

DIGITAL POWER

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Accelerating High-Quality Energy Development
and Bridging the Global Energy Divide**

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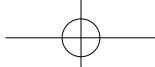
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All-Scenario Grid-Forming Technology: Accelerating High-Quality Energy Development and Bridging the Global Energy Divide

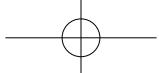


Jinlong Hou

Director of the Board of Huawei
President of Huawei Digital Power

As night falls, it is a stark reminder that hundreds of millions of people worldwide still endure unstable power grids or even live without electricity. Concurrently, wind and photovoltaic (PV) power are rapidly transforming the global energy landscape. The central challenge in this transformation lies in deploying renewable energy with guaranteed stability and equitable access.

Over the past decade, wind and PV have undergone a remarkable transformation from costly power sources to affordable solutions. Today, they account for 30% of the world's total power capacity and rank first among newly installed power sources. However, their contribution to actual power generation stands at only 15%, revealing a significant gap between capacity and output.

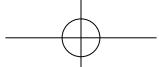


New challenges also arise from integrating high proportions of wind and PV power into grids. The variable and intermittent nature of wind and PV power output, coupled with the low inherent inertia of power electronics devices, poses a threat to power system stability. Over the past two years, frequent grid fluctuations have occurred globally, underscoring the need to address these challenges urgently.

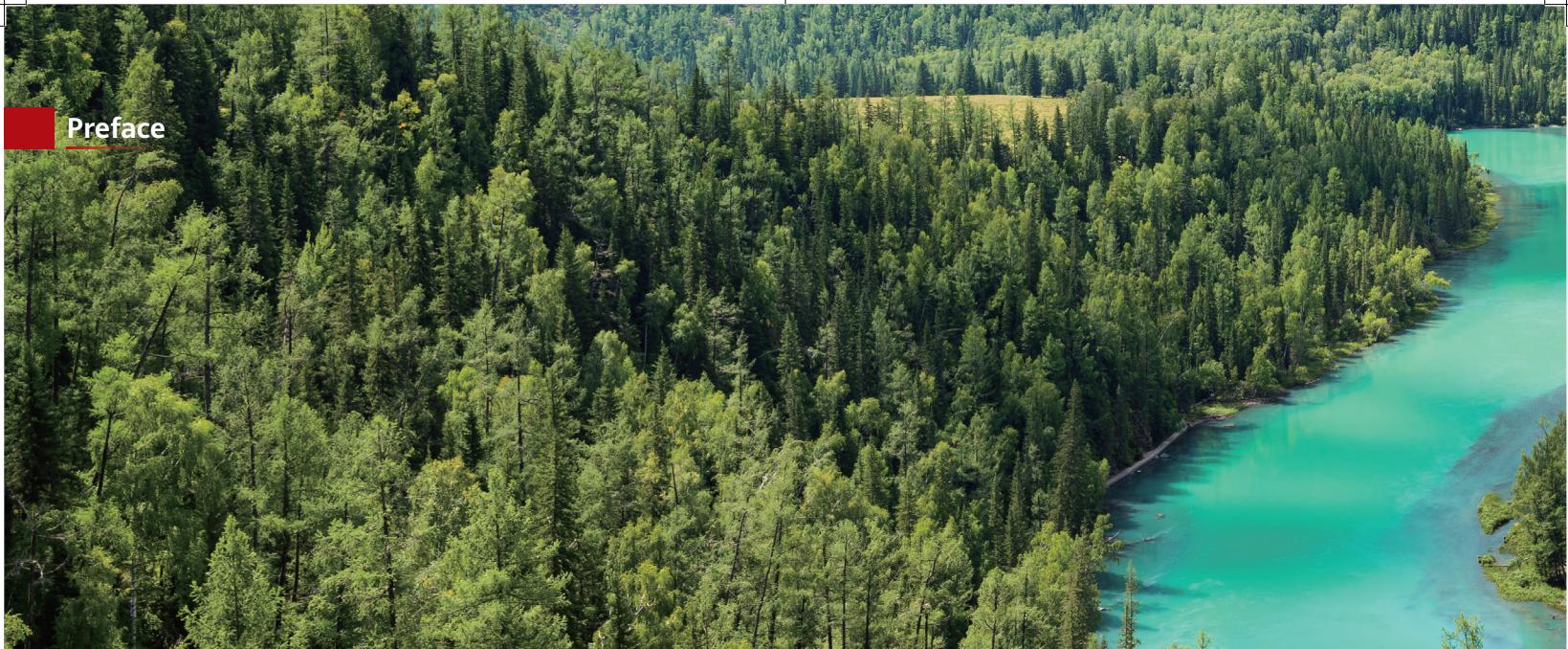
The primary challenge in transitioning wind and PV from supplementary to main power sources lies in enhancing their grid-supporting capabilities, calling for renewable energy systems to actively stabilize the grid as conventional power plants do. Achieving this transition requires the development of new power systems based on power electronics technology that enables a shift from passive grid adaptation to active system support.

The large-scale deployment of energy storage systems (ESSs), along with their deep integration with wind and PV systems, is accelerating the emergence of "wind/PV + ESS" as a robust, reliable energy solution. Projections indicate that the levelized cost of electricity for such a solution will reach parity with that of conventional power generation within the next 2 to 3 years, thereby overcoming the economic barrier.

At the same time, technological innovation is advancing in three key directions: all-scenario grid-forming, artificial intelligence (AI) integration, and full-lifecycle high-quality products. These innovations will form the foundational architecture of new power systems, fundamentally enhancing renewable energy's support for grids and promoting the transition to a safer, more efficient, and inclusive energy future.



Preface



All-scenario grid-forming technology will enable and accelerate the transformation of wind+PV+ESS systems into the main power sources.

Conventional systems rely on mechanical rotational inertia in thermal power units to maintain stability. Conversely, wind+PV+ESS systems leverage power electronics-based methods—including digital control, grid-forming algorithms, and system architectures—to provide virtual inertia and relevant capabilities, thereby ensuring power system stability and grid safety. Grid-forming technology is widely applicable across all power system scenarios, including generation-side wind+PV+ESS plants, grid-side energy storage plants, consumption-side distributed wind+PV+ESS systems, and various types of microgrids.

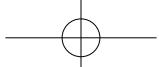
Huawei Digital Power has been investing heavily in grid-forming technology, driving it from theoretical research to practical application and industrializing it on a massive scale. These efforts have provided us with extensive expertise and yielded significant outcomes in industry deployment.

· In Saudi Arabia's Red Sea destination project, we helped our customer build the world's largest PV+ESS microgrid with 400 MW PV and 1.3 GWh ESS. The project was the first of its kind to use a standalone PV+ESS solution to provide a stable power supply. Having performed reliably for more than two years, it has set a low-carbon benchmark for city power systems by providing 100% renewable energy to an entire city.

· In China, we conducted extensive on-site evaluations of grid-forming technology with customers and power grid operators. We performed more than 2,300 grid-forming tests across three scenarios—wind+ESS in Xinjiang, PV+ESS in Xizang, and PV in Qinghai. All tests passed successfully and verified that our grid-forming technology can deliver the same level of stability that synchronous generators of the same capacity provide. This technology offers a new approach for achieving stable power output from renewable energy bases at the edge of power grids. The same approach is also applicable to other regions, including Latin America, Asia Pacific, the Middle East, and Africa.

· In Sweden, where renewable energy constitutes a significant share of the energy mix, the national grid's elongated, north-south configuration gives rise to unique challenges, with its long transmission lines inherently affecting frequency stability. To address this, we worked with customers to deploy multiple grid-forming, frequency-regulation energy storage plants. These plants provide faster response and more accurate regulation, enabling the grid to maintain stable frequency while also accelerating Sweden's renewable energy transition.

· In Mongolia, we pioneered the world's first 100-MW-scale mine microgrid project, featuring an innovative solution that integrates "PV + ESS + diesel generators" to create a self-sustaining microgrid capable of delivering a stable power supply while also reducing energy costs. This project can be replicated in areas with insufficient or no electricity, including mining sites and islands.



