advanced redundancy factor, each module operates independently yet integrates seamlessly into the central system, allowing operations to not face increased load time. In addition to this, for industries where operational continuity cannot be negotiated, the modular approach of these UPS systems not only simplifies maintenance but also reduces downtime.

Through the intricate usage of modern digital management technologies in its UPS units to improve control and monitoring, SMJ prioritizes quality in its products. Predictive maintenance, remote monitoring, and real-time diagnostics are supported by these solutions. This means proactive monitoring of SMJ's power systems, which in turn enables prompt fixes before minor issues escalate into significant disruptions. Additionally, technicians may readily obtain performance data using the user-friendly control interface, ensuring that the system is functioning within optimal parameters.



operational setup benefits from this versatility.

The long-term benefit of ABB's UPS systems is found

in their improved dependability, lower maintenance requirements, and energy efficiency, even though they may require a larger initial investment than those of certain competitors. This results in improved system availability and a reduced total cost of ownership. An example of how strategic technology adoption can increase an organization's resilience against power-related risks is the collaboration between any Industry and ABB.

In conclusion, ABB UPS provided by SMJ is a prime example of how engineering accuracy, intelligent design, and sustainable performance can all come together. SMJ's as a channel partner of ABB's UPS demonstrates a progressive approach to infrastructure dependability that places an emphasis solely on uninterrupted operation. To sum up, ABB's UPS systems continue to set the standard for excellence in power protection and management as industries continue to require uninterrupted energy flow in a world that is becoming more and more digital. (The writer is Deputy General Manager Head of UPS Division at S.M. Jaffer & Co.) ■



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Pakistan is the world's fifth-largest grower of sugarcane, though its yield per hectare is among the lowest globally. The country has a significant sugar industry, which is the second-largest agro-based industry, with 89 operational sugar mills. Sugarcane is a major cash crop, cultivated primarily in Punjab (about 65%) and Sindh (about 25%), and is crucial for employment in both farming and the processing industry.

Pakistan's Water Productivity Among Lowest, Farmers Oppose New Canals

President Sindh Abadgar Board, Mehmood Nawaz Shah, has said that the Board opposes the Cholistan Canal and similar projects because they would lead to further water overuse and expand the area under excessive irrigation — thereby worsening water management challenges instead of solving them.

Speaking to a group of journalists at the Karachi Press Club last week, Shah said, "We told the Chief Minister of Sindh that we oppose the Cholistan Canal — and at

the same time, we also oppose the Reni Canal and the Thar Canal, which are in Sindh province."

He explained that in Pakistan, almost 95 percent of



the total available water is currently being used in agriculture, whereas globally, only about 75 percent of water resources are consumed by this sector. However,

Pakistan's water-use efficiency — measured in cubic meters of water per kilogram of grain — remains among the lowest in the world.

"We produce only 0.1



kilograms of grain per cubic meter of water, whereas India produces 0.33 kilograms, China about 0.56 kilograms, and Australia nearly double from the same

quantity of water," Shah said. "In terms of water consumption versus productivity, Pakistan ranks among the lowest-performing countries."

He emphasized that the flood irrigation system widely used in Pakistan's agriculture is inefficient. "That's why we say that the canal systems proposed in Punjab

recently are completely contrary to Pakistan's water patterns and paradigms of the past 40 years," he added.

According to Shah, the use of water in agriculture is already excessive, and expanding canal irrigation would only increase inefficiencies. "We must address this by improving how existing water is utilized," he said.

Shah noted that very little progress had been made toward improving irrigation efficiency. "When someone receives free or abundant water, they don't feel the need to switch to efficient methods like drip irrigation," he remarked.

He cited India's example, where a shift to high-efficiency irrigation systems began years ago, and today

11–12 percent of agricultural land has been converted to sprinkler and drip irrigation. "And where do we stand? Less than one percent," he said.

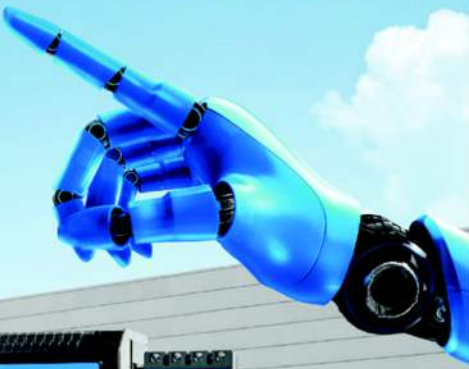
Under a World Bank-supported program covering 30,000 acres, Pakistan was unable to bring even 2,500 acres under drip irrigation.

