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# Punjab to Build New Industrial Estate Along Ring Road

Punjab's Minister for Industries and Commerce, Chaudhry Shafay Hussain, announced plans to construct a new industrial estate near the Rawalpindi Ring Road in response to growing demand from local business owners.

The move comes as Punjab continues to attract both domestic and foreign invest-

ment thanks to its comparatively improved industrial infrastructure.

Speaking during a visit to Rawalpindi Chamber of Commerce and Industry (RCCI), the minister revealed that manufacturing of mobile phones is expected to begin in the province within the next six months — a milestone that would further diversify Punjab's industrial base. To support this growth, he directed immediate upgrades to the access

road leading to Rawat Industrial Estate, which currently



houses more than 500 industrial units once fully opera-

tional.

Chaudhry Shafay Hus-

sain also highlighted other recent infrastructure invest-

ments, including a newly built grid station at Bhalwal Industrial Estate, which will supply electricity to manufacturers at rates lower than prevailing market prices, enhancing energy affordability for industries.

During the session, RCCI President Usman Shaukat outlined the Chamber's ongoing initiatives, particularly around the upcoming Ring Road project. He described proposed industrial and economic zones along the route,

which are expected to significantly boost manufacturing, commerce, and relieve strain on urban traffic by relocating terminals and markets.

A long-standing demand, the construction of the access road to Rawat Industrial Estate drew strong support from business leaders. Former RCCI President Sohail Altaf warned that delays would drive up land prices, urging early acquisition under Section 4 to avoid further escalation.

Also present at the meet-  
**Contd on page 2**

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## Pakistan Auto Sector Urges Technology Transfer, Policy Stability for Local Manufacturing

Pakistan's automotive sector stands at a critical crossroads. Despite decades of assembly operations and a strong ven-

but are still facing some hardships due to import barriers, as imported materials are cheaper. In return, our coil becomes a bit expensive. In fact, basic steel is not produced in Pakistan; this is

This can be addressed. For instance, if we want to make a full car in Pakistan or start assembly here, we can bring the grade a bit down so that buyer affordability is improved. Secondly, there

others. We manufacture specialized grade material. ISL serves three kinds of companies. We provide material in the country and also export abroad. We supply materials to the home appliance sector,

at volumes. We need to conduct research, and improving supply chains can help reduce costs. Ahmad Shakil Paracha, SkyHigh Industries

measures. There is a lot of risk involved in local manufacturing. It was probably possible 10 years back, but now, after the entry of Chinese products, competition has increased manifold. No



dor base, the country still struggles to achieve full local manufacturing of vehicles. High car prices, heavy reliance on imported materials, fluctuating policies, and inconsistent technology-transfer commitments from global manufacturers remain major obstacles. Local engineering firms, however, continue to demonstrate strong capability in metal fabrication, specialized components, radiators, tyres, steel products, and welding consumables. Industry experts

alloy steel, which is imported. We add value to the product, but since finished Chinese products enter Pakistan at lower prices, our final price becomes slightly higher than the imported finished product. However, we have developed a better quality than the Chinese product. We are supplying it to the auto sector, and the performance is satisfactory. Salman Farooq, Kortech Auto Industry

are transport and highway standards, and it must be ensured that safety is not compromised. Therefore, we can localize vehicles in Pakistan if the government decides. The private sector is ready, and we are waiting for the government. Somebody has to take the lead and remain committed. We have been working for the last three decades, initially in copper radiators, and then we started business with Millat and Ghazi Tractors. We have two plants; we

the pipe industry, and we are the backbone of the engineering sector. We work in all grades of materials used in multiple sectors. To bring prices down, we have to look

too high in Pakistan, and Chinese products are cheaper, so we import them. We can bring prices down only if we decrease the power tariff and implement several other

country manufactures a complete vehicle by itself; parts are manufactured in different countries and places. However, we have localized bikes in Pakistan. As for



believe that with stable government policies, reduced production costs, and genuine technology transfer partnerships, Pakistan can significantly enhance localization and open the door to producing more affordable vehicles for the masses.

Abdullah Nasir Sheikh, Uniwire Engineering Industries

we mainly deal in welding consumables. Our parent company, United Wire Industry, is engaged in spring wires, PC wires, and supplies to the construction and automobile sectors. We specifically deal in steel fabrication involving welding and shafting works. We are the first company to produce CO2 welding wire in Pakistan. We have obtained all approvals

This is a million-dollar question. What we need is strong commitment and partnership between the government and the private sector in Pakistan, without which a consistent and effective policy cannot be framed. Until a stable policy is developed and continuously implemented, our dream cannot come true. For instance, in the auto sector, the government introduced 24 changes in its auto policy. If there is no continuity, FDI cannot come smoothly, nor can local investment. But still, we continue with our dream, as we are among a small number of countries that have an auto manufacturing industry. What about the prices and affordability of cars in Pakistan?

make aluminium and copper radiators and supply not only in Pakistan but also export to the US and the UK. EV impact: Yes, it will impact us, but the number of combustion-engine vehicles is huge; one cannot stop them all at once. They will continue to be manufactured because of their strong global infrastructure. EVs are successful in China due to their huge population, indigenous resources, and strong government control. Thus, I see radiator demand going down a bit, but I don't think it will disappear completely. Nasir Mahmood Rana, International Steels Ltd

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Contd on page 4



# Schneider, DWP Showcase Next-Gen Power Resilience Solutions

Schneider Electric Pakistan, in collaboration with its EcoXpert partner DWP Technologies, recently

hosted an exclusive event focused on the evolving landscape of

demonstrations on the latest advancements in uninterruptible power supply systems, including solutions

actively shaping a resilient, sustainable future for critical infrastructure in Pakistan.



laboration with its EcoXpert partner DWP Technologies, recently

mission-critical operations. The event featured in-depth discussions and

optimized for artificial intelligence applications.

Key presentations highlighted the critical role of resilience in ensuring power continuity and enabling sustainable data center operations, underscoring Schneider Electric's unwavering commitment to delivering reliable, future-ready infrastructure.

This successful collaboration reaffirmed that through innovation and trust, Schneider Electric and DWP Technologies are

Company Profile  
Schneider Electric is a global leader in energy management and automation, offering integrated solutions for homes, buildings, data centers, industries, and infrastructure. With a strong presence in Pakistan, the company is dedicated to driving digital transformation through innovative technologies that enhance efficiency, sustainability, and reliability across mission-critical sectors. — PR/ER

## Pakistan Auto Sector

Contd from page 3

prices, the cost of production here is too high. Lowering electricity and land costs would help bring prices down. The government must incentivize the industry. We are vendors of OEMs like

wheeler OEMs. We provide wiring harnesses, cables, gaskets, etc. Complete bike manufacturing in Pakistan — I think we are moving toward that direction. Industry develops slowly and gradually. As for prices, due



Atlas Honda bikes, Honda Atlas Cars, Millat Tractors, Thal Engineering, KE, and SSGC.

Iftexhar Ahmed, Loads Ltd

We manufacture exhaust systems and sheet metal parts. We supply our products to all OEMs like Toyota, Suzuki, and Honda. We are a 30-year-old company.

Why not make a complete vehicle?

Pakistan is not a big market. We have 20 to 22 manufacturers in Pakistan. We make parts with excellent quality for them. We make exhaust systems as per consumer specifications. Small car prices can only be decreased through government intervention. PAAPAM states that taxes alone amount to Rs. 14 lakh in car prices.

Shaher Raza, Millennium Engineering

Millennium Engineering has been working since 1993. We make parts for 2-

to inflation in the recent past, prices have been affected.

Aman Shah, GTR Tyre

There is a lot of potential in the auto sector; we can grow significantly. The government should focus on this segment and consider a relief package for the sector.

Affordability for the consumer

Both the government and the industry should take measures on their respective sides so we can offer better prices by minimizing production costs.

Why not make complete vehicles?

There were issues with technology transfer earlier. But now some OEMs have agreed to transfer technology. China has also provided good support, including technology transfer. We should be able to manufacture components here, especially for EVs. Some groups are already planning to produce lithium batteries in Pakistan. — Engineering Review Report ■

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Tahir Raza

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## Mari Executes Joint Venture Agreement with Ghani Chemical

**M**ari Energies Limited has formally entered into a Joint Venture Agreement (JVA) with Ghani Chemical Industries Ltd. (GCI) to establish a new Project Company dedicated to processing vent and exhaust gas from the Sachal Gas Processing Complex (SGPC) located in Mari Field, Daharki, Sindh.