AI is poised to evolve from a supporting function to a core technology in power generation, enabling truly autonomous operation of wind+PV+ESS power plants.

As the construction and operational environments of GW-scale plants and campuses become increasingly complex—spanning deserts, plateaus, and offshore locations—traditional manual operations and maintenance (O&M) face major limitations. AI will be deeply integrated into wind+PV+ESS systems, transforming "dumb devices" into intelligent assets. Through device-edge-cloud synergy, each power plant will function as an intelligent agent capable of self-optimization, self-prediction, and self-adaptation, evolving into a more efficient and user-friendly plant as AI deployment continues.

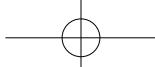
In O&M, an AI platform will collaborate with drones and robots to implement unmanned inspections, establishing unattended or minimally attended O&M as a standard for GW-scale power plants. In energy trading, AI will dynamically adjust wind+PV+ESS strategies based on multi-timescale power and price forecasts. And by optimizing both economic efficiency and system resilience via generation-grid-load-storage collaboration, AI will revolutionize energy transactions. Once embedded in production systems, AI will make wind+PV+ESS plants truly automated and unattended, significantly enhancing the efficiency of O&M, production, and trading processes.

Full-lifecycle high quality is the cornerstone for the sustainable and healthy development of the renewable energy industry.

As a power generation asset, a wind+PV+ESS plant must operate reliably over a 20-year lifecycle. In this context, high quality and safety are not just requirements—they are strategic imperatives that surpass technological performance.

Huawei prioritizes both high quality and safety and has established an end-to-end electrical safety and quality assurance system. For energy storage safety, we have set a new industry benchmark with our "no fire, no explosion, no propagation, and no injury" safety principles. Our innovative approach encompasses comprehensive safety design from cell to grid, combined with AI-driven, digitalized full-link management. This approach redefines energy storage safety through multi-level protection and thermal runaway containment at the battery-pack level.

The next few years will be pivotal in establishing wind+PV+ESS systems as a main power source. Huawei is ready to work with industry stakeholders—including regulatory bodies, associations, enterprises, and standards organizations—to advance industry standards. Our goal is to accelerate the large-scale, standardized, and high-quality development of wind+PV+ESS power systems, further bridging the global energy divide by making such systems universally accessible. Together, we can pave the way for a sustainable energy future where everyone benefits from green, stable, and economical power. ▲



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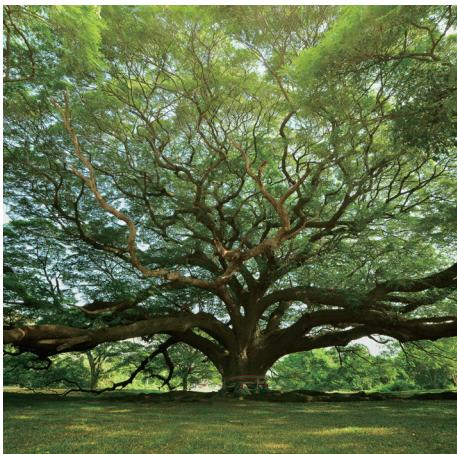
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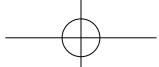
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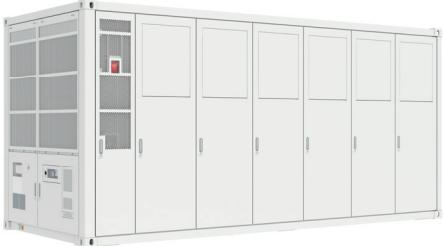
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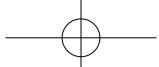
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Global Policy Review



International Energy Agency: Released the World Energy Outlook 2025

The report shows that the global energy demand in 2024 grew unexpectedly fast, with electricity consumption rising by 4.3% year over year, doubling the overall energy demand growth rate. This surge is primarily driven by the rise of artificial intelligence (AI), escalating cooling demands, and industrial electrification. While the growth of energy-related carbon emissions is slowing down, progress remains insufficient. A hindering factor is the sharp resurgence in natural gas demand alongside the persistent reliance on coal and oil. Meanwhile, the record-high temperatures are straining power grids, further complicating efforts to curb emissions. Notably, the global electricity mix underwent a rapid shift toward clean energy in 2024, with renewable energy accounting for 80% of all new power produced. The

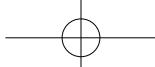
transport sector, fueled by the rising popularity of electric vehicles, saw an 8% increase in electricity consumption.

Global Installed Renewable Energy Capacity Hits a Record High

In March 2025, the International Renewable Energy Agency (IRENA) published the Renewable Capacity Statistics 2025 report. It revealed that the renewable energy capacity installed worldwide increased by 585 GW in 2024, setting a new annual growth record of 15.1%. Renewables now account for a record 92.5% of global power additions.

International Energy Agency: Released the World Energy Investment 2025 Report

The report shows that global energy investments are set to hit US\$3.3 trillion in 2025, up 2% from 2024. Around



US\$2.2 trillion of capital will flow to low-carbon energy sources—including renewables, nuclear, power grids, and electrification—double the US\$1.1 trillion for traditional energy (i.e. oil, natural gas, and coal). Energy spending remains very uneven across regions. China is the world's largest energy investor, with its share of global clean energy investments rising from 25% a decade ago to nearly 33% today. In contrast, Africa's energy investments have shrunk by one-third since 2015, representing just 2% of global clean energy investments.

European Union: Released the 2025 Progress Report on the Competitiveness of Clean Energy Technologies

In February 2025, the European Commission presented the report to the European Parliament and the Council. The report reveals that renewables supplied 48% of EU's electricity in 2024. However, it also highlights challenges confronting the EU's clean energy industry, including high energy prices, a shrinking global market share, reliance on key foreign technologies, waning competitive edge in research and innovation, and limited access to venture capital. In assessing the competitiveness of 15 net-zero technologies, the report notes that while the EU excels in certain areas, it faces growing competition in others. To enhance its position in the clean energy technology sector and drive the transition to clean energy, the EU must achieve progress through efforts, such as increasing R&D investments, improving manufacturing capabilities, and addressing skill shortages.

The Regional Energy Transition Outlook Released for the First Time

The International Renewable Energy Agency (IRENA) worked with the European Commission to issue the "Regional Energy Transition Outlook: European Union" report. By 2050, the installed capacity of renewable energy is projected to grow by 122 million kW annually, and the

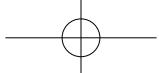
EU power sector is set to generate 90% of its electricity from renewables. Achieving this goal, however, requires significant investments. The report predicts that EU electric power facility investments from 2025 to 2050 will total EUR5.6 trillion (around EUR22 billion annually), a nearly 50% rise from today's level. But to fully decarbonize the energy system, the EU will need to invest roughly EUR1 trillion every year until 2050.

Germany: Launched the Carbon Contracts for Difference (CCfD) Program

In March 2025, the Federal Ministry for Economic Affairs and Climate Action (BMWK) introduced the program as an innovative funding mechanism for global climate governance. Companies from energy-intensive industries like steel, chemical, and cement are eligible for up to EUR5 billion funding over 15 years if they cut emissions by 60% within three years and 90% by the end of the program. Unlike traditional short-term subsidies, the CCfD program employs 15-year climate protection contracts, encouraging companies to develop marketable, climate-friendly technologies. These innovations generate extra green revenue, further motivating businesses to reduce greenhouse gas emissions even more. The contract design features three key innovations: dynamic pricing, technology-neutral flexibility, and cross-border collaboration.

Japan: Revised its Fusion Energy Innovation Strategy

In June 2025, the Japanese government revised its Fusion Energy Innovation Strategy, aiming to industrialize fusion energy within a decade. It plans to produce commercial electricity from fusion energy by the 2030s and secure Japan's leadership in the global fusion energy landscape. The revised strategy underscores the transformative potential of fusion energy as an abundant, clean, and safe energy source. The strategy calls for a comprehensive



Carbon Dynamics

fusion energy ecosystem by enhancing collaboration among government, industry, and academic institutions, increasing investments, and boosting public understanding.

