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2024



PAKISTAN
SUSTAINABILITY
WEEK

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MOVING TOWARDS SUSTAINA- BILITY

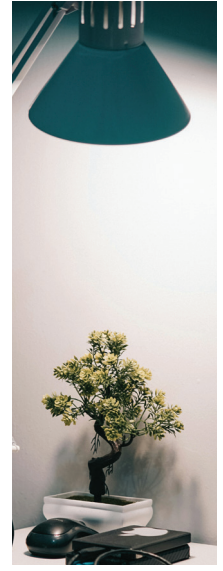


Moving towards sustainable living is not just an ecological obligation; it's a compassionate choice that benefits both us and our planet. Sustainability ensures that we leave a healthier, more harmonious world for future generations. By reducing our environmental footprint through responsible consumption, renewable energy, and mindful resource management, we can mitigate climate change, protect biodiversity, and foster resilient ecosystems.

Sustainable living also brings personal advantages. It promotes a healthier lifestyle, as it encourages fresh, locally sourced foods and active transportation. It fosters community connections and reduces stress, making us happier and more fulfilled. Moreover, it bolsters economic stability, as green industries create jobs and lower our energy bills.

[#cleanenergy](#)

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I find myself reflecting on the importance of plantation and a green energy mindset, especially as we step into the new year. In Pakistan, where we face a challenging energy crisis, the need for sustainable solutions has never been more pressing. It's heartening to see the growing awareness among people of all ages.

This year marks a significant milestone for us – the expansion of Pakistan Sustainability Week to three major cities: Karachi, Lahore, and Islamabad. The enthusiasm and participation we've witnessed so far are truly inspiring. These events symbolize our collective commitment to sustainability and the shared responsibility as human beings. As we bid farewell to the winter season, we anticipate a notable increase in solar installations, a timely reminder of the pressing need to address Pakistan's energy crisis, especially during the summer months.

The onset of the year serves as a crucial prompt for all of us to adopt a 'think green' mindset. This seasonal transition isn't just a change in weather; it's a call to action. It's an opportunity for us to reflect on the importance of sustainable energy solutions and the role each of us can play in mitigating the energy challenges our country faces. Let's use this time to reinvigorate our efforts towards a greener, more energy-efficient Pakistan, where solar power and other renewable energy sources become a staple in combating power shortages.

As the sun shines brighter, let it light up not just our homes but also our commitment to a sustainable future. This year, let's transform the rising temperatures into a driving force for change, actively seeking and supporting renewable energy initiatives.

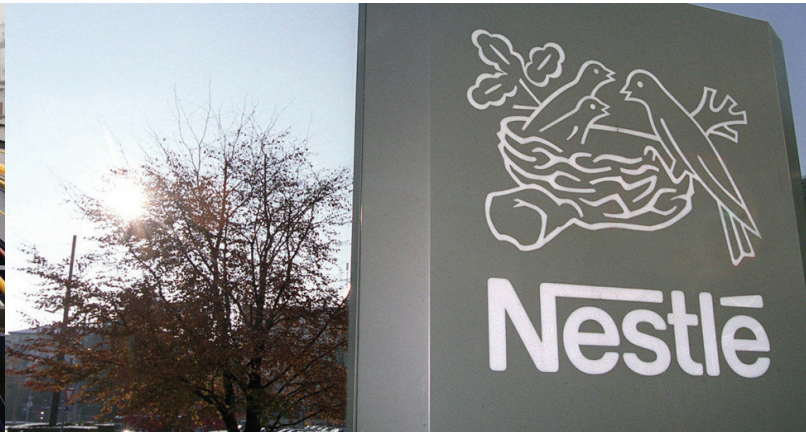
God Bless!

Local Scoop.

Here we bring you the latest updates on the green revolution happening in your region. Read about how your community is harnessing the power of renewables to shape a sustainable future and create positive environmental impact, one innovation at a time. We talk about breakthrough technologies, and local initiatives driving the renewable energy movement forward.



NESTLÉ DRIVES A 2 BILLION INVESTMENT IN PAKISTAN.



The primary objective of this initiative is to diminish annual greenhouse gas emissions by 1,800 tCO₂e.

As part of its Rs 2 billion investment in the country, Nestlé Pakistan has integrated two biomass boilers and additional solar power facilities in its various manufacturing sites. This strategic investment aligns with the company's commitment to reduce greenhouse gas emissions, placing a particular emphasis on renewable energy, in accordance with its 2050 Net Zero objectives and the climate change pledge made by the Pakistan government at the United Nations. During the inauguration, Swiss Ambassador to Pakistan, Georg Steiner, expressed his views, stating, "Nestlé Pakistan's continuous investment and 35-year presence in the country reflect its confidence in Pakistan."

The solar power plant stands as evidence of its dedication to creating shared value for the people of Pakistan and contributing to a cleaner environment. This initiative is pivotal in assisting the Pakistani government in achieving its Nationally Determined Contribution commitment to attain 60% Renewable Energy by 2030."

CEO of Nestlé Pakistan, Jason Avanceña, emphasized the company's commitment to being a positive force in the country's development. Avanceña remarked, "As we mark 35 years of operations in Pakistan, we pledge to play a constructive role in the nation's future by increasing investments in renewable energy and sustainability initiatives." He further outlined Nestlé's broader renewable energy strategy, which includes plans for biomass boilers and a similar solar plant at the Sheikhpura Factory and other manufacturing sites.

Nestlé has announced ambitious emission reduction targets, aiming for a 20% decrease by 2025 (compared to a 2018 baseline), a 50% reduction by 2030, and achieving Net Zero by 2050, in alignment with UN Sustainable Development Goals 13 and 15.

With 35 years of operation in Pakistan, Nestlé is committed to fostering economic growth by increasing exports to USD 18 million across 20 countries to generate foreign revenues. The company is also reinforcing its commitment to localization, with over 90% of raw and packaging materials sourced locally by 2023, thereby contributing to the strengthening of the local industry.

COLLABORATIVE EFFORT: OPEC FUND AND ITFC ENSURE WINTER ENERGY SUPPLIES

The OPEC Fund for International Development (OPEC Fund) and the Islamic Trade Finance Corporation (ITFC) have joined forces to ensure ample energy supplies for Pakistan during its coldest period. Both organizations have committed USD 50 million each to support the importation of essential energy carriers.

Pakistan faces chilly winters, with temperatures dropping to around 4°C in Punjab in January and sub-zero temperatures in northern regions and Balochistan. The challenging mountainous terrain, including peaks above 6,000 meters, necessitates intricate infrastructure and advanced logistics for securing energy supplies.

Having initiated its first operation in Pakistan in 1976, OPEC Fund has approved over US\$645 million through 33 loans in the country. The ongoing Mohmand Dam project, expected to generate 740 MW of hydroelectricity upon completion, is a significant endeavor contributing to economic growth and cost-effective energy production. The government of Pakistan has prioritized hydropower development, aiming for a 50% reduction in emissions by 2030 as part of its national agenda.

PAK-CHINA ENERGY PARTNERSHIP: MAXPOWER AND CHISAGE ESS SEAL \$43M DEAL

MaxPower, Pakistan's leading solar energy product distributor, has inked a \$43 million agreement with CHISAGE ESS, a prominent Chinese new energy company. CHISAGE ESS, known for supplying over 300,000 inverters, will fulfill the order by providing an extensive range of low-voltage single-phase and three-phase hybrid inverters.

In a noteworthy development, Max Power unveiled CHISAGE ESS hybrid inverter prototypes at the 12th International Renewable Energy Exhibition and Conference in Pakistan in March 2023.

The showcase attracted significant attention from local dealers, traders, and EPC companies. This collaboration goes beyond inverters, encompassing discussions and cooperative efforts on battery packs, grid-tie inverters, and various other products, as emphasized by CHISAGE ESS.

HUB POWER COMPANY AND K-ELECTRIC TRANSITION TO CLEAN ENERGY

The Hub Power Company Limited (HUBC) has partnered with K-Electric (KE) to explore transforming its Residual Fuel Oil (RFO)-based Hub Power Plant for Thar coal use. This initiative, as announced by HUBC, aligns with its aim to provide Pakistan with sustainable and cost-efficient energy.

A recently signed Memorandum of Understanding (MOU) between these two energy leaders reflects their commitment to leveraging local resources for energy generation. HUBC's social media updates emphasize that this agreement is a crucial step towards adopting greener and more innovative energy practices.

This partnership follows HUBC's Board of Directors' decision to investigate potential investments in the Sindh Engro Coal Mining Company Limited, reinforcing the company's focus on diversifying its energy mix.

As Pakistan's first Independent Power Producer (IPP), HUBC has a significant role in the national energy landscape. It owns and operates a range of power plants, with a total installed capacity of 3,581MW. Its key assets include the 1292MW RFO-fired Hub Plant in Balochistan and the 225MW RFO-fired Narowal Energy Limited in Punjab.

SCATEC INITIATES COMMERCIAL OPERATIONS OF SOLAR POWER FACILITIES IN PAKISTAN

Scatec ASA, a renewable energy solutions pioneer, has completed construction and commenced energy production from its 150 MW solar power projects in Sukkur, Pakistan. These plants are expected to produce around 300 GWh per year, in line with 25-year USD-indexed power purchase agreements with Pakistan's Central Power Purchasing Agency (CPPA).

Terje Pilskog, Scatec's CEO, proudly announced the start of commercial operations in Sukkur, highlighting the plants' role in providing essential renewable energy to the Pakistani population. The plants are anticipated to meet the electricity requirements of approximately 150,000

households, contributing to both sustainable development and local value creation. Pilskog extended his gratitude to the Scatec team and their partners for achieving this milestone.

Scatec owns a 75% economic interest in these projects and will oversee their Operation & Maintenance, as well as Asset Management services. The other ownership portion is held by Nizam Energy, Scatec's local partner. The projects have secured non-recourse project financing from FMO, the Dutch development bank, along with Faysal Bank, Bank of Punjab, Bank Islami, and Pak Kuwait Investment Company.

600MW WIND, SOLAR PROJECTS: PFREF MOVES ARMY CHIEF

In a letter to the Chief of Army Staff (COAS), Mustafa Abdulla, President of PFREF, commended Gen Asim for his dedicated efforts to overcome bureaucratic obstacles and propel Pakistan towards new economic and financial heights.

The Special Investment Facilitation Council (SIFC) Executive Committee (EC) has established an inter-ministerial panel to comprehensively address issues related to Category-III wind and solar PV projects. These projects, including 13 in advanced stages and other pending Letters of Intent (LoIs), are subject to competitive bidding as per the Alternative Energy Development Board's decisions.

Category-III encompasses 31 wind projects (2,139 MW) and 69 solar PV projects (4,193 MW). Despite having necessary approvals, the bureaucratic process within SIFC has delayed the approval of 13 wind and solar projects, prompting Mustafa Abdulla to highlight the persistence of bureaucracy within the

supposedly “bureaucratic-free” organization.

Abdulla urged the COAS to intervene directly in approving the projects, emphasizing the potential for Rs.12/kWh electricity projects with \$600 million FDI ready for investment. He argued that opting for cheaper wind and solar electricity would alleviate the burden of expensive imported coal and LNG-based electricity generation, benefiting both the people and local industries.

The committee's recommendations include allowing Category-III projects to proceed with an upfront tariff announced by Nepra, declaring financial closing for wind and solar projects on a first-come, first-serve basis, and obtaining approval from the Council of Common Interests (CCI) for processing these projects based on upfront tariffs. Additionally, future solar and wind projects will undergo competitive bidding, conducted by PPIB or Discos according to approved schemes.



PAKISTAN AIMS TO REACH 30% RENEWABLE ENERGY GOAL

In 2023, global renewable energy capacity increased by 50%, totaling nearly 510 GW, largely driven by solar PV.

China showcased remarkable progress, adding as much solar PV in 2023 as the entire world did in 2022. Its wind power capacity also saw a 66% increase. Meanwhile, Europe, the US, and Brazil achieved record highs in renewable energy capacity expansion.

A Centre for Research on Energy and Clean Air (CRECA) report highlighted clean energy as the primary driver of China's 2023 economic growth, contributing ¥11.4 trillion (\$1.6 trillion) to the economy. This was nearly equivalent to the global investment in fossil fuels for the same year. China's contribution to global renewable energy capacity was over 50% in 2023. China's investments in Pakistan's energy sector, including coal, hydropower, and renewable energy projects, were also noted. For instance, China Three Gorges Corporation developed three wind projects totaling nearly 150 MW in Jhimpir and invested in hydroelectric projects.