This announcement follows the earlier disclosure (Notice CA-25-4607, dated July 01, 2025) regarding the execution of a Term Sheet

The Project Company will be responsible for capturing and processing vent/exhaust gas from SGPC to recover valuable hydrocarbons. These recovered components will be utilized to produce liquefied natural gas (LNG) and industrial- and food-grade carbon dioxide (CO<sub>2</sub>).

This initiative represents a significant step toward sustainable energy practices within Pakistan's energy sector. By converting waste gases into commercially viable products, the project will:

Reduce greenhouse gas emissions

Enhance environmental stewardship

administrative costs, and a significant rise in royalty and wellhead charges. Despite the profit decline, the company has shown strong past earnings growth and has exceeded the performance of the broader Pakistani Oil and Gas industry and market over the last year. The company has also actively engaged in expansion, including acquiring new blocks and drilling development wells.

Ghani Chemical Industries Limited (GCIL) has shown strong performance recently, with significant year-on-year increases in revenue and profit in fiscal year 2024 (FY24) and the first quarter of fiscal year 2026 (1QFY26). Key high-



between the two companies outlining their intent to collaborate on this innovative project.

Under the newly executed JVA:

Mari Energies will hold a 51% equity stake in the Project Company.

Ghani Chemical Industries will own the remaining 49% stake.

Project Scope and Impact

Create new economic value for shareholders and stakeholders

Strengthen local industrial output, particularly in CO<sub>2</sub> supply

Mari Energies' recent performance has seen a decrease in net profit for FY25, primarily due to lower production volumes, increased operational and

lights include a 26% revenue growth in FY24 to PKR 5.44 billion and a 51% increase in profit after tax to PKR 786 million, along with a 75% jump in profit to PKR 528.54 million in 1QFY26. The company's stock has also outperformed the Pakistani market and its industry over the past year. – ER News Desk

## Shabbir Khattak Appointed as Managing Director of PECO

**P**akistan Engineering Company Ltd. (PECO) has appointed Abdul Shabbir Khan Khattak as its new Managing Director (MD), following his posting by the Ministry of Industries and Production.

ing held on 22-11-2025, ratified the appointment in accordance with Section 188 of the Companies Act, 2017, read with Section 183 of the Companies Act, 2017, and the Listed Companies Regulations, 2019.

Prior to this appointment, Khattak served as Joint Secretary (A&F) in the Industries and Production Division. His appointment

steel rolled products, electricity transmission towers, and various structural and fabrication works.

The company's first plant was established at Badami Bagh, Lahore, on 34 acres of land. The neighboring area later became part of Pakistan's steel industry hub. As the company diversified its product lines, the original land became



The company announced the development in a notice to the Pakistan Stock Exchange (PSX) on Monday. According to the notice, "Abdul Shabbir Khan Khattak is posted/appointed as MD of PECO through the Ministry of Industries and Production (MoIP) letter no. 1(1)/2022-LED-III dated 07-11-2025."

The Board of Directors of PECO, in its 228th meet-

as PECO's MD took immediate effect.

Founded in 1950 under the name Batala Engineering Company (BECO), PECO initially produced light engineering products. Over the years, the company expanded its portfolio to include high-quality machine tools, pumps, power looms, concrete mixers, cranes, power presses, electric motors, bicycles,

insufficient for expansion, prompting the acquisition of 247 acres in 1960 at Kot Lakhpat Industrial Zone, Lahore, to accommodate future factory premises.

Following government nationalisation reforms in 1972, the company was renamed Pakistan Engineering Company (PECO), marking a new chapter in its long-standing history of engineering excellence. – ER

## Pakistan Proposes Major Maritime Partnerships to Saudi Arabia

**P**akistan has put forward a set of strategic maritime investment proposals to Saudi Arabia during a bilateral meeting held at the International Maritime Organization (IMO) Headquarters in London, reaffirming both countries' commitment to enhancing maritime coop-

eration and regional connectivity.

Chaudhry presented three key investment proposals to the Saudi delegation: A strategic partnership between Pakistan National Shipping Corporation (PNSC) and Saudi Arabia's Albehri shipping line, aimed at boosting fleet capacity and increasing bilateral cargo movement.

Enhanced business-to-business engagement between maritime companies from both countries to drive collaboration in port service-



es, logistics, and shipping operations.

A proposed sister-port agreement between Karachi Port Trust and Jeddah Islamic Port, intended to facilitate technical cooperation, promote bilateral trade, and strengthen regional maritime linkages. The Saudi side welcomed Pakistan's proposals and expressed willingness to proceed further, offering to share a draft Memorandum of Understanding (MoU) to establish a structured framework for long-term maritime cooperation.

Officials emphasized that deepening Pakistan-Saudi Arabia maritime ties will support regional trade connectivity, enhance supply chain resilience, and unlock new investment opportunities across the Red Sea-Arabian Sea corridor. – ER News Desk

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## Lucky Cement to Expand Congo Plant Capacity to 2.91 Million Tons Annually

Lucky Cement Limited has announced a major international expansion, with its joint venture company Nyumba Ya Akiba (NYA) in the Democratic Republic of Congo (DRC) set to significantly increase cement production capacity, according to a disclosure submitted to the Pakistan Stock Exchange (PSX).

The company said the expansion comes in response to rising cement demand in the DRC, driven by strong economic activity and a surge in construction projects across the country.

Under the approved plan, NYA will increase its capacity from 1.31 million tons per annum (MTPA) to 2.91 MTPA, adding a fully integrated 1.6 MTPA cement manufacturing line. Lucky Cement said the enhancement would improve operational efficiency and help the company maintain its market leadership amid anticipated growth in local demand.

Following this expansion, Lucky Cement's total domestic and international

cement production capacity will reach 23.15 MTPA. The updated group-wide capacities are as follows:

Company	Location	Capacity (MTPA)	Type
Lucky Cement Limited	Pakistan	15.30	Fully integrated plants
Al-Mabrooka Cement Company	Basra, Iraq	1.74	Grinding plant

Najmat Al-Samawah Samawah, Iraq 3.20 Grinding capacity

Nyumba Ya Akiba – existing DRC 1.31 Fully integrated plant

Nyumba Ya Akiba – expansion DRC 1.60 Fully integrated plant

Lucky Cement emphasized that the expansion aligns with its core value of entrepreneurship and its strategy to grow both domestic and international operations. The company highlighted its diversified business portfolio, which spans cement, automobiles, chemicals and agricultural sciences, mobile phone assembly, energy, and copper and gold mining.

The company said it remains committed to enhancing earnings quality and maximizing shareholder value through strategic investments and capacity growth. – ER News

## Pakistan HVACR Society Elects New Executive Council for Term 2025–27



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EXECUTIVE COUNCIL MEMBER



**MR. WAQAR ALI SHAH**  
EXECUTIVE COUNCIL MEMBER

Islamabad, November 29, 2025 — The Pakistan HVACR Society has successfully concluded its elections for the 2025–27 term, reaffirming the Society's democratic traditions

and commitment to smooth leadership transitions.

Mr. Yousuf Hasan has been elected President of the Society, as endorsed unanimously during the 14th General Body Meeting held in Islamabad.

According to the official announcement, candi-

dates were elected based on their past contributions to Society affairs and their active role in advancing the HVACR profession nationwide. With the installation of the new leadership, the Society expressed confidence that the incoming office-bearers will strengthen organi-

*Contd on page 7*

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# Fossil Fuel to Electric Conversion of Used Vehicles - 1

## A viable option for low-income individuals to acquire an electric vehicle

By: Jalil ur Rehman

**T**he world is swiftly transitioning towards electric-powered vehicles.

However, the exorbitant prices of new electric vehicles (EVs) pose a significant barrier for low-income individuals / the average consumer. Even the cheapest new EVs carry a high upfront price tag of above Rs. 4 million (with registration and some ancillary expenses being additional). For low-income persons who already own an old petrol vehicle, converting it to electric (retrofitting) can be a lower upfront cost solution compared to purchasing a new electric vehicle. The primary benefit of converting a fuel vehicle to an EV for low-income individuals lies in the reduced total cost of ownership over time.