European Union: Announced Renewable Energy Funding for 16 African Nations

At the Global Gateway Forum, the President of the European Commission announced an EUR1.16 billion package to help 16 African countries shift toward green energy. The funding splits into two portions: EUR618 million will support projects in Nigeria, Togo, the Democratic Republic of the Congo, and other countries, while EUR360 million from the remaining EUR545 million will be allocated for building and modernizing power transmission lines in Côte d'Ivoire to secure rural power supply and reinforce connections between West African power pools.

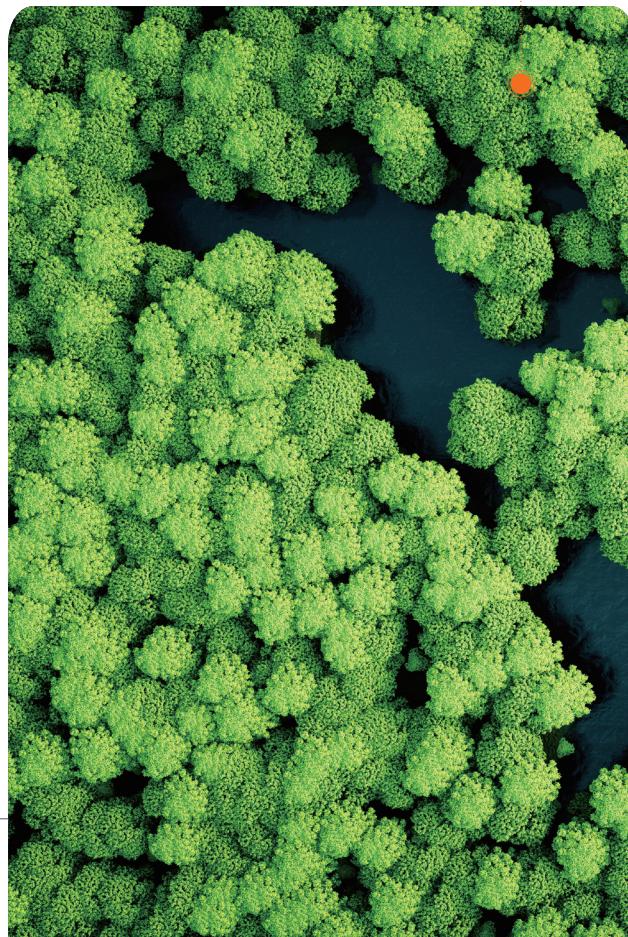
China and ASEAN: Defined Green Economy and New Energy for the First Time

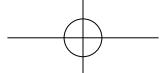
Under the ASEAN-China Free Trade Area (ACFTA) 3.0 Upgrade Protocol, both sides have laid out a comprehensive cooperation framework for the green economy, guided by the Global Development Initiative. For the first time, they have clearly outlined definitions for the green economy, new energy, clean energy, sustainable finance, and green skills. They commit to preventing the misuse of environmental standards for trade protection, removing trade barriers for eco-friendly products and services, and ensuring harmony between trade and environment.

National Energy Administration (NEA): Released the Guide for the Initiation of Energy Industry Standardization Projects (2025)

In March 2025, the Comprehensive Affairs Department of the NEA issued a notice on the guide. The notice highlights the importance of exploring emerging trends and requirements in energy development and reform. It calls for standardizing the energy industry to enhance energy

security and expedite the transition to green, low-carbon energy. The notice also calls for advancing new energy technologies, industries, and business models, with a focus on key areas and key technologies. The guide outlines several crucial areas for energy industry standardization projects in 2025, including electric power (safety and stability of power systems, thermal power, key technologies for power transmission and distribution, power demand management, power market, power supply services, power facilities, etc.), nuclear power, coal, oil, gas, new energy, renewable energy (PV, concentrated solar power, wind, hydro, and their integration), new energy storage, hydrogen energy, and more.





Clean Power Generation

European Union PV Policy: 30% Made in Europe

In May 2025, the European Commission issued four sub-legislation directives and a communication document under the Net Zero Industry Act (NZIA). The NZIA is a cornerstone of the EU's Green Deal Industrial Plan, directed at helping Europe produce at least 40% of its annual demand for net-zero technologies by 2030. Starting from December 30, 2025, non-price criteria must apply to at least 30% of renewable energy auctions in EU member states, averaging at least 6 GW per year per country. Member states are set to implement the new legislation since 2026, marking the beginning of full NZIA enforcement.

France: Planning to Slash its Solar Target for 2035

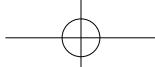
In early 2025, France initiated a final public consultation on the third Multiannual Energy Programming (Programmation pluriannuelle de l'énergie, PPE3),

proposing to scale back its solar target to 90 GW by 2035. Effective from 2025 to 2035, the latest PPE3 draft revises the solar PV target downward from 75–100 GW to 65–90 GW by 2035. The country expects to reach 54 GW of installed solar PV by 2030. To meet its 2030 and 2035 targets, France will commit to allocating or contracting at least 5 GW of solar PV capacity annually from 2025 to 2027 and increasing this to 7.5 GW annually from 2029 to 2030.

United Kingdom: Lifted Ban on Balcony PV Systems

In July 2025, the UK government published the UK Solar Roadmap, lifting the ban on plug-and-play balcony PV systems. This move allows renters and apartment residents to install solar equipment in their own homes. By tapping into the green energy potential of 57% of the population, this policy aims to drive the UK toward its 47 GW solar target by 2030. The roadmap outlines





Carbon Dynamics

several key initiatives, including reviewing the safety of portable plug-in solar panels for balcony use, allowing nationwide adoption of balcony PV systems in the next few years, and rolling out the £13.2 billion Warm Homes Plan to support solar PV installations in existing homes. Furthermore, the Future Homes Standard, set to take effect in the fall of 2025, mandates solar panels on all new homes while allowing minor flexibility in solar panel capacity for heavily shaded areas. These solar panels, alongside heat pumps and energy storage systems, will create a self-sustaining power cycle: generate, store, and consume.

Japan: Released the PV Challenges 2025

Japan's New Energy and Industrial Technology Development Organization (NEDO) unveiled PV Challenges 2025, a strategic plan to advance solar power generation under the country's 7th Strategic Energy Plan. NEDO identified four key challenges for large-scale PV adoption in Japan: land constraints, diverse market needs, long-term stability of solar power generation, and the recycling of end-of-life PV modules. To tackle these challenges, the strategy focuses on two key areas: strengthening industry competitiveness through research and development of high-value products and establishing a sustainable recycling system. Key actions include advancing the development and application of next-gen solar cells, supporting innovative designs for vehicle-mounted and building-integrated PV modules, enhancing operations and maintenance (O&M) technologies, and refining the technologies for separating and recycling PV modules.

Colombia: Invested US\$2.1 Billion to Install PV Systems for Low-Income Homes

The Colombian government has committed around US\$2.1 billion to implement the Colombian Solar Plan

from 2026 to 2030. This initiative will install rooftop PV systems in nearly 1.3 million low-income households.

Mexico: Defined the Role of Energy Storage Systems and Raised the Permit-Exempt Threshold for Distributed Power Generation

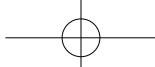
Mexico plans to add 8,412 MW of battery energy storage systems (BESS) between 2024 and 2038, as outlined in its Indicative Program for the Installation and Retirement of Power Plants (PIIRCE for its Spanish acronym). The new regulations mandate that energy storage equipment must now be registered as power plants and represented by electricity generators. Furthermore, the government will speed up the permitting procedure for self-consumption grid-tied plants with capacities of 0.7–20 MW, paving the way for small and medium-sized clean energy projects.

