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Pakistan's Flood Vulnerability: National and Provincial Perspectives

National Overview

Pakistan remains acutely vulnerable to climate-induced disasters, particularly monsoon floods. The country has witnessed repeated large-scale inundations — 2010, 2022, and now 2025 — each displacing millions, damaging infrastructure, and exposing governance gaps.

The 2022 floods alone affected over 14 million people, destroyed 2 million homes, and damaged 20,000 schools, making it one of the worst disasters in recent history.

Despite lessons from past disasters, illegal encroachments, weak governance, and underinvestment in flood management continue to exacerbate risks. Barrages such as Guddu and Sukkur, designed to handle up to 1 million cusecs, have so far held, but they remain under

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Pakistan's Flood Vulnerability: National and Provincial Perspectives

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constant stress during peak monsoon flows.

The key future challenge is clear: unless natural waterways are restored and encroachments removed, every monsoon season will continue to bring large-scale humanitarian crises.

Province-Wise Situation and Challenges

Punjab

Heavy rains and upstream flows from India (Himachal Pradesh, Jammu & Kashmir, Punjab) have pushed combined flows of Chenab and Sutlej to over 600,000 cusecs at Punjnad.

Punjab has an advantage in terms of its topography. This province has a relatively steep gradient; e.g., Sialkot (256m above sea level) down to Rahim Yar Khan (83m) — a drop of 173m. This allows faster natural drainage compared to Sindh.

Challenges Ahead:

• Increasing inflows from India during extreme rainfall events.

• Stress on barrages during multi-day sustained flows.

• Urban flooding in cities due to poor drainage infrastructure.

Sindh

Sindh is currently facing a continuing flood wave moving downstream from Punjab. Guddu Barrage has already seen flows exceeding 500,000 cusecs, with expectations of 700,000 cusecs sustained for 7–10 days.

Unlike Punjab, Sindh has its limitations as regards its topography. It has a flat gradient — Ghotki (north Sindh) to Shahbandar (delta) drops only 32m — traps water for extended periods. This was evident in 2022, when floodwaters stagnated for months.

Large-scale illegal settlements, private bunds, and agricultural land grabs in riverine (katcha) areas obstruct natural drainage. Despite court orders (2020, 2021, 2023) and Flood Inquiry Commission (2022) recommendations, the government has failed to remove them.

Challenges Ahead:

• Sustained flood risk every monsoon due to blocked natural waterways.

• Weak governance and lack of enforcement.

• Need for massive investment in restoring drainage networks (estimated $357.5m for natural channels, $253.1m for floodwater disposal).

• Long-term threat to agriculture, infrastructure, and livelihoods if stagnation continues.

Khyber Pakhtunkhwa (KP)

In August 2025, Buner, Shangla, and Swat saw devastating flash floods and hill torrents, killing over 300 people. Earlier, in Gilgit and Hunza, glacier melt and intense rains triggered landslides, mudflows, and flash floods, trapping hundreds of tourists.

Mountainous terrain amplifies the destructive power of flash floods and glacial lake outbursts. Settlements along riverbanks and valley floors are highly vulnerable.

Challenges Ahead:

• Growing risk of glacial lake outburst floods (GLOFs) due to accelerated glacier melting.

• Weak early warning and evacuation systems in remote valleys.

• Need for climate-resilient infrastructure (roads, bridges, housing).

Balochistan

Balochistan often suffers from flash floods due to its arid terrain and poor drainage capacity. In past floods (2022), its remote districts faced severe isolation and prolonged humanitarian crises.

Challenges Ahead:

• Poor connectivity delays rescue and relief.

• Limited embankment or flood protection structures.

• Water retention vs. flood control dilemma in a drought-prone province.

• Key Future Challenges for Pakistan

Climate Change: Intensifying monsoon rains, glacial melt, and erratic weather patterns will make floods more frequent and destructive.

Encroachments: Illegal structures in riverine areas and blocked natural waterways threaten the effectiveness of flood protection infrastructure.

Governance Gaps: Despite court orders and commission reports, enforcement remains weak, reflecting lack of political will.

Infrastructure Strain: While barrages have held so far, prolonged high flows could test their limits.

Stagnant Waters in Sindh: With minimal slope and blocked channels, Sindh faces months-long waterlogging, causing agricultural, health, and livelihood crises.

Financial Burden: The cost of flood damages far exceeds the cost of preventive infrastructure, yet investments remain delayed.

Pakistan's flood risk is not just a natural hazard but a governance and planning crisis. The north (KP & Gilgit-Baltistan) faces flash floods and glacier-related risks; Punjab confronts rising upstream inflows but benefits from natural drainage; Sindh remains the most exposed due to flat terrain and blocked natural waterways; and Balochistan suffers from isolation and inadequate infrastructure.

Unless systemic reforms, strict enforcement against encroachments, and investments in natural drainage restoration are prioritized, Pakistan will continue to face catastrophic floods every monsoon — with mounting human, economic, and ecological costs.

– ER News Desk

Farewell with Gratitude: H.E. Cemal Sangu Honored by ASHRAE Pakistan

In an evening filled with profound respect and camaraderie, the ASHRAE Pakistan Chapter hosted a farewell reception and business networking forum to honor His Excellency Mr. Cemal Sangu, Consul General of the Republic of Türkiye in Karachi, as he concludes his impactful tenure.

The event, held at the ASHRAE Pakistan Chapter Office, brought together a distinguished assembly of business leaders, industry professionals, and community dignitaries to celebrate a diplomat who became a beloved figure in Karachi.

The evening commenced with the recitation of the Holy Quran and the national anthems of Pakistan and Türkiye, symbolizing the deep and respectful bond between the two nations.

Mr. Muhammad Abbas Sajid delivered a powerful and heartfelt welcome address, setting the tone for the evening. He illuminated the tireless four-year diplomatic journey of H.E. Mr. Sangu from 2021 to 2025, highlighting that he was arguably the most socially, culturally, humanitarily, and diplomatically active Consul General in Karachi. "From engaging with government bodies to fostering business ties, from supporting educational initiatives and welfare projects to connecting with schools and religious communities, His Excellency was everywhere," Sajid stated. "His unparalleled engagement has left an indelible mark on this city, and while people are deeply saddened by his departure, we are here to celebrate a legacy of true friendship and service."

This was followed by a keynote address from Mr. Farooq Mehboob, who built upon this sentiment, outlining the concrete opportunities for future Pakistan-Türkiye collaboration in trade and sustainable technology that Mr. Sangu helped to create.

A highlight of the evening was a special moment of recognition for Mr. Faraz Muhammad Khan. In a surprise announcement, he was presented with a Certificate of Recognition for his outstanding contributions to strengthening Pakistan-Türkiye trade and business relations since 2007. The award underscored the event's theme that strong bilateral ties are built not only by diplomats but also by dedicated business leaders who work tirelessly on the ground for nearly two decades.

In his farewell address, His Excellency Mr. Cemal Sangu shared his reflections, framing the partnership through the enduring principles of "Faith, Friendship, and Future." He expressed his deep affection for Karachi and its people, confident that the ties forged would remain strong.

A brief tribute was offered by Mr. Shuja Khalid, President Elect of the ASHRAE Pakistan Chapter, who presented a commemorative plaque to the Consul General on behalf of the organization, thanking him for his steadfast support.

The formal program concluded with a vibrant networking session, where attendees continued to share stories and explore future partnerships, inspired by the examples of dedication set by both Mr. Sangu and Mr. Khan.

Until Always

With gratitude and heavy hearts, we bid farewell to H.E. Cemal Sangu. Your friendship, compassion, and presence will always be remembered. You will be deeply missed.

About ASHRAE Pakistan Chapter:

The ASHRAE Pakistan Chapter is a leading professional body dedicated to advancing the arts and sciences of heating, ventilation, air conditioning, and refrigeration (HVACR). Through its conferences, educational programs, and networking forums, the Chapter serves as a vital platform for knowledge exchange, promoting sustainable technological solutions and creating business opportunities that benefit both the industry and the community. PR ■

AGRI TECH

Cotton acreage in Pakistan has declined by 7.5 percent, with Sindh bearing the steepest drop. PCGA says, overall production estimates have been revised downward to 4.8 million bales for 2025, nearly 4 percent less than last year. Dr. Yusuf Zafar, Vice President of the Pakistan Central Cotton Committee (PCCC), place the figure even lower at 4.35 million bales.

Pakistan's Cotton at a Crossroads: Record Decline, Climate Pressures, and a Ray of Hope

Pakistan's cotton sector — once the backbone of its textile-driven economy — is facing an unprecedented crisis.

From shrinking acreage to climate-induced disasters and pest infestations, the country's cotton production is projected to hit record lows in 2025. Yet, amidst this gloomy outlook, a breakthrough in seed technology may offer a glimmer of hope for farmers and the textile industry alike.

Historic Decline in Acreage and Output

Recent data reveals that cotton acreage nationwide has declined by 7.5 percent, with Sindh bearing the steepest drop. According to the Pakistan Cotton Ginners Association (PCGA), overall production estimates have been revised downward to 4.8 million bales for 2025, nearly 4 percent less than last year. Some experts, including Dr. Yusuf Zafar, Vice President of the Pakistan Central Cotton Committee (PCCC), place the figure even lower at 4.35 million bales.

Both estimates represent the lowest levels in Pakistan's history, a stark contrast to the record-high 14.8 million bales achieved in 2011-12. In just over a decade, output has plummeted by nearly 70 percent. Last year's crop, at 5.6 million bales, was already the lowest in three decades — and the current season threatens to dip further.

Climate Change and Other Challenges

Behind these numbers lies a combination of systemic and climate-driven challenges. Heat waves, erratic rains, floods, and water shortages have put immense pressure on cotton cultivation. The cotton curl leaf virus and pink bollworm infestations have further ravaged crops, while declining use of fertilizers — particularly phosphorus, Sulphate of Potash (SOP), and nitrogen-based varieties — has compounded the problem.

According to Sajid Mahmood, Head of Technology Transfer at the Central Cotton Research Institute Multan, early fruiting looked promising this year, but June–July heat waves and water scarcity caused fruit shedding and stunted growth. Subsequent floods worsened the situation, submerging cotton fields across Punjab and Sindh.

In Punjab alone, production could decline by as much as 35 percent, with over 2,100 villages losing crops worth billions of rupees. Key cotton-growing districts such as Pakpattan, Vehari, Bahawalnagar, Bahawalpur, and Rajanpur have suffered massive damage. Meanwhile, Sindh managed to achieve only 65 percent of its sowing target due to water shortages, affecting both yield and quality.

Ginning Factories and Market Signals

Despite poor crop conditions, ginning activity has shown relative improvement. This year, 299 ginning factories are operational compared to 272 last year, with Punjab accounting for most of the increase. Stock levels have surged to 200,700 bales, up from just

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IEP Karachi Holds Int'l Conference on Occupational Health, Safety & Environment

The 13th International Conference on Occupational Health, Safety & Environment (OHSE-2025) was organized by the Institution of Engineers Pakistan (IEP), Karachi Center, and NED University of Engineering & Technology.

This flagship conference of the institution highlighted the growing importance of workplace safety in an era shaped by artificial intelligence (AI).

The conference, which began in 2001 as a workshop before evolving into a national and later an international moot, has steadily gained recognition for bringing industry and academia together. This year's event drew wide participation from industry experts, practitioners, and engineers across Pakistan, alongside international speakers.

A keynote address was delivered by an expert from the United States representing ASHRAE, while another distinguished speaker joined from Saudi Arabia. Their participation added global insights to the discussions, underscoring the conference's international standing.

"This is a flagship conference of IEP Karachi. Its significance lies in the fact that people from industry actively participate, share practices, and later incorporate improved standards in their organizations. It's a learning process with thought-provoking ideas," said Ayaz Mirza, a representative of the organizing team.

The theme of this year's conference was "Safety under AI", reflecting how artificial intelligence is reshaping occupational health and safety. Speakers and paper presenters examined how AI can be harnessed to build safer work environments, reduce risks, and promote a culture of prevention across sectors.

Representatives from leading companies, including Engro, K-Electric, and Siddiq Sons, attended the conference. Their presence reflected the industry's acknowledgment that safety is no longer just a compliance issue, but a driver of productivity and sustainability.

In today's industrial landscape, occupational health and safety have become central to business competitiveness. With rapid technological changes, especially the integration of AI, organizations must rethink traditional safety approaches. Conferences like this play a vital role in creating awareness, shaping policies, and building a culture of continuous improvement in Pakistan's industries. – ER Report ■

Pakistan's Cotton at a Crossroads: Record Decline, Climate Pressures,

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53,564 bales at the same point last year, reflecting stronger early arrivals. However, deliveries to textile mills dropped by 3.16 percent compared to last year, signaling weaker downstream supply.

Triple-Gene Cotton Seed: A Potential Game-Changer

Amid this crisis, innovation is emerging as a critical factor. Pakistani agribusiness company Four Brothers has introduced a new triple-gene cotton seed, designed to boost yields and withstand the pressures of climate change. The seed claims resilience against heat stress, water scarcity, and pest infestations — three of the most critical challenges facing farmers today.