The trend to switch to electric includes significant long-term savings attributable to lower fuel and maintenance expenses, the convenience of home charging, environmental benefits like zero tailpipe emissions and reduced noise pollution, and a superior driving experience featuring smooth, silent acceleration and instant torque. Furthermore, government incentives make EVs a more attractive option for most drivers.

In light of substantial economic benefits of shifting from fuel vehicles to EVs, the Government of Pakistan has announced the New Energy Vehicle Policy (NEV) for 2025 to 2030 (for NEW VEHICLES), which outlines plans to shift from fuel vehicles to EVs, build charging stations, pilot battery swapping, and enhance public awareness, while reducing costs through subsidies, tax incentives, and lower import duties, in addition to supporting local industry through public-private partnerships. The policy aims for 30% of new vehicles to be electric by 2030, 90% by 2040, and a

complete transition by 2060, with projected savings of \$800 billion over 25 years, a reduction of 2.07 billion liters of fuel annually, \$1 billion in foreign exchange savings, and \$405 million in healthcare cost reductions.

2025–2030: Build charging stations, test battery swapping, and enhance public awareness.

2030–2035: Scale local manufacturing and expand EV use in urban and rural areas.

2035–2040: Make EVs economically accessible for mass adoption.

Benefits of Electric Vehicles:

- **Lower Running Costs:** Electricity is significantly cheaper per kilometer than petrol or diesel, resulting in substantial savings on fuel costs. It is up to 70% cheaper in some analyses. The fuel benefit alone can be huge.

Converted EVs are significantly cheaper to operate than petrol cars. The electricity cost can be as much as four times less per kilometer. Running cost of various vehicle types (small & medium) ranges from Rs. 4.00 to 7.00 per km (based on electricity cost of Rs. 50.00 per unit). Utilizing solar panel charging can reduce charging costs by around 70%.

- **Energy Efficient:** EVs are significantly more energy efficient, converting 85% or more of their energy to motion, in stark contrast to the mere 20–25% achieved by internal combustion engine (ICE) vehicles.

- **Reduced Maintenance:** EVs typically possess around 20–25 moving parts in their powertrain compared to over 2,000 in an ICE vehicle, which means less wear and tear and remarkably lower maintenance and repair expenses, while eliminating the need for oil changes, filter changes, complex engine servicing and repairs.

- **Home Charging Convenience:** Charging an EV at home isn't just more convenient than going to the petrol

station. It is easily chargeable using a Level 1 charger, which is provided with the vehicle, taking around 6 to 8 hours to charge an 18–20 kWh battery and providing around 200 km range. The Level 2 charger (single phase 3 kW) reduces the charging time to 3–4 hours.

- **Enhanced Performance:** Electric vehicles offer instant torque, providing immediate acceleration in response to pressing the accelerator pedal, with a surge of speed that's perfect for pulling out onto busy roads and for nipping through traffic. Vehicles originally designed as electric-powered incorporate bat-

tery packs situated within the floor, providing excellent balance and weight distribution.

- **Relaxed Driving:** Electric vehicles are much quieter than diesel and petrol versions and create a far more comfortable and tranquil driving experience. With a simple control mechanism featuring 'drive', 'reverse', and 'park' options, drivers are relieved of the constant gear changes typical in conventional vehicles. The driving experience becomes less stressful, especially in congested urban environments where start-stop traffic is the norm.

- **Faster Return on Investment (ROI):** Due to substantial operational savings, the return on investment for a conversion can be achieved in as little as less than 4 years, compared to 8 years for a new EV purchase.

- **Zero Emissions:** Electric vehicles don't burn diesel or petrol, thereby producing zero exhaust emissions. That means no harmful gases like carbon dioxide that contribute to global warming.

- **Healthcare Cost Reduction:** The absence of sooty particulates that degrade air quality is significant, as poor air quality has been linked to an increase in respiratory

issues, like asthma. On average, a single electric vehicle can prevent 1.5 million grams of CO<sub>2</sub>. As a result of successful implementation of the 5-year NEV Policy, Pakistan stands to save \$405 million in the healthcare sector.

- **Saving in Government Capacity Payments:** Pakistan represents a favorable market for the sale of EVs because it has surplus electricity generation capacity relative to current demand. Promoting EVs can help utilize this idle capacity and potentially reduce the financial burden of capacity payments to power producers. –

To be continued



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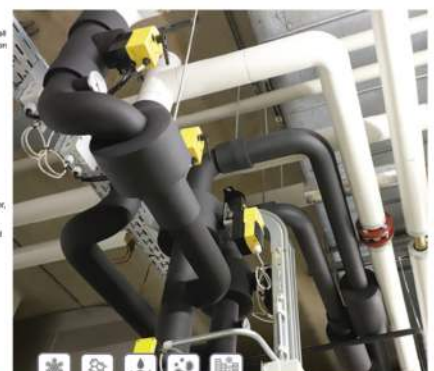
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## Pakistan HVACR Society Elects New Executive Council for Term 2025–27

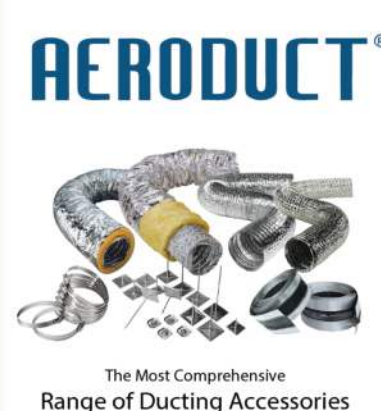
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zational capacity and steer it toward new achievements. The newly elected President, Mr. Yousuf Hasan, addressed the General Body and shared an outline of his vision and plans for the Society. Members also acknowledged and appreciated the efforts of the election officers for conducting the electoral process efficiently and transparently.

The Pakistan HVACR Society congratulated all successful candidates

elected at both the Executive Council and Local Council levels, reiterating its resolve to continue promoting professional excellence, collaboration, and technical advancement within the HVACR community.

The newly elected Executive Council for the term 2025–27 includes office-bearers from various chapters across the country, representing diverse expertise and sectors within the HVACR industry. ■



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# Agriculture Review



## BARI Chakwal Develops 60+ Crop Varieties, Leads Water-Saving Innovations in Drylands

Pakistan's leading dry-land research institute has developed more than 60 crop varieties and a suite of water-efficient technologies, significantly boosting agricultural resilience across the country's vast rain-fed farming belt.

The Barani Agricultural Research Institute (BARI), Chakwal, established in 1979 to address the unique farming challenges of the Potohar plateau, has today evolved into a multidisciplinary centre for innovation in crop improvement, water management, and farmer training.

"So far, BARI has developed over 60 crop varieties — including wheat, groundnut, oilseeds, pulses, and fruits — alongside technologies that conserve soil moisture and enhance irrigation efficiency," Director BARI Dr. Nadeem Ahmed told Wealth Pakistan.

**A Mission Rooted in Rain-Fed Challenges**

Dr. Ahmed explained that agriculture in the Potohar region is entirely dependent on rainfall, lacking the irrigation networks

available in other parts of Punjab.

"There was a great need for an institute dedicated to improving crop productivity, yield, and water availability in rain-fed areas," he said. "The main purpose of BARI's establishment was to address the problems faced by farming communities in Potohar and other barani regions."

Over the decades, BARI Chakwal has expanded its research portfolio to become a multi-crop, multi-disciplinary institute. "We have developed improved varieties of wheat, groundnut, oilseed crops, pulses, vegetables, and various fruit crops including high-value peach, grapes, pistachio, pecan nut, and avocado," Dr. Ahmed noted.

Driving Water Efficiency and Modern Irrigation Beyond crop breeding, BARI is at the forefront of introducing water-saving technologies.

"We work on high-efficiency irrigation systems and develop techniques that allow farmers to achieve maximum output using minimum water," he said. These include soil-moisture conservation practices, rainwater harvesting, and modern drip and sprinkler systems tai-

lored to dryland conditions.

**Strengthening Skills Through Training and Technical Support**

Dr. Ahmed emphasized BARI's focus on human resource development.

"We regularly conduct workshops and seminars to train scientists, extension workers, and students. Our goal is to ensure that research reaches farming communities effectively," he explained. "We also provide direct technical assistance to farmers so they can adopt improved practices and enhance their livelihoods."