China's National Energy Administration: Issued the Management Measures for the Development and Construction of Distributed Photovoltaic Power Generation

In January 2025, the National Energy Administration issued these measurement measures to regulate and foster the growth of distributed PV power generation in line with emerging trends and needs. These measures establish a comprehensive regulatory framework for defining distributed PV power generation, as well as industry management, filing procedures, project implementation, grid connection, and regulatory supervision.

China's National Energy Administration: Advancing the "Sunshine for Thousands of Households" Initiative

In March 2025, the National Energy Administration issued a notice to further implement the initiative. The notice highlights voluntary farmer participation and market-driven development of distributed PV power



projects. Local authorities are encouraged to reinforce fair competition among developers, respect farmer choices in supporting industries, prevent monopolistic practices, and protect farmer interests. A total of 56 counties (cities or districts) were selected as pilot sites.

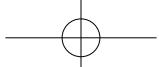
China: A High Growth Momentum for the Installed PV Capacity

According to the National Energy Administration, China's installed PV capacity has shown robust growth in 2025. From January to May, the new grid-connected PV capacity totaled almost 200 million kW, up 57% from a year earlier. China's installed PV capacity has surpassed 1 billion kW for the first time, hitting 1.08 billion kW. This equals the combined capacity of around 48 Three Gorges Power Plants, making up 30% of China's total installed power capacity and nearly half of the world's installed PV capacity.

China: Issued the Action Plan for Quality Development of the New Energy Storage Manufacturing Industry

Eight governmental authorities, including the Ministry of Industry and Information Technology, jointly issued the action plan to boost high-quality growth of the new energy storage manufacturing industry and create a growth engine by integrating next-gen IT and new energy. It emphasizes deepening supply-side structural reforms, balancing growth and security, and fostering the convergence of technological and industrial innovations. By 2027, the country aims to transform the industry into an advanced, intelligent, and eco-friendly one. The plan is incredibly significant, as it not only paves the way for a new energy system and a modern industrial framework but also enhances China's global standing in energy storage innovations and overall competitiveness.





Mobility Electrification



International Energy Agency: Released the Global EV Outlook 2025

In May 2025, the International Energy Agency reported that global electric vehicle (EV) sales hit 17 million in 2024, up 25% from the previous year. For the first time, EVs made up 20% of the global car market. In the first quarter of 2025, sales grew by 35% year over year, with annual sales projected to top 20 million—over 25% of total new car sales. In 2024, China sold more than 11 million EVs, nearly half of its new car sales. In the first quarter of 2025, both sales and production rose by more than 47% year over year. China represented 70% of global EV production and 40% of global EV exports in 2024.

Germany: Announced its 2025 Incentives for Electric Vehicle Purchases

In Germany, battery electric vehicles (BEVs) priced below EUR40,000 will now receive a subsidy of EUR6,000, while those priced higher will receive a subsidy of EUR5,000. This policy operates on a "first-come, first-served" basis and could help between 650,000 and 700,000 buyers. Funding of the subsidy will be shared equally between

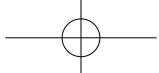
the government and automakers, and will take effect immediately. Compared to the previous policy, the new subsidy is 50% higher than before, totaling nearly EUR4 billion. This move underscores Germany's commitment to advancing electric vehicle adoption.

South Korea: Released Measures to Strengthen the Competitiveness of Electric Vehicles and Rechargeable Batteries

South Korea announced the comprehensive plan to revitalize its electric vehicle industry. By 2027, the country aims to commercialize level-4 autonomous driving. To accomplish this target, South Korea developed an Autonomous Driving R&D Roadmap in the first half of 2025 through cross-department collaboration and planned to finish building a comprehensive control platform for self-driving vehicles by late 2026.

New Zealand: Accelerating the Rollout of Public EV Chargers

The New Zealand government plans to change its investment and collaboration strategy with the private sector to speed up the rollout of public EV chargers.



By the end of 2024, the country had 1,378 public EV chargers, roughly one for every 84 EVs. The government is targeting 10,000 public chargers by 2030, equivalent to one for every 40 EVs. This move will make owning an EV a lot easier. EVs now make up over 2% of New Zealand's light vehicle fleet and are projected to make up around 11% by 2030. Inspired by the success of the ultra-fast broadband model, the government is moving to a more mature and commercial procurement model.

China: Issued the Notice on Promoting the Scientific Planning and Construction of High-Power Charging Facilities

On July 7, 2025, the National Development and Reform Commission, along with three other governmental authorities, issued a notice outlining a plan to install over 100,000 high-power charging facilities nationwide by the end of 2027 while continuously improving charging service quality and technological application. The launch of this policy signals China's shift into the high-power era of electric vehicle (EV) infrastructure. By alleviating charging shortages during peak demand, the initiative accelerates EV market growth, drives advancements in next-gen electric power systems, and steers the transport sector toward green, low-carbon energy systems.

China: Issued the Notice on Continuing the Car Trade-in Program in 2025

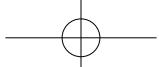
The Ministry of Commerce, along with seven other government bodies, announced in January 2025 that fuel-powered vehicles meeting the IV emission standard are now eligible for subsidies. Consumers who scrap their old cars and buy electric vehicles (EVs) can receive a subsidy of up to CNY20,000, while those who opt for fuel-powered vehicles can get a subsidy of CNY15,000. Since the policy was launched, EV trade-in orders in the first quarter skyrocketed by 120% year over year. Notably, brands like BYD and NIO captured over 60% of the trade-in orders in the Yangtze River Delta region.

China: Started Accepting Applications for its 2025 Pilot Program to Expand EV Charging and Battery Swapping Facilities Across Counties

The Ministry of Finance, Ministry of Industry and Information Technology, and Ministry of Transport jointly issued a notice inviting applications for the 2025 pilot program. The program encourages collaboration between at least two counties to undertake pilot tasks and assess their performance together as one pilot site. In 2025, a total of 75 pilot counties will be selected for the pilot program. The number of pilot counties per province depends on factors such as EV market growth and potential, availability of public charging facilities and battery swapping facilities, area size, the number of counties or county-level cities, financial health, and the registration and performance of these facilities on the 2024 Reward Fund Settlement Platform.

China: Multiple Governmental Authorities Collaborate to Drive the Integration of Transport and Energy Sectors

The Ministry of Transport, along with nine other governmental authorities, unveiled guidelines to advance the integration of the transport and energy sectors. By 2027, a coordinated development framework across multiple departments will be largely established. Electricity is expected to make up 10% of the transport sector's energy consumption, while at least 5 million kW of non-fossil energy capacity will be installed along the transport infrastructure, with a steady increase in both local and nearby consumption. Meanwhile, the share of electric vehicles (EVs) in annual vehicle sales is expected to grow and the green fuel production capacity for the transport sector will expand significantly. By 2035, the transport and new energy sectors will be fully integrated, creating a clean, low-carbon, smart, efficient, and technologically innovative energy system for the transport sector. Battery electric vehicles are projected to dominate new vehicle sales.



ICT Infrastructure

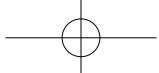
European Union: Released the AI Continent Action Plan to Set Course for Its AI Leadership Across Five Key Pillars

In April 2025, the European Commission launched an ambitious plan to boost the EU's position in the global AI landscape by leveraging its industry ecosystem and institutional strengths. The initiative hinges on five key pillars: strengthening AI computing infrastructure, advancing high-quality data development, fostering AI adoption in strategic sectors, enhancing AI skills and talent, and simplifying regulatory frameworks.

India: Proposed the National Data Center Policy 2025

The Indian government's policy offers up to 20 years of tax exemptions for data center developers who meet capacity, energy efficiency, and employment targets. The policy also calls for input tax credit on Goods and Services Tax (GST) for capital assets (such as construction, cooling, and air conditioning equipment) and wider use of renewable energy. Meanwhile, a "single window clearance" mechanism will be set up to speed up approvals for data center establishments like land acquisition and power assurance.