Industry insiders believe this innovation could provide a lifeline to farmers struggling with declining productivity. If scaled effectively, the seed could enhance per-acre yields, stabilize national production, and help Pakistan's textile sector — which relies on cotton as its primary raw material — regain competitiveness in global markets.

Institutional and Policy Bottlenecks

However, experts caution that seed technology alone cannot rescue the sector. Delays in policy and institutional reforms remain a stumbling block. The merger of PCCC and the Pakistan Agricultural Research Council (PARC), mandated for completion by June 30, 2025, is still pending. At the same time, textile mills have failed to pay outstanding cotton cess dues under their July 2025 agreement with the government, depriving research institutions of much-needed funds.

Without addressing these governance gaps, research activities — including trials and scaling of climate-resilient seeds — will remain underfunded and fragmented.

Looking Ahead

The road ahead for Pakistan's cotton sector is challenging but not without opportunities. Experts suggest that by learning from this year's devastation, strengthening climate adaptation strategies, and adopting resilient seed varieties, Pakistan can gradually recover its cotton output. Early sowing in Punjab, which yielded 20 maunds of phutti per acre, shows that better planning and timely interventions can deliver results.

Still, the threat of climate-induced floods and heat waves looms large. Unless the government, researchers, and industry collaborate to promote innovations like the triple-gene seed, ensure timely fertilizer supply, and strengthen irrigation infrastructure, Pakistan risks further erosion of its cotton economy — with direct consequences for its textile exports and rural livelihoods.

In short, Pakistan's cotton stands at a crossroads: a fragile present weighed down by climate shocks, and a hopeful future pinned on innovation and reform. – ER News Desk ■

Engineering Startups: From University Labs to Market

Engr. Dr. Muhammad Nawaz Iqbal

Engineering startups with their roots in university laboratories are the purest form of innovation, as they emerge from an atmosphere of curiosity, experimentation, and a lack of business pressures.

They tend to begin as exploratory projects, either driven by the vision of a professor or the initiative of a student to address an urgent issue. The university environment provides fertile soil within which disruptive technology can take root due to the academic rigor and outside-the-box thinking that is not inherent in traditional corporate R&D.

The lab-to-market process is not a simple one. A lot of the inventions in university laboratories are still paper innovations that never reach the level of publication in journals. What is new is the ability to fill this gap by developing researchers who think of commercialization not as a violation of academic purity but as a kind of continuation of problem-solving. Faculty and students can become entrepreneurs, but when they accept the mindset, they make their prototypes a solution with a real effect on society. Interdisciplinary resources that most early-stage startups cannot afford are also available to university labs.

With a biomedical engineering project in mind, we can easily collaborate with

data science, materials engineering, and healthcare policy colleagues at the same institution. Due to this cross-pollination across disciplines, such startups are more robust and effective as they predict market complexity at a very young age, resulting in innovative solutions. Among the most invigorating things about university-based engineering startups is how they are aligned with cutting-edge research areas. In the industry, there is a tendency towards risk-aversion, but at the level of academic laboratories, quantum computing, renewable energy, AI-controlled manufacturing, and nanotechnology are pushed to their limits.

Commercializing these kinds of research allows startups to bypass the established players in the market and form completely new industries. The importance of universities as a place of radical change is highlighted in this dynamic. The innovation of the university-to-market route is in the fact that it has two aims: to expand knowledge and to generate wealth. Such startups are more than profit-seeking; they are an effort to bring intellectual discovery to practice. This two-fold mission tends to lead to products and services that are not merely innovative, but also socially driven, and address external issues like clean water, green energy, or cheap medical diagnostics. Mentorship is an important part of this change.

Universities with entrepreneurial ecosystems offer mentorship in the form of professors with industry experience, successful alumni ready to build companies, and corporate partners happy to share knowledge. In contrast to accelerators that strictly emphasize scaling, such academic mentors foster patience, endurance, and a research-oriented orientation--these are attributes necessary in engineering projects that may take extensive development time. The issue of funding is a challenge, and it also leads to a modulation of financing models.

University startups can exploit seed grants, industry-sponsored research or government innovation funds instead of waiting around for venture capital. Others also seek innovative templates such as joint venture with a local industry or licensing their intellectual property and maintaining entrepreneurial independence. Different types of diversified funding lower the chances of a business becoming commercialized prematurely and enable the opportunity to develop ideas. Another innovative dimension is the part played by intellectual property.

Traditionally, universities claimed inventions through patents, but more recently, universities are migrating to an open innovation and shared IP platform. Certain startups in engineering will publish portions of their work under open license as a strategic move to find collaborators and sell special components. This mixed method is faster to adopt and yet achieves a sustainable level of revenue. Many of the ideas born in the university fail at the point of transitioning the prototype to a scalable product. When startups consider engineering concepts of modularity and scalability early on, novelty occurs. They do not design independent prototypes, but rather come up with flexible systems that can be adapted to the market. This would include a laboratory that develops a new type of sensor, which they can then customize to the measurement of the environment and the automation of the industry, and it would be more generalizable. Another unique advantage is the involvement of the students as co-founders.

Students introduce a fresh and unfiltered viewpoint, combining technical curiosity with fearless risk-taking, unlike the corporate engineers who are bound to an organizational hierarchy. Their readiness to break the rules often makes business models as new as technologies themselves. Furthermore, they are the future generation of entrepreneurs who consider global sustainability and inclusiveness as a non-nego-

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فرمانِ قائداعظمؒ

ایمان ، اتحاد ، تنظیم

اصول اور تفصیلات

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

(مسلم لیگ کانفرنس' بمبئی۔ 26 مئی 1940ء)

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

اے ہمالہ کوئی بازی گاہ ہے تو بھی' جسے
دست قدرت نے بنایا ہے عناصر کے لئے

ہائے کیا فرط طرب میں جھومتا جاتا ہے ابر
فیل بے زنجیر کی صورت اڑا جاتا ہے ابر

تیری عمر رفتہ کی اک آن ہے عہد کہن
وادیوں میں ہیں تیری کالی گھٹائیں خیمہ زن

چوٹیاں تیری ثریا سے ہیں سرگرم سخن
تو زمیں پر اور پہنائے فلک تیرا وطن

چشمہ دامن ترا آئینہ سیال ہے
دامن موج ہوا جس کے لئے رومال ہے

ابر کے ہاتھوں میں رہوار ہوا کے واسطے
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بن برسے ہی چھٹ جاتے ہیں جو
وہ بادل کمیاب ہوئے تھے

گلیوں میں پانی ہی پانی تھا
باغیچے تالاب ہوئے تھے

دریا نے جو کھیت اجاڑے
دریا سے سیراب ہوئے تھے

ڈوبے ان میں لوگ بہت سے
رستوں میں گرداب ہوئے تھے

ہم بھی، جل تھل ایک ہوا جب
ماہیٔ بے آب ہوئے تھے

کوئی نہ آیا، دیں صدائیں
چارہ گر نایاب ہوئے تھے

اتنا ہی پھر صبر کیا تھا
جتنا ہم بے تاب ہوئے تھے

جگنو لے کے روشنی آئے
مل کے وہ، مہ تاب ہوئے تھے

سید نوید حیدر جعفری

BISMILLAH HIR REHMAN NIR RAHEEM

Light Upon Light (Surah An Nur; 35-37)

By Muhammad Tariq Haq | www.eslpk.com

Of heaven and earth, Allah is the light
— His light, by an example of a niche, is symbolised

Within the niche, a lamp is inside
— The lamp in a glass lantern resides

The glass is like a brilliant star shining bright
— It's light, from a blessed tree olive, is derived

Neither from east nor from the west side
— Its oil would just glow, on its own, with no fire to ignite

Light upon light
— To His light, whom Allah wills, guides

For the people, these are the examples which Allah has described
— Of everything Allah has knowledge and insight

Allah commands building of His worship sites
— Where His remembrance is emphasised

In the morning and the evening
— His name must be glorified

Men (imbued with light), when for trade and commerce strive
— Make sure, they are with remembrance of Allah, occupied

They offer the prayers
— And pay the alms prescribed

And fear the Day (of Judgement) in which the hearts and the sights
— Will be overturned with fright

Engineering Startups: From University Labs to Market

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tiable default feature and not a nice-to-have element. University lab-engineering startups also change the definition of success.

Rather than tracking revenue milestones alone, most are tracking impact by counting the number of patents filed, technologies deployed in underserved markets, or partnerships with NGOs and governments. This general perception of value creation sets them apart as compared to profit-motivated enterprises and appeals to the socially aware investor and consumer. The university startups have also been enhanced by globalization. Digital platforms allow a lab in Pakistan, Germany, or Brazil to immediately access global markets, find international partners, and attract international customers. This interconnectedness increases the speed at which innovations will spread to other countries that previously might have required decades to do so. What is new is that the global networks are not only used to provide scale, but also to co-create and adapt locally.

Colleges are also trying entrepreneurial programs that combine business skills with technical training. Students of engineering are now taught venture financing, intellectual property, and customer discovery along with thermodynamics or circuit design. The result of this merger is a breed of innovators who can step out of the lab benches and onto board-rooms without the richness of technical knowledge. Technology transfer offices which were considered bureaucratic gatekeepers are evolving into nimble facilitators of entrepreneurship. These offices are further redefining the role of a university within regional innovation systems through the streamlining of IP licensing, startup boot camps, and the connection of researchers to industry partners. What is new is that commercialization has become a natural aspect of academic life instead of a far-off consideration.

The last point is that the real novelty of engineering startups created in universities is their ethos of purpose. They do not appear to pursue market share but to confront long-standing inefficiencies, re-invent old systems and devise solutions to a future that is not yet even here. A combination of scholarly excellence, young imagination, and entrepreneurial enterprise, these startups are on the edge where science becomes action--influencing industries, cultures, and lives in a way that goes way beyond the laboratory.■

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پاکستان نے جدید ریموٹ سینسنگ سیٹلائٹ خلا میں روانہ کر دیا

چین کے شی چانگ سیٹلائٹ لانچ سینٹر سے لانچ سیٹلائٹ شہری منصوبہ بندی، انفرااسٹرکچر کی ترقی، آفات کی نگرانی میں کردار ادا کریگا

اگلے برس ہمارا پہلا خلا باز خلائی اسٹیشن پر قدم رکھے گا، وفاقی وزیر احسن اقبال کا تقریب سے خطاب، صدر، وزیر اعظم اور دیگر کی مبارکباد

پاکستان نے خلا کی تلاش اور سائنسی ترقی کے میدان میں ایک اہم سنگ میل عبور کرتے ہوئے چین کے اشتراک سے تیار شی چانگ سیٹلائٹ لانچ سینٹر سے اپنا چوتھا جدید ریموٹ سینسنگ سیٹلائٹ کامیابی سے خلا میں روانہ کر دیا۔

ترجمان دفتر خارجہ کے مطابق یہ سیٹلائٹ اعلیٰ ریزولوشن کے ساتھ 24 گھنٹے مسلسل زمینی مشاہدے کی صلاحیت رکھتا ہے جو پاکستان کی شہری منصوبہ بندی، بنیادی ڈھانچے کی ترقی، آفات کی نگرانی و نظم، زرعی نظام، خوراک کی سیکیورٹی، ماحولیاتی تحفظ، جنگلات کی کٹائی کی نگرانی، موسمیاتی تبدیلی کے تجزیے اور آبی وسائل کے نظم و نسق جیسے اہم شعبوں میں فیصلہ کن کردار ادا کرے گا۔

یہ سیٹلائٹ پاکستان کی قومی خلائی ایجنسی سپارکو نے چین کی الیکٹرانکس ٹیکنالوجی گروپ کارپوریشن (CETC) اور مائیکرو سیٹ چائنا کے تعاون سے تیار کیا ہے۔ یہ ایک مربوط زمینی مشاہداتی نظام کا حصہ ہے جو پائیدار سماجی و اقتصادی ترقی کے فروغ اور عوامی معیار زندگی کو بہتر بنانے کے لیے ایک اہم قدم ثابت ہو

گا۔ ترجمان نے کہا اس شاندار کامیابی کے ساتھ پاکستان نے ایک مرتبہ پھر خلا میں قدم رکھنے والی اقوام کی صف میں اپنی حیثیت کو مستحکم کر دیا ہے نائب وزیر اعظم و وزیر خارجہ سینیٹر اسحاق ڈار نے سپارکو، MICROSAT، CETC چین کے انجینئرز، سائنسدانوں اور ٹیکنیکی ماہرین کو ان کی پیشہ ورانہ لگن، شاندار تعاون اور مشن سے وابستگی پر خراج تحسین پیش کیا اور اس کامیابی پر دلی مبارکباد دی۔ اس تاریخی موقع پر چین میں منعقدہ خصوصی تقریب میں وزیر منصوبہ بندی پروفیسر احسن اقبال نے بطور مہمان خصوصی شرکت کی۔ تقریب سے خطاب کرتے ہوئے احسن اقبال نے کہا کہ آج کا دن صرف ایک تکنیکی کامیابی نہیں بلکہ قومی وقار اور پاکستان و چین کی دوستی کو آسمانوں سے بھی بلند کرنے کا لمحہ ہے۔