The institute supports university students through research collaborations, internships, and field exposure programmes.

**Pioneering Olive and High-Value Fruit Cultivation**

Among its recent achievements, BARI has made significant progress in promoting olive cultivation across Potohar.

"We have achieved remarkable success in olive propagation and dissemination. Potohar is now recognized as a centre of excellence for olive development," Dr. Ahmed said, adding that the institute has developed a complete value chain for olive production.

BARI has also introduced blackberry as a promising high-value crop for smallholders.

"We brought blackberry to the region to provide farmers with a quick-return, profitable crop suitable for small landholders," he added.

**A Crucial Region for Punjab's Ecology and Economy**

The Punjab Barani Tract spans 14 districts,

including Attock, Rawalpindi, Jhelum, Chakwal, and parts of Sialkot, Narowal, Gujrat, Khushab, Mianwali, Jhang, Bhakkar, Layyah, DG Khan, and Rajanpur. This region forms the backbone of Punjab's dry-land agriculture and rangeland economy.

It also contains around 75% of the province's forest resources and nearly 10 million acres of high-quality

rangeland, considered among the finest globally.

With continuous innovation in crop varieties, water management, and value-added horticulture, BARI Chakwal remains at the forefront of strengthening Pakistan's dryland agriculture — helping farmers adapt to climate change while unlocking new income opportunities across the barani belt. — ER News Desk

## SECP Clears PMEX Takeover of NCMCL to Boost Agri Financing

The Securities and Exchange Commission of Pakistan (SECP) has approved Pakistan Mercantile Exchange Limited's (PMEX) proposal to acquire a majority stake in Naymat Collateral Management Company Limited (NCMCL), a move expected to fast-track the expansion of Pakistan's Electronic Warehouse Receipt (EWR) ecosystem and reinforce the country's agricultural market infrastructure.



In a statement issued last week, the SECP said the integration of PMEX and NCMCL aligns with its broader strategic vision of linking the commodity futures market more closely with the real economy. The development also complements the Commission's ongoing efforts to modernize agricultural value chains through technology-enabled reforms and enhanced collaboration with provincial governments.

The success of the Government of Punjab's adoption of the EWR system for wheat storage last year demonstrated the strength and practical benefits of the model. The SECP noted that the latest decision will help scale the system nationwide, delivering greater long-term impact for farmers, warehouses, and market participants.

The Electronic Warehouse Receipt system is a secure digital platform that allows farmers and warehouse operators to record stored agricultural commodities in a verifiable, nationally recognized registry. By documenting the quantity and quality of produce, EWRs enable farmers and agribusinesses to use these receipts as collateral

for financing, sell their commodities, or engage in commodity trading with improved transparency and efficiency.

NCMCL, as the central institution overseeing the EWR framework, plays a critical role by accrediting warehouses, maintaining the receipts registry, and ensuring trust and transparency throughout the process. Without its oversight, the system cannot function effectively, often leaving farmers without reliable avenues for financing or structured market access.

With PMEX acquiring a majority stake, the exchange's leadership capacity, technological infrastructure, and governance expertise are expected to strengthen the EWR ecosystem. The partnership will help expand the network of accredited warehouses, reinforce confidence in stored commodities, and improve farmers' access to formal finance.

The SECP added that a stronger EWR foundation will also pave the way for the introduction of deliverable agricultural futures contracts, aligning Pakistan's commodity markets with global best practices and deepening market participation. — APP ■



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## غزل

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ہم سے لا تعلق ہیں، چلے یہ بھی اچھا ہے  
وہ اگر ہو جائیں مائل، بڑے مسائل ہیں

سیّدہ حیدر حفی

## PEF, North Punjab Organizes Seminar Waste-to-Energy: Turning Biomass into Clean Power

Pakistan Engineers Forum (North Punjab) organized an insightful seminar titled "Waste-to-Energy" on Sunday, 15 November 2025, at Trade Expeditors Pakistan, Islamabad.

The event brought together leading experts from the energy, sustainability, and engineering sectors to dis-

Key Highlights from the Speakers  
Engr. Ahmed Sohail Khan  
(Ex-World Bank Consultant on Renewable Energy, Ex-USAID Technical Advisor for USPCAS-E)

1. Emphasized Pakistan's untapped biomass potential.
2. Discussed global waste-to-energy models and how Pakistan can replicate them.
3. Highlighted techni-

reduce energy costs.

3. Highlighted indigenous technological solutions and future innovations.

### Event Outcome

The seminar concluded with a strong message: Pakistan can significantly reduce landfill waste, generate cost-effective clean energy, and earn carbon credits by investing in the waste-to-energy sector. Participants appreciated the technical depth and practical direction offered by the speakers.



cuss modern solutions for converting biomass waste into clean and commercially viable energy.

The session was moderated by Naeem Ahmad Subhani, a renowned HSE & ESG Consultant, who highlighted the urgent need for innovative waste-management strategies to combat environmental challenges and support Pakistan's energy transition.

cal challenges in biomass conversion and solutions for scalability.

Muhammad Siddique (CEO CRECO, Biomass Gasifier Development Expert)

1. Shared practical case studies of successful biomass gasifier installations in Pakistan.
2. Discussed how local industries can adopt gasification technology to



Pakistan Engineers Forum (North Punjab) reaffirmed its commitment to hosting more knowledge-

sharing events that strengthen national capacity in engineering, environment, and sustainable development. ■

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## Engineering Review 50

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- George Fisher

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# Managing Technology in the Healthcare Sector: Opportunities and Challenges

Engr. Dr. Muhammad Nawaz Iqbal

**T**echnology management in the health sector has been a fundamental aspect of contemporary health systems, which have significantly transformed the process of administering, tracking, and enhancing care.

The increased use of digital tools—such as electronic health records and remote monitoring devices—indicates the transition to data-driven decision-making and patient-centered care. However, this development also brings complex issues of fair access, system interoperability, and sustainability in implementation. The innovations and challenges in this field are crucial in shaping the future of healthcare, especially in developing nations where the level of digital maturity varies considerably.

The adoption of clinical decision support systems in daily medical practice demonstrates how technology can make diagnostic processes more accurate and minimize medical errors. These systems process patient data, compare it with established clinical guidelines, and provide recommendations to practitioners. Their value is unquestionable, but their usefulness relies on the quality of data, clinician training,

and regular system updates. Such systems may lead to incorrect assumptions without proper monitoring and can cause overreliance on automated decisions.

One of the most transformative innovations of recent years is telemedicine, driven in particular by global health crises that highlighted the necessity for remote diagno-

sion, specific policy reforms and infrastructural improvements are essential.

Wearable technologies have broadened the scope of patient monitoring by enabling continuous collection of physiological data such as heart rate, blood glucose levels, physical activity, and sleep patterns. These innovations allow patients to

Predictive analytics and personalized medicine have become key areas of artificial intelligence applications. AI algorithms can identify disease patterns, forecast outbreaks, and tailor treatment options based on individual characteristics. AI-driven imaging analysis—especially in oncology—has shown remarkable accuracy in

assisted surgeries offer greater precision, smaller incisions, and shorter recovery times, resulting in improved patient outcomes. Robots can also support drug dispensing, disinfection, and patient mobility. The challenge lies in the high costs of procurement, maintenance, and training, which may further widen disparities



sis and treatment. It enables patients to consult specialists without geographical limitations and reduces the burden on already overstretched hospital systems. However, telemedicine deepens the issue of the digital divide, as individuals lacking internet access or digital literacy may be marginalized. To ensure telehealth serves as a tool of inclusion rather than exclu-

take greater control of their health and enable clinicians to intervene earlier when abnormalities arise. Nevertheless, wearables generate large volumes of sensitive data, raising significant concerns related to privacy, cybersecurity, and the ethical use of personal information. Hospitals need strong data-governance frameworks to prevent breaches and misuse.

detecting diseases at early stages. However, AI systems are vulnerable to biases present in training data, which may unintentionally disadvantage certain populations. Transparent algorithm design and rigorous validation are necessary to earn the trust of clinicians and patients.

Robotics is transforming hospital logistics, rehabilitation, and surgery. Robot-

between well-resourced and resource-limited medical facilities.