"That's why we told the Chief Minister of Sindh that we oppose the Cholistan Canal, and we also oppose the Reni and Thar Canals — because such projects will only lead to further water overuse and aggravate irrigation problems," Shah concluded. "This is the fundamental reason for our opposition to the Cholistan Canal project." - **By Manzoor Shaikh**

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The Case for a Primary Education Commission

By Prof. Dr. Tariq Rahim Soomro

As an educationist who has spent decades in our nation's classrooms and lecture halls, I have witnessed firsthand the immense potential of our children.

Yet, I have also observed a growing void that our current system is failing to fill. We are proficient at teaching children what to memorize, but we are neglecting to teach them how to think, how to be—how to be ethical, compassionate, and actively responsible citizens. Teaching must be with training.

This is not a minor oversight; it is a national crisis in the making. The challenges of social division, rising incivility, and ethical ambiguity we see in public life will not be solved at the highest levels of government alone. They must be addressed at their root: in the primary school classroom. Today, I propose a transformative solution for the leadership and citizens of our province to consider: the immediate establishment of a dedicated Provincial Primary Education Commission (PPEC).

Our current educational framework, while striving for improvement, treats character development as an afterthought. Lessons on morality in Islamiyat or civics in Social Studies are often taught in isolation, disconnected from a child's daily life. Our teachers, heroic in their efforts, are burdened with administrative tasks and are not trained to facilitate the complex discussions on ethics and civic duty that our times demand.

The result is an inconsistent and unmeasured approach to building the very character of our next generation.

The PPEC is designed to be the surgical instrument that fixes this core issue. Modelled on the successful autonomous structure of our Higher Education Commission (HEC), and drawing inspiration from bodies like Nigeria's Universal Basic Education Commission, the PPEC would be an expert-led body focused exclusively on the qualitative transformation of primary education.

Its mission would be guided by three non-negotiable pillars:

1. **Morality:** Moving beyond textbook definitions to use storytelling and reflective discussions to cultivate an intrinsic understanding of honesty, integrity, sympathy and empathy in our children.

2. **Ethics:** Introducing "ethical reasoning" as a core skill, where children grapple with age-appropriate, real-life scenarios to learn the art of making reasoned, responsible choices.

3. **Civic Sense:** Transforming citizenship from a theoretical concept into a lived experience. This means student-led community projects, mock assemblies, and instilling a genuine, informed pride in our national identity and struggles.

The Commission's mandate would be clear and action-oriented: to redesign the curriculum, establish mandatory teacher certification in "Value-Based Education," develop new learning resources, and create a school environment, where these values are



reinforced daily.

The outcomes we can expect are both measurable and profound. In the short term, we will see improved school environments and greater respect for teachers and peers. In the medium term, we will nurture a generation that demonstrates stronger community involvement and ethical reasoning. In the long term, we can finally build the cohesive, responsible, and virtuous citizenry that is the foundation of a prosperous nation.

This is more than an educational reform; it is a national imperative. I call upon our provincial government to take three concrete steps: constitute a high-level committee to deliberate this proposal, draft the necessary legislation, and allocate seed funding in the upcoming budget.

Investing in infrastructure and textbooks is crucial, but investing in the character of our children is the highest-return investment a nation can make. The future of Pakistan will not be defined by the buildings we erect, but by the citizens we nurture. Let us begin that transformation today, from the very foundation. (The author is Rector, Institute of Business Management (IoBM).) - tariqsoomro@gmail.com ■

NED University, PSO Sign MoU to Strengthen Academia-Industry Collaboration

NED University of Engineering and Technology and Pakistan State Oil Company Limited (PSO) have

signed a Memorandum of Understanding (MoU) to enhance collaboration between academia and industry, according to a university communication. The

development opportunities for students and faculty members. It reflects a shared commitment to advancing innovation, practical learning, and industry-driven education. The ceremony was

attended by the Vice Chancellor and senior management of NED University, along with PSO's CEO and leadership team. Both sides expressed their commitment to empowering the next generation of engineers through



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On social media, the university extended appreciation to PSO, stating: "A big thank-you to the PSO team for their warm welcome and spirit of partnership!" ■

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Green Entrepreneurship: A Pathway to Scalable Solutions

Engr. Dr. Muhammad Nawaz Iqbal

Green entrepreneurship is a new paradigm where sustainability and profitability intersect, which develops business models able to meet market demand as well as environmental and social issues.