Brazil: Introduced REDATA to Strengthen Data Center Services and Cloud Infrastructure

In September 2025, Brazil's federal government enacted the provisional measure MP No. 1.318/2025 (commonly known as REDATA) to establish a special tax regime for data center services. This initiative aims to reduce the costs of building and operating data centers. Earlier, the federal Ministry of Finance suggested removing major taxes (PIS, COFINS, IPI, and import duties) to attract large AI-focused data centers. Some states are also considering waiving the ICMS sales tax on data center equipment to align with federal initiatives.

African Union: Released the AU Data Policy Framework to Enhance Data Infrastructure and Sovereign Governance

The framework views data and its supporting infrastructure (including data centers and connectivity networks) as strategic assets. Member states are tasked with creating a localized, cross-border, and trustworthy data ecosystem. The framework also stresses the importance of building national digital infrastructure, such as data centers and high-performance networks, to form the backbone of the continent's digital economy. The African Union advocates for increased investments in these areas. African countries like South Africa are progressing with new spectrum plans for 5G/6G deployment and promoting shared infrastructure to reduce resource duplication.

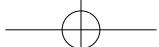
China: Green Energy Sources Will Supply 80% of Electricity for National Hubs' New Data Centers by 2025

In March 2025, the National Development and Reform Commission, National Energy Administration,

and National Data Administration jointly issued the "Opinions on Boosting the Green Electricity Certificate Market (GEC) for Renewable Energy Expansion". The document outlines several key measures to achieve the country's carbon peak and neutrality goals: building a solid accounting system to track and verify green electricity usage data; increasing GEC adoption in data centers; expanding green electricity supply to data centers; modernizing small, scattered, or energy-inefficient data centers for better energy performance; creating green large-scale data centers at national hubs; optimizing the distribution of compute resources; and more. By 2025, the goal is to have 80% of the electricity consumed by national hubs' new data centers come from renewable energy sources, with plans to raise this share even further.

China Academy of Information and Communications Technology (CAICT): Released "Research Report on the Panorama of Liquid Cooling Industry in Intelligent Computing Center (2025)"

China's liquid cooling market for intelligent computing centers hit CNY18.4 billion in 2024, up 66.1% from 2023, and this figure will soar past CNY130 billion by 2029, according to the report unveiled by the CAICT. The report highlights that liquid cooling technology has become a "must-have" for intelligent computing centers. This technology, compared to traditional air cooling solutions, is simpler and cuts out some energy-intensive equipment, reducing operating costs significantly for intelligent computing centers. It not only addresses heat dissipation issues common in AI servers with high power density, but also plays a crucial role in new energy infrastructure, such as energy storage and ultra-fast charging stations.



Cover Story



Rooted in Sunlight: A "World Tree" That Powers the Planet

Across cultures, the myth of a "World Tree" is a common thread.

In Norse mythology, the world tree is called Yggdrasil, a giant ash tree that connects the Nine Worlds, including Asgard (the home of the gods) and Midgard (the home of humans). In Mayan culture, the world tree is called Yaxche (tree of life), which is the center of the universe and connects the entire human world. And in Chinese mythology, the world tree is called Fusang, which is the dwelling place of the Sun.

Scattered across diverse continents, cultures, languages, and civilizations, these world trees embody a universal human yearning for the cycle of life and reverence for nature. We aspire to plant a tree that can connect the entire world to protect our home and future.

Today, we are nurturing such a world tree. Its seeds are

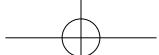
humanity's ambition for carbon neutrality. Its roots run deep in the energy revolution and digitalization. Its leaves unfurl as solar PV plants. And its canopy shelters the future of green living and zero-carbon production.

We call this world tree the Global Energy Revolution. As the wind stirs its branches, its protective shade stretches across continents, touching every corner of the Earth. This article traces the journey of this living symbol.

Renewable Energy Reaches the Caribbean Coast

Nestled in the northwestern Caribbean Sea, Essex Valley is a lush basin cradled by tropical rainforests that have thrived for millions of years. Home to Jamaica's most fertile soil, it is an agricultural center in South America.

However, the valley now faces mounting challenges, with agricultural productivity under pressure and local farmers' livelihoods at risk. Jamaica's reliance on imported fossil fuels



has kept energy costs high and resulted in an unstable power supply—factors that have contributed significantly to the valley's challenges. A typical household spends a substantial portion of its income on electricity bills. These issues make it nearly impossible to modernize farming practices, and many people have been forced to leave this productive land.

But change has arrived. In 2024, Jamaica commissioned four PV plants in Essex Valley, with a total installed capacity of 3,500 kW and 7,000 kWh of energy storage systems (ESSs). While these plants might not offer the highest installed capacity and power output in the PV industry, they have provided affordable, stable electricity to the region, helping address the severe energy shortage in Essex Valley.

As of December 2024, about 750 million people worldwide lacked access to electricity, according to International Energy Agency data. In Africa, South America, and Asia Pacific, countless people continue to wait for stable electricity—similar to the farmers in Essex Valley. New power generation systems, led by PV, have extended the branches of the energy revolution deep into the Essex Valley and countless other areas waiting for energy.

The defining characteristic of this world tree is its ability to

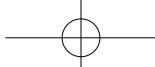
make energy truly accessible to every region and every person.

At the Foot of Alps, Solar Leaves on the Roof

Innsbruck, Austria, nestled in the foothills of the Alps, is a world-renowned ski destination that attracts over 10 million visitors each year. To support this vibrant tourism economy, local businesses place heavy demands on electricity resources. Yet despite such high energy needs, the community remains deeply committed to preserving the pristine alpine environment. Driven by the vision of harmony between electricity and nature, the locals have embraced renewable energy solutions.

Today, rooftop PV systems have become the town's most favored option. The largest in Innsbruck is a 7,838 square meters commercial complex equipped with a 1,750 kW rooftop PV system. The returns are clear. Austria's industrial power costs 0.15–0.25 euros per kWh, whereas this system produces power at 0.035 euros per kWh, resulting in substantial savings for investors.

Austria's Renewable Energy Expansion Act mandates the installation of 1 million solar rooftops by 2030 to achieve 100% green power. To meet these targets, a technology-driven rooftop PV revolution is underway in the snowy mountains. At



Cover Story

Innsbruck's commercial complex, Huawei Digital Power's 150 kW PV inverters continuously produce green power. These inverters, which feature a conversion efficiency of nearly 99% and a unique DC short-circuit protection system, ensure the safe and stable operation of the entire plant.

The leaves of sunlight unfurling across the alpine town and flourishing on billions of rooftops worldwide herald the arrival of the energy revolution. And the continued efforts of every household illuminate the path to global carbon neutrality.

On the Coast of the Red Sea, the Root of a City's Energy Storage

Saudi Arabia's Red Sea destination has become one of the world's most coveted travel havens. Spanning over 28,000 square kilometers with pristine sea and desert, this "city of tomorrow" is a breathtaking holiday paradise where planes and ferries link over 50 luxury hotels, dozens of private islands, exclusive diving sites, and world-class golf courses.

The Red Sea destination is powered by a stand-alone microgrid designed to eliminate dependency on fossil fuels, relying solely on renewable energy. Solar power will serve as the main energy source, though its inherent intermittency— influenced by the changing natural environment—poses challenges for building a safe and stable energy system that supports the operation of an entire city. To address this, leading global energy solution providers were invited to propose their solutions. Huawei Digital Power ultimately emerged as the sole supplier of core power-generation equipment for this futuristic system, thanks to its innovative

grid-forming energy storage solution.

To meet the energy needs of The Red Sea destination, Huawei Digital Power uses digital technologies to set voltage reference signals in the ESS. This enables each ESS to function as an independent generator and stably output the required voltage and frequency, responding instantly to grid fluctuations with self-regulating precision akin to conventional plants. Because of the proactive role these ESSs play in grid stabilization, they are collectively called a "grid-forming ESS."

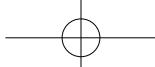
In May 2025, this project was recognized by Guinness World Records as the "world's largest off-grid battery energy storage project by capacity." Grid-forming ESS enables the energy miracle of a future city, and proves that "using bits to manage watts" is the key to the global energy revolution.