The Internet of Medical Things (IoMT), a network of interconnected devices and medical systems, enhances real-time information exchange and coordinated care. Smart infusion pumps, connected ventilators, and remote monitoring systems allow clinicians to track

patient conditions continuously. However, the interconnected nature of IoMT increases vulnerability to cyberattacks. Healthcare systems must invest in cybersecurity measures, including periodic vulnerability assessments, encryption protocols, and employee training on digital hygiene.

Digital health transformation relies heavily on electronic health records (EHRs), which improve documentation, coordination, and continuity of care. They enable real-time access to patient histories, lab reports, and prescription records across departments. Despite their advantages, EHRs often suffer from low interoperability, making them unable to communicate effectively across institutions and platforms. Such fragmentation prevents efficient data sharing, leading to duplicated tests, delayed treatment, and increased healthcare costs. Standardiza-

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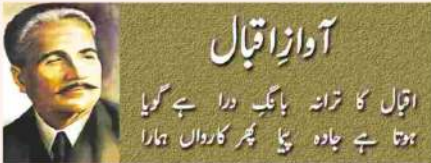
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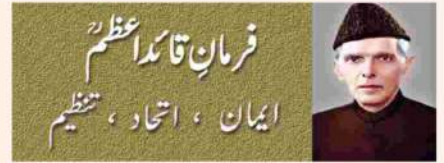


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## Managing Technology in the Healthcare Sector: Opportunities and Challenges

Contd from page 10

tion of data formats and supportive regulations is essential.

Blockchain has emerged as a potential solution to challenges related to medical data security, traceability, and integrity. As a decentralized ledger, blockchain can maintain tamper-proof patient records accessible only to authorized stakeholders. It can also streamline supply chains by tracking pharmaceuticals from manufacturing to the point of care, helping eliminate counterfeit medicines. However, widespread adoption requires significant technical expertise and financial investment—difficult for already resource-constrained healthcare systems.

Cloud computing offers scalable storage and computational power, enabling healthcare organizations to manage large volumes of data without maintaining costly onsite servers. It supports collaborative research, telehealth, and AI applications. However, transferring sensitive medical data to the cloud requires strict compliance with data-protection regulations and controls on cross-border data movement. Healthcare organizations must carefully evaluate cloud vendors for

security and regulatory compliance.

The capabilities of 3D printing have opened new opportunities for personalized healthcare, ranging from customized prosthetics to patient-specific surgical models and even bioprinted tissues. These technologies enhance treatment precision and reduce production time. Nevertheless, regulatory challenges related to safety, quality control, and clinical testing of 3D-printed medical devices remain unresolved. Integrating 3D printing into clinical practice requires clear guidelines, trained personnel, and robust quality-assurance systems.

Virtual reality (VR) and augmented reality (AR) applications are enhancing medical education and patient care. Surgeons can train in immersive environments, and patients can use VR for pain management or cognitive rehabilitation. Although these tools improve engagement and effectiveness, they require high-quality hardware and software, which are costly. Improper use can also cause digital fatigue or sensory overload, necessitating careful implementation.

Big data analytics helps

healthcare providers identify population-level trends, allocate resources efficiently, and plan public-health interventions. By analyzing millions of data points—ranging from hospital admissions to social determinants of health—organizations can predict disease outbreaks and enhance preventive care. However, aggregating data from multiple sources poses challenges in harmonization, cleaning, and ensuring data relevance. These practices must be guided by ethical frameworks addressing consent and data ownership.

The evolution toward the smart hospital marks a new era of digitized and automated healthcare environments. Smart hospitals utilize sensors, IoT, AI applications, and analytics dashboards to optimize patient flow, bed allocation, and equipment tracking. While these facilities enhance efficiency and reduce human error, they require significant upfront investment and highly skilled professionals to manage complex digital systems. Such infrastructure is particularly difficult to deploy in developing countries.

Change management remains one of the most critical

cal challenges in healthcare innovation, regardless of technological advancements. Staff resistance, inadequate training, and cultural barriers within organizations can slow adoption. Successful implementation requires leadership commitment, continuous training, user-friendly interfaces, and feedback mechanisms that engage frontline workers in the innovation process.

The path forward for technology management in healthcare lies in balancing innovation with responsibility. Advanced technologies have tremendous potential to improve healthcare quality, access, and efficiency—but only when applied ethically, securely, and inclusively. Technology developers, policymakers, and healthcare leaders must collaborate to create ecosystems where innovation thrives without compromising patient rights. As healthcare continues to evolve, embracing technology thoughtfully and responsibly will be essential to building stronger health systems and enhancing human well-being. ■

### Sales Blog for Young Engineers and Entrepreneurs

## Singer sewing machine - Every mother's dream A. The Sewing Machine Revolution:

Muhammad Tariq Haq | www.eslpk.com

Isaac Singer transformed from a struggling actor into the entrepreneur who put the sewing machine in nearly every home.

His life is a masterclass in innovation, showing how quickly a great idea can change the world when made affordable and accessible. B. From Failure to Breakthrough: Singer's early life was full of setbacks. He was a failed actor and his initial inventions—a drilling machine and a carving machine—didn't make him rich. Disaster struck when an early factory was destroyed. \* 1850: The Turning Point In a Boston machine shop, Singer was asked to repair a old, unreliable sewing machine (the Lerow and Blodgett). Instead of just fixing the machine, he decided to reinvent it completely. \* The Ingenious Fix In just 11 days, Singer created a far superior machine. His key improvements made sewing practical for the first time: \* He used a straight, vertical needle instead of a curved one. \* He included a horizontal table to hold the fabric flat. \* His design allowed for continuous, fast

stitching (900 stitches per minute). C. Turning an Invention into an Empire Having the best machine wasn't enough. Singer faced lawsuits over

Production: They pioneered interchangeable parts and assembly-line production, drastically lowering the cost of manufacturing. 2. Accessible



patents and the problem of high cost. His partner, Edward Clark, provided the final two steps to global success: 1. Mass

Financing: Singer and Clark introduced the world's first widely used "hire-purchase" plan (installment payment),

allowing ordinary families to buy a machine for just a few dollars a month. By 1860, Singer Manufacturing was the world's largest sewing machine company. The Singer machine revolutionized clothing production, saving millions of hours of labor and empowering women to make and mend clothes quickly at home. D. Singer's Blueprint: Instant Lessons Singer's success offers four core lessons for founders and innovators: 1. Solve the Real Problem: He didn't just repair a broken machine; he reimaged the entire design to make it truly useful. 2. Move Fast & Iterate: He built a working prototype in days, not months, and secured 22+ patents by constantly improving. 3. Make Innovation Accessible: He used mass production and a payment plan to ensure millions, not just the wealthy, could own his invention. 4. Persevere Through Setbacks: He leveraged a failed acting career, a destroyed factory, and constant lawsuits as fuel for his next breakthrough. The biggest impact comes not just from inventing a better product, but from making it available to everyone. ■



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پختونخوا، پن بجلی کے

3 منصوبے مکمل، 63

میگا واٹ پیداوار شروع

صوبے کو سالانہ 4.4 ارب آمدن متوقع، سوات میں 3 فلیگ

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پیداوار آئندہ 2 سالوں میں شروع ہو جائے گی۔ سوات کو ریڈر پر 40 کلومیٹر طویل ٹرانسمیشن لائن بچھانے پر بھی کام تیز کر دیا گیا ہے جو آئندہ سال مکمل کر لیا جائے گا جس کی تکمیل سے صوبے کے صنعتی شعبے کو سستی بجلی فروخت کی جائے گی۔

ان خیالات کا اظہار سیکرٹری توانائی و برقیات محمد زبیر خان نے پیڑو ہاس میں پن بجلی کے جاری 17 اہم منصوبوں پر ہونے والی ٹیژن رفت کے حوالے سے جائزہ اجلاس کی صدارت کرتے ہوئے کیا۔

خیبر پختونخوا حکومت اپنے وسائل سے توانائی کے جاری منصوبوں پر تیزی سے کام کر رہی ہے۔ رواں سال پن بجلی کے 13 اہم منصوبے کامیابی کے ساتھ مکمل کر لئے گئے ہیں جن سے مجموعی طور پر 63 میگا واٹ بجلی کی پیداوار شروع ہو چکی ہے۔ ان منصوبوں کی تکمیل سے صوبے کو سالانہ 14.4 ارب روپے کی آمدن متوقع ہے۔