WAPDA PURSUES INTERNATIONAL COLLABORATION FOR PAKISTAN'S PREMIER 300 MW FLOATING SOLAR INITIATIVE

The Water & Power Development Authority (WAPDA) hosted a Bangkok road show to draw international bids for its pioneering 300-megawatt floating solar project in Pakistan. This first-of-its-kind project plans to utilize floating solar panels on two reservoirs at the Tarbela-Ghazi Barotha hydropower complex, aiming to provide affordable, clean electricity to the national grid. The event saw participation from 58 delegates representing 50 global companies. Presentations focused on the project's financial, technical, and bidding details, following the release of bidding documents in October 2023 as per World Bank guidelines, with bids due by March 12, 2024.

The World Bank has expressed interest in funding 95% of the \$300 million project. Key figures at the event included WAPDA Chairman Engr (retd) Lt Gen Sajjad Ghani and Pakistan's Charge d' Affairs in Thailand, Yasir Hussain. Chairman Ghani emphasized the project's potential for lucrative business through a transparent international bidding process and WAPDA's commitment to collaborate with top firms. The project, combining floating solar with hydropower, will establish two 150 MW plants at the Tarbela-Ghazi Barotha Complex, annually contributing 484 million units of low-cost electricity to the national grid. The road show provided a platform for dialogue between WAPDA, consultants, and interested bidders.

PHMA ADVOCATES FOR INCREASED FUNDING TOWARD RENEWABLE ENERGY INITIATIVES

The PHMA regional office held discussions, led by Amanullah Khan, on private sector credit uptake, focusing on SMEs in the Apparel sector. Participants urged the FBR to expedite payments, citing a backlog of DLT 2021 refund claims and the need for swift sales tax refunds. Concerns were raised about the FBR's commitment to releasing exporters' tax refunds through the FASTER System.

Amanullah Khan proposed the central bank allocate a special quota for SMEs in the hosiery sector, emphasizing that major concessional export loan facilities predominantly benefit large industries, leaving limited options for PHMA members. He highlighted the credit gap faced by 5 million SMEs, receiving only 7% of private sector credit, and advocated for targeted allocations, particularly in renewable and solar energy financing for export-oriented SMEs.

Despite State Bank of Pakistan's SME finance initiatives, desired results were elusive, with banks hesitant to fund SMEs, resulting in persistent negative growth. PHMA members emphasized the government's need to fortify the industry, especially SMEs, suggesting a visible reduction in the markup rate to spur business growth and address the annual job needs.

EMPHASIS ON COLLABORATION WITH RUSSIA: COMMENCEMENT OF DEVELOPMENT FOR THE 13TH FIVE-YEAR ENERGY PLAN

During a Petroleum Division meeting aimed at advancing a comprehensive energy collaboration plan with Russia, progress was assessed, with ISGS updating on the development led by the EPRC in partnership with the Petroleum Division. The meeting focused on the 13th five-year energy plan, covering various energy sources and involving stakeholders from different sectors. The plan will integrate gas sector recommendations for collaboration with Russia. Discussions led by the Additional Secretary highlighted the need for an inclusive strategy, examining gas demand/supply forecasts, economic factors, and infrastructure projects. Concerns over gas affordability prompted discussions on LNG and LPG policies, with an emphasis on evaluating new infrastructure projects to address supply/demand gaps and explore alternative energy and efficiency measures.

SUNGROW

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GLOBAL LEADING PV & ESS SUPPLIER

No.1

No.1 PV Inverter global shipment

Source: S&P Global Commodity Insights



Sungrow residential and C&I solutions

Global Scoop.

Here we dive into the latest developments in the industry as we explore the remarkable strides countries are making towards sustainable power sources, highlighting groundbreaking innovations and initiatives that promise a greener future for our planet.

From cutting-edge solar technologies to revolutionary wind farms, this is your gateway to staying informed on the global transition to clean energy.



SUNGROW COLLABORATES WITH METRO LIGERO OESTE FOR ECO-FRIENDLY TRANSIT: MADRID



Sungrow has shared news about supplying its inverter solutions for an 800 kW solar project carried out by Metro Ligero Oeste, a public transport operator in Spain. Metro Ligero Oeste serves over 200,000 people across 28 stations and 22.4 km of tracks connecting Pozuelo de Alarcón, Boadilla del Monte, Alcorcón, and Madrid.

The project, based in Pozuelo de Alarcón, Madrid, involves installing six units of Sungrow's string inverters (SG110CX) and two units of SG50CX. The installation was done by the SICA installers' team with support from Saltoki, emphasizing their commitment to expanding renewable energy usage, particularly for Metro Ligero Oeste.

This initiative is a significant step forward for Metro Ligero Oeste, promoting environmental sustainability. The solar project

is expected to self-generate about 13% of the energy consumed by the transport company, producing an annual clean energy generation of 1.2 GWh.

Pablo Escoda, the General Manager of Metro Ligero Oeste, highlighted the environmental benefits of the project, emphasizing its contribution to sustainability and the company's commitment to self-consumption and clean energy production.

Guillermo Donézar, Head of Distribution Southern Europe at Sungrow, expressed the company's dedication to promoting renewable energy and enhancing the passenger experience. The project signifies a joint commitment between Sungrow and Metro Ligero Oeste towards a cleaner and more sustainable future.

MITSUBISHI HC CAPITAL ACQUIRES 20% STAKE IN EUROPEAN ENERGY

Mitsubishi HC Capital, a specialized finance firm, is set to acquire a 20% stake in Danish renewable energy developer European Energy, investing €700 million (\$763 million). This investment will significantly boost European Energy's capital and growth prospects. Mitsubishi HC Capital will subscribe to 72 million new shares and buy 3 million shares from the main shareholders, becoming the second-largest shareholder with 20% of capital and voting rights. This strategic involvement aims to enhance

European Energy's development, with the deal expected to close in the first half of 2024. Jens Due Olsen, European Energy's Board Chair, sees this partnership as vital for growth in the green energy sector. European Energy operates in 28 countries, focusing on renewable energy and Power-to-X technologies, having developed 3GW of renewable energy with 60GW in the pipeline, highlighting its significant global growth potential.

BLOOMBERG SIGNS 15-YEAR ENERGY DEAL WITH ØRSTED

Ørsted, a leading global energy developer, has announced a 15-year power purchase agreement (PPA) for renewable energy with Bloomberg, a prominent provider of business and financial market information. This agreement entails Ørsted supplying 80MW of solar energy from its Mockingbird Solar Center in Texas, which is currently under construction, to Bloomberg.

Bloomberg aims to power its operations entirely with renewable energy by 2025, aligning with its commitment to the RE100, a global corporate initiative. With this new deal with Ørsted, Bloomberg is on track to meet 100% of its electricity needs in the U.S. and 80% globally through renewable sources.

Ørsted made the final investment decision in early 2023 to proceed with the Mockingbird project near Paris, Texas. This 471 MW solar project, spanning 4,900 acres, is set to be Ørsted's largest in the U.S., capable of powering over 80,000 homes annually. Notably, the project includes conservation efforts, protecting 1,000 acres of native tallgrass prairie in collaboration with The Nature Conservancy (TNC).

The PPA with Bloomberg marks the Mockingbird project as fully contracted, alongside other agreements with companies like Covestro and Royal DSM.

“BITECH AND BRIDGELINK FORGE GREEN ENERGY PARTNERSHIP”

Bitech Technologies Corporation (NASDAQ: BTTC), a global green energy technology provider, has signed a binding Letter of Agreement (LOA) for a strategic merger with Bridgelink Development, LLC (Bridgelink or BLD), a notable solar and energy storage development company based in Fort Worth, Texas. The collaboration aims to fast-track renewable energy projects in the United States, focusing on Texas, Arizona, and Louisiana.

The LOA outlines key merger elements, including a capital injection of at least \$50 million into the combined entity post-transaction. This funding will support operations, drive development projects, and foster ongoing technological advancements. The merged entity will comprise a BESS and Solar Division dedicated to project execution and a Technology Solutions and Acquisition Division focused on exploring and acquiring technologies within the clean energy sector.

Bitech and Bridgelink plan to utilize a Share Subscription Agreement for up to \$250 million, a committed Letter of Intent for a late-stage BESS project near Houston, TX, for up to \$100 million, and the sale of Incentive Tax Credits (ITC) as part of their strategic initiatives. The LOA reflects a mutual commitment to the merger, with Bridgelink transferring its assets into a newly established entity and receiving a significant equity conversion of \$50 million in Bitech's Common Stock.

CLEAN ENERGY SHARE ON GERMAN POWER GRIDS REACHES 55% IN 2023

Germany witnessed a notable increase in the share of renewable energy on its power grids, marking a rise of 6.6 percentage points to reach 55% of the total in the previous year, according to statements from the country's regulatory authority. This advancement aligns with Germany's pursuit of its 2030 target, aspiring for 80% of its energy mix to be sourced from green power. The nation has transitioned away from nuclear power, with plans to phase out a significant portion of coal generation, utilizing remaining gas plants primarily for grid backup purposes.

Breaking down the renewable energy sources, offshore wind made up 31.1%, solar contributed 12.1%, and biomass accounted for 8.4%, while the remaining 3.4% was derived from hydropower and other renewable sources, as detailed by the regulator Bundesnetzagentur. The increase in 2023 was attributed to both capacity expansion and favorable weather conditions, the statement noted.

Economy Minister Robert Habeck celebrated the achievement, stating, “We have broken the 50% mark for renewables for the first time,” and highlighted the impact of measures to streamline planning and approvals, which are beginning to show results.

AXIAN ENERGY SPARKS AFRICA'S RENEWABLE REVOLUTION

The Emerging Africa Infrastructure Fund (EAIF), a subsidiary of the Private Infrastructure Development Group (PIDG), has announced its commitment to provide a senior secured loan facility of \$30 million to AXIAN Energy. This financial support plays a crucial role in AXIAN Energy's strategic growth plan, aiming to establish over 460 Megawatts (MW) of utility-scale renewable energy generation capacity across Africa in the next decade. Despite initially focusing on oil and gas distribution, AXIAN Energy shifted its strategic emphasis to renewable energy in 2017.

The backing from EAIF significantly boosts AXIAN's endeavors to acquire, develop, and implement utility-scale solar projects in various African regions, prioritizing sustainability. EAIF's Project Development Facility addresses the challenges associated with developing greenfield projects in emerging markets, ensuring their viability and attractiveness to potential investors.

This investment aligns seamlessly with EAIF's overarching objective of improving energy access, directly supporting AXIAN Energy Group's initiatives in rural areas with limited power access. Benjamin Memmi, CEO of AXIAN Energy, emphasized the significance of this facility, stating, "This marks a significant milestone in our pursuit of sustainable development and energy inclusion across Africa. EAIF's financial infusion will not only expedite our transition to renewable energy but also reinforce our commitment to providing clean and accessible power to communities across the continent."

\$2T PER YEAR REQUIRED TO TRIPLE GLOBAL RENEWABLES BY 2030

Tripling global renewable energy capacity by 2030, as pledged at the UN climate summit in Dubai, requires an annual investment of US\$2 trillion, reports the Berlin-based Climate Analytics. This figure is double the 2023 investment in renewables but significantly less than the \$7 trillion spent on fossil fuel subsidies in 2022. Achieving this goal, which is crucial for reducing emissions as per the Intergovernmental Panel on Climate Change, would cost less than one-third of fossil fuel subsidies and under 2% of 2022's global GDP.

The report emphasizes the importance of this investment for transitioning away from fossil fuels, especially highlighting the potential impacts on clean air, cheaper power, and energy security. However, it notes significant investment shortfalls, particularly in Sub-Saharan Africa, jeopardizing the achievement of these targets. The required \$12 trillion investment from 2024 to 2029 would mainly fund new renewable installations and necessary grid and storage enhancements.

Despite the ambitious goals, many regions are lagging, with Asia, led by China and India, being the closest to meeting the targets. The report calls for massive investment in renewables and grid expansion to align with a 1.5°C transition, warning against the ongoing construction of coal plants in China and India as a threat to this transition.



PAKISTAN'S LEADING BRAND IN HIGH-TECH SOLAR ENGINEERING



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Z PACK



Models Available in:

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200AH-51.2V

Z6 SERIES



Models Available in:

PV 8500, PV11000
PV12000, & PV15000

Happen- ings.

Get ready to immerse yourself in a comprehensive exploration of the dynamic world of renewable energy and beyond. Here we will uncover the latest trends, breakthroughs, and impactful events shaping the global transition to sustainable practices, empowering you with the knowledge and inspiration to be at the forefront of the green revolution.





CES 2024: MUST-SEE CLEAN TECH ANNOUNCEMENTS

CES 2024 UNFOLDED IN LAS VEGAS, NEVADA, BRINGING A WAVE OF TECH ANNOUNCEMENTS. TO SPARE YOU FROM SIFTING THROUGH MARKETING EMAILS, WE'VE COMPILED KEY UPDATES RELEVANT TO RENEWABLE ENERGY, FEATURING NEW EV CHARGING SOLUTIONS, CLEAN ENERGY STORAGE, AND ELECTRIC CATERPILLAR VEHICLES.