As the energy storage market enters a phase of rapid expansion, the shift from traditional energy storage to grid-forming ESS is becoming a defining trend in the global pursuit of carbon neutrality. At the root of energy storage, a new era of energy is taking shape.

On the Roof of the World, the Energy Revolution Fruit of Hydro-Solar Hybrid

Ganzi, China—part of the Qinghai-Xizang Plateau, often called the "roof of the world"—is renowned for its breathtaking natural beauty and abundant solar resources, far surpassing those of the lowlands. With an average of 2,000 hours of sunshine annually, the area represents a prime location for solar energy.





Rooted in Sunlight: A "World Tree" That Powers the Planet

However, the environment there is a harsh and remote one. Marking humanity's first energy matrix built on 4,600 m of permafrost is the Kela PV Plant, which boasts a total installed capacity of 1 GW and an annual energy yield of 2 billion kWh. On the snowy plateau in the cold winter, the PV plant faces severe challenges, including temperatures as low as -30°C and relentless level-13 winds. Such challenges make conventional inspection and maintenance impossible.

The Kela PV Plant leverages advanced digital capabilities as a critical enabler for its operation. Over 5,300 smart string inverters are deployed across more than 2 million PV modules spanning 16 million square meters. These inverters diagnose PV string health in real time, tracking each module's "vital signs" with precision. Featuring IP66 protection, they ensure reliable performance even during gales and snowstorms, significantly reducing the plant's operations and maintenance (O&M) challenges. The string diagnosis technology enables comprehensive online health checking of PV strings, boosting O&M efficiency by more than 70%.

Ensuring stable green power output at such a large-scale PV plant on the plateau was challenging. But to achieve this, the Kela PV Plant adopted an ingenious solution—a hydro-solar hybrid.

Instead of feeding PV energy directly into the grid, the plant transmits it to the Lianghekou Hydropower Plant, located 50 km away. On sunny days with abundant solar energy, the hydropower plant scales back hydro output to conserve water. Conversely, when solar generation dips, the plant augments output by releasing stored water to generate electricity. This way, the two systems complement each other, delivering green and stable power to the grid.

The Yalong River clean energy base (including the Kela PV Plant) is expected to achieve a total capacity exceeding 80 million kW after completion, making it the world's largest utility-scale renewable project. Even in the face of adversity, people can leverage intelligence and technology to overcome challenges and unlock the benefits of the energy revolution.

Global Energy Revolution, the Tree of Life

Achieving global carbon neutrality and reshaping the energy mix around renewable, electricity-centered solutions have become a shared dream. It has taken root in the fertile soil of energy systems and digital intelligence technologies, manifesting in the energy revolution landscape we explore in this article.

Deep within the rainforests of Jamaica, the construction of a renewable energy system is easing people's anxieties about access to power. It stands as a vital key to reducing poverty and improving livelihoods.

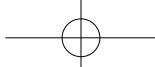
Across the Alps and beyond, everyday encounters with renewable energy are multiplying through the adoption of rooftop PV and other accessible solutions. Homes and shopping malls have transitioned from consumers to key nodes of power generation and storage, bringing zero-carbon living within reach.

With grid-forming ESS as the foundation, a new model of urban energy planning is taking shape. From the pioneering energy system of The Red Sea destination to the evolving innovations in our cities, a sustainable energy future is steadily unfolding. Perhaps every city will eventually become a city of the future.

Hydro and solar energy complement each other, offering abundant power even in the most barren and unforgiving landscapes. Progress is being made to address the global challenge of integrating renewables into the grid, and the reality of clean energy becoming the dominant source is closer than ever.

This energy revolution is the world tree planted by our generation. Its vigorous growth spans every corner of the planet, providing inexhaustible, eco-friendly energy to all. It is both the tree of global energy revolution and the tree of life for humanity's future.

There is no greater spectacle than witnessing this myth unfold before our eyes. ▲



From Grid Following to Grid Forming: Exploring High-Quality Development Pathways for the Global Renewable Energy Industry

2025 marks a pivotal moment for the renewable energy industry, transitioning from "quantitative accumulation" to a "qualitative leap." The industry landscape is shifting from rapid, policy-driven expansion toward market-led, high-quality development and autonomous profitability. As the cornerstone of new power systems, renewable energy sources like solar and wind can only support the grid's safe, stable, and sustainable operations by using technological innovation as the engine and high quality as the core.

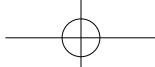
The International Energy Agency (IEA) predicts that in 2025, electricity generation from renewables will surpass that from coal for the first time, with coal's share falling below 33%, a first in nearly 100 years. By 2027, solar PV is expected to become the world's second-largest low-emission source of electricity, trailing hydropower. Building new power systems dominated by renewable energy sources will advance the sustainable development of digital, intelligent, and green energy.

Soaring Renewable Energy Sources

As fossil fuels recede, green electricity blossoms across the land. In 2025, driven by the combined effects of

policy, technological innovation, market expansion, and application penetration, the global renewable energy industry is transitioning from scale growth to quality improvement. Breakthroughs in solar PV and wind power efficiency, diversified applications for energy storage and hydrogen, and the revival of nuclear power collectively propel the energy mix toward a cleaner, safer, and more energy-efficient future.

2025 proved to be a critical turning point for the global energy transition. The IEA's *Renewables 2025* report indicates that from 2025 to 2030, global renewable power capacity is expected to grow by 4,600 GW, reaching 2.6



From Grid Following to Grid Forming: Exploring High-Quality Development Pathways for the Global Renewable Energy Industry

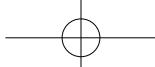


times the total capacity of 2022. Solar PV will account for nearly 80% of this growth and become the main driver. However, due to policy adjustments in some countries, the growth forecast for renewables from 2025 to 2030 has been revised down by 5% compared to 2024. Overall, while the global PV industry faces challenges such as slowing growth, overcapacity, and policy fragmentation in 2025, its fundamental, long-term upward trajectory remains unchanged.

As the global PV industry enters a period of rational development, the regional market landscape has also undergone significant changes. A pattern of steady growth

in Europe and a leadership role for emerging markets has become the new normal. For instance, regions like the Middle East, North Africa, and Southeast Asia are experiencing a surge in PV demand due to volatile fossil fuel prices and electricity shortages. Advancing the sustainable development of the PV market requires leveraging innovative technologies and system synergies. This can help achieve substantial cost reductions and efficiency gains while meeting the needs of diverse application scenarios.

In 2025, the global wind energy market navigated a complex landscape of challenges and opportunities.



Industry Outlook

The Global Wind Report 2025, published by the Global Wind Energy Council (GWEC), shows that in 2024, global new wind energy installations reached 117 GW, with cumulative capacity surpassing 1,136 GW. Offshore wind capacity is projected to exceed 230 GW globally by 2030. In the short term, the wind energy market will continue to face challenges, including policy changes, cost constraints, and grid connection bottlenecks. In the long run, however, the energy transition driven by carbon neutrality, the cost-reduction potential from technological breakthroughs, and the expansion potential of emerging markets will continue to support the industry's growth. Structurally, the steady scaling of onshore wind power and the accelerated growth of offshore wind power are becoming mainstream. GWEC's *Global Offshore Wind Report* (GOWR25) shows that by the end of 2024, global grid-connected offshore wind capacity reached 83 GW, enough to power 73 million homes. Experts suggest that 2025 served as a "springboard" for the wind energy industry's transformation. Companies that can overcome supply chain bottlenecks, adapt flexibly to policy changes, and master core technologies will dominate future global competition.