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کراچی پاکستان کا دل، ریلوے نیٹ ورک کو

وسطی ایشیاء تک توسیع دینگے، وزیر اعظم

کراچی تالا ہو رشا لیمارا یکسپریس کوئی اپ گریڈ شکل میں چلایا جا رہا ہے، ریلوے اسٹیشنوں کی اپ گریڈیشن یقینی بنائیں گے

کینٹ اسٹیشن کے اپ گریڈ وینٹگ ایریا ز اور لاؤنجر کی افتتاحی تقریب سے خطاب، اسلام آباد۔ استنبول ریل روٹ کی بحالی پر زور

جاری ہے جس کے تحت کراچی سٹی اسٹیشن پر بھی کام جاری ہے۔ وزیر اعلیٰ سندھ سید مراد علی شاہ نے وزیر اعظم کا کراچی آمد پر خیر مقدم کیا اور صوبائی حکومت کی جانب سے مکمل تعاون کی یقین دہانی کرائی۔

بعد ازاں وزیر اعظم نے کراچی کینٹ اسٹیشن پر نئی شالیمارا یکسپریس کا افتتاح کیا اور اپ گریڈ وینٹگ ایریا ز کی پی لاؤنجر، جدید ڈاکٹنگ ہال اور کمپیوٹرائزڈ ٹکٹنگ سسٹم کا معائنہ کیا، اس موقع پر وفاقی وزیر، سیکرٹری ریلوے حکام، آئی جی ریلوے اور غیر ملکی سفارتکار بھی موجود تھے۔

وزیر اعظم نے کہا کہ وفاقی حکومت تمام صوبوں کے ساتھ مل کر ریلوے نیٹ ورک کو وسطی ایشیاء تک توسیع دے گی اور پاکستان۔ افغانستان۔ پاکستان کا حامل ہے۔ انھوں نے اسلام آباد۔ استنبول ریل روٹ کی بحالی پر بھی زور دیا، وزیر اعظم نے کہا کہ وفاقی وزیر

ریلوے نے ایشیائی ترقیاتی بینک کے ساتھ پاکستان ریلوے کی بہتری کیلئے دو ارب ڈالر کی فنڈنگ پر بات چیت کی ہے، وزیر اعلیٰ سندھ کی جانب سے کئی آرکائیو بیک میں شامل کرنے کی تجویز پر وزیر اعظم نے مکمل تعاون کی یقین دہانی

کرائی اور اسے اہم منصوبہ قرار دیا۔

قبل ازیں وفاقی وزیر ریلوے محمد حنیف عباسی نے کہا کہ وزیر اعظم کی رہنمائی میں آجھ ماہ کے قبل عرصے میں نمایاں بہتری حاصل کی گئی ہے جن میں کراچی کینٹ اسٹیشن کی جدیدیت اور شالیمارا یکسپریس کی بحالی شامل ہے، انھوں نے کہا کہ روہڑی اسٹیشن کی اپ گریڈیشن پر ایک ارب روپے خرچ کیے

سہولیات سے آراستہ کر دیا گیا ہے، سندھ حکومت کے تعاون سے صوبے کے تمام ریلوے اسٹیشن جدید خطوط پر استوار کیے جائیں گے، کراچی تالا ہو رشا لیمارا یکسپریس کوئی، اپ گریڈ شکل میں چلایا جا رہا ہے، انھوں نے کراچی کو ملک کا معاشی مرکز اور پاکستان کا دل قرار دیا، انھوں نے کہا کہ پنجاب، سندھ،

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وزیر ریلوے محمد حنیف عباسی، وفاقی وزیر اطلاعات و نشریات عطاء اللہ تارڑ اور دیگر شخصیات بھی تقریب میں موجود تھیں۔

وزیر اعظم محمد شہباز شریف نے کہا ہے کہ پاکستان ریلوے کی ڈیجیٹائزیشن اور جدید سہولیات کی فراہمی ملکی معیشت کو مستحکم بنانے میں اہم کردار ادا کرے گی، وفاقی حکومت، سندھ حکومت کے تعاون سے کراچی سرکٹر ریلوے (کے آ آر) کی جدیدیت اور صوبے سمیت ملک بھر کے ریلوے اسٹیشنوں کی اپ گریڈیشن کو یقینی بنائے

گی، انھوں نے ان خیالات کا اظہار کراچی کے دورے کے دوران نئی شالیمارا یکسپریس اور کراچی کینٹ ریلوے اسٹیشن کے اپ گریڈ شدہ وینٹگ ایریا ز اور لاؤنجر کی افتتاحی تقریب سے خطاب کرتے ہوئے کیا، وزیر اعلیٰ سندھ سید مراد علی شاہ، وفاقی



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سٹمشی توانائی کی صلاحیت 33

گیگا واٹ سے تجاوز، رپورٹ

یہ صلاحیت قومی گرڈ کی کل طلب سے بھی زیادہ، عوام کی جانب سے خاموش انقلاب

PRIED کی رپورٹ کی تقریب رونمائی سے ڈاکٹر شمس زامصوب، بد عالم و دیگر کا خطاب

مطابق پاکستان میں سٹمشی توانائی کی صلاحیت 33 گیگا واٹ کے تجاوز کر چکی ہے جو ہمارے قومی گرڈ کی کل طلب سے بھی زیادہ ہے۔

مہمان خصوصی وزیر مملکت برائے موسمیاتی تبدیلی ڈاکٹر شمس زامصوب علی خان کھر نے اپنے خطاب میں اس رپورٹ کو پاکستان کے پائیدار توانائی مستقبل کی جانب ایک اہم قدم قرار دیا۔

کرتے ہوئے بیرسٹر دانیال نے کہا کہ یہ تحقیق پاکستان کے توانائی منظر نامے میں ایک انقلابی پیش رفت ہے جس نے عوامی سطح پر جاری سٹمشی انقلاب کو واضح کیا ہے۔ انہوں نے شاندھی کی کردہ رپورٹ میں پیش کردہ اعداد و شمار سرکاری اعداد سے مکمل طور پر مختلف ہیں۔ "سرکاری اعداد کے مطابق ملک میں محض 1,75,000 میٹر ڈسولر سٹمز ہیں، جبکہ اس رپورٹ کے

وفاقی پارلیمانی سیکریٹری اطلاعات و نشریات اور پارلیمانی فورم برائے انرجی اینڈ اکنامی کے سیکریٹری بیرسٹر دانیال چوہدری نے پالیسی ریسرچ انشٹیٹیوٹ فار ایکویٹی ٹیبل ڈیولپمنٹ (PRIED) کی جانب سے جاری کردہ رپورٹ کو پاکستان کی توانائی پالیسی کے لیے ایک بیداری کی گھنٹی قرار دیا ہے۔

رپورٹ کی تقریب رونمائی سے خطاب





## Clean energy found in old coal mines

**C**umberland, B.C. was built on coal mining—both literally and practically. Thousands of workers were employed and millions of tons of coal were exported over 80 years before the mines were shuttered, leaving deep holes in the ground and a deeper void in the village's economy.

Now, thanks to a partnership with the University of Victoria-led Accelerating Community Energy Transformation (ACET) initiative, Cumberland is planning for a future built on clean energy that comes from the maze of abandoned mine shafts and extraction tunnels that snake beneath its streets.

Through the Cumberland District Energy project, ACET is determining how the water trapped in those tunnels could be used to produce geothermal energy that would heat and cool buildings.

Cumberland Mayor Vickey Brown sees this project as a step toward the reimagining of Cumberland—already an attraction for nature lovers and mountain bikers—as a clean, green outdoor adventure destination. It also represents a potential shift in how longtime locals, relative newcomers and visitors alike view the village.

"This is a way to highlight the history of Cumberland and bring it into a sustainable-future, clean-energy ethos," she says. "It's something that old Cumberland can be proud of, because we're using the waste of that old resource to transition to cleaner energy."

An old asset, a new opportunity for clean energy

Here's how it would work: water trapped underground in the abandoned mines is cooler in summer and warmer in winter than the temperature above ground, explains ACET community energy planner and project lead Zachary Gould.

Taking advantage of that temperature difference, heat pumps could use the water from the abandoned mines to provide heating and cooling to buildings at a relatively low cost and with near-zero carbon output.