Green entrepreneurship is unlike in traditional entrepreneurship where short-term profit may tend to be prioritized; ecological stewardship is integrated in the business venture's mission. This is not only an ideological transformation, but it is becoming more practical, on the one hand, as consumers and investors require solutions with the ability to positively impact climate resilience, resource efficiency, and sustainable growth. Green entrepreneurship at its core focuses on the development of scalable solutions that can grow both across industries and geographies, and without consuming natural resources. The scalability aspect is critical as the management of environmental challenges, such as carbon emission, waste management and renewable energy, cannot be

limited to a small-scale project. Business people that create products or services with inherent flexibility allow their creations to expand beyond their local influence and impact whole industries globally.

The ability to combine environmental science with the latest technology is one of

ing, but fluid systems that would adapt to the changing markets.

Consumer behavior is of key importance in driving green entrepreneurship. The growing awareness of the world regarding climate change and sustainable lifestyles has served as a ground for business ventures

bility is also another issue that green entrepreneurs address by re-evaluating supply chains. Old supply chains tend to generate gigantic ecological footprint because of inefficiencies and overuse of resources. Green startups can show how efficient sustainable supply chains can be lean, cost-efficient, and easily

more and more money into startups making dual value propositions, namely, financial payoff and quantifiable environmental impact. This two-fold concentration enhances the process of scaling by providing resources enabling the entrepreneurs to perfect their prototypes, develop infrastructure, and market expansion. Green investments, unlike traditional funding, are usually accompanied by mentorship and networks, which enable ideas to proliferate in a more strategic and faster direction.

Scalability is another aspect in policy support. Green policies, renewable energy subsidies and harsh carbon regulations are being implemented by governments around the world. By ensuring that their ventures are aligned with these frameworks, the entrepreneur will be in a position to expand at a high rate in good policy environments. Moreover, their scalable solutions usually form a case study to continue with policy innovation, which establishes a cyclic reinforcement of governance and entrepreneurship. Educational establishments and research centers are also driving green entrepreneurship as they act as incubators for ideas. Innovation labs, sustainability



accelerators, and interdisciplinary research have become the creation of green startups in universities. These ecosystems, along with entrepreneurial training, enable people to manage to take scientific breakthroughs and scale them to profitable ventures by responding to urgent environmental issues.

The other characteristic of scalable green entrepreneurship is collaboration. Most of the green ventures, unlike the traditional businesses that protect their intellectual property, open up to partnership and innovation. Such partnerships are accelerating the scale, whether it is cross-industry collaborations to reduce plastic waste or a collaboration between energy companies and startups to decentralize the grid by sharing resources, experience, and reach. Green business has been scaled because of the digital transformation. Eco-friendly businesses can go online and tap into international markets with minimum overheads. As an example, e-commerce websites that are dedicated to eco-friendly

Contd on page 11



the peculiarities of green entrepreneurship. These entrepreneurs are creating platforms that grow with technological adoption, starting with the use of artificial intelligence to track the energy use and moving to creating blockchain-based systems to conduct transparent carbon credits trading. This type of integration would make sure that sustainability initiatives are not mere window dress-

that support the ideologies of environmental friendliness. Entrepreneurs are taking this chance to create products that are not only less harmful but actually restoring the ecosystems- biodegradable packaging, plant-based food alternatives, and circular fashion models are just a few such things. These ventures are organically scaled by values-driven consumers, through loyalty and advocacy. Scal-

duplicable across boundaries with the introduction of closed-loop systems, local sourcing, and renewable energy-powered logistics. These models are systemic thus make scalability economically and environmentally sustainable.

There is also a shift in investment of green entrepreneurship. Venture capitalists, impact investors, and government agencies are pouring

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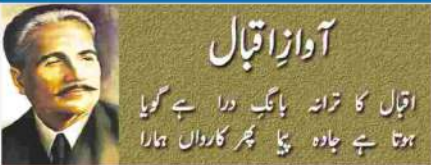
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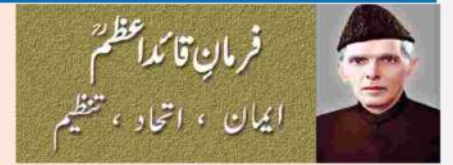


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تیری عمر رفتہ کی اک آن ہے عہد کہن
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صرف اس وجہ سے ہے کہ انگریز اس سارے ملک پر حکمران ہیں۔
(مسلم لیگ کانفرنس، بمبئی، 26 مئی 1940ء)



اصول اور تفصیلات

گاندھی جی کہتے ہیں: "ہندوستان کو جیتنے کی کلڑے کلڑے کیا جا رہا ہے۔"
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Macter Int'l Secures Licenses for Advanced Biotech Facilities

Macter International Limited has announced that it has obtained the requisite licenses for its Pre-Filled Syringe (PFS) and Pre-Filled Pen (PFP) manufacturing

three key injectable biotechnology dosage forms — Vials, Pre-Filled Syringes, and Pre-Filled Pens.