سیٹلائیٹ پاکستانی قوم کے لیے امید اور عزم کی علامت ہے۔ ہمارا وژن ہے کہ پاکستان کو دوبارہ سپیس ٹیکنالوجی کے شعبے میں ایک قائدانہ کردار ادا کرنے والے ممالک کی صف میں شامل کریں۔ صدر مملکت، وزیر اعظم اور دیگر رہنماؤں نے ریموٹ سینسنگ سیٹلائٹ کی کامیاب لانچ پر پاکستانی سائنسدانوں کو مبارکباد پیش کی۔■

جاپان کا نیا ریکارڈ، تیز ترین ڈیٹا منتقلی والی فائبر آپٹک ایجاد

ڈیٹا 402 ٹیرابائٹس فی سیکنڈ کی رفتار سے 2 ہزار کلومیٹر کا فاصلہ طے کر سکتا

فی سیکنڈ 50 ہزار فلمیں ڈاؤن لوڈ ہونگی، پاکستان میں رفتار 8 میگا بائٹ فی سیکنڈ

دور جدید میں انٹرنیٹ جتنا زیادہ تیز ہو، وہ معیشت و معاشرت پر اتنے ہی مثبت اثرات مرتب کرتا ہے۔ یہ امر مدنظر رکھ کر جاپانی سائنسدانوں نے ایسے خصوصی فائبر آپٹکس تارا یجاد کیے ہیں جن میں ڈیٹا 402 ٹیرابائٹس فی سیکنڈ کی رفتار سے دو ہزار کلومیٹر فاصلے (کراچی تا گلگت) تک سفر کر سکتا، یوں نیٹ سپیڈ کا نیا ریکارڈ بن گیا، ان تاروں میں 1

لاکھ 25 ہزار گیگا بائٹ ڈیٹا فی سیکنڈ ایک جگہ سے دو ہزار کلومیٹر دور واقع دوسری جگہ منتقل ہوتا ہے۔ یہ رفتار ایسی ہے کہ ایک سیکنڈ میں 50 ہزار فلمیں ڈاؤن لوڈ کر لیں جبکہ پوری انٹرنیٹ دنیا میں محفوظ ڈیٹا چار منٹ میں ڈاؤن لوڈ کرنا ممکن ہے۔ یاد رہے پاکستان میں نیٹ کی اوسط رفتار 8 میگا بائٹ فی سیکنڈ جو جاپان کے مقابلے میں بہت کم ہے۔■

FORTNIGHTLY
ENGINEERING REVIEW
The voice of engineers

IEEEP Fair 2025: Showcasing Innovation Amid Power Sector Challenges

The IEEEP Fair 2025, now in its 14th consecutive year, has established itself as Pakistan's most prestigious engineering industry exhibition.

Organized under the banner of the Institution of Electrical and Electronics Engineers Pakistan (IEEEP), the fair provides a vital platform for showcasing cutting-edge technology, products, and services from across the electrical, electronics, and allied engineering sectors.

From renewable energy solutions to industrial automation and advanced power systems, the exhibition reflects the country's growing appetite for technological advancement and sustainable energy sources. Companies from Pakistan and abroad participate to introduce innovations, explore new business avenues, and strengthen ties with industry stakeholders.

A Hub for Innovation and Networking

The IEEEP Fair is more than just a trade show. It is a

Contd on page 12

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Universal Cables Empowering the Transition to Sustainability – Shaping the Nation's Energy Future

A conversation with Muhammad Munib Naim, Director, Universal Cables Industries Ltd.

Innovation with Affordability

Balancing innovation with affordability has long been one of Universal Cables' biggest challenges and one the company has successfully navigated. With the joint efforts of our R&D and finance departments, we've been able to innovate continuously while keeping our products affordable for local customers, said Munib.

Strong Footprint & Sustainable Practices

Universal Cables' products are powering some of Pakistan's most prestigious projects and industries like Descon, Dawlance, Gul Ahmed, PARCO, Suparco, PEL, KE, and FFC. Alongside this, the company has embraced sustainable practices. We have acquired HSE certification and are committed to controlling emissions and managing waste responsibly.

Investing in People & Knowledge

Universal Cables invests heavily in training and exposure for its teams. We conduct regular technical training programs and send our people to international conferences, exhibitions, and seminars. This helps us stay aligned with global advancements and apply them practically in our systems.

Market Challenges & Awareness

Our industry's challenge is the unorganized sector. They often compromise on quality to offer cheaper alternatives. We have been working to create awareness among consultants and project engineers to ensure every project uses safe and reliable cables.

Ambition & Future Outlook

Looking ahead, the company has a clear vision: "Our ambition is to become Pakistan's leading cable manufacturer within the next five years and to establish ourselves as a significant global exporter."

Reliability as a Cornerstone

Established in 1978, Universal Cables has built its name on reliability and quality for nearly five decades. We are an ISO-certified company, strictly following international standards. Our state-of-the-art laboratory ensures that every product meets the highest benchmarks of safety and reliability.

Supporting Industrial & Infrastructure Growth

Universal Cables has been a key supplier for Pakistan's industrial and infrastructure development. We supply to major institutions like KE, WAPDA, and other stakeholders shaping Pakistan's infrastructure. Our products also support industrialization and maintenance to keep industries running smoothly.

Driving the Solar Transition

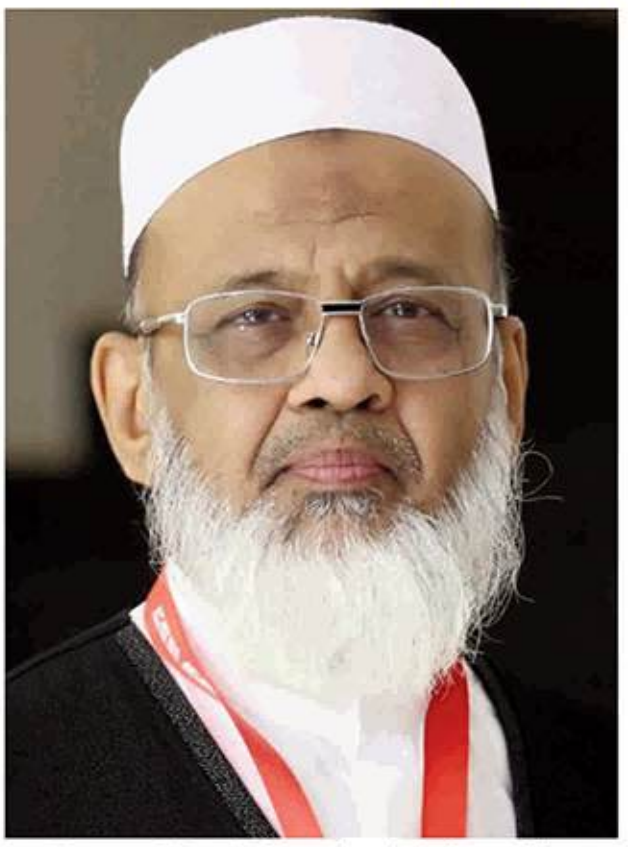
As solar adoption accelerates in Pakistan, Universal Cables has positioned itself at the forefront. We have been manufacturing solar cables to international standards for years. Solar cables are now one of our core product lines, and we are taking a futuristic approach to meet this growing demand.

Final Message

Universal Cables is one of the oldest and most trusted cable manufacturers in Pakistan. We remain committed to quality, innovation, and safety. For those seeking reliability, Universal Cables will always be the first choice.■

Pakistan's Economy and the Crisis of Engineering

Engr. Khalid Pervez discusses how debt-driven growth, weak industries, and the rise of AI threaten development and engineering jobs.



Economy: Where Do We Stand?

The data released by governments on the economy is available, but scrutiny is imperative. Now, with the flow of information becoming swift and easily accessible through the internet, it is necessary to examine the ground reality behind the perception that the economy has improved.

Interestingly, the Pakistan Stock Exchange has crossed new and higher barriers over the last year and a half. For someone like me, who is not an economist, it is surprising to see this when the country is staggering under heavy debts. According to noted economist Dr. Kaiser Bengali, the work of ministers has become so easy that, for example, the finance minister's main task is simply to secure more loans in order to pay back the markup on previous ones. There is no real planning or development, which is essential.

If our stock exchange is performing so well, then it should translate into the execution of projects across the country; our industrial output should have risen; and our imports should have increased. As a private-sector consultant, I should be seeing many projects, but the reality is otherwise. The projects that come to us do not reflect any improvement in the economy. For many consultants and contractors, it has become a matter of survival. Take the energy sector as an example: no industry can sustain itself given the cost of energy in the country.

So, how does this country continue to sustain itself?

It is largely because of the undocumented economy, which is so vast that it is beyond comprehension. A large number of people evade taxes, and the claim that the FBR is cracking down on tax evasion is almost laughable. The FBR has created two categories—"filers" and "non-filers"—even though everyone is registered with NADRA. Non-filers carry out all kinds of business activities but are simply subjected to different tax rates. The FBR seems content with this arrangement, but why doesn't the agency take stricter action?

The economy is run in such a way that the poor live miserable lives while the ruling elite continue to capture resources. Judges and parliamentarians, for instance, have increased their salaries, and others in power can do whatever they want. This practice must end once and for all.

Why Engineering Is Losing Interest

Engineering is the backbone of development in any country. Take any sector—you cannot achieve progress without engineering. In today's world, youth are highly informed due to faster communication and easy access to information. Given this situation, public-sector universities have failed to upgrade themselves according to current needs. As a result, their graduates do not match industry requirements.

At the same time, the industry itself is not in good shape; it is fighting for survival. With no real development happening, no large projects are coming up in construction or energy. Where, then, will young engineers go? How will they be accommodated?

There was a time when Pakistan had a strong industrial base. Companies like Siemens operated here, employing a large number of engineers. We can feel both pride and shame remembering that we once manufactured engines for British tanks used in the Second World War in Lahore. It is unimaginable today. In the early 1960s, we used to make electronic components such as transistors and capacitors. Later, we shifted to trading, abandoning manufacturing, and governments failed to support the industrial base in Pakistan.

Due to these factors, many universities are now considering closing departments because students have stopped applying in such disciplines. Ultimately, everything rests on the economy. If it were strong, it would positively affect every sector. Unfortunately, our economy is weak. Political interference and incompetence have gripped all institutions. Political will drives the economy, and ironically, that will is absent in the country.

AI and Our Engineering Industry

The rise of Artificial Intelligence is dangerous, and it is now taking practical shape. A huge number of people had rushed to IT during its boom, but today AI itself is writing software. As a result, our software engineers and developers face rising unemployment. The scenario for engineers is no different. We are using ChatGPT and similar tools everywhere, which are spreading and updating rapidly. Now, even non-engineers can perform many engineering tasks. That is why I call on universities to align themselves with these new developments.

Are We Cognizant of the Situation?

Not in my view. With a heavy heart, I must say that the Pakistan Engineering Council (PEC) should play its part. This is supposed to be PEC's core function, but unfortunately, its role is not visible. Instead, PEC has reduced itself to a clerical body that merely registers contractors and issues notices.

The council's structure itself is inefficient—it has an 84-member Governing Body. How can such a large body function effectively? Governance is clearly lacking.■

By Manzoor Shaikh

IEEEP Fair 2025

Contd from page 9

meeting ground for engineers, entrepreneurs, policymakers, and investors who converge to exchange ideas and discover solutions for the country's pressing power and energy challenges. With a growing focus on renewable energy, particularly solar, the fair has become a catalyst for businesses aiming to capitalize on Pakistan's evolving energy market.

By highlighting alternate energy sources and presenting case studies of successful implementations, the event contributes to raising awareness of sustainability while opening opportunities for technical consultations and partnerships. Its role in connecting businesses with prospective partners, suppliers, and global markets makes it indispensable for industry growth.

Pakistan's Energy Challenges

While the fair projects an optimistic outlook, Pakistan's power sector continues to face deep-rooted challenges. Despite having vast potential in renewable energy — including solar, wind, and hydropower — the country remains heavily reliant on imported fossil fuels, creating economic and environmental burdens.

The energy mix is imbalanced, with more than 60 percent still coming from thermal power plants dependent on coal, oil, and LNG. Price volatility in global fuel markets directly affects Pakistan's economy, leading to high electricity tariffs for industries and households. This, in turn, erodes competitiveness for exporters and raises the cost of living for ordinary citizens.

Adding to this are structural inefficiencies. Transmission and distribution losses hover around 17-18 percent, far higher than international benchmarks, while circular debt has crossed Rs 2.6 trillion, crippling the financial sustainability of power sector entities. Load-shedding remains common, with industries frequently turning to expensive backup generators to keep operations running.

Climate Change and Renewable Energy

Climate change has amplified the urgency of addressing these issues. Heatwaves, erratic rainfall, and water shortages threaten hydropower generation, while rising demand for cooling during summers further strains the grid. In this context, renewable energy, particularly solar and wind, offers a viable path forward.

However, the adoption of renewables faces hurdles such as high upfront costs, lack of localized technology, weak policy implementation, and limited financing options for small and medium enterprises.

The Role of IEEEP Fair

By bringing stakeholders together, the IEEEP Fair plays a critical role in bridging these gaps. Exhibitors showcase not only solar and storage systems but also smart grids, AI-driven energy management, and energy-efficient industrial equipment. These innovations, if adopted widely, could reduce costs, enhance productivity, and improve sustainability.