Bosch Technologies showcased automated valet EV charging, heat pumps, and hydrogen plans at CES 2024.

Automated valet charging: Electric cars equipped with this technology can autonomously navigate to a parking space with a charging spot in a garage with an automated valet parking system. Controlled via smartphone input, a robot manages the charging process without human intervention. After charging, the vehicle moves to another parking space, freeing up the spot for the next car.

IDS Ultra Heat Pump: Tailored for North America, this heat pump provides 100% heating capacity even in frigid conditions, operating efficiently down to minus 13 degrees Fahrenheit (minus 25 degrees Celsius).

Hydrogen investments: Bosch views hydrogen as crucial for meeting global energy demand sustainably. The company is investing in technologies along the hydrogen value chain, focusing on the mobile fuel cell, now in volume production in Stuttgart and a key component of the powertrain system for heavy vehicles.



Siemens unveils smart home energy management portfolio.



Siemens revealed its Inhab smart home energy management portfolio at CES, offering users complete control and transparency over energy sources and distribution within their homes. The suite of Intelligent Habitat solutions, equipped with features like real-time alerts, 24/7 monitoring,

and energy goal setting, is designed to address the growing use of electric appliances, EV charging, and solar arrays. Siemens aims to reduce energy consumption and utility bills while enhancing safety and capacity through its portfolio.

Caterpillar's electric machines and onsite power/storage.



Caterpillar showcased its electric machines and energy solutions at CES 2024, catering to the changing needs of customers electrifying their job sites. The spotlight was on the R1700 XE, a zero-exhaust-emission underground loader used in mining, featuring what Caterpillar claims is the industry's sole onboard battery.

This tech encompasses on-site power generation through versatile generators capable of running on renewable fuels, solar panels, and hydrogen-powered fuel cells. Their energy storage solutions are

designed to seamlessly integrate with a combination of diesel, natural gas, or renewable energy sources, ensuring optimal power functionality. The company provides tested and validated chargers specifically tailored for the demanding conditions of construction and mining sites. Inverters play a pivotal role in transferring power from generators or batteries to electric motors in machines, optimizing power delivery. To enhance operational efficiency, the provider incorporates digital monitoring and advanced analytics, simplifying the management of battery-electric machines and infrastructure.



ECOFLOW DELTA PRO



EcoFlow launches DELTA Pro, a hybrid whole-house battery generator.

EcoFlow presents the DELTA Pro Ultra, an intelligent hybrid residential battery generator and backup system designed for prolonged outages and daily use. With a 6kWh capacity, 7200W output, and 5.6kW solar input, this system can power an entire home. It is versatile, compatible with various energy sources such as solar and gas, addressing energy insecurity

stemming from grid failures and extreme weather. To seamlessly transition from grid to backup power with automatic switch-over, EcoFlow offers the Smart Home Panel 2 as a complementary component. The overall objective is to empower users to select optimal power solutions, providing peace of mind during outages, optimizing energy usage, and reducing costs.

Ambient Photonics announces collaboration with Google to develop a new indoor solar-powered device.

Ambient Photonics has revealed a collaboration with Google at CES 2024 to develop an innovative indoor solar-powered device. The company, known for its low-light, indoor solar cell technology used in everyday

electronics, is partnering with Google to create a consumer product that utilizes indoor solar cell technology, transforming any light source into a power generator.

Bates Marshall, Co-Founder & CEO of Ambient Photonics, expressed great enthusiasm about the collaboration, describing it as a groundbreaking endeavor that fully exploits their revolutionary low-light, indoor solar cell technology. He emphasized the significance of making this announcement at CES 2024 in Las Vegas, the hub of pioneering consumer technologies. Ambient Photonics employs bifacial solar cell technology, allowing the harvesting of

light power from both sides of the cell. This approach increases energy production, enhances cell efficiency, and enables the development of more powerful electronics.

The front side of an Ambient bifacial solar cell delivers 100% of the power compared to a typical Ambient cell, while the back side contributes at least 50% of the energy generated by the front side.

Zendure’s “Plug-and-Play” energy storage systems.

Zendure, an provider of energy solutions, is presenting its latest storage systems and associated technology after introducing the SuperBase V system at CES 2023. Tailored for both on-grid and off-grid scenarios, Zendure's Plug-and-Play energy storage system, the SuperBase V, offers versatile functionality.

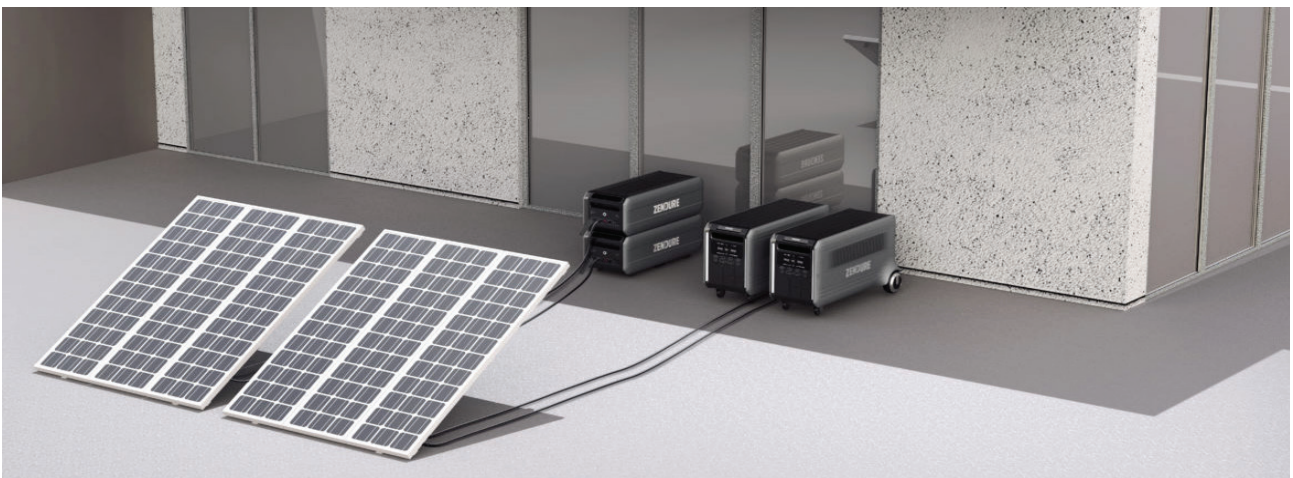
In on-grid setups, it seamlessly integrates with the PVHub 2000, connecting with a microinverter and solar panel. Zendure claims that this configuration can save up to 12.8 kWh daily, supporting high-power Maximum Power Point Tracking (MPPT) with a combined capacity of 4800W.

For off-grid applications, the SuperBase V can link to the transfer switch via the Zen Y Pro cable, designed to be compatible with dual voltage appliances (120V/240V). The system

includes smart control and customizable power options ranging from 3600W to 7200W AC, offering a capacity of 4.6 to 64 kWh. Eligible for a 30% tax rebate under the ITC, Zendure positions it as an ideal solution for blackout situations, camping, RV trips, and off-grid living.

As part of the Plug & Play Home Storage System, Zendure's Smart Home Panel supports up to 10 power circuits. Integrated with the Zendure App for energy management, it enables users to monitor, manage, and customize their energy usage.

The PVHub 2000, optimized for large-scale photovoltaic systems, is designed to improve power generation efficiency. It accommodates solar panels with a capacity of up to 2340W and incorporates fast charging features.



WEF OPENS OPPORTUNITIES FOR THE PV INDUSTRY IN PAKISTAN AND GLOBALLY



At the 2024 World Economic Forum (WEF) in Davos, LONGi, a leading global renewable energy company, provided insights into the photovoltaic (PV) industry's potential worldwide, according to its President, Zhong Baoshen. In an interview with China Economic Net (CEN), Zhong stressed the importance of using WEF as a platform to showcase Chinese companies' innovative contributions to global energy transformation and decarbonization efforts.

LONGi's Vice President, Dennis She, highlighted during the Davos Summit the critical role of affordable and clean energy (SDG7) in achieving the United Nations Sustainable Development Goals. He pointed out that the reduction in solar power costs is fundamental to achieving energy equity globally, especially in underdeveloped regions. LONGi has recently committed to providing PV systems and solutions to Pakistan from 2024. This initiative aims to deliver safe, reliable, and clean energy to public facilities in refugee and host communities, enabling education, work, and business operations.

It is estimated that approximately 780 million people, around 10% of the global population, live in off-grid areas, predominantly in Sub-Saharan Africa. Since overtaking Germany in 2013 as the largest photovoltaic market, China's PV industry has seen consistent growth.

The International Energy Agency (IEA) reports that in 2023, the world's installed renewable energy capacity is set to expand rapidly, reaching over 440GW—a historical increase of 107GW year-on-year.

In December 2023, LONGi's Jiaxing Production Base in East Zhejiang Province, China, was recognized by the WEF as a Global Lighthouse Factory. This facility became the first solar module manufacturing base to join the WEF's Global Lighthouse Network (GLN) and was among the 21 new Global Lighthouse Factories recognized in 2023.

The WEF noted that many of LONGi's technological innovations are industry-leading and independently patented, leading to a reduction in unit manufacturing costs by 28% and unit energy consumption by 20% within a year.

MAXPOWER

SOLAR ENERGY

ENERGIZING THE FUTURE TODAY WITH MAXPOWER PREMIUM PRODUCTS



COP28, IS THE WORLD LISTENING?



THE UNITED NATIONS CLIMATE CHANGE CONFERENCE (COP28) CLOSED WITH AN AGREEMENT THAT SIGNALS THE “BEGINNING OF THE END” OF THE FOSSIL FUEL ERA BY LAYING THE GROUND FOR A SWIFT, JUST AND EQUITABLE TRANSITION, UNDERPINNED BY DEEP EMISSIONS CUTS AND SCALED-UP FINANCE.

In a demonstration of global solidarity, negotiators from nearly 200 Parties came together in Dubai with a decision on the world’s first ‘global stocktake’ to ratchet up climate action before the end of the decade – with the overarching aim to keep the global temperature limit of 1.5°C within reach.

“Whilst we didn’t turn the page on the fossil fuel era in Dubai, this outcome is the beginning of the end,” said UN Climate Change Executive Secretary Simon Stiell in his closing speech. “Now all governments and businesses need to turn these pledges into real-economy outcomes, without delay.”

The global stocktake is considered the central outcome of COP28 – as it contains every element that was under negotiation and can now be used by countries to develop stronger climate action plans due by 2025. It recognizes the science that indicates global greenhouse gas emissions need to be cut 43% by 2030, compared to 2019 levels, to limit global warming to 1.5°C. But it notes Parties are off track when it comes to meeting their Paris Agreement goals.

The stocktake calls on Parties to take actions towards achieving, at a global scale, a tripling of renewable energy capacity and doubling energy efficiency improvements by 2030. The list also includes accelerating efforts towards



Dubai,
30 Nov-12 Dec
2023

the phase-down of unabated coal power, phasing out inefficient fossil fuel subsidies, and other measures that drive the transition away from fossil fuels in energy systems, in a just, orderly and equitable manner, with developed countries continuing to take the lead.

In the short-term, Parties are encouraged to come forward with ambitious, economy-wide emission reduction targets, covering all greenhouse gases, sectors and categories and aligned with the 1.5°C limit in their next round of climate action plans (known as nationally determined contributions) by 2025.

HELPING COUNTRIES STRENGTHEN RESILIENCE TO THE EFFECTS OF CLIMATE CHANGE

and Government. Parties reached a historic agreement on the operationalization of the loss and damage fund and funding

arrangements – the first time a substantive decision was adopted on the first day of the conference. Commitments to the fund started coming in moments after the decision was gavelled, totaling more than USD 700 million to date.

There was more progress on the loss and damage agenda with an agreement also reached that the UN Office for Disaster Risk Reduction and the UN Office for Project Services will host the secretariat of the Santiago Network for Loss and Damage. This platform will catalyze technical assistance to developing countries that are particularly vulnerable to the adverse effects of climate change.

Parties agreed on targets for the Global Goal on Adaptation (GGA) and its framework, which identify where the world needs to get to in order to be resilient to the impacts of a changing climate and to assess countries' efforts. The GGA framework reflects a global consensus on adaptation targets and the need for finance, technology and capacity-building support to achieve them.

INCREASING CLIMATE FINANCE

Climate finance took center stage at the conference, with Stiell repeatedly calling it the "great enabler of climate action."

The Green Climate Fund (GCF) received a boost to its second replenishment with six countries pledging new funding at COP28 with total pledges now standing at a record USD 12.8 billion from 31 countries, with further contributions expected.

Eight donor governments announced new commitments to the Least Developed Countries Fund and Special Climate Change Fund totaling more than USD 174 million to date, while new pledges, totaling nearly USD 188 million so far, were made to the Adaptation Fund at COP28.