Terming it a significant milestone, the company said this achievement will enable it to introduce advanced biotechnological products designed to offer greater therapeutic benefits and enhanced convenience for



facilities within its biotechnology division, marking a major advancement in the company's production capabilities.

With these new licenses, Macter now possesses the capability to manufacture all

patients.

The expansion underscores Macter's commitment to strengthening its biotech manufacturing footprint in Pakistan, improving patient access to quality and innovative treatments, and aligning with global standards in healthcare technology. — ER News Desk

Pakistan Oilfields Brings Razgir-1 Well Onstream

Contd from page 6

POL further informed that its pre-commercial working interest in the TAL Block stands at 25%.

The company stated that the commencement of production from Razgir-1 marks another step toward enhancing domestic energy supplies and strengthening Pakistan's upstream sector.

In accordance with Section 96 and 131 of the Securities Act, 2015 and Clause

5.6.1 of the Rule Book of the Pakistan Stock Exchange Limited (PSX), we hereby convey the following material information:

With reference to the order issued by Competition Commission of Pakistan (CCP) and the imposition of penalty on International Steels Limited ("the Company"), the Company is reviewing the details and will take appropriate legal steps as needed. — ER News Desk ■

BISMILLAH HIR REHMAN NIR RAHEEM

Spending in the Way of Allah

By Muhammad Tariq Haq | www.eslpk.com

Our Lord puts forth an illustration — about one who spends from his possessions.

With a seed it is likened — it is grown up to seven hundred times, minimum.

A God-fearing person believes in that which Allah has kept hidden — he establishes prayers and spends out of his provisions.

"Spend in His cause," is His instruction — "and do not contribute to your own destruction."

Spend before a day comes when no bargaining will be done — nor any friendship or intercession will benefit anyone.

The likeness of the one who spends with a good intention — is similar to a garden.

When it receives rains, it doubles its vegetation — if it doesn't, even a drizzle is sufficient.

Those of you who spend and then make an injurious statement — such are the ones who render their good deeds undone.

He has enjoined upon us to spend what is more than our own consumption — on parents, kindred, and orphans, and others He mentioned.

Unless we spend out of our most beloved possessions — the chance to become a pious person is absolutely none.

Spend only of the good things you earn — and not of the bad which you would yourself shun.

A deceased person would yearn that he be to life returned — so that he could spend from his provisions,

and amongst the righteous ones he may then be reckoned — alas! this will never happen.

Those who recite the Book, offer prayers, and spend from their provisions — they hope for a transaction in which there will never be a reduction.

Allah destroys interest — and what in charity is given, blossoms.

Who'll be the one who gives Allah a goodly loan from what to him is given — so that He multiplies it manifold, with gracious returns in the Heaven.

Those who spend in His way, hidden or open — during the day or when the night darkens,

with Him is present their remuneration — neither will they be frightened about the future outcome,

nor saddened — on what has already happened.

Green Entrepreneurship: A Pathway to Scalable Solutions

Contd from page 10

items can increase the presence of local artists or green technology developers in the global market. Meanwhile, online marketing enables the multiplication of consumer awareness, forming groups of environmentally conscious consumers who make these enterprises sustainable. Green solutions that are scalable are usually found in the fact that the responses to local environmental issues have a global applicability. An irrigation system that uses sunlight to power irrigation, built to serve rural farmers in South Asia, can be scaled down to serve African or Latin American communities. Through transferability,

green entrepreneurs will know that their models are not restricted to one specific niche market but can be developed as solutions to universal sustainability problems.