As Pakistan navigates the twin challenges of energy security and economic stability, platforms like the IEEEP Fair provide hope. They enable knowledge-sharing, encourage investment, and highlight the solutions needed to transition toward a resilient, diversified, and sustainable energy future.

In many ways, the fair symbolizes both the challenges and opportunities of Pakistan's energy landscape — a reminder that while the road ahead is daunting, innovation and collaboration can pave the way forward. – ER

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Hussain & Co.: Powering Pakistan's Industrial Future with World-Class Switchgear Solutions

For over five decades, Hussain & Co. has stood as a hallmark of reliability, innovation, and quality in Pakistan's electrical industry.

Established in 1971 under the visionary leadership of Syed Farhat Hussain, the company has evolved from modest beginnings with manual machines into a cutting-edge manufacturer and distributor of medium and low-voltage electrical solutions. Today, guided by the commitment of Raza Hussain, the legacy continues as the firm scales new heights in technology and service excellence.

Blending Local Expertise with Global Standards

Hussain & Co. does more than manufacture switchgear; it engineers reliability, efficiency, and safety into every product it delivers. With a strong presence across Sindh and Balochistan, the company has built an enduring reputation among designers, consultants, and industrial clients for its top-quality, type-tested solutions.

As an authorized licensee of ABB, a global leader in electrification and automation, Hussain & Co. leverages exclusive access to ABB's advanced technologies. This enables it to offer state-of-the-art Medium Voltage (Unisafe 2.0) and Low Voltage (System Pro E Power) switchboards that meet the highest international standards, including AFLR internal arc classification and IEC Form 1–4 designs.

Pioneers in the Utility Sector with New Technology

Hussain & Co. has taken a leading step in the utility sector by delivering fixed-type panels designed to meet K-Electric's latest specifications. This innovation is setting a new benchmark for performance and reliability in Pakistan's power sector, positioning the company as a true pioneer in bringing world-class technology to the country's utility infrastructure.

Expanding into New Dimensions

Hussain & Co. has also established itself as a leading name in kiosk-type substations, delivering integrated and dependable power solutions for diverse industrial and utility applications. Now, taking a step further, the company is venturing into new dimensions of switchgear technology, broadening its portfolio and redefining the standards of power distribution in Pakistan.

Comprehensive Product Portfolio

- Medium Voltage Panels (11 kV to 132 kV)
- Low Voltage Panels
- Synchronizing & Motor Control Centers (MCCs)
- Automatic Transfer/AMF Panels
- Process Control (PCC) and Distribution Boards
- LT Power Factor Improvement (PFI) Panels

In addition to switchboards, the company offers allied accessories such as:

- Cast Resin Dry Type Transformers up to 15 MVA/36 kV
- Insulated Busbar Trunking Systems from Gersan
- Power Quality Solutions including Active Power Filters, Static VAR Generators, LV Capacitors, and Harmonic Filter Reactors
- Automatic Voltage Regulators up to 6300 kVA

This comprehensive range positions Hussain & Co. as a one-stop solution provider for industries looking to enhance energy efficiency, power quality, and operational safety.

Driving Growth through Partnerships and Innovation

Hussain & Co.'s robust affiliate network and proactive approach enable it to handle projects of all sizes while optimizing inventory, minimizing waste, and prioritizing customer satisfaction. Its team of skilled engineers and technicians combines human expertise with technological advancement to deliver solutions that are both innovative and cost-effective.

Looking ahead, the company aims to expand its footprint nationwide, particularly into Punjab, Khyber Pakhtunkhwa, and Islamabad, to serve Pakistan's largest industrial hubs. Its long-term vision is to emerge as a global player in the switchgear market, providing sustainable and cutting-edge electrical solutions to customers worldwide.

A Legacy Built on Trust

As Chairman Syed Farhat Hussain reflects on over 50 years of excellence, he credits the company's loyal customers and dedicated workforce for shaping its journey. "Our unwavering commitment to innovation, quality, and customer satisfaction has been the cornerstone of our success," he says.

With a solid foundation and forward-looking vision, Hussain & Co. is poised to remain a trusted name in Pakistan's industrial landscape—delivering world-class switchgear solutions where innovation and excellence converge.

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Windmason Arabia, Habib Rafiq Ltd. join hands, sign MoU

In a significant step toward strengthening engineering and construction ties between Saudi Arabia and Pakistan, Windmason Arabia and Habib Rafiq Limited (HRL) signed a Memorandum of Understanding (MoU) in Riyadh for collaboration in mechanical, electrical, and plumbing (MEP) projects.

The agreement is being seen as a milestone partnership, supporting Saudi Vision 2030 objectives and advancing sustainable engineering practices in the region.

The ceremony brought together senior representatives from both organizations. From Windmason Arabia, the attendees included Founders Muhammad Shakeel Kayani and Engineer Wali Khan, Tauseef Ahmed (Business Development Executive), Engineer Javeria Asad (HVAC Technical Sales Manager), and Yasir Riaz (Former Chief PMO, Lahore Time Square). Representing Habib Rafiq Limited were Muhammad Zahid Nadeem (General Manager), Muhammad Asif (Project Director), Umar Khalid Butt (Project Manager), and Dr. Tahir Masood (Former Managing Director, NESPAK).

Habib Rafiq Limited is widely recognized for delivering landmark projects in Pakistan, such as national motorways, international airports, major power plants, and the country's first smart cities — Capital Smart City and Lahore Smart City. In Saudi Arabia, the company has played a leading role in large-scale healthcare and infrastructure projects, including Saudi German Hospitals in Riyadh, Medina, and Abha, as well as the Saudi German Hospital Medical College in Jeddah, alongside several power and energy ventures.

Speaking on the occasion, both sides expressed optimism that the collaboration would usher in a new era of cooperation in the engineering and construction sector, while also enhancing bilateral relations between Saudi Arabia and Pakistan. RIYADH, Saudi Arabia: PR ■

Pakistan's Renewable Energy Market Gathers Momentum

Engr. Ahmed Godil of Emerging Green Solutions highlights the solar boom, energy storage innovations, and how renewables can lower costs and boost exports.

Pakistan has long relied on fossil fuels such as coal and natural gas for power generation. However, the scenario is changing as the country gradually transitions toward renewable solutions. A noticeable boom is evident in solar adoption within the industry, alongside a growing shift toward wind energy.

Overall, Pakistan is increasingly focusing on solar power, which is both free and sustainable, and is emerging as the preferred source of electricity.

Approach Towards Renewables

There is a clear shift in approach toward solar energy. In the industrial sector, electricity generated from fossil fuels accounts for a significant portion of production costs. With the induction of solar power, these costs are reduced, thereby lowering the overall cost of products and making them more competitive in the market. This gives exporters a distinct advantage in international trade. The payback period of a solar plant is around one and a half years; after that, the plant generates free electricity. We are providing sustainable solutions that directly reduce per-unit production costs in industry.

Sustainability and the Environment

Technology has advanced significantly. Today, solar panels come with warranties of around 30 years, while inverters typically carry a 10-year warranty. Once the payback period is over, the system can continue generating power for decades, underscoring its sustainability and long-term benefits.

Pakistan is a fast-emerging market for renewable energy solutions such as solar, says Engr. Ahmed Godil, a mechanical engineer from Nottingham University. He is the Director of Emerging Green Solutions, a Karachi-based company offering green energy solutions to industry and commercial entities. He not only sees a paradigm shift in Pakistan's power generation sector but also explains how these changes can help raise exports. Here is the viewpoint he shared with Engineering Review.

Storage Systems

The industry is also moving toward battery-based storage systems. Gas shortages have severely impacted industrial operations, particularly critical loads, leading to significant losses. To address this, batteries charged through renewable energy solutions are now being deployed. The per-unit cost of stored energy is lower, making it a practical and affordable solution for industry.

Era of Advanced Systems

Storage systems are becoming central to industrial energy management. The electricity stored in batteries can be used during non-solar hours or in the event of power breakdowns, ensuring uninterrupted supply.

Batteries and Storage Capacity

The duration of battery supply depends on the type of batteries used. Currently, most widely used battery storage systems discharge at 0.5C or 1C. However, we are developing an advanced solution capable of discharging at 2C. This means that if you have a 1 MW battery pack, it could potentially discharge up to 2 MW. After completing the testing phase, we will launch this solution across commercial, industrial, and residential segments. (MS) ■

Jubilee Corporation: Pioneering Excellence in Pakistan's Electrical Industry

For over six decades, Jubilee Corporation (JC), private engineering organization, has been a leading player in the electrical industry of Pakistan.

Established in 1962, JC has consistently upheld its mission of delivering high-quality, reliable, and cost-effective electrical products and solutions to its valued customers. With a commitment to excellence and dedication to customer satisfaction, JC has established itself as a trusted supplier of electrical, electronics, and automation technology products throughout the country.

Jubilee Corporation offers products and services in the areas of Low Voltage Switchgear, Power Distribution, Automation, Motion Division, and Instrumentation and Controls. The company also provides comprehensive solutions for Energy Management, Power Quality, External Lightning Protection, Surge Protection and Earthing, and Pneumatics.

With its Head Office in Karachi, Regional office in Lahore, and Liaison offices in Islamabad, Faisalabad, Multan, and Peshawar, JC also maintains a distribution network spread nationwide that aspires to continue growing its network.

Quality Products from World-Renowned Brands

One of JC's key strengths lies in its extensive portfolio of products from more than 35 world-renowned manufacturers from around the world. This allows JC to offer a wide range of top-tier engineering products tailored to meet the specific needs of its customers. JC takes pride in being the authorized distributed of the specialist manufacturers and aims to keep satisfying its customers through the strength of its diverse product portfolio.

Commitment to Customer Satisfaction

Jubilee Corporation believes in providing exceptional customer service. Hence, JC prioritizes its customers at every stage of their interaction, from initial consultation to after-sales support.

The team of experts is dedicated to providing customized solutions and building lasting relationships with its customers. Whether it's advising them on the best products for their particular application or assisting them with safety measures and concerns, customers can rely on JC's support to be there every step of the way.

One of the key factors that set JC apart is its commitment to providing technical after-sale support. The company's team of highly skilled and experienced engineers is always on hand to help customers with any technical issues they may encounter. This level of support ensures that customers can trust JC's products and services for years to come.

The Way Forward

In an industry that constantly evolves, JC remains at the forefront by staying up-to-date with the latest industry trends. Their commitment to delivering technologically advanced and specialized products is unwavering. With over 60 years of experience, JC continues to be the company of choice for businesses seeking reliable and cost-effective solutions for their electrical needs.

With a wide range of top-quality products, an unmatched commitment to customer satisfaction, and a nationwide presence, JC has solidified its position as an industry leader. Looking to the future, Jubilee Corporation remains dedicated to upholding its legacy of excellence and serving both its customers and the community with the same passion and dedication.

For further details and queries, reach out to us at jubilee.corp@jubileecorporation.com or UAN: +92 21 111 000 520 or visit our website at www.jubileecorporation.com.

How Pakistan's energy revolution can power affordable, reliable electricity for all

- **Pakistan is experiencing an energy revolution as households and businesses rapidly adopt solar-plus-battery systems to meet their own energy needs.**
- **Making this transition more inclusive will require financing mechanisms that lower costs for underserved users and support grid upgrades for all.**
- **The country's approach to this shift offers valuable lessons for other emerging economies navigating their own energy transitions.**

For years, and especially during the 2022-23 energy crisis, Pakistan has struggled with chronic power shortages and soaring electricity costs as heavy reliance on imported coal and gas leaves it exposed to global price shocks.

In response, residential, commercial and industrial consumers are increasingly turning to decentralized energy solutions, most notably rooftop solar combined with battery energy storage systems.

In 2024, Pakistan imported 17 gigawatts (GW) of solar photovoltaic (PV). The country also imported an estimated 1.25 gigawatt-hours (GWh) of lithium-ion battery packs in 2024. These are substantial additions to an energy system with approximately 40 GW of total installed capacity. If this trend continues, total battery imports could reach 8.75 GWh by 2030. This would be enough to meet over a quarter of peak demand, while

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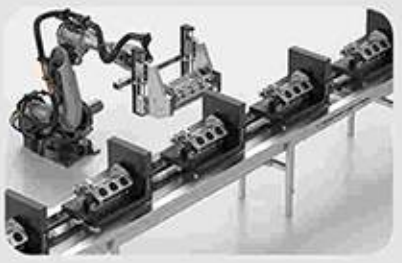

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8 **Pneumatics**

9 **Power Quality**

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AdamjeeDurabuilt: Pioneering uPVC Solutions in Pakistan

The Adamjee Durabuilt (Pvt.) Limited is a part of Adamjee Group of Companies which has been well known in the South Asian subcontinent and internationally for over 100 years.

Durabuilt was incorporated in 1984 to manufacture uPVC profiles. Adamjee Durabuilt is the pioneer in introducing ducting/ channel patti into Pakistan in the 80's. Since then, we have been manufacturing quality electrical trunking, uPVC pipe, flexible pipe & fitting, uPVC electrical conduit, and in 2009, we diversified ranges to include water applications with the DuraSDR, DuraSch-40, DuraPE, DuraFitting and DuraPPRC.

Adamjee Durabuilt maintains regular, continuous and very strict quality control based on ISO 9001:2015 standards on all of its products, at every stage of production from initial compounding to final delivery of finished goods. Irregular products are rejected during inspection, and testing assures that all products meet our standards.