From an overall trend perspective, the global renewable energy storage market in 2025 can be summarized as "leapfrog growth in total volume, transition from a single technology to diverse technologies, and phased release of regional demand." According to BloombergNEF's forecast, the newly installed capacity of global renewable energy storage is expected to grow at a CAGR of 21% between 2025 and 2030, reaching 137 GW/442 GWh by 2030. From the demand side, energy storage demand in commercial & industrial markets is surging as businesses combine energy storage with PV for self-consumption and to feed surplus power back to the grid, thereby reducing energy costs. Emerging scenarios, such as data centers and battery swapping stations, are rapidly growing: the need for uninterrupted power supply in data centers drives the rapid development of energy storage applications, and distributed storage provides peak shaving and valley filling services for battery

swapping stations. In the residential storage sector, Europe is leading the global market, with residential storage becoming the main choice due to high residential electricity prices and stable subsidies. Residential storage in China is growing rapidly, particularly in rural areas, where the PV + residential storage model is becoming increasingly popular. It is foreseeable that, driven by both policy and market forces, grid-forming energy storage systems (ESSs), PV+ESS integration, and long-duration hydrogen ESSs will become key drivers of future energy storage development.

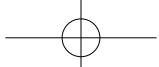
Technological Route Transition: Grid-Forming Technology Takes Center Stage

As the proportion of renewable energy sources continues to increase in the overall energy mix, it is crucial to ensure that these sources are integrated into the grid more stably and safely to maximize their value. Breakthroughs in core technologies, including upgrades to grid-forming inverters and grid-forming ESSs, are key to addressing stability issues in renewable energy grid integration and improving energy consumption efficiency.

The development of grid-forming inverters and grid-forming ESSs addresses a fundamental conflict: the traditional grid's reliance on synchronous generators for voltage and frequency support is incompatible with the intermittent nature of high-penetration renewable energy sources like wind and solar. By enabling renewable energy generation and storage equipment to actively form and stabilize the grid, grid-forming technology ensures safe and reliable integration of renewables. More than just technical upgrades, grid-forming inverters and grid-forming ESSs represent a paradigm shift. They function as the "heart and nerves" of new power systems. This evolution from merely connecting to the grid to actively forming the grid is a giant technological leap and an inevitable direction for the global energy transition.

(1) The Cornerstone of New Power Systems

In the context of high renewable energy penetration,



From Grid Following to Grid Forming: Exploring High-Quality Development Pathways for the Global Renewable Energy Industry

traditional power systems that rely on large-scale synchronous generators for inertia and voltage support are gradually being phased out. Grid-forming inverters and ESSs are being developed because they can precisely adapt to the core characteristics of new power systems: a high proportion of renewable energy and extensive use of power electronics. They effectively address problems such as insufficient grid inertia and weak anti-disturbance capability caused by renewable energy integration, thereby ensuring the balance of power supply and demand. By actively establishing voltage/frequency references, grid-forming inverters and ESSs essentially inject virtual inertia into the grid, thus becoming the underlying support for the stable operation of new power systems.

Due to the integration of high proportions of renewable energy, the explosive growth of distributed energy, and the impact of multiple load types, traditional power systems are struggling with stability control and flexible regulation. To address these challenges, Huawei Digital Power launched the world's first Smart String Grid Forming PV+ESS Solution in 2025, ushering in an era of full-scenario grid-forming. Centered on "True Grid-Forming, Full Intelligence, and High Quality," the solution achieved three key breakthroughs: upgrading from ESS-only grid forming to PV+ESS grid forming, from generation-side grid forming to all-scenario grid forming covering generation, transmission, distribution, and consumption, and from site visibility and manageability to full-link device-edge-cloud intelligence and full-lifecycle intelligent management. With comprehensive innovation across components, algorithms, equipment, and systems, the solution features six key capabilities: inertia response, primary frequency regulation, short circuit capacity, power oscillation damping, black start, and on/off-grid switching. It delivers leading performance in multi-machine parallel connection, oscillation damping, and reliability.

In regions with a large proportion of renewable energy generation, such as Xizang, Xinjiang, Inner Mongolia, and Qinghai, the application scale of grid-forming energy storage plants is gradually expanding. Huawei's Smart

String Grid Forming PV+ESS Solution will propel the industry from ESS-only grid forming to all-scenario grid forming, and from equipment-level management to full-link device-edge-cloud intelligence, and provide a replicable energy transition solution.

(2) Deep Synergy of Generation, Grid, Load, and Storage Is the Only Path

As the high proportion of renewable energy integration intensifies power system volatility, deep synergy among generation, grid, load, and storage is the only way to ensure safe and stable grid operation. This synergy achieves optimized coordination across the entire electricity chain (generation, transmission, consumption, and storage) by linking technologies and mechanisms. This collaborative model improves the utilization efficiency of renewable energy, optimizes energy resource allocation, and accelerates the evolution of power systems from the traditional "generation-follows-load" model toward low-carbon, flexible, and intelligent new power systems.

Grid-forming inverters are key equipment supporting the stable operation of new power systems. Unlike traditional grid-following inverters that rely on the grid voltage reference, grid-forming inverters actively establish voltage and frequency references. They provide virtual synchronous generator (VSG) characteristics even in weak-grid or islanded operating conditions, enhancing the system's inertia support and voltage stability. In power systems with a high proportion of renewable energy, grid-forming inverters can effectively enhance the grid's dynamic response and improve power quality. These inverters can provide the required grid-support capability for future power systems based on renewables.

Grid-forming ESSs connect generation, grid, load, and storage, enabling wind energy+PV+ESS systems to operate independently, supply power in islanded mode, and even perform system-level functions such as black start. In weak-grid areas, such as remote PV power plants, grid-forming ESSs can independently establish microgrids,



Industry Outlook

ensure reliable power supply to the load, and serve as the link that enables tight synergy among generation, grid, load, and storage.

In 2025, Huawei Digital Power collaborated with SchneiTec to build Cambodia's first energy storage plant. The 12 MWh project includes 2 MWh dedicated to validating the stabilizing effect of the Huawei Smart String Grid Forming ESS in off-grid and weak-grid scenarios. The project achieves a stable output from intermittent renewable energy sources and has received a TÜV SÜD certification.

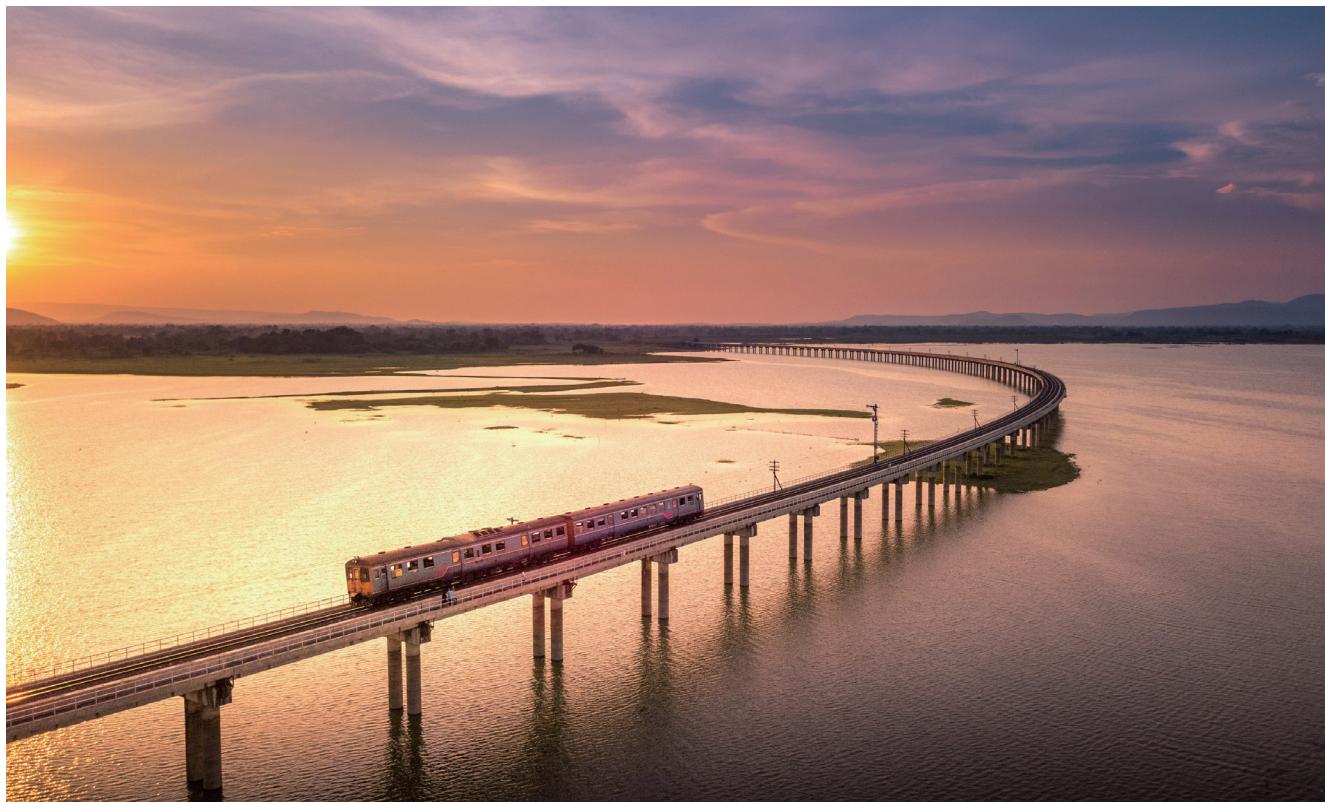
In conclusion, integrating grid-forming inverters and grid-forming ESSs enables distributed renewable energy to shift from grid-following to grid-forming mode.