Scalability is another feature that is enhanced by cultural adaptation. Green entrepreneurship does not mean a one-size-fits-all model, and it is about creating flexible systems that can change in accordance with various cultural and socioeconomic conditions. Businesspeople with this sensibility can expand their solutions to the extent they do not interfere with local practices, demands, and capabilities without compromising their sustainability objectives. A key motivation to green entrepreneurship is that it brings

into the environment the aspect of social equity. Scalable solutions usually take into account marginalized communities so that they can enjoy the availability of renewable energy, clean water, or green jobs. Not only does this inclusivity increase social legitimacy, but it also produces a wider market uptake, as the ventures will deal with environmental development issues and human development issues at the same time. Green entrepreneurship DNA is resilient and therefore scalable in the long run. Climate-conscious design of businesses creates resilience against economic instability or shortage of resources or changes in policies. The nature of resilient mod-

els is that they become scalable through the fact that they are flexible, stable, and trusted by the stakeholders even in uncertain circumstances. Green entrepreneurship is not only a business movement but is a way to create a new vision of the economic order. The solutions in this field, which are scalable, demonstrate the way in which businesses are able to flourish and ecosystems are regenerated, equity is promoted, and ecological footprints are minimized. With the escalation of the climate crisis, the need to engage in such business will keep increasing, and green entrepreneurship will not be an option but a primary driver of the future of sustainable economies. ■

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ایفیشنسی سے بجلی بنانے لگا۔

داؤد یونیورسٹی کا مقامی ٹیکنالوجی کی ترقی اور درآمدی انحصار میں کمی کیلئے اقدام

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فراہم کیا ہے جبکہ ان کے انکچول پر اپنی کے اخراجات بھی
خود ادا کیے ہیں۔

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ڈی یو کا مقصد ایسی مصنوعات تیار کرنا ہے جو درآمدی اشیاء کا
متبادل بن سکیں۔ انہوں نے ملک بھر کی جامعات کے
درمیان تعاون اور وسائل کے اشتراک پر زور دیتے ہوئے
کہا کہ اس سے عوامی فائدہ کی بچت ممکن ہوگی۔ تقریب کے
اختتام پر وائس چانسلر نے شرکاء کا شکریہ ادا کیا۔

کاروباری جدوجہد کا ذکر کرتے ہوئے نوجوانوں کو نصیحت
کی کہ وہ ناکامی کے خوف کے بجائے اپنی صلاحیتوں پر اعتماد
کریں۔ انہوں نے داؤد یونیورسٹی کو پیشکش ایریو آپسیس



سائنس اینڈ ٹیکنالوجی پارک میں سیٹ اپ قائم کرنے والی
یونیورسٹی بننے پر مبارکباد دی۔ اس موقع پر وائس چانسلر

ممبران کی ماؤں سے کروایا گیا، جسے شرکاء نے بے حد سراہا۔
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آر پی ڈی یو کے قیام کو اختراع، ایجاد اور کمرشلائزیشن کے