However as highlighted in the global stocktake, these financial pledges are far short of the trillions eventually needed to support developing countries with clean energy transitions, implementing their national climate plans and adaptation efforts.

In order to deliver such funding, the global stocktake underscores the importance of reforming the multilateral financial architecture, and accelerating the ongoing establishment of new and innovative sources of finance.

At COP28, discussions continued on setting a 'new collective quantified goal on climate finance' in 2024, taking into account the needs and priorities of developing countries. The new goal, which will start from a baseline of USD 100 billion per year, will be a building block for the design and subsequent implementation of national climate plans that need to be delivered by 2025.

Looking ahead to the transitions to decarbonized economies and societies that lie ahead, there was agreement that the mitigation work programme, which was launched at COP27 last year, will continue until 2030, with at least two global dialogues held each year.

EVENT PARTICIPATION AND INCLUSIVITY

World leaders at COP28 were joined by civil society, business, Indigenous Peoples, youth, philanthropy, and international organizations in a spirit of shared determination to close the gaps to 2030. Some 85,000 participants attended COP28 to share ideas, solutions, and build partnerships and coalitions.

The decisions taken here today also reemphasize the critical importance of empowering all stakeholders to engage in climate action; in particular through the action plan on Action for Climate Empowerment and the Gender Action Plan.

STRENGTHENING COLLABORATION BETWEEN GOVERNMENTS AND KEY STAKEHOLDERS

In parallel with the formal negotiations, the Global Climate Action space at COP28 provided a platform for governments, businesses and civil society to collaborate and showcase their real-world climate solutions.

The High-Level Champions, under the Marrakech Partnership for Global Climate Action, launched their implementation roadmap of 2030 Climate Solutions. These are a set of solutions, with insights from a wide range of non-Party stakeholders on effective measures that need to be scaled up and replicated to halve global emissions, address adaptation gaps and increase resilience by 2030.

The conference also saw several announcements to boost the resilience of food and public health systems, and to reduce emissions related to agriculture and methane.



LOOKING AHEAD

The negotiations on the ‘enhanced transparency framework’ at COP28 laid the ground for a new era of implementing the Paris Agreement. UN Climate Change is developing the transparency reporting and review tools for use by Parties, which were showcased and tested at COP28. The final versions of the reporting tools should be made available to Parties by June 2024.

COP28 also saw Parties agree to Azerbaijan as host of COP29 from 11-22 November 2024, and Brazil as COP30 host from 10-21 November 2025.

The next two years will be critical. At COP29, governments must establish a new climate finance goal, reflecting the scale and urgency of the climate challenge. And at COP30, they must come prepared with new nationally determined contributions that are economy-wide, cover all greenhouse gases and are fully aligned with the 1.5°C temperature limit.

“We must get on with the job of putting the Paris Agreement fully to work,” said Stiell. “In early 2025, countries must deliver new nationally determined contributions. Every single commitment – on finance, adaptation, and mitigation – must bring us in line with a 1.5-degree world.”

“My final message is to ordinary people everywhere raising their voices for change,” Stiell added. “Every one of you is making a real difference. In the crucial coming years your voices and determination will be more important than ever. I urge you never to relent. We are still in this race. We will be with you every single step of the way.”

“The world needed to find a new way. By following our North Star, we have found that path,” said COP28 President, Dr. Sultan Al Jaber during his closing speech. “We have worked very hard to secure a better future for our people and our planet. We should be proud of our historic achievement.”





Flexible planning with Fronius Tauro helps to create cost-efficient large-scale systems.

With large-scale systems, the aim is to achieve maximum yields with the photovoltaic system, while keeping the total operating costs as low as possible. With its commercial inverter Fronius Tauro, Fronius delivers the perfect solution to tailor a solar system to individual system requirements – even in very difficult environments.



Maximum flexibility in system planning

The Fronius Tauro, available from 50 to 100 kW, offers countless options to tailor a PV installation efficiently to the system requirements. Whether installed in centralised or decentralised systems, vertically or horizontally, for roof systems or free-standing systems, with Fronius Tauro there are virtually no limitations on the positioning of the inverters. For systems with cutting-edge high capacity modules, Fronius has also equipped the Tauro with a new 30 A fuse variant. Options such as AC Daisy Chaining also help to achieve unprecedented optimisation and simplification of the AC installation.

Our customers frequently said that they wanted to reduce BOS costs with the inverter. The option to link the AC cables for several Tauro inverters directly in the device drastically reduces the number of AC combiner boxes that are required. This saves on costs.

Johannes Starzinger, Fronius Development Team

High yields in direct sunlight and in sand, dust and humidity

The Fronius Tauro can be installed in direct sunlight in unprotected outdoor areas without the need for an additional protective cover thanks to an IP 65 protection class and

the Active Cooling Technology. Electronic components in the device are kept cool in ambient temperatures from -40°C to +65°C.

Many of our customers around the world are faced with harsh external conditions that other commercial inverters struggle to contend with. So it quickly became clear to us that we had to develop a robust and straightforward alternative Tauro model for high yields. And we have achieved this by developing features such as active double-walled cooling. This ensures that, even at high outdoor temperatures, the inverter doesn't break a sweat and still delivers high yields.

Peter Schmidhuber, Fronius Product Manager

Optimising costs with Fronius Tauro

The Fronius Tauro doesn't just help to reduce the installation costs but also keeps running costs down. Where service intervention is required, the Fronius Tauro is particularly time and cost-efficient. As with many Fronius products, the power stage set in Fronius inverters can be replaced by one person single-handedly directly onsite.

Fronius GEN24



Backup even without a battery.

with Fronius GEN24 and its PV Point.

Our Fronius GEN24 inverter is the heart of every PV system. With the PV Point, the Fronius GEN24 offers an integrated 3 kW emergency power supply. Connected devices are supplied with emergency power via a fused socket as long as the sun is shining. Get convinced by the Fronius GEN24 fast installation and configuration, along with reliable quality Made in Europe.

Fronius GEN24. Designed to empower.

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FOR THE FOURTH CONSECUTIVE YEAR, AMAZON HOLDS THE TITLE OF BEING THE LARGEST GLOBAL CORPORATE BUYER OF RENEWABLE ENERGY.

With more than 500 solar and wind projects globally, Amazon's portfolio is now big enough to power 7.2 million U.S. homes each year.

In 2023, Amazon ventured into over 100 novel solar and wind energy initiatives, solidifying its position as the leading global corporate buyer of renewable energy for the fourth consecutive year. Among these investments are notable projects such as the company's inaugural brownfield endeavor, repurposing a previously contaminated Maryland coal mine into a solar farm, and Amazon's inaugural renewable energy initiative in South Korea. With a global count surpassing 500, Amazon's wind and solar projects, once operational, are poised to yield over 77,000 gigawatt-hours (GWh) of clean energy annually. This output equates to powering approximately 7.2 million U.S. households. Notably, Amazon has consistently outpaced other companies in renewable energy procurement since 2020, as reported by BloombergNEF and publicly available sources. The culmination of these initiatives aligns with Amazon's goal of attributing 100% of its operational electricity to renewable sources by 2025.



These ventures are instrumental in energizing Amazon Web Services (AWS) data centers, fulfillment centers, physical stores, and corporate offices. Simultaneously, they contribute clean power to the local communities hosting these projects. Moreover, Amazon's solar and wind farms have generated an estimated \$12 billion in global economic investment from 2014 to 2022 and supported 39,000 full-time equivalent (FTE) jobs in 2022 alone, according to an economic model developed by Amazon.

Adam Selipsky, CEO of AWS, emphasized, "Amazon's investments in solar and wind projects are helping power our operations, while also providing new sources of clean energy to the grid, spurring economic growth, and supporting jobs in the communities where our customers live and work."

While more than 90% of Amazon's operations were powered by renewables in the past year, the company remains committed to further innovation, addressing grid limitations, and collaborating with policymakers to mitigate climate change impacts. These efforts reflect Amazon's determination to achieve its target of 100% renewable energy by 2025.

Kyle Harrison, Head of Sustainability Research at BloombergNEF, commended Amazon's unwavering commitment, stating, "Amazon's renewable energy investments continue to bring new solar and wind projects to market at a rapid pace and cement the company as a global leader in this space."

Amazon's renewable energy portfolio now spans 27 countries and over 20 U.S. states. The company has initiated projects in various locations, including Arkansas, Georgia, Maryland, Michigan, Mississippi, Missouri, Ohio, Oklahoma, and Virginia, along with international projects in Canada, Greece, and South Korea.

once completed, according to publicly available data from the Energy Information Administration and PJM, and it will feature more than 300,000 solar panels. It's also expected to employ more than 200 skilled

during peak construction activities, provide millions of dollars in local tax revenue, and help avoid more than 133,000 tons of CO₂ each year—the equivalent of taking more than 26,000 cars off the road, according to the developer Competitive Power Ventures (CPV).

CONVERTING A COAL MINE SITE FROM BROWNFIELD TO SOLAR FARM

Amazon recently announced its first renewable energy project built on a brownfield—land that has been abandoned due to industrial pollution. Amazon Solar Farm Maryland—CPV Backbone is being built on the site of the recently closed Arch Coal Mine in Garrett County, Maryland. The 120-year-old mining site was previously contaminated with more than 45 acres of coal refuse, which has since been reclaimed. The U.S. Environmental Protection Agency (EPA) estimates that there are more than 450,000 brownfields in the U.S., which is an emerging opportunity for solar energy projects. Brownfields—which can include abandoned factories, mines, or landfills—are often located near power lines and public roads, making it easier to connect a project to the grid and turn unused land into an economic opportunity for local communities. The CPV Backbone project is expected to be the largest solar farm in Maryland workers

GENERATING 1,000 EMPLOYMENT OPPORTUNITIES IN BRAZIL THROUGH A NOVEL WIND PROJECT

The construction of a new wind farm within the Seridó Wind Complex has resulted in an estimated 1,000 job opportunities in Brazil. Elera Renováveis, the developer behind the project, reported that almost half of these positions were occupied by workers from local communities in the rural areas of the Rio Grande do Norte region. Utilizing drone technology, Elera Renováveis installed the overhead transmission line conductors for the wind farm, while the wind turbines, boasting a diameter of 150 meters each—equivalent to nearly 1.5 football fields—underscore the magnitude of the endeavor.



ACCELERATING THE ADOPTION OF CLEAN ENERGY ACROSS THE ASIA-PACIFIC REGION

Amazon has expanded its clean energy initiatives with over a dozen new projects in the Asia-Pacific region this year. In South Korea, the company unveiled its inaugural renewable energy project, projected to create approximately 2,400 jobs during the construction phase. In India, Amazon intensified its clean energy investments, announcing seven utility-scale renewable energy projects, including a 198-megawatt wind farm in Osmanabad. The company has also invested in numerous solar projects on the rooftops of its local facilities, establishing Amazon as the leading corporate buyer of renewables in India, with a total clean energy capacity purchase of 1.1 gigawatts to date.

NEW WIND AND SOLAR PROJECTS IN CHINA, AUSTRALIA, JAPAN, AND NEW ZEALAND

Amazon’s commitment to renewable energy extends to China, where it disclosed two new wind farms, including the operational Amazon Wind Farm China–Daqing and

the upcoming Amazon Wind Farm China–Bobai. Additionally, Amazon invested in solar projects in Australia, Japan, and New Zealand, reinforcing its global efforts to promote sustainable energy practices.

LARGEST GLOBAL RENEWABLE ENERGY PROJECT IN TEXAS

Amazon’s largest renewable energy venture globally, Amazon Wind Farm Texas–Great Prairie, recently commenced operations in Hansford County, Texas. With more than 350 wind turbines and a total capacity exceeding 1,000 megawatts, the project is projected to contribute an estimated \$70 million in additional tax revenue over the next three decades, according to developer NextEra.

Capacity installed Evolution
in MW



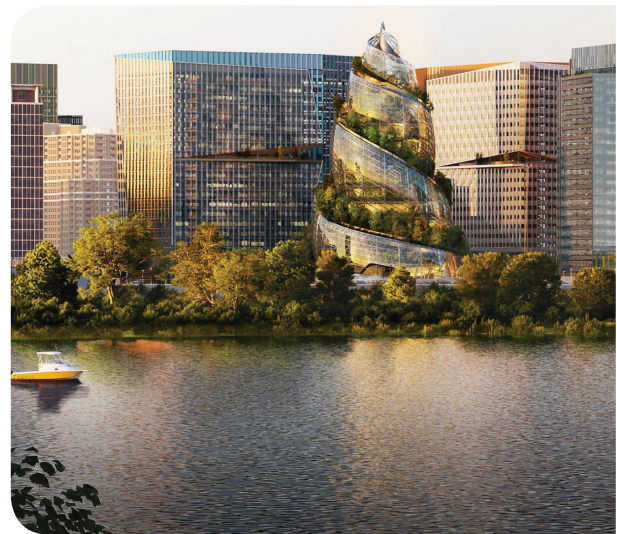
ADVANCING CLEAN ENERGY IN FOSSIL FUEL-DEPENDENT GRIDS

A notable aspect of Amazon’s renewable energy endeavors is their launch in regions with electric grids heavily reliant on fossil fuels. This strategic approach enhances the impact of the projects in reducing carbon emissions from local power sectors. Notably, Amazon recently announced its inaugural utility-scale renewable energy project in Greece, where a significant portion of power originates from carbon-intensive coal and oil sources. Once operational, this solar project in Greece is poised to prevent more than 16,000 tons of carbon emissions annually. This impact is nearly six times greater than if the same project were situated in a country like Sweden, characterized by a higher concentration of clean energy sources in its grid.