To meet future requirements and challenges, product lines need to adjust to the changing needs of the market environment. Adamjee Durabuilt spends substantial amount of its revenue on research and development. We established an R&D Department in 1991, which is led by our engineering designs, ergonomics and process flows, as well as maintaining our research data base in Pakistan. Adamjee Durabuilt leads the uPVC Industry in developing new products for the market. Corner duct and Slotted base duct were introduced into Pakistan by Adamjee Durabuilt.■

How Pakistan's energy revolution can power affordable, reliable electricity for all

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solar could cover most daytime electricity needs.

This surge in solar and batteries is driving down energy costs and improving reliability for individual users in Pakistan. By reducing dependence on imported fuels like LNG, it is easing pressure on Pakistan's balance of payments and strengthening the country's energy sovereignty.

This revolution is redefining energy access and the country's future from the ground up. And while it is also creating new challenges for the grid and overall system resilience, Pakistan's handling of this shift offers valuable lessons for other emerging economies navigating their own energy transitions.

Grid versus off-grid energy divide

The rapid, uncoordinated growth of distributed energy and a lack of system-level planning and integration is raising critical questions for Pakistan's national grid.

One of the biggest challenges is ensuring fairness in how costs are shared. Many households and small businesses, especially those in flats or small dwellings, cannot install rooftop solar or afford batteries. As other users reduce their reliance on the grid using these methods, the utility's fixed costs for maintaining generation and transmission are spread across a shrinking pool of customers.

At the same time, legacy gas and coal plants continue to be remunerated even when underutilized due to "take-or-pay" agreements that impose penalties if a minimum amount of power is not purchased. Pakistan's National Electric Power Regulatory Authority (NEPRA) reports that capacity payments to

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The Power Play: Selling Energy Solutions at the Boardroom Table

By Muhammad Tariq Haq

It was a humid afternoon in Dubai when Amir, a seasoned sales engineer, walked into the glass-walled boardroom of a multinational manufacturing company.

He wasn't just carrying brochures about diesel, gas, and renewable generators—he was carrying a strategy. Amir knew that selling energy solutions wasn't about watts and volts; it was about aligning power with people's priorities.

He glanced around the table. Each face represented a different concern, a different lens through which the value of his solution would be judged. Amir understood that if he spoke the same language to everyone, he'd lose them all. Instead, he tailored his story to each role.

The Foreman: Speed and Simplicity

Amir began with the foreman, the man who lived in the trenches of the plant.

"Imagine a breakdown at 2 a.m.," Amir said. "Our generators integrate seamlessly with your existing machinery, and we provide on-site training so your team can respond instantly. No delays, no confusion—just uptime."

The foreman nodded. He cared about speed of response and ease of integration more than financial models. Amir had spoken his language.

The Plant Engineers: Reliability and Metrics

Next, Amir turned to the plant engineers. They weren't swayed by promises—they wanted numbers.

"Our systems are designed for high MTBF (Mean Time Between Failures) and low MTTR (Mean Time To Repair). Local service teams ensure downtime is minimal, and the learning curve is short. Your engineers won't be burdened—they'll be empowered."

The engineers leaned forward. This was their world: technical reliability, service availability, and measurable performance.

The Directors: Efficiency and Growth

The directors were listening for something else: scalability.

"This isn't just about today's power needs. As your operations grow, our generators scale with you. Whether you expand regionally or globally, your power backbone will never hold you back."

Here, Amir connected the dots between operational efficiency and long-term scalability.

The CFO: The Numbers That Matter

Then came the CFO—the gatekeeper of budgets. Amir knew this was where many deals died.

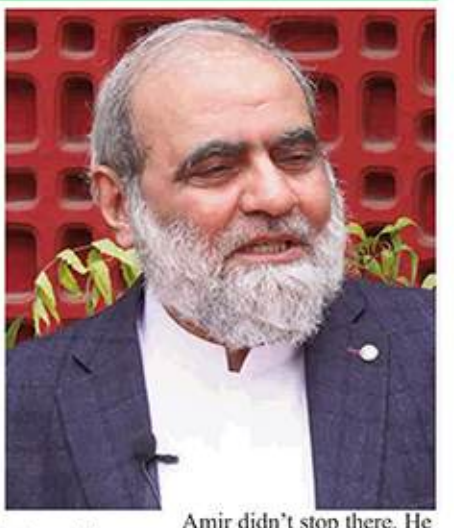
"Let's talk ROI. With fuel efficiency, lower maintenance costs, and flexible financing options, your total cost of ownership is significantly reduced. This isn't just a purchase—it's a financial strategy."

The CFO's pen stopped tapping. Amir had reframed the generator as an investment, not an expense.

The CEO and Chairman: Vision and Sustainability

Finally, Amir addressed the CEO and chairman. They weren't interested in kilowatts; they were interested in legacy.

"Your competitors are already aligning with sustainability goals. Our renewable-compatible solutions reduce emissions, improve fuel efficiency, and position your brand as a leader in eco-friendly practices. This isn't just about keeping the lights on—it's about keeping your company relevant."



The CEO exchanged a glance with the chairman. Amir had aligned the solution with their strategic vision, sustainability goals, and market competitiveness.

Proof, Trust, and Differentiation

Amir didn't stop there. He pulled out case studies from similar industries, showing real-world performance. He highlighted regulatory compliance and risk mitigation,

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Tabular View of Stakeholders & Value Propositions

Stakeholder	Priorities / Concerns	Tailored Value Proposition
Foreman	Speed of response, integration with existing machinery, training	Quick deployment, seamless integration, on-site training
Plant Engineers	Technical reliability, MTTR, MTBF, service availability	Proven reliability, strong service network, short learning curve
Directors	Operational efficiency, scalability, alignment with growth	Scalable solutions that grow with the business
CFO	ROI, cost savings, financing, total cost of ownership	Clear ROI, reduced TCO, flexible financing options
CEO / Chairman	Strategic vision, sustainability, market competitiveness	Renewable compatibility, sustainability alignment, brand leadership

The Silent Revolution: Your Factory is Talking. Are You Listening?

By: Muhammad Ibrahim, Head of Automation & Digitalization, BSE:

For decades, the word "automation" painted a picture of giant, expensive robots on a car assembly line, a reality far removed from the textile mills of Faisalabad or the pharmaceutical plants in Lahore.

That picture is now obsolete. Today, a silent revolution is underway, one driven not by massive robots, but by smart sensors, intelligent data, and the simple goal of making every single rupee of operational expenditure work harder.

This is the new face of automation. It's less about replacing people and more about augmenting their capabilities. It's about giving your managers, engineers, and operators the X-ray vision they need to see waste, predict failures, and guarantee quality before a single product leaves the factory floor.

At Bilal Switchgear Engineering Pvt Ltd, as an Authorized Siemens System Integrator, we see this transformation firsthand. The question our most successful clients ask is no longer, "Can we afford to automate?" but rather, "Can we afford not to?"

Myth vs. Reality: Automation for Pakistan

The primary hurdles for Pakistani industry are not unique, but they are acute: soaring energy costs, intense global competition on quality, and the constant pressure to reduce downtime. Traditional thinking tackles these with more manpower or stricter oversight. The modern approach embeds intelligence directly into the process.

Let's break down the three core pillars of this practical, ROI-focused automation.

1. The Power of Sight: From Guesswork to Certainty

You can't manage what you can't measure. The foundation of all modern automation is visibility. This starts with advanced process instrumentation - sensors that act as the nervous system for your factory.

Consider a textile dyeing unit. For years, achieving the perfect color consistency across batches was an art, dependent on the experience of a master operator. Today, precise Siemens sensors for temperature, pressure, flow, analyzers, and pH can monitor every variable in real-time. The system doesn't just follow a recipe; it ensures the conditions are perfect, every second.

• **The Result:** A 99.9% batch-to-batch consistency, slashing rejection rates for export orders. The "art" is now a repeatable, data-backed science. This isn't about removing the operator; it's about giving him a perfect set of eyes and an unerring memory.

2. The Engine of Efficiency: From Wasting Energy to Optimizing It

Once you can see everything, the next step is to control it with precision. This is where controllers (PLCs) and supervisory systems (SCADA) come in. But the single biggest impact we see is in energy management.

Energy is often the second-highest operational cost for local industries. Yet, most

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Powerzone Karachi: 20 Years of Powering Industry with Generators, Solar, and AI Solutions

Waqas ul Haq, Sales Head, Powerzone Karachi, discusses Pakistan's evolving power market, citing decades-long energy crises, rising demand for generators, solar with storage, and AI-driven solutions to sustain industries amid supply shortages.

New Energy Solutions and the Industry

We have everything, but utilization still lags behind. The energy crisis is nothing new; it has continued for nearly three decades.

Our primary option remains K-Electric and WAPDA's supply. Because of this crisis, alternative solutions like generators are essential, and we specialize in diesel generators. The maximum demand comes from industry, which relies on them as backup power.

We work with Cummins in Pakistan, as well as an Italian brand, for which we are sole proprietors, and also with Perkins.

Our company has been in this business for the past 20 years. Beyond utilities and generators, solar is the next viable option. Solar works well if there is sufficient sunlight and backup through a battery energy storage system. We have signed a contract with a Chinese company to serve as their representative across Pakistan. Energy storage is critical to ensure there are no lapses in the production process.

Our system works within 0.2 ms, giving industries time to switch over to generators. This battery storage system is charged by solar power, which provides cheaper electricity. In many ways, it functions like a large UPS system — but unlike a UPS that requires conventional electricity to charge, this one uses solar supply. This makes solar a one-time investment.

The minimum system starts at 5 kW, making it both practical and useful for factories as well as houses. For industrial use, a 20 ft container provides up to 3.34 MW. The industry is convinced this system will ensure an uninterrupted production process.

Climate Change & Battery

The shelf life of a solar system is around 20 years. One challenge will be how to decommission systems once they expire, though I am confident the industry will find safe disposal solutions.

We use lithium batteries with the system, and for safety, we ensure an IP60 rating — making them both water- and fireproof. Each system also has its own cooling mechanism installed.

Powerzone: Two Decades in the Business

Beyond generators, what else do we offer? Our core products remain diesel generators from Cummins, Perkins, and others. We also deal in gas-powered products through a contract with Siemens. However, due to the shortage of gas, even Siemens is awaiting supply replenishment in Pakistan.

Additionally, we provide Turkish lifts, which are already in use in the country. While there is competition from Chinese products, our technology is European, offering higher standards.

AI and Power Systems

AI has transformed every sector, and energy is no exception. Various AI tools are already in use and will influence the market even more in the future. We have introduced new smart panels through our contract with Data Com, enabling remote operation from anywhere. This gives users multiple options to control systems via AI.

Karachi & the Power Business

We have continuously participated in the IEEEP exhibition. For the last 8–9 years, we have seen every major player in the power business and industry come together. Karachi remains the hub of the country, attracting visitors from across Pakistan. It provides a great opportunity for networking and business growth once again.■

Sana Bahadar Wins Women's Open at 5th Independence Day Championship 2025

The Independence Day Open Championship 2025, a prestigious event in the squash community, concluded its fifth edition today, with Sana Bahadar emerging victorious after a thrilling final match in the Women's Open.

Sana Bahadar (Pak) defeated Sarah Nelson (Aus) in a decisive victory, marking a significant achievement for the talented athlete.

The final match, held at Canterbury League Club, saw a dominant performance by Sana, who demonstrated exceptional skill, securing the title with a score of 3-1. This victory adds to Sana's impressive career and solidifies their position as a top-tier competitor in the sport of squash.

Sana Bahadar said, "I'm so grateful to everyone who supported me, especially my parents and the Amir Sultan Chinoy Foundation. Competing in this category was not easy for me, but I am so proud that I did".

Saif Bahadar, who is accompanying his sister, successfully reached the quarter-finals in the men's open squash category. The talented sibling duo is currently on tour in Australia.

Sher Bahadar, the proud father of the sibling duo, acknowledged the support of Sana and Sai'f's coaches and mentors, which included Riaz Khan, Muhammad Sohail, Owais Khan, and Qamar Zaman. He said, "I thank Allah Almighty for this blessing and express my heartfelt gratitude to her sponsors, Amir Sultan Chinoy Foundation and the Pakistan Squash Federation for their continuous support," and also thanks the organizers.

Classified as Persons with disabilities, they are Pakistan's emerging squash duo (under 23) who are defying all odds. The Amir Sultan Chinoy Foundation has sponsored a multi-year agreement with Sana and Saif Bahadar, talented squash players from Pakistan, to support their training and enable them to showcase Pakistan's squash talent globally.

The 5th Independence Day Tournament 2025 attracted world-class talent from across the globe, showcasing high-level competition and generating excitement among squash enthusiasts.

About Amir S. Chinoy Foundation:

ASCF is one of the oldest foundations in the nation that is working in the multi-

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From Load Shedding to Grid Savior: How Industrial Microgrids Can Power Pakistan's Energy Future

By Farhan Mujeeb

The energy landscape in Pakistan is undergoing a silent revolution.