"[The Cumberland District Energy project] is technically a very large ground-source heat exchanger," adds Emily Smejkal, a fellow with the Victoria-based Cascade Institute who specializes in geothermal energy.

Smejkal notes that having a network of mine shafts underneath the village means the entire town could access this clean energy resource.

Geologists have mapped the extensive mine system running beneath Cumberland to better understand its energy potential for the community above. Image: ACET

To start, however, initial modeling of potential energy systems for Cumberland is focused on a proposed civic precinct redevelop-

ment—a community center, municipal offices, even affordable housing—and a large industrial zone closer to Comox Lake.

"It's been a big motivation to think about this energy system in the context of how we can reduce the costs of critical infrastructure and provide critical amenities for community members," says Gould.

"But it's not just an energy system," he notes. "It's an opportunity to look at resource extraction in a new way in a village that was built on extractive principles. This project could turn those ruins of extraction, so to speak, into an opportunity and a shared community asset."

Mining was historically the core of Cumberland community  
From the Union Bay Wharf, millions of

were exploited and their jobs were dangerous. Many miners died and many more were injured while companies sold a product whose burning contributed to climate change.

Using those same abandoned coal mines to produce clean energy doesn't rewrite Cumberland's history, Copeman says, but it does use that past to flip the script for its future.

Noting that a proposal in 2011 for a coal mine near Union Bay attracted "a lot of push-back," she says. In contrast, Cumberland's proposal to use its abandoned mines to produce geothermal heating and cooling provides a constructive opportunity.

"Being able to use something that's already there for heating, I think it's positive," she says.

It's about reimagining these old relics of

and across the country in Springhill, N.S., another former mining town.

"It's about reimagining these old resources and relics of industry," he says. "It's really powerful to look at all of this mining and look at ways that we can benefit from it from a more environmental standpoint."

Highlighting the past while building a sustainable future

When Brown sat in on one of the geologists' discussions, she was already aware of the Nanaimo geothermal project at Vancouver Island University and of conversations between a previous Cumberland mayor and officials in Nova Scotia about their geothermal project.

What put the pieces together for her was an ACET webinar for municipal politicians.

"They said, 'We're looking for projects to work with municipalities.' And I thought, 'I have a project.'"

She explains there are two blocks of municipal property occupied by the village office, council chambers, public works and a rec center that sit on top of the former No. 6 mine.

"I thought we could use this project as a way to figure out whether or not we could use geothermal for heating and cooling of the buildings because we want to redevelop the block," she says.

As a small municipality with a population of approximately 4,800, Cumberland doesn't have an engineering department to study such a project. Brown saw that ACET had what the village needed.

"We need their academic expertise and their capacity to help us do those business cases, and also do the [geothermal] exploration side of it," Brown says.

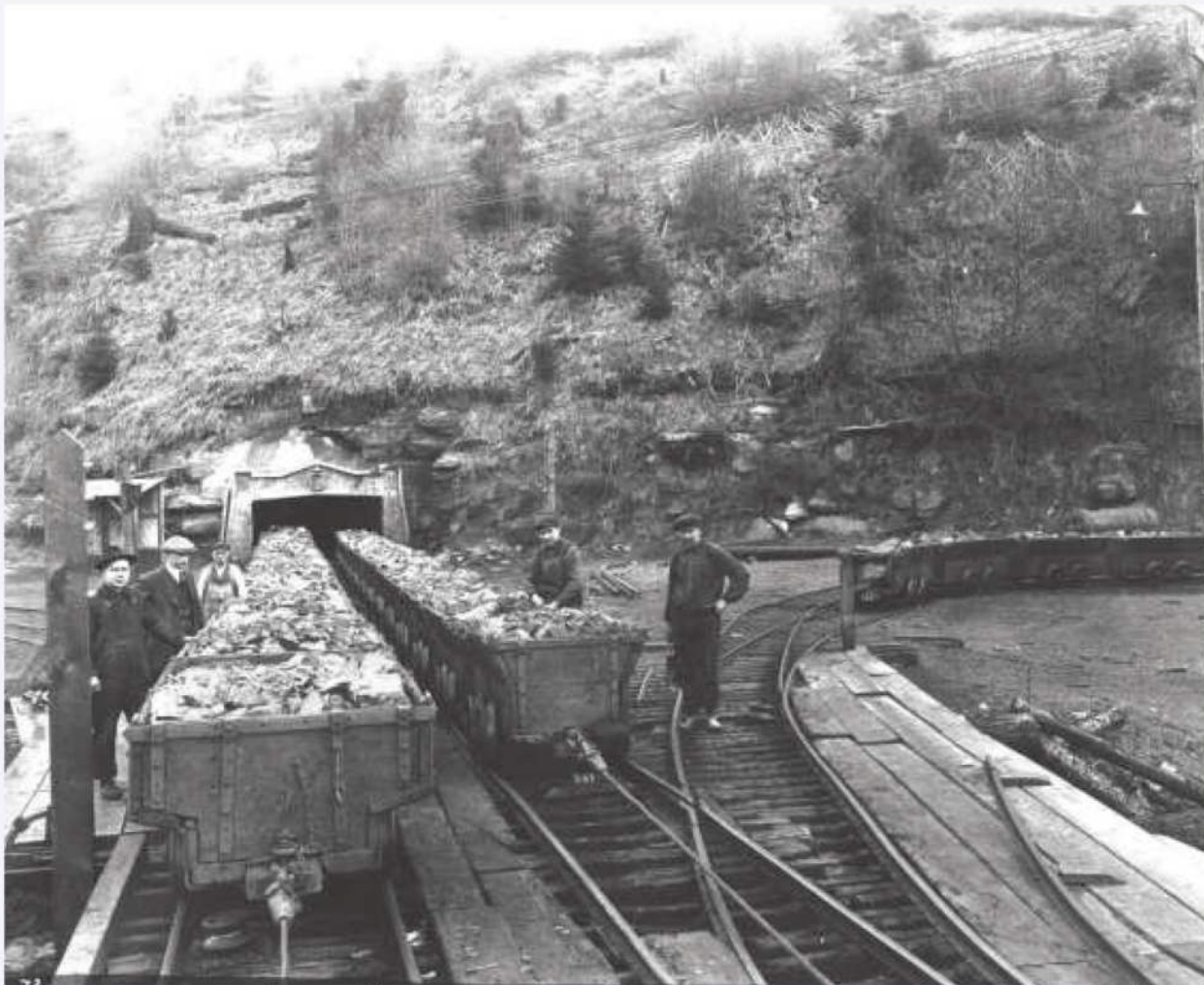
While the project was initially motivated by the desire to redevelop the municipal precinct, she says, if a pilot geothermal project proves to be successful and sustainable, there

is additional potential in what Copeman calls the "vast labyrinth" of tunnels beneath the village.

Brown says providing cheap, clean heating and cooling to businesses could make Cumberland industrial land more attractive for development—especially to enterprises that produce or consume considerable amounts of heat, such as greenhouses and food processors.

awing businesses, she says, would mean adding jobs and contributing to the tax base, all potentially making the village more livable and sustainable for its residents.

"We haven't always worked very well with natural systems," Brown says. "But I think this is a model of using the tools and resources you have in place to look after the needs of your community. And I think that's far more resilient than the way we've done it in the past." ■



tons of coal excavated from Cumberland's mines were shipped globally, fueling economies as far away as Japan and establishing the region as a vital industrial hub for decades. Image: Cumberland Museum and Archive

From 1888, when the first mine opened in Cumberland, until the late 1960s, when the last one was closed, some 16 million tons of bituminous coal were excavated and shipped from the Comox Valley, says Dawn Copeman, a historian with Cumberland Museum and Archives.

A wharf at nearby Union Bay loaded ships that were destined for international markets. Cumberland coal fueled steamships and heated homes. Coal coked in Union Bay was sold to smelters for lead and zinc production.

While the mines were the core of the local economy and community for decades, workers

industry'

The history of the Cumberland geothermal project started—more than 130 years after the first mine opened—as a discussion among geologists who live in the region and gather regularly.

As Cory MacNeill, a Cumberland local and geologist, recounts it, a conversation among peers about the common issue of methane produced by the former mines evolved into chats about other geothermal applications for abandoned coal shafts. While the widely known application of drilling deep into the Earth to access super-heated water wasn't an option in Cumberland, accessing the water closer to the surface to offset the heat of summer and the cold of winter was.