CONTRIBUTION TO THE EMISSIONS FIRST PARTNERSHIP

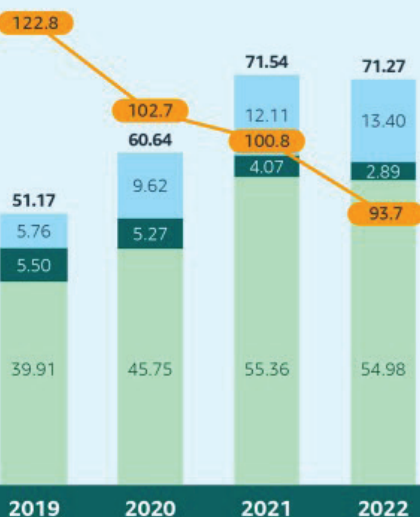
As part of its broader commitment to expeditiously decarbonizing power grids,

Amazon played a pivotal role in co-founding the Emissions First Partnership. This coalition of companies is dedicated to modernizing greenhouse gas accounting standards for the power sector, incentivizing corporations to invest in renewable energy projects in markets where they can facilitate a faster decarbonization of the power system—an imperative step in addressing climate change.



Amazon's Carbon Footprint (MMT CO₂e*)

■ Scope 1 ■ Scope 2† ■ Scope 3
— Carbon intensity (gCO₂e/\$GMS‡)



Invest in wind and solar farm capacity equal to the energy use of Echo, Fire TV, and Ring devices worldwide by 2025

We are on a path to power our operations with **100% renewable energy** by 2025, five years ahead of our 2030 goal

10,000 electric vehicles in our India delivery fleet by 2025

Climate Pledge Fund: A \$2 billion venture investment program supporting the development of sustainable technologies and services

Right Now Climate Fund: A \$100 million fund for nature-based solutions to restore and conserve forests, wetlands, and grasslands around the world

100,000 Rivian electric delivery vans on the road by 2030

Reach net-zero carbon across Amazon by 2040, **10 years ahead of the Paris Agreement**

Through **The Climate Pledge**, inspire and empower others to join us on a mission to **reach net-zero carbon by 2040**

Net-Zero Carbon Emissions

* Million metric tons carbon dioxide equivalent.

† Scope 2 and 3 carbon emissions are calculated using a market-based method.

‡ Grams of carbon dioxide equivalent per dollar of gross merchandise sales.

SIGNIFICANT SURGE IN RENEWABLE POWER CAPACITY PAVES THE WAY AT COP28



THE GLOBAL ADDITION OF RENEWABLE CAPACITY IN 2023 SURPASSED THAT OF 2022 BY 50%, AND THE NEXT FIVE YEARS ARE ANTICIPATED TO WITNESS THE MOST RAPID GROWTH TO DATE. HOWEVER, A SIGNIFICANT CHALLENGE LIES IN THE INSUFFICIENT FINANCING AVAILABLE FOR EMERGING AND DEVELOPING ECONOMIES.

According to a recent report by the International Energy Agency (IEA), the global capacity for generating renewable electricity is expanding at an unprecedented rate, presenting a genuine opportunity to achieve the goal set by governments at the COP28 climate change conference to triple global capacity by 2030. In 2023, the addition of renewable energy capacity to global energy systems increased by 50%, reaching nearly 510 gigawatts (GW). Notably, solar PV contributed three-quarters of these additions on a global scale, with China leading the growth by commissioning as much solar PV in 2023 as the entire world did in 2022. Additionally, China's wind power additions rose by 66% year-on-year, while Europe, the United States, and Brazil also experienced record-high increases in renewable energy capacity.

This latest analysis, marking the first

comprehensive assessment of global renewable energy deployment trends since the COP28 conference in Dubai in December, projects that under existing policies and market conditions, global renewable power capacity will grow to 7,300 GW from 2023 to 2028. Solar PV and wind are expected to contribute to 95% of this expansion, leading renewables to surpass coal as the largest source of global electricity generation by early 2025. Despite the significant growth observed over the past year, the report emphasizes the need for further efforts to triple capacity by 2030, as agreed upon by countries at COP28.

In conjunction with the report, the IEA introduced a new Renewable Energy Progress Tracker, enabling users to explore historical data and forecasts at regional and country levels, including progress tracking towards the tripling goal.



“The recent IEA report indicates that, under existing policies and market conditions, global renewable capacity is on track to grow by two-and-a-half times by 2030. Although this progress falls short of achieving the COP28 goal to triple renewables, we are approaching it, and governments possess the necessary tools to bridge the gap,” remarked IEA Executive Director Fatih Birol. “Onshore wind and solar PV are now more cost-effective than new fossil fuel plants in nearly every location and cheaper than existing fossil fuel plants in most countries. Despite facing challenges in the global macroeconomic environment, a critical challenge for the international community is the swift scaling up of financing and deployment of renewables in emerging and developing economies, many of which are lagging in the new energy landscape. Success in meeting the tripling goal hinges on overcoming these challenges.”

Dr. Birol highlighted that the report marks the initial installment of the IEA's post-COP28 work on energy outcomes, extending into 2024 and beyond. Based on the five key pillars outlined before COP28, the focus

encompasses tripling renewables, doubling energy efficiency, reducing methane emissions, transitioning away from fossil fuels, and amplifying financing for emerging and developing economies. Vigilant monitoring will assess whether countries fulfill their promises and implement suitable policies. The report outlines an accelerated scenario where swift policy implementation results in a 21% higher growth in renewable power capacity compared to the main forecast, aligning the world with the global tripling pledge.

Varied needs to triple renewables by 2030 exist, contingent on the country, region, and technology. The report emphasizes an accelerated case addressing policy uncertainties, insufficient grid infrastructure investment, and administrative barriers, especially in advanced and large emerging economies. In other regions, essential elements include access to finance, strong governance, robust regulatory frameworks, and the establishment of new targets and policies.

The projection for solar PV and onshore wind deployment through 2028 anticipates more than doubling in the United States, the European Union, India, and Brazil, surpassing the figures from the last five years. Solar PV module prices declined by nearly 50% in 2023, and global manufacturing capacity is forecasted to reach 1,100 GW by the end of 2024, surpassing demand. Conversely, the wind industry (excluding China) faces challenges such as ongoing supply chain disruption, higher costs, and extended permitting timelines, necessitating heightened policy attention.

The report provides a realistic assessment of the momentum behind renewable-based hydrogen, indicating that only 7% of announced projects worldwide are expected to be operational by 2030. Slower project progress, limited off-taker interest, and higher production costs necessitate consistent policies supporting demand to garner investor confidence.

DO WIND TURBINES BREAK IN COLD SNAPS? HERE'S HOW THE TECH KEEPS TURNING IN FREEZING TEMPERATURES

Misinformation about wind farms often spreads, especially during colder seasons, from regions like Texas to Sweden. Here's the accurate information you need to understand:

Wind power is increasingly crucial to Europe's electricity supply, providing about 20% of the region's energy. This contribution is even more significant in northern countries, with Denmark at 55% and Ireland at 34%. The North Sea alone hosts nearly 3,000 wind turbines, with others operating in the harsh climates of Antarctica, demonstrating their capability in cold weather.

Despite this, skeptics of renewable energy often downplay the effectiveness of wind turbines, especially in winter. A recent misleading blog post, for instance, claimed that a cold wave in Sweden led to a substantial drop in electricity production from wind farms, with a sarcastic remark about the benefits of global warming. Addressing the question of whether wind turbines freeze in cold weather, these turbines are indeed designed to operate in temperatures as low as -30 degrees Celsius. Under certain conditions, such as snow, freezing rain, high wind chill, or humidity, ice can form on the blades. This can impact their aerodynamics, leading to reduced efficiency and potential imbalances. WindEurope, the European wind energy association, notes that turbines may need to pause operation under these circumstances for both efficiency and safety reasons, including the risk of ice throw.

HOW DO WIND TURBINES COPE WITH FREEZING TEMPERATURES?

The industry has developed several solutions to prevent or remove ice. These include

internal heating systems, mechanical de-icing devices, blade vibration systems, and even innovative coatings like those developed by Skellefteå Kraft in Sweden, which involve heating a thin carbon fiber layer on the blades. German manufacturer Nordex offers 'cold climate packages' to significantly reduce energy losses due to icing. These de-icing strategies, largely derived from aviation, are continually being optimized as the wind energy sector grows. In rare cases where ice still forms, specialized services such as helicopter de-icing are used.

The misinformation about wind energy's winter performance was highlighted during the February 2021 Texas cold snap. The state experienced severe power outages, with some wind turbines freezing and leading to a 16GW loss in renewable energy capacity. However, the larger issue, a 30GW shortfall, was due to failures in fossil fuel, coal, and nuclear sources. Critics wrongly blamed wind energy, but the real problem was the lack of preparation for such extreme cold, as pointed out by MIT's Michael Howland.

Heather Zichal, then CEO of American Clean Power, criticized those using the situation for political gain against clean energy. She emphasized that the incident showed the need for more investment in renewable energy with better transmission and storage, not a fundamental flaw in clean power.

EPEVER PRODUCTS

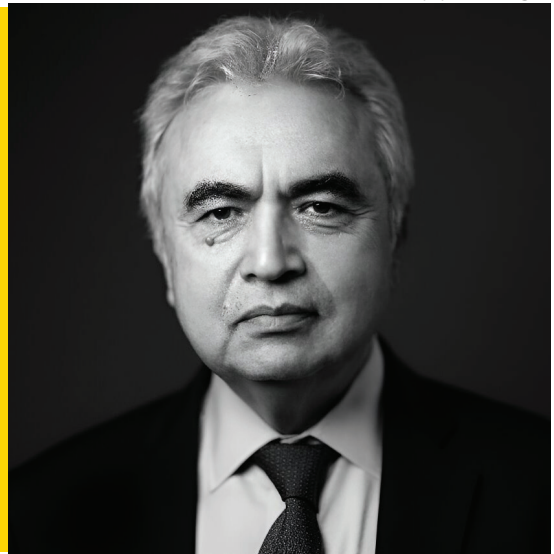
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COP28 PROVED DOUBTERS WRONG WITH STRING OF MAJOR SUCCESSSES, IEA CHIEF SAYS



FATIH BIROL SPOKE TO THE NATIONAL ABOUT COP28, INSTABILITY IN THE MIDDLE EAST, OIL PRICES AND OUTLOOK FOR THE YEA

At the World Economic Forum, the International Energy Agency's head, Fatih Birol, declared Cop28 a significant triumph that defied skeptics' expectations. In his discussion with The National in Davos, Switzerland, Birol praised Cop28 for its achievements, especially its pledge to shift away from fossil fuels.

Birol, a prominent economist and the executive director of the IEA, downplayed the impact of Middle Eastern unrest, including Houthi attacks in the Red Sea, on global oil markets. He remarked, "Cop28 marked a significant turning point for the global energy landscape." Reflecting on previous skepticism in Davos about Dr. Sultan Al Jaber's appointment as Cop28 President, Birol recalled his confidence in Al Jaber's leadership and the positive outcomes of Cop28, particularly in accelerating the transition to clean energy.

Describing last year's climate conference in Dubai's Expo City as highly influential, Birol noted that the UAE Consensus effectively shifted the dialogue around energy transition. He emphasized key achievements of Cop28,

including commitments to significantly increase global renewable energy capacity, enhance energy efficiency, and reduce methane emissions, known for their high global warming potential. Birol concluded, "Cop28 was pivotal in advancing our goals for a clean energy transition."

Mr. Birol emphasized the IEA's commitment to work alongside the UAE in ensuring that countries meet their Cop28 commitments. He also looked forward to future conferences, including Cop29 in Azerbaijan this November and Cop30 in Brazil in 2025, expressing hope for the establishment of financial mechanisms to aid developing countries in addressing climate change. "I will be visiting Brazil next week to discuss with President Lula and his ministers how to build upon our achievements in Dubai within the G20 framework," he mentioned.