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چیئر مین اینگرو جناب حسین داؤد نے پیشکش ایریو آپسیس
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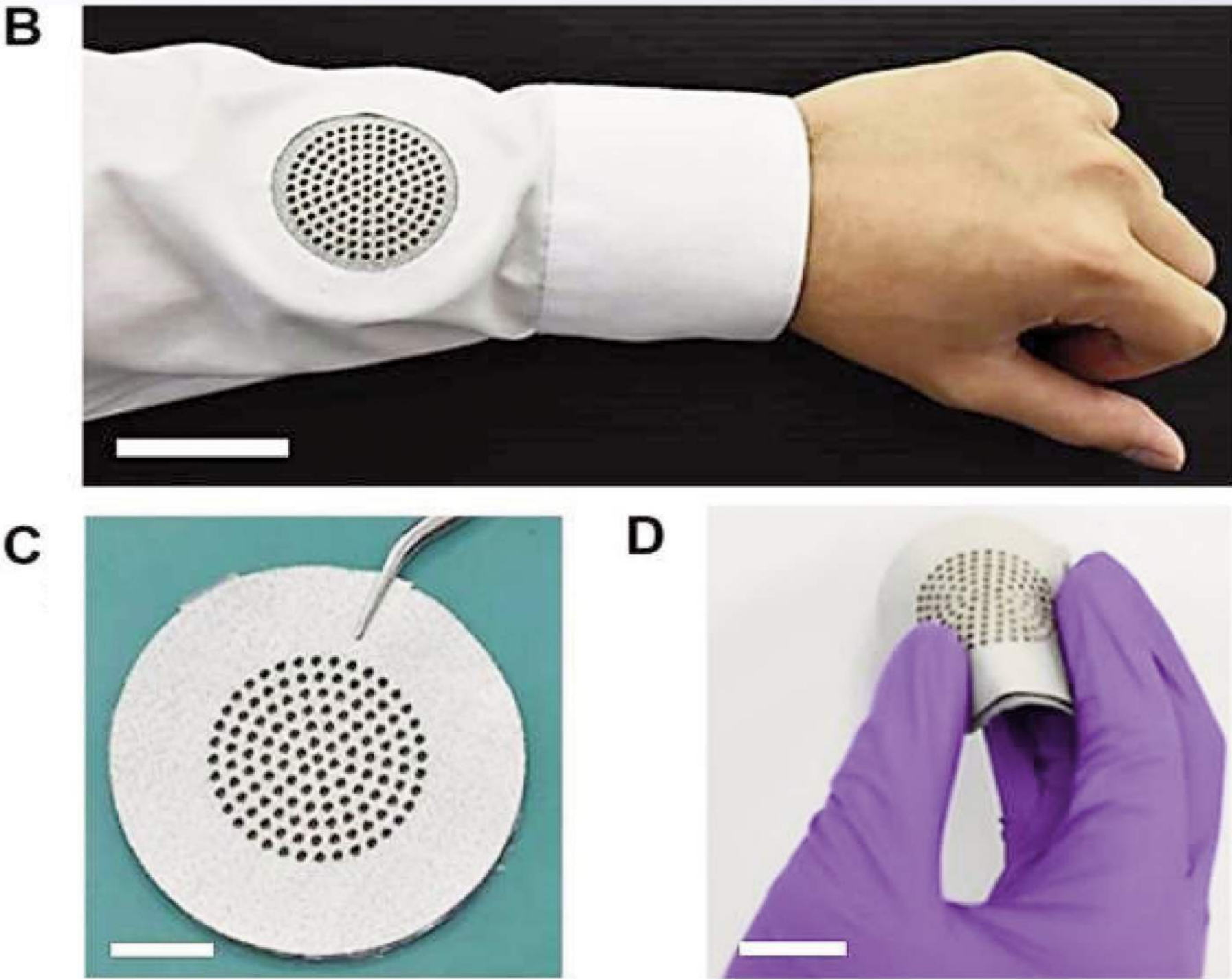
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How a fabric patch uses static electricity in your clothes to let you chat with AI and control smart devices



There could soon be a new way to interact with your favorite AI chatbots—through the clothing you wear.

An international team of researchers has developed a voice-sensing fabric called A-Textile. This flexible patch of smart material turns everyday garments into a kind of microphone, allowing you to speak commands directly to what you're wearing. This lets you communicate with AI systems such as ChatGPT

or smart home devices.

Wearable devices that sense and interact with the world around us have long been the stuff of science fiction dreams. However, traditional sensors currently in use are often bulky, rigid and uncomfortable. They also lack sensitivity, meaning they struggle to hear soft or normal speaking voices, making it hard for AI to understand commands.

The researchers addressed this issue by exploring triboelectricity, the principle behind static elec-

tricity. A-Textile is a multi-layered fabric, and as you move the layers, they rub together to create a tiny electrostatic charge on the fabric. When you speak, the sound waves cause the charged layers to vibrate slightly, generating an electrical signal that represents your voice. To boost the signal, the team embedded flower-shaped nanoparticles into the fabric to help capture the charge and prevent it from dissipating. This ensures it is clear enough to be recognized by AI.

The signal is then sent wirelessly to a device, such as a smartphone or a computer, that hosts a deep learning model the team developed, which recognizes the commands generated by the fabric. One of the technology's best aspects is that it doesn't require the wholesale redesign of clothing. You can simply sew or attach an A-Textile patch to any common garment, like a collar or shirt sleeve.

"This work develops voice-AI clothing by com-

binning advanced materials, device design, and DL [deep learning] to transform everyday garments into intuitive voice-AI interfaces," wrote the researchers in a paper about their technology published in the journal *Science Advances*.

Putting A-Textile to the test

In tests, the prototype A-Textile generated an output of up to 21 volts and recognized commands with 97.5% accuracy, even in noisy environments. The system could also interact directly with

ChatGPT and control smart home appliances, such as turning a lamp on and off, using only voice commands.

But these applications may only be the beginning, according to the team. "It is believed that the integration of imperceptible voice AI systems into clothing will provide easy access to AI while providing previously unexplored application prospects in various areas such as health care, fitness monitoring, and personalized assistance." - TX

Prototype battery powered by glucose and vitamin B2 offers path to more affordable energy storage

Researchers reporting in ACS Energy Letters have devised a battery powered by vitamin B2 (riboflavin) and glucose. Inspired by how human bodies break down glucose for energy using enzymes, the team incorporated riboflavin into a prototype flow cell battery.