And they had examples to follow. MacNeill notes similar projects have been established about an hour south in Nanaimo, B.C.



# Double harvest from the fields: Potential and challenges of agrivoltaics

What are the benefits of placing solar panels over agricultural land? Where do they make sense, and who is already using them today?

An international team, including researchers from Forschungszentrum Jülich, has investigated these and other questions and summarized the current state of agrivoltaics research in a new review article published in

growing rapidly, as it not only provides renewable energy but also offers solutions to challenges such as climate adaptation and land-use conflicts.

A key advantage is the additional and more stable source of income: harvest plus electricity. The land equivalent ratio (LER), which measures the combined crop and energy yield

that less water evaporates—an effect that can reduce the need for irrigation.

And there are also crops, such as raspberries, that have been shown to benefit from this moderate shading. Taken together, these factors mean that agrivoltaics can help stabilize agricultural yields in the long term, even as climate conditions continue to change

complex, because many crops require more light and overall solar radiation is lower. This makes it all the more important to adapt the system design to local conditions—for example, through the right module height, suitable spacing between rows, or by choosing crops that cope well with partial shading. In this way, agricultural and energy yields can be

is an important component in the overall mix.

We believe the potential lies where agrivoltaics offers ecological benefits and stabilizes yields. This then only applies to around 1–2% of all agricultural land in Germany that is realistically suitable for the expansion of agrivoltaics. That would correspond to an installed agrivoltaic capacity of 170 to 340

partners in the field to test how technology, crops, and cultivation behave under real conditions. On the other hand, we combine agrivoltaics with our expertise in plant phenotyping. This allows us to examine very precisely how plants react to the altered light and microclimate conditions—knowledge that helps both the science community and users to



Nature Reviews Clean Technology. We asked Dr. Onno Muller and Dr. Matthias Meier-Grüll from Jülich's Institute of Bio- and Geosciences—Plant Sciences about the technology's global potential and the hurdles that still need to be overcome.

What exactly is agrivoltaics and what benefits does it offer?

Agrivoltaics refers to the combined use of agricultural land for crop production and photovoltaics. The modules are integrated into farming activities so that agriculture and energy production can take place in parallel. Our paper shows that global interest in this dual use of land is

relative to separate land uses, is often positive because agricultural and PV yields complement each other. Put simply, if the combined use produces more per unit area than two separate areas for crops and PV, the LER is above 1, and agrivoltaics is worthwhile.

There are also agronomic benefits. The partial shading effects of the modules can protect plants from heat and drought stress, thus increasing the resilience of crops, especially in warmer regions. At the same time, a slightly altered microclimate is created under the modules: the air and soil remain somewhat cooler and more humid, so

Where are agrivoltaic systems already in use—and where is their use particularly worthwhile?

At the moment, agrivoltaics is primarily used in countries with high electricity prices, since this creates the greatest economic benefit. Interestingly, these are not always the regions with the best solar energy conditions. The models presented in the paper show, for instance, that the Mediterranean regions are particularly well suited for agrivoltaics due to a combination of high solar radiation and favorable growing conditions.

In Western Europe, by contrast, conditions are more

optimally aligned.

How great is the theoretical potential—and how can agrivoltaics contribute to the energy transition?

The Fraunhofer Institute in Freiburg has calculated that around 10% of German agricultural land would be technically suitable for agrivoltaics, and that, in theory, around 1.7 TW of PV capacity could be installed. To meet national climate targets, a total of 500 gigawatts of PV capacity will be needed by 2040. This can be provided on all available surfaces—for example, roofs, facades, car parks, infrastructure areas, and conventional open-field PV installations. Agrivoltaics

gigawatts, which could contribute significantly to Germany's PV electricity by 2040.

What hurdles are there—and how is Forschungszentrum Jülich advancing the technology?

The main challenges include higher investment costs compared to conventional PV systems, a lack of uniform standards, and very different regulations and levels of acceptance from region to region. To overcome these hurdles, the team from Jülich is active on several fronts.

On the one hand, we are demonstrating a variety of agrivoltaic setups in the region, where we work with

select and further develop suitable systems.

Finally, we also support the creation of reliable regulatory frameworks. One key step is the development of the existing DIN SPEC 91434, a preliminary version of a DIN standard currently in a trial phase, into a full standard.

In Germany, this standard specifies how agrivoltaic systems must be constructed and what approval authorities need to consider for new projects. Such standards ensure planning security—for farmers as well as investors and authorities—and help to implement projects more quickly and reliably.

## Soft robots harvest ambient heat for self-sustained motion

A warm hand is enough to drive motion in tiny *Salmonella*-inspired robots that harness molecular-level dynamic bonding.

A team of researchers from China and the U.S. came together to design soft robots with a coordination-motorized oscillator (CoMO) that can make self-sustained micromovements by harvesting small amounts of energy from sunlight or body heat. At the heart of this innovation is a new supramolecular polydimethylsiloxane (PDMS)-based elastic polymer dynamically crosslinked by  $\text{Eu}^{3+}$  at the center.

The findings are published in *Angewandte Chemie*.

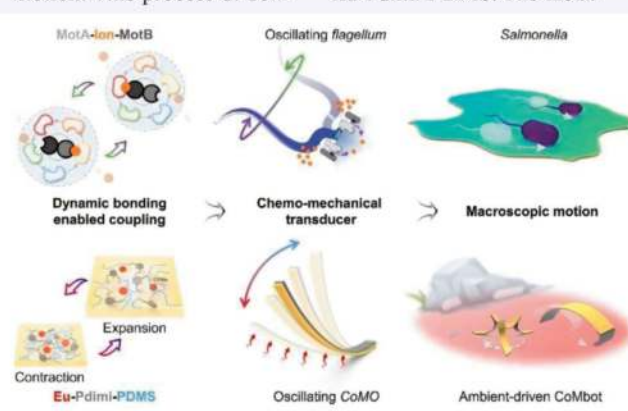
Inspired by bacteria

At a molecular level, living creatures translate energy captured from their surroundings or metabolized from the food they consume into motion. Artificial systems like soft robots require substantial energy, such as electrical stimulation, powerful lasers, or strong heaters, to get them moving. Even designs that rely on heat differences usually require temperatures much higher than those we encounter in everyday environments.

To achieve untethered soft robots that can self-sustain, we need materials that can tap ambient energy and convert it into locomotion.

To build such a system, the researchers drew inspiration from *Salmonella*, whose flagella moves continuously

through dynamic ion-binding. They developed CoMO, which uses a similar chemical strategy—a cyclic process of bond-breaking and bond-forming—to power its motion. This process of con-



verting a molecular transition into continuous, tiny mechanical movement is known as chemo-mechanical coupling.

Wiggling away from heat

The CoMO strips designed by the team comprised two layers: a passive layer of commercial cellulose paper and an active layer of an  $\text{Eu}(\text{III})$ -coordinated rubber-like material,  $\text{Eu-Pdmi-PDMS}$ . The metal-

ligand cross-links of the active material are tailored to be highly dynamic, weak, and temperature-sensitive, allowing reversible breaking upon heating and reforming upon cooling.

When heated, the active

layer expands 2,000 times more than its passive counterpart, thus pushing the CoMO strip away from the heat source. As it moves

outward, it begins to cool, and the material contracts again as the  $\text{Eu}$ -ions draw the PDMS polymer chains back together. The contraction causes the strip to bend back toward the heat source, kick-starting the entire expansion process.

The Coordination motorized robots (CoMbots) oscillate even when the temperature difference between its highest and lowest positions is only about  $2^\circ\text{C}$ —a gradient so small that conventional thermal actuators wouldn't even react.

The CoMbot prototypes completed more than 4,000

cycles of stable, continuous oscillation for five hours on different heated surfaces at temperatures ranging from  $30^\circ\text{C}$  to  $100^\circ\text{C}$ . It only showed a small drop in expansion length after the first two hours.

The team also found that this principle of dynamic chemo-mechanical coupling was also applicable to other metal ions such as  $\text{Al}^{3+}$  and  $\text{Zr}^{4+}$ .

By harvesting gentle energy, this material could power battery-free soft sensors and robots for environmental monitoring in remote natural settings. Researchers also believe that with some improvement, the CoMO materials can be used to build biomedical robots that can enter biological systems where conventional power sources aren't available. - TP ■