Significant advancements in climate finance were a highlight of Cop28, notably the substantial pledges made to the Green Climate Fund, a UN-initiated program to help developing nations mitigate and adapt to climate change, which received \$12.8 billion

from 31 countries.

Regarding the Middle East's instability, Mr. Birol pointed out that while Red Sea shipping attacks have marginally increased transportation costs due to longer detours, they haven't substantially affected oil production. Following recent US-led actions against Houthi rebels in Yemen, there was a slight increase in prices, but he believes the markets will remain stable as long as major oil-producing nations stay out of these conflicts. "I anticipate a calm year for oil markets, provided there is no direct involvement from any major oil-producing countries," he stated. The IEA again raised its oil demand outlook. It now predicts global consumption will rise by 1.24 million barrels per day (bpd) in 2024, representing the third consecutive upwards revision over the past three months, but remains below Opec's 2.25 million bpd projection.

Mr Birol said that "if there were no geopolitical developments, we would see a comfortable year this year, because we see substantial new oil coming from the Americas, the US, Canada, Brazil and Guayana, and when I look at the demand, it is much weaker than last year because the Chinese economy is slowing down. unless there are some geopolitical surprises". Mr Birol also concurred that countries in the Middle East are often unfairly criticised more often than other nations for continued high levels of oil production.

"Oil production is up from the Americas, by about 1.5 million barrels a day, meaning [that in] the so-called non-Opec countries and Americas, production is growing faster than global oil demand," he said.

Mr Birol praised the UAE for diversifying its economy, drawing a contrast with other nations in the region where economic growth and oil prices remain closely linked.

"The UAE did embark on diversification, in many of the other countries there remains an iron link between oil and their economic growth," he said.

In terms of priorities for this year, high on the list for Mr Birol is reducing the number of highly polluting cookstoves being used in sub-Saharan Africa, an issue he said he is "personally very passionate about".

The IEA has once again updated its oil demand forecast, now anticipating a global increase of 1.24 million barrels per day (bpd) in 2024. This marks the third upward revision in the last three months, though it still falls short of OPEC's projection of 2.25 million bpd. Mr. Birol commented, "In the absence of geopolitical shifts, we expect a stable year ahead. There's a significant influx of new oil from the Americas – the US, Canada, Brazil, and Guyana. Meanwhile, demand looks weaker than last year, partly due to the slowdown in China's economy, barring any geopolitical surprises."

He also addressed the frequent criticism of Middle Eastern countries for high oil production, noting it's often disproportionate. "Production in the Americas has increased by about 1.5 million barrels a day, meaning production in non-OPEC countries, including the Americas, is outpacing global demand," he explained.

Mr. Birol commended the UAE for its economic diversification efforts, contrasting it with other regional nations where oil prices and economic growth are tightly intertwined. "The UAE has embarked on diversification, while many other countries still have a strong dependence on oil for economic growth," he stated.

A top priority for Mr. Birol this year is tackling the issue of polluting cookstoves in sub-Saharan Africa, a cause he is deeply passionate about. He emphasizes the importance of reducing the reliance on these cookstoves to improve both environmental and living conditions in the region.

SUNGROW

Clean power for all

OPENS NEW OFFICE TOWER AT ITS GLOBAL HEADQUARTERS TOP OF FORM

Sungrow, the global leading inverter and energy storage system supplier, opened its new and expanded headquarters office tower on December 26th, 2023 in Hefei, China. The milestone event was graced by the presence of Sungrow's Chairman, Cao Renxian, who presided over the opening ceremony and commemorated the occasion alongside valued partners, ushering in the new year with fervor and camaraderie.

Inspired by the concept of a "sinusoidal waveform superimposed with three harmonics", this magnificent building is a testament to its commitment to advancing clean energy technologies. It also symbolizes its dedication to "connect the green mission and create long-term value" in the clean energy field.

The newly opened Sungrow Tower spans an area of 60,000 square meters and stands as a certified green building, boasting a forward-thinking design integrated with sustainable principles. Notably, the tower's rooftop consists of a PV plant generating clean energy to power the office. Enhanced by a

sloped glazing curtain wall, the space enjoys increased natural light, fostering a brighter and more comfortable working environment.

In tandem with Sungrow's expanding global presence, the facilities within the new office have been meticulously crafted to foster collaborative workspaces for colleagues around the globe. The office is fully equipped with cutting-edge tech-enabled meeting rooms, social and break-out areas, and an immersive exhibition hall showcasing products and solutions across five business segments, encompassing PV, energy storage, wind power, electric vehicles, and green hydrogen.

Dr. Jack Gu, Vice Chairman of Sungrow and President of Sungrow PV & Storage Business Group said, "This marks an exciting chapter for our team. The Sungrow Tower truly reflects the growth we have experienced and will allow us to provide our team with fantastic collaborative workspaces. This new space enables us to meet the evolving demands of our global clients and partners."



About Sungrow

Sungrow Power Supply Co., Ltd. ("Sungrow") is the world's most bankable inverter brand with over 405 GW installed worldwide as of June 2023. Founded in 1997 by University Professor Cao Renxian, Sungrow is a leader in the research and development of solar inverters with the largest dedicated R&D team in the industry and a broad product portfolio offering PV inverter solutions and energy storage systems for utility-scale, commercial & industrial, and residential applications, as well as internationally recognized floating PV plant solutions, NEV driving solutions, EV charging solutions and renewable hydrogen production systems. With a strong 26-year track record in the PV space, Sungrow products power over 150 countries worldwide. For more information about Sungrow, visit www.sungrowpower.com.



THE RENEWABLE ENERGY INDUSTRY TRIUMPHS - PAKISTAN SUSTAINABILITY WEEK 2023

From the 7th to the 9th of September, the Expo Center in Karachi was abuzz with innovation and enthusiasm as it played host to the much-anticipated Pakistan Sustainability Week Exhibition. This three-day event brought together industry leaders, government representatives, researchers, and the public to celebrate and promote sustainable practices in the domains of energy and environmental conservation.

The event was marked by two main events, Solar Pakistan and Electricity Pakistan, which were designed to showcase the latest advancements and breakthroughs in the fields of solar energy, electricity generation, and conservation methods. The amalgamation of these two key events created a dynamic platform that explored the synergies between renewable energy and efficient electricity management.

A significant highlight of the Pakistan Sustainability Week was the impressive turnout of participants and visitors. The event drew attention from various sectors, including businesses, academics, and environmental enthusiasts, reflecting a growing awareness and interest in sustainability and green technologies in Pakistan.

One of the standout features of the exhibition was the SOLECT competition, which provided

a unique opportunity for the youth to showcase their innovative and sustainable projects. Teams from over 10 universities across the country enthusiastically participated in this competition, displaying their independent projects that aimed to address various energy and environmental challenges.

The SOLECT competition was not merely a demonstration of cutting-edge technology but also a testament to the passion and commitment of the young generation in Pakistan towards creating a more sustainable future. These projects ranged from solar-powered water purification systems to smart grids for efficient electricity distribution. The competition fostered an environment of healthy competition and collaboration, enabling students to exchange ideas and experiences in the pursuit of sustainable solutions.

The Exhibition served as a valuable platform for networking, knowledge exchange, and collaboration. It brought together experts, policymakers, industry leaders, and the youth to discuss and address the pressing sustainability issues facing Pakistan today. The event highlighted the potential of renewable energy, efficient electricity generation, and sustainable practices in meeting the country's energy demands while reducing its carbon footprint.







**Plant this
card.**



Congratulations, you just
made the world greener!

Here we have a special kind of treat for you, a seed card! It contains the following seeds:

Basil, Banyan, Chia and Fig tree. It's a surprise which one you'll get. All you have to do is pull it out and plant it into the ground, water it and watch it grow. Having done so you will have made the difference this planet needs.



Sustainable Living

The Way Forward

In a world increasingly focused on sustainability, the simple act of planting has emerged as a delightful, yet powerful tool in our quest for a greener planet. The importance of planting, whether it's a vegetable garden, a flowering bush, or a towering oak tree, extends far beyond the aesthetic pleasure it brings. It's a gentle, yet potent reminder of our intimate connection with nature and our role as stewards of the Earth.

Imagine a tiny seed – it's almost nothing, really. But give it some soil, water, and love, and it transforms into something that can provide food, shelter, and oxygen. This little

act of planting is a testament to the power of growth and change. It's nature's own way of teaching us about patience and the beauty of nurturing something over time.

Planting is not just about beautifying our immediate surroundings. It's a crucial step towards sustainability. Trees, for example, are like the Earth's lungs. They breathe in carbon dioxide and breathe out oxygen, contributing to cleaner air. They offer shelter to wildlife, create microhabitats, and play a significant role in maintaining the ecological balance. Every tree planted is a step towards combating climate change, a gesture of hope for future generations.

But let's not forget the **humble kitchen garden** – a small patch of herbs, vegetables, or fruits. It's a sustainable way to produce some of our own food, reducing our carbon footprint. It reconnects us with the cycle of life, from seed to plate. There's something incredibly satisfying about cooking a meal with ingredients you've grown yourself. It's a reminder that the best things in life often require time and effort.

Planting is an engaging, hands-on way to educate the **younger generation** about environmental responsibility. When children plant seeds and watch them grow, they learn about the interdependence of life. They see first-hand the impact of water and sunlight, and they begin to understand the delicate balance of ecosystems. These are lessons no textbook can fully convey.

But beyond these tangible benefits, there's a deeper, more personal aspect to planting. Gardening, for many, is a **therapeutic activity**. It's a chance to disconnect from the digital world and engage with the earth. Digging in the soil, feeling its texture, and seeing life sprout from the ground is a grounding experience – pun intended! It's a form of mindfulness, a way to slow down and appreciate the present moment.

In a fast-paced world, planting is a rebellion of sorts – a way to reclaim our time and attention, to focus on slow, organic growth rather than instant gratification. It's a statement that we care, not just about our own well-being, but about the planet's health as well.

Finally, let's consider the social aspect of planting. Community gardens bring people together, fostering a sense of belonging and cooperation. They're a place where stories and tips are shared, where friendships blossom alongside flowers and vegetables. In urban areas, where green space is often limited, these gardens become vital oases of tranquility and community spirit.



In this latest issue of PV+ Journal, we're excited to introduce a unique and eco-friendly initiative – the inclusion of a seed card. This small yet significant addition to our journal represents our commitment to fostering environmental awareness and action.

Pakistan needs more plantations primarily to combat the environmental and climate challenges it faces, including deforestation, desertification, and rising temperatures. The country is highly vulnerable to climate change, with its water resources and agricultural productivity under threat. Increasing green cover through plantations can help mitigate these impacts by absorbing carbon dioxide, improving air quality, and regulating temperature. Furthermore, trees play a crucial role in water conservation, helping to replenish groundwater levels and reduce the risk of floods by absorbing excess rainfall. This is particularly important in areas prone to drought and water scarcity, ensuring communities have access to clean water.

Expanding plantations in Pakistan can bolster biodiversity, providing habitats for wildlife and preserving the natural ecosystem. This is vital for maintaining ecological balance and supporting agriculture, which is a cornerstone of the country's economy. Plantations can also contribute to economic development by creating job opportunities in forestry management, conservation, and related industries. In the long term, these green spaces can enhance the quality of life for the population, offering recreational areas and improving mental health. Therefore, investing in more plantations is not only an environmental imperative but also a socio-economic necessity for Pakistan's sustainable development.

At PV+ Journal, we understand the critical role that each individual plays in creating a sustainable future. Our seed card is a tangible reminder of this responsibility and an invitation for you, our valued reader, to actively participate in nurturing a greener

Pakistan. By planting this seed card, you're not just cultivating plants; you're sowing the seeds of change and hope for our environment.

The seed card is embedded with a mix of seeds chosen for their ability to thrive in Pakistan's diverse climate. When planted and cared for, these seeds will grow into plants that contribute to cleaner air, support biodiversity, and add natural beauty to our surroundings. This act of planting is a simple yet powerful gesture towards environmental stewardship.

We encourage you to join us in this green initiative. Plant your seed card in a pot or garden and watch as your contribution to a greener Pakistan takes root and flourishes. Share your planting journey with us and others, inspiring more people to take part in this collective effort. Together, let's nurture a healthier, more sustainable environment for current and future generations. Your participation is a step forward in our journey towards a greener, more sustainable Pakistan.





WE DON'T HAVE TO ENGAGE IN GRAND,
HEROIC ACTIONS
TO PARTICIPATE IN CHANGE. SMALL ACTS,
WHEN MULTIPLIED
BY MILLIONS OF PEOPLE,
CAN TRANSFORM THE WORLD.

- HOWARD ZINN

Sustainability is not just about adopting the latest energy-efficient technologies or turning to renewable sources of power. Sustainability is the responsibility of every individual every day. It is about changing our behaviour and mindset to reduce power and water consumption, thereby helping to control emissions and pollution levels." - Joe Kaeser



Techno- logy.