The riboflavin mediator helped shuttle electrons between the battery's electrodes and the glucose electrolyte, generating an electrochemical flow from the energy stored in the sugar.

"Riboflavin and glucose flow cells can generate electricity from naturally derived energy sources," says Jong-Hwa Shon, the study's lead author.

"Using non-toxic components that are both inexpensive and naturally abundant, this system offers a promising pathway toward safer and

more affordable residential energy storage."

A flow cell battery stores electrochemical energy in

two electrolytes that flow through the system. As reactions occur in the electrolyte and at the electrodes, the stored chemical energy converts into electrical energy, and vice versa.

And because most plants contain glucose, this sugar has the potential to be an abundant and low-cost electrolyte as the energy source in a flow cell battery.

Current glucose fuel cell prototypes require noble

metal catalysts to break down the sugar molecules to generate power, but these models produce little power and are

difficult to scale up for industrial use. Riboflavin has shown

promise in other flow battery types as an alternative to metal catalysts because the vitamin is stable at the basic pH needed by electrolytes in

a glucose fuel cell with riboflavin as the catalyst.

For the battery, the team used a carbon material to form the positive and negative electrodes.

The electrolyte flowing around the negative electrode contained an active form of riboflavin and glucose, and at the positive electrode, the electrolyte included potassium ferricyanide or oxygen (as is used in conventional fuel cells) in a solution at a basic pH.

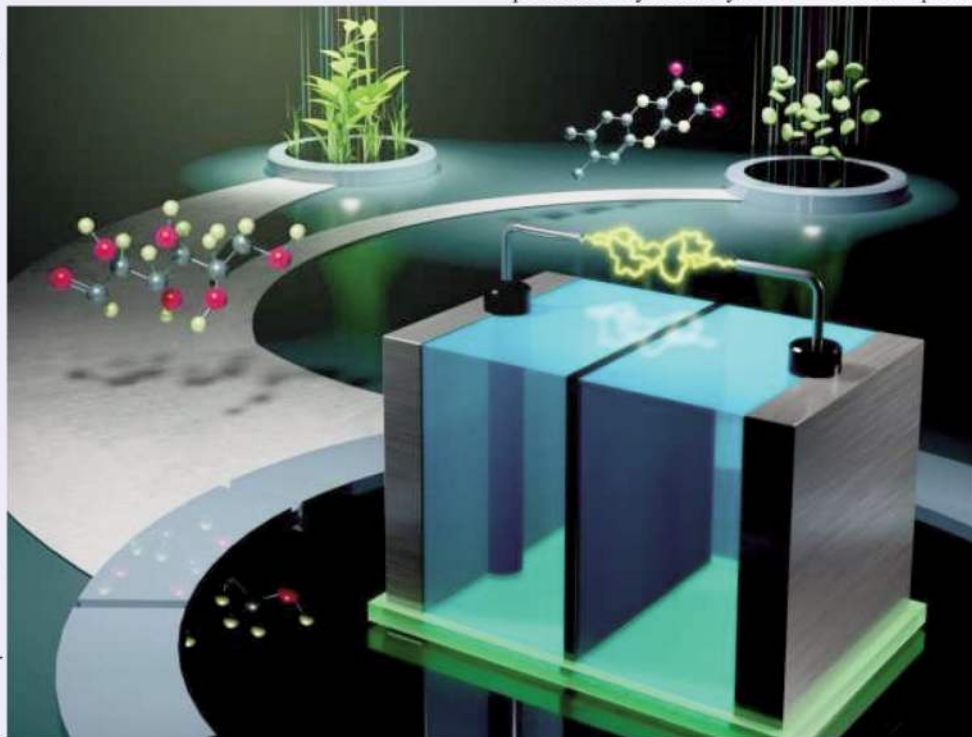
Although the cell with potassium ferricyanide allowed the team to precisely measure riboflavin's catalytic activity,

the cell with oxygen is a more cost-effective option for large-scale, practical use.

In a demonstration with the flow cell containing potassium ferricyanide, the team observed electrons moving across the cell and a power density at room temperature comparable to that of existing flow cell batteries using vanadium metal. Contrarily, the flow cell containing oxygen had slower reactions at the electrodes than the potassium ferricyanide design.

The researchers say this is likely due to oxygen breaking down riboflavin in the presence of light, which would self-discharge the battery. However, the oxygen version still demonstrated improved power density compared to the previous reports.