On one hand, electricity tariffs are consistently rising, whereas as grid is aging and becoming unreliable. On the other hand, the costs of photovoltaic (PV) systems and battery energy storage systems (BESS) are steadily declining. The balance for maintaining economic and reliable industrial operations is tilting towards solar-plus-storage solutions from traditional utility connection. Many industries are overlooking a critical component that could amplify their savings and operational efficiency: the integration of smart microgrids and advanced energy monitoring systems. While the shift to renewable energy is a step in the right direction, the full potential of these systems remains untapped without intelligent management and real-time optimization.

Industries that install solar panels and batteries without smart monitoring are essentially flying blind when it comes to energy consumption. They miss out on valuable insights that could help them identify inefficiencies, reduce waste, and optimize their energy usage. Real-time energy monitoring provides visibility into where and how power is being consumed, allowing businesses to pinpoint high-demand equipment, detect anomalies, and implement corrective measures. For example, smart metering can reveal hidden energy drains from outdated machinery or inefficient HVAC systems, which, when addressed, can lead to immediate cost reductions of 10-20%. Additionally, predictive maintenance enabled by continuous monitoring can prevent costly equipment failures and extend the lifespan of critical assets.

Smart Microgrid goes beyond simply combining solar panels with batteries. It is an intelligent, self-sufficient energy ecosystem that dynamically manages power generation, storage, and consumption. By incorporating AI-driven energy management systems (EMS), microgrids can help optimize between solar power, battery storage, and grid electricity based on cost and availability. This capability is particularly valuable in Pakistan, where peak demand charges significantly inflate energy bills. A smart microgrid can automatically discharge stored energy during high-tariff periods, slashing peak demand penalties by as much as 50%. Furthermore, energy arbitrage, storing excess solar energy, and using it during evening peak hours can dramatically reduce overall electricity costs.

One of the most compelling advantages of smart microgrids is their ability to operate in "island mode," ensuring an uninterrupted power supply during grid outages. For industries where downtime translates to lost production and revenue, this feature alone justifies the investment. Beyond immediate cost savings and reliability, microgrids also future-proof industrial operations. As Pakistan's energy sector evolves with the implementation of the Competitive Trading Bilateral Contract Market (CTBCM), industrial facilities with smart microgrids will be uniquely positioned to participate in exciting new market opportunities. These advanced energy systems could enable factories to become active participants in ancillary services markets, providing crucial grid support through frequency regulation and voltage control. By leveraging their battery storage capacity, industrial microgrid operators may bid into the real-time energy market, selling excess stored power during peak demand periods when prices are highest. The CTBCM framework could also open doors for demand response aggregators to represent clusters of industrial microgrids, allowing them to collectively offer load flexibility as a market commodity.

Artificial intelligence and machine learning are revolutionizing energy management by enabling predictive analytics and automated decision-making. AI-powered microgrids can forecast solar generation based on weather patterns, optimize battery charging and discharging cycles to prolong lifespan, and continuously select the most cost-effective energy sources in real time. These advanced capabilities can unlock an additional 5-15% in savings, pushing total cost reductions to 60-70% compared to traditional grid reliance. The combination of smart monitoring, microgrid intelligence, and AI-driven optimization creates a powerful toolset for industries looking to

maximize their energy efficiency and minimize expenses.

For Pakistani industries ready to embark on this energy transformation, the roadmap is clear. The first step is deploying smart meters and conducting comprehensive energy audits to establish a baseline of consumption patterns. Next, businesses should upgrade their solar and battery systems to fully integrated smart microgrids with AI-based energy management. Implementing peak shaving strategies and demand response programs can further reduce costs, while

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How Pakistan's energy revolution can power affordable, reliable electricity for all

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power plants exceeded PKR2 trillion (Pakistani rupee) or $7 billion in 2024. These costs must be recovered through higher tariffs on fewer ratepayers regardless of actual usage.

Without regulatory reform such as redesigning tariffs or planning for flexible grid infrastructure, Pakistan could see a widening energy divide. On one side, a growing class of energy "prosumers" would enjoy more reliable, low-cost power off-grid, while those still tied to the grid would be left paying ever-higher costs for a legacy system.

Affordable energy for all

To make the transition more inclusive, Pakistan needs financing mechanisms that lower entry costs for underserved users and support grid upgrades that benefit everyone.

Blended finance, which uses public or philanthropic funds to help unlock private investment, could play a key role here. Low-interest credit lines for rooftop solar and batteries, as well as guarantees to de-risk lending, could make solar-plus-battery energy solutions more accessible.

Development banks such as the Asian Development Bank (ADB) and Green Climate Fund (GCF) are already active in Pakistan and could help structure these facilities. The Pakistan Distributed Solar Project already uses a GCF-backed guarantee to finance 43 megawatts of solar PV installations for households, agribusinesses and small- and medium-sized enterprises. The facility supports lending through the State Bank of Pakistan's renewable energy scheme, enabling partners like JS Bank to offer concessional loans to new customer segments while also providing technical assistance and market awareness support.

Pakistan will also need to expand utility-scale solar to complement rooftop and distributed systems. While this may reduce the use of existing thermal plants even further, such projects are essential to meet growing demand and drive the transition.

Ultimately, financing must go beyond what works for early adopters. Creating mechanisms that make clean, reliable power accessible to all will ensure Pakistan's rapid shift to solar and storage strengthens the entire power system.

Lessons for other emerging economies

The factors driving Pakistan's solar and battery boom are not unique to the country. Many other developing economies face the same pressures of high power prices, unreliable electricity and gaps in energy access. They can also benefit from the rapid drop in the cost of solar panels and, more recently, batteries.

Pakistan's experience is an important case study for other emerging economies. Five key recommendations include:

1. Make the energy transition inclusive

Help households and businesses that cannot yet afford the investment in solar and storage to do so in a coordinated and collective manner.

2. Integrate distributed energy into the system

Encourage sharing, trading and coordinated use of power from small, decentralized installations so surplus energy is not wasted and the whole grid benefits. Incentivize battery charging and discharge when it makes sense for the system.

3. Include legacy assets

Develop business models and financial arrangements for existing thermal plants so they can serve as backup, grid stabilizers and providers of ancillary services, while minimizing emissions and keeping the system reliable during periods of low renewable output.

4. Incorporate the mobility sector

Use the growth of distributed solar and battery systems to support the electrification of transport. Align charging infrastructure planning with local generation and storage capacity, and design incentives that encourage EV charging when solar output is high. This reduces strain on the grid and links two major energy transitions.

5. Plan ahead for scale

Treat solar-plus-batteries as a major source of capacity growth and generation in the next decade, rather than a fringe add-on. Grid planning and policy must anticipate this shift rather than react to it.

For many emerging markets, the question is no longer if the energy transition will happen, but how to manage it. With the right planning and smarter financing instruments, countries can turn a rocky, uneven shift to clean power into a coordinated pathway towards affordable, reliable and low-carbon energy for all. - WEF ■

Sana Bahadar Wins Women's Open at 5th Independence Day Championship 2025

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ple areas in the society, the vision of ASCF is to support those in needs that could contribute to nationwide. Moreover, the ASCF is committed to work on quality education, health and social Welfare in the society.

About Amir S. Chinoy Group:

The ASC Group stands as one of Pakistan's leading industrial conglomerates, with established strengths in manufacturing, trading, and industrial services. Within Pakistan, the Group operates seven manufacturing facilities, maintains a nationwide presence through its offices, and supports a broad distribution network that spans more than 1,600 outlets across over 500 cities and towns.

Internationally, the ASC Group boasts a strong export track record, generating combined export revenues exceeding USD 65 million. Its global reach is reflected through a growing number of international subsidiaries and a physical presence in countries including Australia, Canada, Ireland, Sri Lanka, and Qatar.

Committed to environmental sustainability and social responsibility, the ASC Group incorporates eco-friendly practices into its operations and community initiatives. As a signatory of the UN Global Compact and an advocate of UN Sustainable Development Goal 7 (Affordable and Clean Energy), the Group has implemented over 13 megawatts of renewable energy and has planted more than 50,000 trees across its industrial sites. - Sydney, Australia: PR ■

From Load Shedding to Grid Savior

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exploring innovative financing models like Energy-as-a-Service (EaaS) can make the transition more accessible by eliminating upfront capital expenditures. The question is no longer whether industries should adopt these technologies, but how quickly they can implement them to stay competitive.

The bottom line is that solar and batteries alone are just the beginning. The real game-changer lies in smart microgrids and advanced energy monitoring, which can deliver unparalleled cost savings, operational resilience, and long-term sustainability. Pakistani industries that embrace this holistic approach will not only shield themselves from rising electricity tariffs but also gain a significant competitive edge in an increasingly energy-conscious market. The smart energy revolution is here, and the time to act is now.■

Breaking the Cycle: Engineering a Techno-Nationalist Future for Pakistan

By: Mirza Abdul Aleem Baig

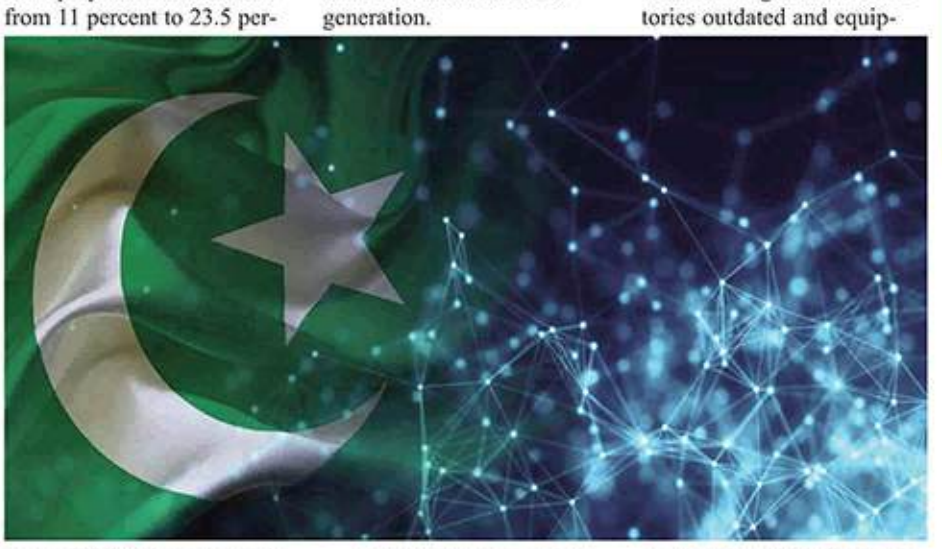
Pakistan today stands at a decisive crossroads. The global economy is shifting toward knowledge-intensive technologies (techno-economy) where nations no longer compete primarily on raw resources or low-cost labor but on innovation ecosystems, and sovereign mastery of critical systems.

For Pakistan to survive and thrive in the 21st century, its engineering education must be fundamentally re-engineered.

For decades, our engineering syllabi have remained static – anchored to outdated theory, rote memorization, and examinations that test memory more than skill. The majority of graduates often leave universities with degrees but without the competencies to design a semiconductor, program a robotics stack, or secure a digital network.

In an era where artificial intelligence, renewable energy, secure communication, and advanced manufacturing define power hierarchies, this gap is not merely academic – it is existential. If we continue producing engineers detached from real-world problem solving, Pakistan will sink deeper and deeper into technological dependency.

The urgency of reform is underscored by recent data. Surveys indicate that nearly one in four engineering graduates is unemployed and the unemployment rate doubled from 11 percent to 23.5 percent in 2022-2025, about 70 percent of female engineers are either unemployed or out of labor force, a rate far higher than the national average.



This reflects a stark mismatch between what universities teach and what the market demands. At the same time, Pakistan is bleeding talent. Tens of thousands of professionals, including thousands of engineers, left the country in 2023–24, part of a record wave of skilled emigration that has stripped Pakistan of the very people needed to seed new industries and mentor the next generation.

Enrollment in engineering programs has also dropped sharply in some provinces, by as much as 76 percent over the past decade, while higher education access nationwide remains limited to only about one in eight young adults. These trends paint a worrying picture: fewer students entering engineering, rising unemployment among those who do graduate, and a worsening brain drain among those with valuable skills.

On top of this, structural weaknesses persist. Chronic underfunding leaves laboratories outdated and equipment under-maintained. Faculty often lack exposure to modern toolchains and industry practices. Regulatory bodies such as the Higher Education Commission (HEC) and the Pakistan Engineering Council (PEC) are attempting reforms, but accreditation remains heavily weighted toward rote exams rather than innovation outcomes.

This is why Pakistan must embrace a techno-nationalist approach; a deliberate strategy that prioritizes technological sovereignty, aligns curricula with national missions, and orients graduates toward solving Pakistan's own strategic challenges. This is not isolationism; rather, it is equipping engineers to contribute to global standards and open-source ecosystems while ensuring that Pakistan can independently design, build, and maintain its critical technologies from chips and communication systems to renewable grids and medical devices.

A redesigned syllabus should revolve around mission-driven tracks; semiconductors and embedded systems, AI and robotics, secure digital infrastructure, climate and energy technologies, health tech, etc. Each of these fields addresses both global opportunities and Pakistan's local needs. Imagine graduates designing open RISC-V processors for secure ID systems, developing Urdu-enabled OCR pipelines for digitization, or building low-cost ventilators for hospitals. Such alignment ensures education is not abstract but tied directly to national survival and growth.