Here we talk about cutting-edge technology regarding alternative energy! Let's explore the latest advancements and innovations driving the future of clean, renewable power sources. From solar to hydro, we uncover groundbreaking solutions that promise a greener, more sustainable world.



OCEAN ENERGY TECHNOLOGY FROM NREL SECURES PATENT FOR THE FUTURE

Researchers at the National Renewable Energy Laboratory have developed an innovative ocean energy technology, which has recently been granted its first patent. This technology, known as hexagonal distributed embedded energy converters (hexDEEC), consists of ultraflexible, centimeter-sized electric machines. Each hexDEEC can produce only a tiny amount of energy - one-millionth of a joule - but when combined into larger structures called metamaterials, they become much more powerful.

James Niffenegger, a mechanical engineer at NREL, highlights the abundant potential energy in everyday movements - the rolling of waves, the swaying of buildings, the compression of pavement under vehicles. All these actions hold untapped renewable energy, which hexDEECs aim to harness. Constructed from durable and cost-effective materials like silicone rubber, hexDEECs are well-suited for harsh environments such as

the ocean. Blake Boren, a senior engineer at NREL and co-inventor of hexDEEC, envisions applications like mooring lines composed of braided hexDEECs on the ocean floor. Niffenegger suggests that hexDEECs could be integrated into structures that already exist in marine environments, such as navigational buoys or mooring systems, to generate power.

The development of hexDEECs emerged from a broader exploration by NREL staff, including Panagiotis George Datskos, a senior research advisor, and Jochem Weber, chief engineer of the water power program. They were initially investigating electricity generation from electric fields, similar to the static electricity created by socks rubbing on a carpet. Their initial concept involved an electrostatic variable capacitance generator, utilizing two plates (akin to a sock and carpet) connected by a spring, which generates electricity when compressed by external forces like wind or waves.



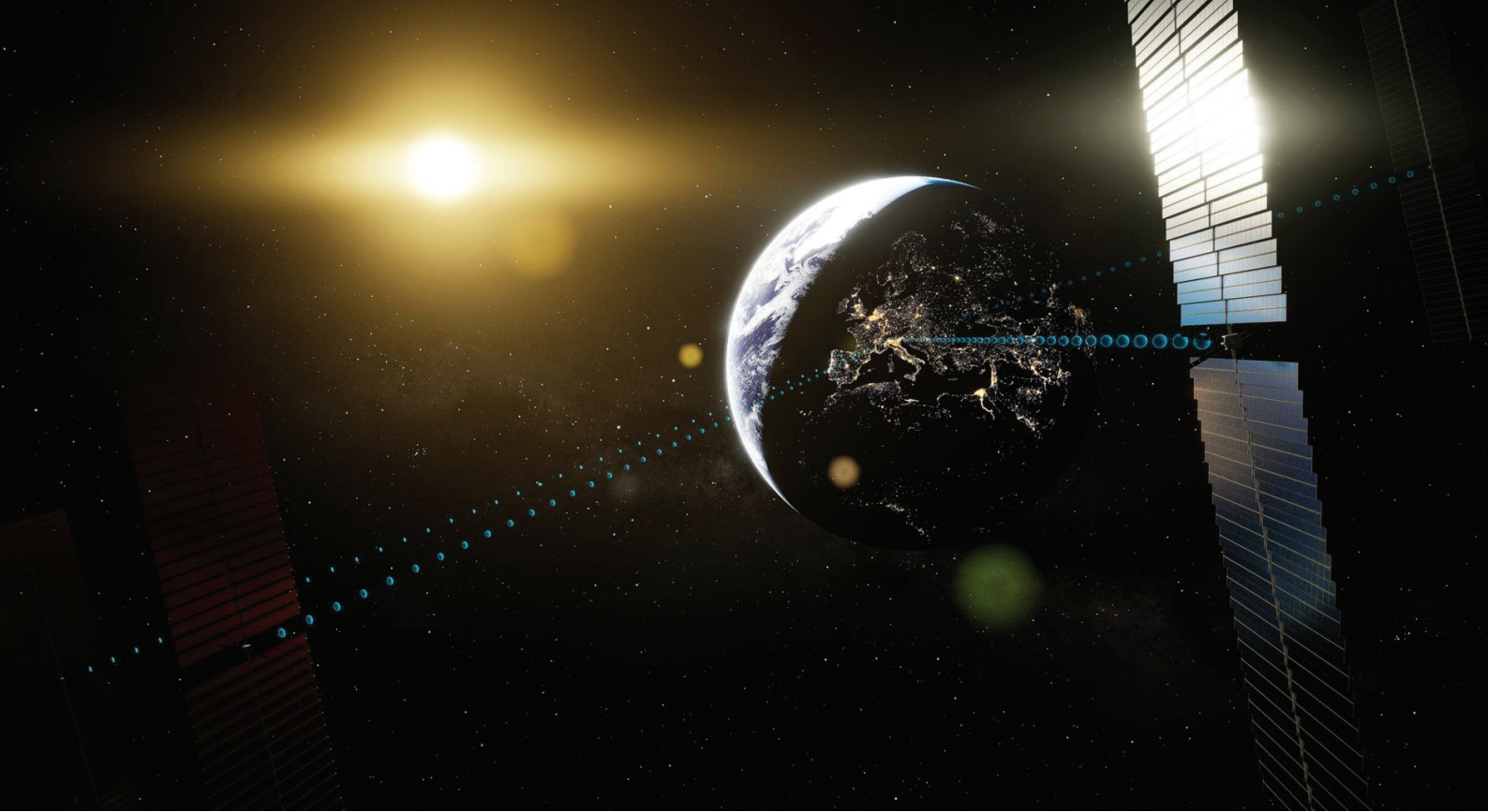
The design evolved when Boren joined the team, proposing a more versatile, springless design. His hexagonal silicone rubber model uses its flexibility to generate electricity by alternating between compressed and relaxed states. The hexagonal shape also allows for the integration of these units into larger, more potent metamaterials. Thus, the concept of hexDEEC was conceived, marking a significant advancement in harnessing renewable energy from everyday movements.

While the hexDEEC technology is currently in a conceptual phase, there have been successful implementations of similar technologies. For instance, SBM Offshore, a wave energy company, has successfully encircled a large tube with mini energy generators based on variable capacitance to transform wave motion into electrical power. Additionally, researchers at the University of Colorado Boulder have developed materials that, although they look more like exotic marine life than machinery, function on a similar principle.

The potential applications of hexDEECs extend beyond mere energy generation. In their actuator form, these metamaterials could morph to adapt to various needs. For example, hexDEEC-enabled windows could adjust to minimize glare, walls could become more rigid to withstand strong winds or seismic activity, and solar panels could subtly vibrate to shed dust that blocks sunlight.

Blake Boren envisions applications for hexDEECs that reach far beyond marine environments. One of his innovative ideas involves embedding hexDEECs in highways. In this scenario, passing cars would compress the hexDEECs in the road, and as they move away, the hexDEECs would reopen, creating electricity. This energy could then power features like self-lighting road markings or street lamps. Both Boren and James Niffenegger are dedicated to further developing and refining hexDEECs to make these theoretical applications a reality and enhance the technology's overall efficacy.





SPACE-BASED SOLAR POWER: A VISION OF THE FUTURE OR AN UNATTAINABLE DREAM?

The latest developments in space-based solar power (SBSP) have sparked conversations about its sustainability as a green energy source. NASA's recent report and successful experiments conducted by Caltech have ignited discussions regarding the future prospects of SBSP. In this exploration, we will delve into the details of this emerging technology, its associated challenges, and its potential implications for clean energy in the future.

NASA's Critical Analysis and Advocacy Responses

A recently released NASA report questions the feasibility of obtaining cost-effective and clean energy from solar power in space. On January 10, the Office of Technology, Policy, and Strategy at NASA presented its findings, examining two SBSP designs and revealing that their costs are considerably higher than those of renewable energy generated on Earth. Specifically, the projected cost for

space-based energy ranges between \$0.61 and \$1.59 per kilowatt-hour, significantly surpassing the \$0.02 to \$0.05 costs associated with wind, water, and solar energy on Earth.

Despite the report's conclusions, proponents of SBSP have expressed reservations about NASA's assumptions. John Mankins, an SBSP expert and former NASA official, criticized

the report for its pessimistic assumptions, particularly in relation to launch costs, which constitute over 70% of the overall costs of SBSP systems. Mankins highlighted advancements such as SpaceX's Starship as potential cost reducers, challenging NASA's assumption of \$1,000 per kilogram launch costs.

Moreover, the report's sensitivity analysis suggested that incorporating lower launch costs, electric propulsion, and longer component lifetimes could substantially decrease SBSP electricity costs, bringing them closer to those of terrestrial renewable alternatives. However, Mankins and other experts found this analysis unconventional, expecting a more "middle of the road" baseline scenario.

Global Interest and Advancements in SBSP

Interest in SBSP is growing globally, with the European Space Agency, China, Japan, and the United Kingdom actively conducting research and analysis. The National Space Society and the Space Frontier Foundation view NASA's report as an acknowledgment of SBSP's potential climate-friendly economic benefits, emphasizing the importance of continued exploration in this field.

Caltech's Breakthrough in SBSP Technologies

The California Institute of Technology recently announced the successful completion of its Space Solar Power Demonstrator 1 (SSPD-1) project. Initiated in January of the previous year, the project aimed to assess the feasibility of collecting solar power in space and transmitting it to Earth wirelessly. The team developed a foldable solar panel, tested various types of solar cells, and utilized a microwave transmitter.

While this marked the first successful gathering of solar energy in space and its transmission to Earth, Caltech acknowledges that several challenges, including high material costs and the need to address space radiation, must be addressed before these technologies can be deployed commercially.

Emerging Technologies and Future Prospects

Research at the University of Pennsylvania and the University of Sydney has introduced innovative technologies, such as ultra-lightweight solar cells with doubled efficiency and self-healing solar panels capable of recovering from space radiation damage. These advancements could play a pivotal role in making SBSP a commercially viable option in the future.

The Role of International Collaboration

The advancement of SBSP technology may hinge on international collaboration. With various countries and organizations exploring the feasibility of SBSP, pooling resources, expertise, and research could lead to more cost-effective and technologically advanced solutions. Collaborative efforts can also address concerns related to the equitable use of space and the sharing of energy resources harvested in orbit.

While SBSP presents an exciting prospect for sustainable energy, it remains a complex and costly endeavor. The ongoing debate between NASA's skepticism and advocates' optimism reflects the inherent challenges and potential of this technology. With global interest and continuous research, SBSP may still illuminate our world, but overcoming significant hurdles is imperative for its realization.

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Dialogue.

In this comprehensive feature, we delve into the world of renewable energy through the expert lens of Khalid Pervez, providing an insightful article on the latest developments. Additionally, we bring you an exclusive interview with Dr. Syed Sajjad Haider Zaidi from NUST, offering his expert perspective on the advancements and challenges in the field.





SOLAR ENERGY IN PAKISTAN

BY KHALID PERVEZ

CEO, KPWS Consulting Karachi & Chairman IEEEEP, Karachi Centre

Pakistan has been immensely blessed with such a huge stack of natural resources including solar energy that only few countries come to that stature. As per the estimates of NEPRA, Pakistan has a potential of solar energy of around 40GW, whereas it has harnessed only about 3GW so far. The current energy mix of Pakistan is highly tilted towards mostly imported fossil fuels which, over the passage of time, has made the electricity generation cost very high, impacting all business sectors and the common household.

The contribution of solar energy in Pakistan's

total installed capacity of about 43,775MW is only about 3,000MW or 6.85%, which certainly is on much lower side.

It should be noted that moving very rationally, Pakistan constructed large sized hydroelectric projects including Mangla Dam [1,000MW; 1967] and Tarbela Dam [4,888MW; 1976] in early days and Ghazi Barotha Dam [1,450MW; 2003] later which greatly contributed to providing low-cost electricity. However, considering the various engineering and other studies that are a must, construction of a hydroelectric project is a very time consuming and costly process

which is too difficult to accommodate in today's socio-economic dynamics.

To cope with the timely needs, it's extremely important that solar energy is given due consideration in Pakistan's long-term energy landscape.

Bottlenecks

For a long time, Pakistan has been passing through uncertain socio-economic conditions which primary stem from lack of governance and its vision, and political will, leading to abrupt changes in key policies. For example, there was no rationale of adding in recent past huge coal fired powerplants operating on imported fuel.

Most likely this was done under political pressure from the project sponsors. Even if the projects [which immediately become controversial] were provided on soft economic terms, the corresponding transmission infrastructure for power evacuation had to be domestically arranged. Obviously, such undertakings severely diminish Pakistan's capacity for initiating large size solar projects.