The researchers say they plan to improve the power density of the glucose flow cell containing oxygen by preventing light reactions with riboflavin and by refining cell engineering. - TX ■



Electric and biomass power could bring paper mills to net zero emissions, study suggests

A study finds that replacing natural gas with electric and biomass power, along with improved energy efficiency, could help some pulp and paper mills reach zero net emissions.

The paper, "Advancing sustainability in the U.S. pulp and paper industry: Decarbonization through energy efficiency, electrification, low-carbon fuels, and the social cost of emissions," is published in the Journal of Cleaner Production.

Researchers began with a simulation of mills defined by two characteristics: whether they used virgin or recycled fibers, and whether they were integrated or not.

A virgin mill creates pulp and paper from fresh wood that is being used for the first time, while a recycled fiber mill re-uses readily available fibers which may have been previously processed.

A mill is considered integrated if it has the capability to turn wood and other biomass into pulp and paper on site, whereas a non-integrated mill uses pulp that has been produced and dried off site.

"When looking at decarbonization, most prior studies have looked at one product or one type of mill," said Lokendra Pal, co-author of the study and professor in the Department of Forest Biomaterials and the Department of Mechanical & Aerospace Engineering at NC State.

"By building a whole-

mill simulation for each of these four categories, we can capture the relative strengths and weaknesses of each.

Mixing these different variables lets us understand the tradeoffs and interdependencies of operations in far more detail than has previously been available."

Virgin integrated mills

entirely on natural gas boilers and purchase electricity for heating and drying during the paper-making process.

Taken together, the paper industry accounts for 6% of the total U.S. industrial energy consumption, making it the fourth-largest industrial energy consumer.

Researchers found that

2050, which would make boilers powered by that electricity much cleaner than using natural gas," he said. "What we've found is that there is a path toward zero emissions for these mills, but only if that progress is made in the electrical grid."

Researchers also examined the decarbonization

cylinders to boil and evaporate the rest. This heating method, known as thermal drying, is the most energy-intensive part of the paper-making process.

Increasing the water removal during pressing resulted in significant energy savings and reductions in greenhouse gas emissions,

"Mill operations are often interdependent, so if you change one process it may impact others. We are trying to overcome the interdependency by offering multiple strategies for mills to pick and choose from."

The final strategy researchers analyzed was the use of low-carbon alternatives, like using waste wood in boilers instead of fossil fuels. The effectiveness of the method changed depending on whether or not the mill was integrated, but all types saw reductions in greenhouse gas emissions.

Integrated mills benefited significantly from replacing their limited fossil fuel usage with biomass, especially when electricity costs exceeded that of natural gas. They could also opt to supplement the steam used for powering their turbines with biomass combustion.

Overall, this method showed decarbonization rates of between 24 and 48%, depending on how completely the mill replaced its fossil fuels. While these numbers do not reach the emission reductions gained from full electrification, biomass is also a readily available fuel source which could provide mills with higher energy independence, Pal said.

"Looking at all three of these strategies together is a significant step toward improving the sustainability and competitive edge of the U.S. pulp and paper industry," Pal said. "Trade-offs like this appear no matter what strategy or strategies you use. There is no one-size-fits-all answer to sustainability." - TX ■



account for 30% of annual U.S. paper production and 33% of greenhouse gas emissions, the largest shares of both between the four types of mills.

While these mills produce between 80 and 90% of their energy using waste wood sourced on site, they also typically include a natural gas boiler to provide the remaining necessary energy. Non-integrated mills, on the other hand, do not produce energy on site and rely

by moving to electric-powered boilers, these mills could reduce their emissions by as much as 61%, potentially reaching zero net emissions. Doing so would require changes in how electricity is produced, Pal said, so that emissions from electricity production would not cancel out reductions at the mill.

"The electric system in the United States is expected to increase its share of clean and renewable energy by

effects of using energy-efficient dewatering methods and mechanical presses to remove excess water before the thermal drying process.

Drying traditionally involves jetting wet pulp on a moving wire, removing most of the water by gravity and vacuum, and then transferring the wet paper web to press rollers which mechanically squeeze out more water before the paper is passed around steam-heated metal

said Maria E. González, lead author and Ph.D. student in the Department of Forest Biomaterials at NC State. Doing so could have trade-offs when it comes to energy production on site, however.

"We found that each 1% of water removed before drying translated to a 3% increase in total energy efficiency for the papermaking process. However, it also meant less steam production, which is used to power turbines," said González.