Reform must also change how we teach and assess. Industry co-ops should be mandatory, with students spending extended periods embedded in real firms. Challenge-based learning should replace textbook rehearsals, with students solving problems drawn directly from national missions such as flood resilience, smart agriculture, or secure power grids. Assessment should shift from high-stakes written exams to prototypes and deployments.

Equally important is fac-

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About the author

Mirza Abdul Aleem Baig is President of Strategic Science Advisory Council (SSAC) – Pakistan. He is an independent observer of global dynamics, with a deep interest in the intricate working of techno-geopolitics, exploring how science & technology, international relations, foreign policy, and strategic alliances shape the emerging world order.

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Energy and AI: the power couple that could usher in a net-zero world

As the world embraces both technological innovation and environmental responsibility, the demand for clean, sustainable energy solutions has never been more urgent.

Across industries, the call for energy systems that provide maximum power, minimal emissions and energy security is growing louder.

To meet these goals, the energy sector must undergo a rapid transformation – reducing emissions while delivering reliable, scalable energy to support economic growth. Central to unlocking this potential is artificial intelligence (AI), which offers unprecedented opportunities to revolutionize the production, management and consumption of energy.

AI has the potential to be a powerful tool for transforming how energy is produced and managed. Through advanced machine learning and data analytics, AI can optimize energy consumption, improve grid resilience and enable smarter, more efficient use of resources. AI-driven energy efficiency measures and smart grid technologies could generate up to $1.3 trillion in economic value by 2030. Furthermore, AI has the potential to reduce global greenhouse gas (GHG) emissions by 5-10% – an amount equivalent to the annual emissions of the entire European Union.

One of AI's most promising contributions is its ability to accelerate the energy transition. By enhancing the management and integration of renewable energy sources, AI can stabilize grids, forecast energy demand and minimize waste. Predictive maintenance is another key benefit, as AI can identify potential issues in energy infrastructure before they lead to costly failures, thereby improving the reliability and sustainability of energy systems.

AI's growing energy footprint

While AI plays a critical role in advancing the energy sector, it also presents a significant challenge: AI itself consumes vast amounts of energy. Currently, AI-powered processes require far more energy than traditional digital services. For instance, a single AI-powered query, such as a ChatGPT inquiry, consumes about 10 times the energy of a typical Google search.

This energy demand is expected to rise dramatically. By 2030, global power demand from data centres – primarily driven by AI – could increase by 18-20% annually, reaching over 1,000 terawatt-hours (TWh). This amount is equivalent to nearly a quarter of the United States' current power demand.

This increasing demand for energy presents a dual challenge for global energy providers: how to meet the growing power needs of AI, while simultaneously reducing emissions and transitioning to cleaner energy sources. By 2030, electricity consumption for AI-driven technologies could multiply by a factor of 3.6, further intensifying the strain on energy systems. This makes it imperative for the energy sector to find innovative ways to accommodate AI's growth while ensuring sustainability.

To address this challenge, energy producers must leverage AI to optimize their own operations, enhance efficiency and accelerate the shift toward renewable energy. For example, AI can improve demand optimization, diversify energy sources and increase grid resilience. In doing so, energy producers can not only meet the rising demand for power, but also unlock new efficiencies, reduce operational costs by up to 15%, and boost productivity by 10%.

Abu Dhabi on the frontline

ADNOC is laser-focused on this transformation. By effectively integrating the AI and energy sectors, we can sustainably power prosperity, progress and social value everywhere. AI will play a vital role in decarbonizing our energy production, while also enhancing safety and efficiency. As part of our ongoing transformation, we are investing in world-class digital infrastructure to ensure data-driven automa-

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Breaking the Cycle: Engineering a Techno-Nationalist Future for Pakistan

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ulty capacity. Teachers must be retrained through "teach-the-teachers" academies, incentivized to learn open-source toolchains, and offered sabbaticals in industry or national R&D labs. Promotion criteria should reward labs maintained, partnerships built, and prototypes delivered, not just lecture hours or years served.

The state, too, must play its part. The government should act as the "buyer of first resort" for promising student prototypes, fast-tracking them into pilot deployments. Shared regional "sovereignty labs" can provide access to expensive equipment like FPGAs, fabrication partnerships, and cyber ranges. Policies must also address brain drain by career pathways in R&D, and recognition for graduates who remain and build at home.

Countries that fail to assert technological sovereignty will remain at the mercy of those that do. For Pakistan, re-engineering the engineering syllabus with a techno-nationalist approach is not just an educational reform – it is a survival strategy, a nation-building imperative, and a moral obligation to future generations.

To cut a long story short, with rising graduate unemployment, falling enrollment, and record brain drain, the evidence is all around us; the current system is broken and out-of-date. But with courage, coherence, and urgency, we can transform our engineering classrooms into the engine rooms of Pakistan's technological future.■

IEA Report Explores AI's Wide-Ranging Impact on Global Energy

Major new IEA report brings groundbreaking data and analysis to one of the most pressing and least understood energy issues today, exploring AI's wide range of potential impacts.

Artificial intelligence has the potential to transform the energy sector in the coming decade, driving a surge in electricity demand from data centres around the world while also unlocking significant opportunities to cut costs, enhance competitiveness, and reduce emissions, according to a major new report from the IEA.

The IEA's special report Energy and AI, out this year, offers the most comprehensive, data-driven global analysis to date on the growing connections between energy and AI. The report draws on new datasets and extensive consultation with policy makers, the tech sector, the energy industry and international experts. It projects that electricity demand from data centres worldwide is set to more than double by 2030 to around 945 terawatt-hours (TWh), slightly more than the entire electricity consumption of Japan today. AI will be the most significant driver of this increase, with electricity demand from AI-optimised data centres projected to more than quadruple by 2030.

In the United States, power consumption by data centres is on course to account for almost half of the growth in electricity demand between now and 2030. Driven by AI use, the US economy is set to consume more electricity in 2030 for processing data than for manufacturing all energy-intensive goods combined, including aluminium, steel, cement and chemicals. In advanced economies more broadly, data centres are projected to drive more than 20% of the growth in electricity demand between now and 2030, putting the power sector in those economies back on a growth footing after years of stagnating or declining demand in many of them.

A diverse range of energy sources will be tapped to meet data centres' rising electricity needs, according to the report – though renewables and natural gas are set to take the lead due to their cost-competitiveness and availability in key markets.

"AI is one of the biggest stories in the energy world today – but until now, policy makers and markets lacked the tools to fully understand the wide-ranging impacts," said IEA Executive Director Fatih Birol. "Global electricity demand from data centres is set to more than double over the next five years, consuming as much electricity by 2030 as the whole of Japan does today. The effects will be particularly strong in some countries. For example, in the United States, data centres are on course to account for almost half of the growth in electricity demand; in Japan, more than half; and in Malaysia, as much as one-fifth."

The report emphasises the significant uncertainties that remain, from the macroeconomic outlook to how quickly AI will be adopted. It also notes questions over how capable and productive AI will become, how fast efficiency improvements will occur, and whether bottlenecks in the energy sector can be resolved.

AI could intensify some energy security strains while helping to address others, according to the report. Cyberattacks on energy utilities have tripled in the past four years and become more sophisticated because of AI. At the same time, AI is becoming a critical tool for energy companies to defend against such attacks. Another energy security concern relates to the expanding demand for critical minerals used in the equipment in the data centres that power AI. The report provides first-of-its-kind estimates of demand from data centres for critical minerals, whose global supply is today highly concentrated.

While the increase in electricity demand for data centres is set to drive up emissions, this increase will be small in the context of the overall energy sector and could potentially be offset by emissions reductions enabled by AI if adoption of the technology is widespread, according to the report. Additionally, as AI becomes increasingly integral to scientific discovery, the report finds that it could accelerate innovation in energy technologies such as batteries and solar PV.

"With the rise of AI, the energy sector is at the forefront of one of the most important technological revolutions of our time," Dr Birol said. "AI is a tool, potentially an incredibly powerful one, but it is up to us – our societies, governments and companies – how we use it. The IEA will continue to provide the data, analysis and forums for dialogue to help policy makers and other stakeholders navigate the path ahead as the energy sector shapes the future of AI – and AI shapes the future of energy."

According to the report, countries that want to benefit from the potential of AI need to quickly accelerate new investments in electricity generation and grids, improve the efficiency and flexibility of data centres, and strengthen the dialogue between policy makers, the tech sector and the energy industry.

The report is part of the IEA's expanding work analysing the deepening ties between energy and AI. It builds on the Global Conference on Energy and AI the IEA hosted in December 2024 – the largest conference on this topic to date – and the Agency's contributions to the AI Action Summit chaired by France and India in February. The IEA will also soon launch a new Observatory on Energy, AI and Data Centres, which will gather the most comprehensive and recent data worldwide on AI's electricity needs, in addition to tracking cutting-edge AI applications across the energy sector.

Alongside the report, the IEA is publishing a new AI agent to help readers interact with its findings. The AI agent is available on the report's main web page and answers questions on the report's contents in an easy and conversational manner. -■

Energy and AI: the power couple that could usher in a net-zero world

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tion and decision-making from the control room to the boardroom.

In 2023 alone, ADNOC's AI energy-saving efforts generated $500 million in value and reduced carbon emissions by about a million tonnes – the equivalent of removing around 200,000 gasoline-powered cars from the road. Energy companies worldwide are making inroads into innovative use of technology, but as with all global challenges, the rapid, considered and inclusive change required can only come through meaningful worldwide collaboration.

The future of energy and AI cannot be shaped in isolation. It requires a concerted global effort that brings together industry leaders, policy-makers and innovators to develop solutions that ensure both energy security and sustainability. Global partnerships are essential for addressing the challenges posed by AI's energy needs and ensuring that AI fulfills its potential to drive a more sustainable future.

By integrating the AI and energy sectors more effectively, we can reduce emissions while ensuring sustainability and prosperity, driving social and economic value everywhere. - By Ibrahim Al-Zu'bi, WEF ■

Energy outlook 2025: emerging trends and predictions for the power industry

As the world transitions toward cleaner energy sources and grapples with critical political shifts, 2025 is shaping up to be a pivotal year for the power sector.

According to Power Technology parent company GlobalData's Power Predictions 2025 report, several key themes are set to dominate the global power landscape this year, from geopolitical shifts affecting supply chains to advancements in electric vehicles (EVs), energy storage, nuclear power and hydrogen.

Geopolitics, supply chains and the energy transition

The power sector in 2025 will not be immune to geopolitical shifts, with supply chain dynamics in particular set to be struck by the blow.

According to the report, international tensions will continue to influence trade policies, resource availability and transportation routes this year, thereby affecting the efficiency and reliability of supply chain operations.

Supply chain disruptions are expected to prevail in the Middle East, with the spillover of the Gaza conflict into neighbouring Lebanon and ongoing threats to maritime trade in the Red Sea. This geopolitical instability will impact the availability and pricing of materials such as semiconductors, which are essential for both renewable energy technologies and EVs.

Another major concern is the concentration of critical minerals in specific regions across the world, with sizeable portion of the world's lithium reserves in South America and Australia, the Democratic Republic of the Congo dominating cobalt and Indonesia leading in the production of nickel.

The competition to secure supply from these geographic monopolies has sharpened rivalries among China, the US and the EU. With China leading in the mineral supply chain and the development of transition technologies, Western nations have implemented various sanctions and tariffs to level the playing field. China has retaliated with similar measures.

These tensions have disrupted global supply chains and market stability and "will continue to do so this year", says GlobalData power sector senior analyst Pavan Vyakaranam, adding that President Donald Trump's return to office will escalate the US-China trade war in 2025, further straining supply chain dynamics.

However, Vyakaranam believes that such disruptions will not pose a significant risk to the global power sector and energy transition, as "the world is learning to work around these geopolitical tensions".

"Looking back at the Russian invasion of Ukraine, everybody panicked and thought it would be incredibly difficult to manage – and it was, initially – but then supply chains and other aspects evolved, and we figured things out. So, although geopolitical crises will continue to come up this year, they will not have a fatal impact on the energy sector."

Batteries in charge: EVs and energy storage

Despite potential troubles in its supply chain, batteries are set to take centre stage this year.

According to GlobalData's report, electrification of the transportation sector will catalyse demand for batteries in 2025.

GlobalData forecasts global EV sales will reach 13.68 million this year.

"The projection for all-electric vehicle sales to increase nearly 30% from last year underscores the acceleration of EV production and, by extension, battery demand," says Raphael Héliot, policy manager at E-Mobility Europe, formerly known as AVERE.

Although supply chain challenges may continue to impact the costs of raw materials needed for batteries, John Higham, board member of the Electric Vehicle Association, says that "costs for raw materials make a small impact on the overall cost of the battery" and hence will not deter the growth of the battery market – and with it, the EV market.

Lithium-ion (Li-ion) batteries are poised to maintain their dominance in the battery market due to their superior performance and elevated energy density. GlobalData projects the Li-ion battery industry's revenues will grow to $160bn this year, constituting 95% of global battery sales.