It's regretful that so far, no direct incentives are available from the government for individuals and for the industrial and commercial sectors for investment in solar installations. Yes, there's net-metering but that too is tilted towards utilities.

Way forward

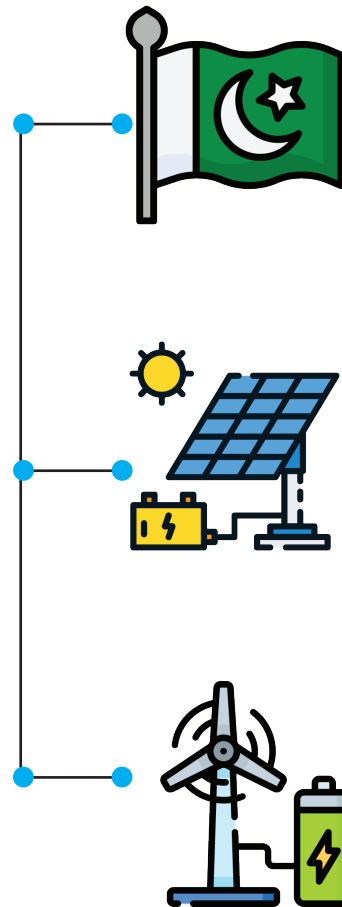
Its highly desirable that the government adopts a target oriented multi-prong strategy to develop and promote renewable energy [solar and wind] sector. This could include:

Putting a strict ban on new imported fuel-based power generation projects.

No further renewals of the IPP contracts that were signed in 90s for imported fossil fuel based projects.

Promotion of public-private partnerships in renewable energy sector to construct large size projects.

Provision of incentives in taxes, etc. for solar investments.





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INTERVIEW WITH DR. SYED SAJJAD HAIDER ZAIDI

Commodore, Associate Professor, NUST

What strategies and initiatives are universities around the world and in Pakistan implementing to embed sustainability principles into their curricula, research, and campus operations, and what evidence exists to support the effectiveness of these efforts?

Solar energy is a promising renewable energy of the present day and of near future. It offers huge research potentials. NUST students are always eager to work on challenging and futurist project and solar is no exception to it. There are number of exciting projects which are being pursued by NUST students. Students at PN Engineering College (NUST – Karachi Campus) are working on many projects related to Solar

power and associated services. Few of such projects “Assessment of PV ingress in Distribution grid and stability analysis”, “Smart Automatic Cleaning System for Solar Panels”, “STATCOM for PV enabled Power grid”, “IOT Based Intelligent System for Greenhouse Environment Monitoring and Controlling System”, “MPPT Solar Charger Controller”, “Design & prototyping of Hybrid solar inverter’.

The list is exhaustive, and the above projects are some of the recent ones. I have also established a research lab, which is name “Power Research Lab (PRL). The lab has working on a number of technologies related to future smart grid. The has delivered a number of useful project/products related to power and distribution grid.

Future Outlook of Solar Energy: “Based on your expert opinion towards the direction that you believe solar energy will take in the upcoming decade modifying technology and many changes advanced on policy, what is your ideal future outlook on such?”

Future outlook of solar energy is promising and it can be a game changer. Many advanced countries, especially German and some other European countries are doing exceptionally good in the field of solar power grid. However, a careful and well-planned approach is mandatory to accrue true benefits. There are technical and administrative challenges which are peculiar in nature with respect to our country. These challenges have to be addressed by local experts who have understanding of the system, its limitations, our limitations and other dynamics.

Historically, the power grid was vertically monopolized. All the three prime segments, generation, transmission and distribution, have been centrally controlled. Though challenging but managing, controlling and planning power grid was easier. With the ingress of extensive PV solar, grid planning is facing new challenges. Planning has to be smarter and more dynamic; execution will require technological advancements and customer handling policies need adequate changes.

In my opinion, we need to start working on the PowerNet (similar to internet) which should be decentralized, block chained based and will have lots of accurate predictions exploiting full potential of AI technologies.

Current and Future Projects: “Are there any substantial solar energy projects that are underway or about to commence in NUST or in the industry in general, which you would like to mention?”

Yes sure. We have MoU with KE for assessment of PV ingress in distribution grid. We are working as consultant on installation of power system on the canals and waterways in Sindh. Besides this, our students are also working on a number of smaller projects and studies related to solar. My lab, PRL, is working on number of technologies which are essential for realization of Smart Grid. Such as blockchain based power metering, design and development of smart meters and automation in cleaning of PV solar. Many of them are being carried out as Master/PhD research work. Few undergraduate project and industrial linkage activities are also related to Solar based work.

Industry Trends and Innovations: “How do you look at the present state of the solar and renewable energy industry, the world over, and in Pakistan? What are some of the major trends and innovations that you feel affect this industry at present?”

Presently, solar energy constitutes small portion of the world energy mix. Only ~5% is acquired from solar. Due to environmental issues and depleting fossil fuels, solar is being more and more popular alternate source. It is an easy and relatively cheap green energy source. All major countries have set ambitious targets for solar energy.

Pakistan has committed to have 60% of solar power by 2030 which is very ambitious and challenging. As compared to other countries of the world, it is a high number and we have to work very seriously to meet this target. Increasing fuel cost and dollar issues, have made it imperative for Pakistan to explore as much as possible solar energy.

All over the world, extensive research is going on improving the efficiency of solar cells and related systems. Major power companies are extensively working to improve overall enhancement of systems such as battery capacity, inverters efficiency, life of component and others.

However, the associate challenges such power quality, grid stability, grid planning and other technical and admin aspect must be carefully managed. I strongly recommend that alternate energy board must constitute team of experts from academia, industry and power sector to device realistic policies for our countries.

Challenges and Opportunities: “What are the front challenges that the solar energy sector faces, particularly as concerns Pakistan’s energy portfolio?”

As I have already mentioned, that Pakistan has committed in UN that we will shift to 60% renewable energy by 2030. We need to aggressively pursue for maximum solar energy from all possible sources. This is a huge opportunity for many sectors in our country. I suggest to install solar system on waterways (canal), railway tracks, road, bus stops, Govt and semi govt building. Moreover, public private partnership should be encouraged for maximum installation of solar system. Incentive based loan should be proved for installation of solar systems on residential building. In this way our banking sector, technical sector and service sector will be benefited. Capex for solar is a big challenge which can be met through smart monetary policy for solar related loans.

Power quality and grid management is second most related challenge. We need to start detailed working by all DISCOs for these issues immediately as this can be very concerning issues if the solar ingress exceeds a certain limit depending upon grid stability and dynamics.

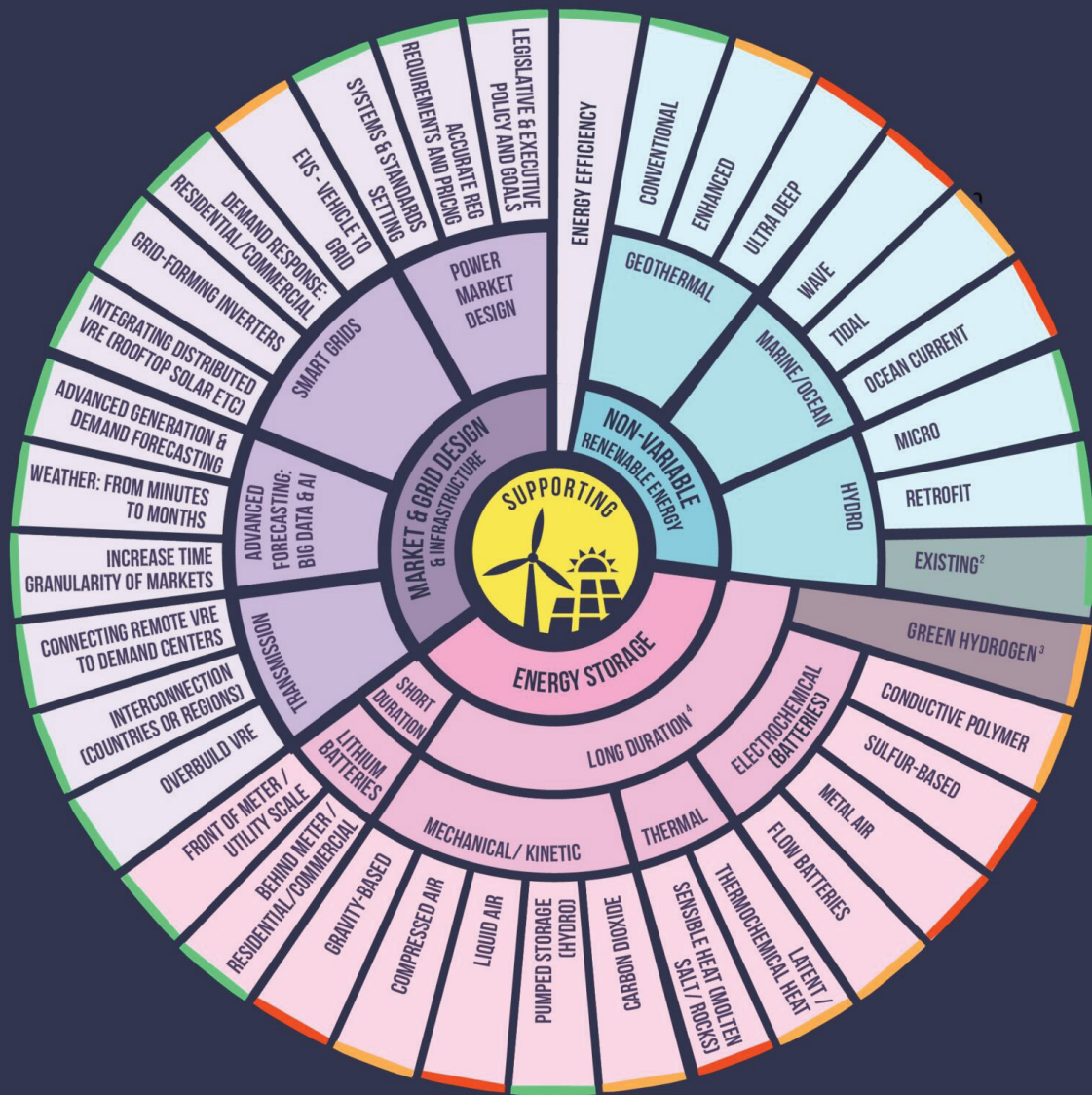
The third challenge, which I foresee is the discarding of the used solar panel. We should device and implement a detailed policy regarding used solar panel as early as possible. Based on technical research and study, Pakistan must set standards for the import of solar related hardware in the country as well as should also define how the used hardware of solar system will be discarded upon completion of its life. We must engage academia to define use of such material, place where to dump that and who is responsible for overall effective implementation of policies.

Finally, some authority may be NEPRA, Alternate Energy Board (AEB) or any other suitable should be mandated for routine inspection of installed solar system with well-defined standards. The nominated organization must also be capacity build for this purpose.

● *Students at NUST were previously talked about in our SEPT/OCT edition where they won the first prize at Pakistan Sustainability Week 2023 in Karachi for their project Envision.*

Achieving Fossil-Free Electricity¹

Policies, Tools and Technologies for Supporting Wind and Solar



Key: Market Readiness

- Commercial
- Newly Commercial
- Demo/Pilot

Footnotes:

1. Infographic shows the many choices available for supporting wind & solar to achieve reliable, dispatchable fossil-free energy. There is no one silver bullet. Not all are necessary, although most Market & Grid Design reforms are. List is not exhaustive.
2. No new large hydropower dams should be built. Existing projects should be operated in a way that minimizes impact on vulnerable communities.
3. Converting electricity to hydrogen and back again is inherently inefficient but may make sense in some contexts. Hydrogen should be manufactured, stored, and converted back to electricity, all at the same location, in order to limit inefficiencies and leakage risks.
4. Long Duration storage is mostly not needed until over 50% VRE penetration.

GLOBAL EVENTS



PSW
Date: 09 - 11 May 2024
Venue: Islamabad,
Pak China Friendship Centre



Electricity Pakistan
Date: 09 - 11 May 2024
Venue: Islamabad,
Pak China Friendship Centre



ADSW
Date: 16 - 18 April, 2024
Venue: ADNEC, Abu Dhabi



ASEAN Sustainable Energy Week
Date: 5 - 3 July, 2024
Venue: Bangkok, Thailand



WETEX & DSS
Date: 1 - 3 October, 2024
Venue: Dubai World Trade Centre (DWTC)

Global Events



Solar Pakistan
Date: 09 - 11 May 2024
Venue: Islamabad,
Pak China Friendship Centre



WFES
Date: 16 - 18 April, 2024
Venue: ADNEC, Abu Dhabi



Intersolar South America
Date: 19 - 21 June, 2024
Venue: Messe, München



RE+
Date: 9 - 12 September, 2024
Venue: ANAHEIM, CA



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