Concurrently, lithium-iron phosphate (LFP) and sodium-ion batteries are expected to gain more ground. "There is a lot of pressure for companies to reduce supply chain costs, so many have been trying to find better alternatives,"

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Unlocking Pakistan's Industrial Potential through Smart Resource Management

By M. Hasan Masood

Pakistan's Strength — A Nation Built to Industrialize

Pakistan is naturally equipped for industrial success. With rich mineral and agricultural resources, a young population, and a strategic geographic location, the country has immense untapped potential.

Pakistan is the fifth-largest cotton producer in the world, with significant reserves of coal, salt, copper, and gypsum. Over 64 percent of the population is under the age of 30, offering a large labor force. Our location at the crossroads of South Asia, Central Asia, and the Middle East gives us direct access to regional trade routes.

However, despite these strengths, Pakistan's industrial sector remains underutilized due to inefficiencies in energy use, workforce readiness, and outdated production practices.

Smarter Use of Resources — the Need of the Hour

Pakistan does not necessarily need more resources; it needs to use its existing ones more wisely.

Energy Efficiency

Power shortages, high tariffs, and inconsistent supply reduce industrial productivity. The shift toward renewable energy sources like solar, along with industrial energy audits and smart grids, can reduce costs and improve output.

Skilled Workforce

Less than 15 percent of the labor force has formal technical or vocational training. Bridging this gap requires strengthening vocational education programs, building industry-academia linkages, and encouraging on-site training through apprenticeships.

Raw Materials and Waste Reduction

Industries face high losses due to inefficient use of raw materials, outdated machinery, and lack of quality control. Lean manufacturing practices, waste reduction strategies, and digital supply chain management can make production more competitive and sustainable.

Digital Transformation

While global industries move toward automation, Pakistan must accelerate digital adoption in manufacturing, quality control, and export logistics. Introducing affordable automation tools and training for small and medium enterprises can bring a significant shift.

Industrial Zones and Policy Alignment

Industrial estates and Special Economic Zones (SEZs) have the potential to become hubs of growth if they are supported by reliable infrastructure, simplified regulations, and centralized facilitation. Better coordination between public

institutions and private investors is critical to ensuring that these zones meet the needs of modern industry.

Conclusion

Pakistan has the raw potential to become a regional industrial leader. What we need now is a national focus on smart resource management. From energy and human capital to materials and digital capacity, improving efficiency in every area can drive sustainable growth, job creation, and export competitiveness.

As someone closely involved with Pakistan's industrial ecosystem, I believe that our next leap forward will come not from acquiring more resources, but from managing our existing strengths more intelligently. The global economy rewards efficiency, and it is time Pakistan turns that into its competitive advantage.■

The Silent Revolution: Your Factory is Talking. Are You Listening?

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factories treat it like a fixed utility bill. With a system like the Siemens SIMATIC Energy Manager, you can see exactly which machine, which line, and which shift is consuming the most power.

• **A Real-World Example:** A client in the beverage sector ran three large compressors, believing all were necessary for their peak load. After installing a simple energy monitoring system, we discovered one compressor was running inefficiently, while the load could be met by two optimized machines for 90% of the day.

• **The Result:** By intelligently cycling the compressors and shifting specific high-load processes to off-peak tariff hours, they cut their electricity bill by 18% in the first quarter. The system paid for itself in under eight months. That's not a cost; it's an investment with a guaranteed, rapid return.

3. The Promise of Intelligence: From Reactive to Predictive

The final, most exciting frontier is using the data you're collecting to predict the future. Every motor, pump, and valve in your facility generates operational data. Most of it vanishes into thin air. Digitalization is about capturing this data and listening to the story it tells.

Are a motor's vibrations slowly increasing over time? That's a clear sign of bearing wear. Is its temperature consistently higher than its twin on the next line? It could be heading for a failure.

Instead of waiting for a critical machine to break down on a Friday afternoon—halting production for the entire weekend—an intelligent system can flag the anomaly weeks in advance. It can automatically schedule maintenance during planned downtime.

• **The Result:** A shift from costly, chaotic reactive maintenance to low-cost, scheduled predictive maintenance. This simple change can boost plant availability by 5-10% annually, unlocking hidden production capacity without a single new machine.

The Human Equation: Creating System Supervisors

The fear that automation eliminates jobs is understandable but misplaced. It changes jobs. It automates the repetitive, strenuous, and mundane tasks, freeing up your skilled workforce to do what humans do best: solve problems, innovate, and manage complex systems.

An operator who once manually opened and closed valves becomes a technician who monitors an entire water treatment process from a central SCADA screen. A maintenance worker who used to react to breakdowns becomes a reliability engineer who analyzes data to prevent them. You're not losing an employee; you're upgrading their role and making their expertise more valuable.

The future of Pakistani industry hinges on our ability to compete on a global stage. That won't be achieved by having the lowest labor costs, but by being the smartest, most efficient, and most reliable producers. The revolution is already here. It's quiet, it's data-driven, and it's waiting in the signals your own factory is sending you.

The only question is, are you ready to listen? ■

The Power Play: Selling Energy Solutions

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assuring them that power reliability was guaranteed even in the worst conditions. He offered a trial run, confident that performance would speak louder than promises.

Most importantly, Amir built trust. He wasn't just selling a generator—he was building a partnership. He spoke with honesty, demonstrated local market knowledge, and positioned his company as the one that understood their unique challenges better than any competitor.

The Deal: A Story of Alignment

By the end of the meeting, the boardroom wasn't discussing "a generator" anymore. They were discussing a growth enabler, a financial strategy, and a sustainability milestone.

Amir had transformed a technical product into a strategic solution. Each decision-maker saw their own reflection in his pitch:

The foreman saw uptime.

The engineers saw reliability.

The directors saw scalability.

The CFO saw ROI.

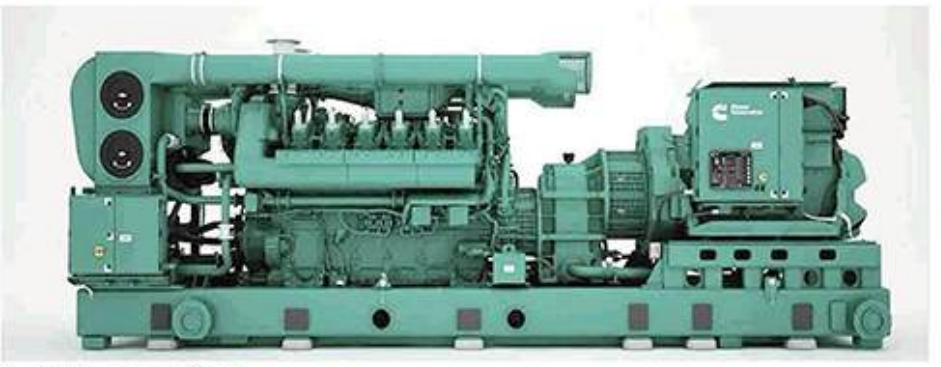
The CEO saw vision.

And that's when the chairman leaned back and said,

"This isn't just power. This is progress."

Key Takeaway for Sales Engineers and Entrepreneurs

Selling diesel, gas, and renewable solutions at higher organizational levels isn't about specs—it's about storytelling with strategy. When you align your pitch with each stakeholder's priorities—speed, reliability, growth, ROI, and vision—you don't just sell a generator. You sell the future of the organization.■



Energy outlook 2025: emerging trends and predictions for the power industry

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Vyakaranam explains.

LFP batteries have expanded their market presence, particularly in China, and now predominate in the lower-tier EV market. Their growing popularity owes largely to their relatively reduced supply chain costs, as they obviate the need for nickel or cobalt.

Meanwhile, sodium-ion batteries have a lower energy density than Li-ion alternatives but use a safer, more abundant and sustainable material, making them an attractive option for short-range EVs.

Vyakaranam caveats: "There have been developments [with alternatives to Li-ion], but nothing that will reach commercial phase any time soon."

In tandem with rising EV adoption, investment in EV charging infrastructure is growing. Companies such as Charge Zone and GLIDA are investing millions to expand charging networks, while policy measures in regions such as the EU and California are driving the transition away from combustion engines.

Héliot notes the "stop-and-go" effect the EV industry has experienced: encouraging policies initially boosted adoption, but it was followed by stagnation due to pushback; however, momentum is expected to pick up again.

"2025 will mark the beginning of a new growth phase, driven by the enforcement of stricter emissions targets and the introduction of more affordable EV models," he says. "We anticipate broader consumer adoption as automakers expand beyond premium segments to target mainstream and budget-conscious buyers. This shift will further democratise EVs, fostering growth across a wider range of market segments globally."

While the Trump administration's hostility towards EVs presents yet another potential setback for the industry, Higham and Vyakaranam believe that it will not be enough to deter the growth of the market this year. "The drive for EVs and EV infrastructure comes ultimately from the consumer side," Vyakaranam says.

Another driver of batteries – albeit different – is the recognition of energy storage as a key enabler of the energy transition, with battery energy storage systems (BESS) poised to lead the way.

Global BESS deployment is set to register 154.6GW by the end of this year, up 56% from 98.78GW in 2024, according to GlobalData. The BESS market is expected to reach $14.89bn by 2027.

BESS help balance the intermittent nature of solar and wind power by storing excess energy and releasing it when demand peaks.

"BESS act as a very good integrator for maintaining grid stability in areas where there have been mass renewables deployment. So, regions with ambitious plans for renewables – the US, China, India and the EU, for instance – are likely to make moves on BESS this year," says Vyakaranam.

Nuclear as the solution to increasing power demand

GlobalData's report highlights that nuclear power will pick up steam this year, especially in helping meet increasing power demand driven by the expansion of AI and data centres.

"The emergence of a new market of end-energy users such as heavy industry and technology sectors, notably with the concept of nuclear-powered data centres, will drive nuclear expansion," Henry Preston, a representative of the World Nuclear Association, tells Power Technology. "These sectors require large amounts of clean energy, but crucially, this energy needs to be secure and reliable – which nuclear is well suited for.

"This means we will see an increase in public-private partnerships for financing and developing nuclear projects."

One of the most promising developments in the nuclear sector is the rise of small modular reactors (SMRs), which offer a range of benefits over traditional large reactors, including greater flexibility and inherent safety features.

Like Preston, Alexandra Wyler, a representative of SMR producer Blykalla, believes that "the trend of partnerships between tech giants and advanced SMR concepts will continue" as "the need for more direct current capacity to support the growing AI and cloud market is growing at a much faster pace than power can be provided, and SMRs are one of the best solutions to clean and collocated base power".

While the technology is yet to be commercialised, with growing political and financial backing, SMR demonstrations are now in the advanced stage of construction in countries such as Argentina, China, Russia and the US, whereas the UK, Poland, Canada and Romania have entered development stages.

Around 42.8GW of SMR capacity is currently in the pipeline, constituting around 279 reactors globally. Out of the total pipeline capacity, about 22.8GW is in the announced stage, 19.6GW in the permitting stage, 819MW under construction and 320MW in the finance stage.

"SMRs are a game-changer. They will play a crucial role in how fast countries can meet their transition goals," Vyakaranam says. "I won't say that SMRs will completely shift the balance in 2025, but this year will be critical in SMRs proving to be relatively safer and more flexible than conventional nuclear technologies."

However, Vyakaranam says a critical challenge for SMRs will be financing. "There is a lot more [funding] needed for research and development, waste management, safety and security."

Wyler agrees that "the most significant hurdles are related to access to sufficient capex [capital expenditure]", adding that "lengthy regulatory processes could also inhibit the speed of deployment".

Regardless, the nuclear industry is expected to continue its growth trajectory. GlobalData forecasts that total nuclear power generation will reach 2.67 terawatt-hours in 2025 with 5GW of capacity additions – more than five times the 989MW added in 2023.

GlobalData also predicts that more countries in 2025 will join the pledge to triple global nuclear capacity by 2050 – a target first set by 21 countries at COP28, which grew to 31 signatories at COP29.

"Nuclear energy's role in mitigating the impacts of climate change has become much more appreciated at the COP conferences in the past two years," Preston says, adding: "The new US administration's decision to withdraw from the Paris Agreement may have an impact on that progress, but we believe there will continue to be strong support for nuclear from the US because of the enhanced energy security that nuclear can provide."

Hydrogen also on the rise

"While hydrogen of all types is gaining some traction, the overall drive is towards green hydrogen, which is set to become more economical to produce," says Vyakaranam.

Indeed, a recent study by the Hydrogen Council indicated that the cost of renewable hydrogen production is projected to decrease by up to 60% within the next decade, largely due to the reduced cost of renewable electricity generation and the expansion of electrolyser manufacturing.

Hydrogen's potential extends beyond its role as a clean fuel; it is also increasingly being seen as a solution for storing renewable energy as well as improving energy efficiency through combined heat and power generation.

According to GlobalData, global green hydrogen production capacity is expected to reach 2.76 million tonnes per annum (mtpa) by the end of 2025, compared with 270,000tpa registered this year.

North America holds the leading position in the global hydrogen market. "With many projects in the pipeline, the region will maintain a substantial share of the market this year and in the near future," Vyakaranam says.

"There is a lot of project activity coming up in APAC [Asia-Pacific], but in terms of scale, it needs to catch up and does not compare to North America at this moment," he adds.

The report notes that Australia, with its vast renewable resources, is also well-positioned to become a key player in the green hydrogen economy. Europe, too, is investing heavily in hydrogen and may emerge as a notable competitor in coming years.■

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