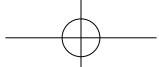
(3) Balancing Grid Safety and Flexibility

The increased penetration of renewable energy sources, such as wind and solar, is leading to greater frequency

fluctuations, voltage instability, and islanding in power systems. Grid-forming technology ensures grid stability through active support and intelligent control. This technology provides renewable energy sources with inertia support and reactive power regulation, enhancing stability by suppressing disturbances and fluctuations. This supports grid connection requirements in weak-grid conditions and emerging markets. In terms of flexibility, grid-forming technology removes dependence on strong grids, maintains stability in weak-grid and off-grid conditions, and adapts to supply-demand changes through stepless inertia adjustment. The world's largest 100% renewable-energy microgrid project, built by Huawei Digital Power in The Red Sea destination in Saudi Arabia, has been operating for over 2 years and continues to supply green electricity.

With its dual capabilities of active support and scenario adaptation, grid-forming technology addresses the reduced inertia and stability margin associated with integrating high levels of renewable energy into the grid.





From Grid Following to Grid Forming: Exploring High-Quality Development Pathways for the Global Renewable Energy Industry

(4) Accelerating Standardization, Continuous Market Evolution

The transition of any new technology from R&D to large-scale deployment relies on a systematic framework of standards and normative guidance. Standards are the compass for technological breakthroughs and the ballast for industrial implementation.

Internationally, the development of standards for grid-forming technology focuses on scenario-based functional definitions, with significant differences between countries: some focus on model verification, some emphasize functional detail, and others innovate with visual guidance. Despite these differing priorities and the lack of a unified international standard for grid-forming technology, the standardization process is undeniably accelerating. The UK, Australia, and China have already incorporated grid-forming technology into the technical requirements for energy storage and inverter projects. Grid-forming capability in inverters and energy storage equipment will likely become a non-negotiable prerequisite for future market entry.

China's systemic standardization effort follows a clear path from policies and pilot verification to association standards and national standards. For example, in 2023, the China Electrotechnical Society officially approved the release of the association standards: Technical Specification for Application of Grid-Forming Energy Storage System (T/CES 243-2023) and Test Specification for Application of Grid-Forming Energy Storage System (T/CES 244-2023), drafted by the China Electric Power Research Institute of State Grid Xinjiang and other companies. This was the first release of association standards in China for grid-forming energy storage technology, filling a gap in the domestic standards system for testing the connection and operation of grid-forming ESSs. With the successful deployment of leading grid-forming energy storage solutions in multiple countries, China's standards are rapidly going global.

Energy Storage Safety and Risk Governance: The Unbreakable Bottom Line

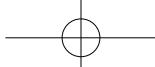
Grid-forming energy storage is currently entering a phase of rapid development. Application scenarios are expanding from power generation to distribution and consumption, with a corresponding increase in industry scale. However, alongside rapid growth, safety hazards are becoming increasingly prominent, and risk governance systems are not keeping pace with the development.

In July 2021, a fire occurred at an energy storage project in Victoria, Australia, completely igniting 13 tons of lithium-ion batteries in a single container. In February 2025, a fire broke out at a 50 MW/100 MWh energy storage plant in Scotland, UK, possibly linked to battery unit failure. In June 2025, a fire erupted at a 62 MWh lithium-ion battery energy storage plant in Pohang, Gyeongsangbuk-do, South Korea, the fifth such fire in South Korea since the start of 2025. These disastrous events expose the risks of thermal runaway and re-ignition, impacting public acceptance of and investment confidence in new energy.

Addressing these issues requires a focus on three areas:

Across the industry, there is a heavy emphasis on construction and use rather than on operation, maintenance, and decommissioning. To address this imbalance, standards development should encompass the entire ESS lifecycle, from initial design through final disposal. At the same time, specialized safety standards must be formulated, focusing on critical links. For instance, issuing specialized standards for core links with high fire accident rates to strengthen risk control. Specialized standards for emergency response should also be established.

European and North American countries have built a comprehensive, stringent system for energy storage safety that spans cell selection, battery management systems (BMSs), and electrical design. In the North American market, many regions have made UL 9540A certification



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a prerequisite for the grid connection of ESSs. Europe primarily relies on the International Electrical Commission (IEC) framework. Standards such as IEC 61508 impose strict monitoring requirements on BMSs. In recent years, some countries in the Asia-Pacific region have also gradually introduced relevant mandatory certifications. For instance, Malaysia requires batteries and ESSs to be certified by the Standards and Industrial Research Institute of Malaysia (SIRIM). Singapore requires ESSs to be certified by the Energy Market Authority (EMA) and energy storage plants to comply with NFPA 855 (Standard for the Installation of Stationary Energy Storage Systems). The Electrical Energy Storage Equipment - Safety Requirements Specification (SA TS 5398:2025), released by Standards Australia in July 2025, outlines the minimum safety requirements for original equipment manufacturers and importers. Japan requires residential ESSs to pass JET (Japan Electrical Safety & Environment Technology Laboratories) certification, and electrical equipment, such as power conversion systems (PCCs), to pass PSE (Product Safety Electrical Appliance & Material) certification.

In China, the standard GB 44240-2024 "Secondary lithium cells and batteries used in electrical energy storage systems—Safety requirements" has been officially implemented. This is China's first mandatory national safety standard for energy storage batteries. It upgrades the safety requirements for lithium batteries used in ESSs from an industry recommendation to a mandate, filling a critical regulatory gap in the renewable energy sector.

Second, from a technology and solutions perspective, systematic protection should be implemented, covering critical aspects such as cell selection, compartment isolation, intelligent warning, and fire-fighting linkage, to provide comprehensive safety assurance.

For instance, Huawei Digital Power's innovative triple-protection design for battery packs, string-level dual-stage architecture, and intelligent health diagnosis ensure the safety of ESSs throughout their lifecycle. Specifically, the battery pack is considered the minimum safety unit,

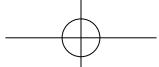
and a triple-insulation approach is used to prevent arcing, thermal propagation, and fire, in line with the mechanism of battery thermal runaway. The optimized architecture effectively prevents current backflow, maintains stable active power during high- and low-voltage ride-throughs, and supports rapid grid recovery. The leading digital management platform visualizes safety, facilitating management. The intelligent safety protection from the cell to the grid supports fault warning for up to 7 days, fault identification for over 30 types, and 24-hour real-time status detection.

Furthermore, Huawei Digital Power, in collaboration with the international authority DNV, conducted an extreme ignition test on its Smart String Grid Forming ESS to verify its safety protection capabilities under extreme burning conditions. Looking ahead, Huawei Digital Power will continue to provide customers with high-quality, high-safety PV+ESS solutions covering the entire lifecycle.

Third, from the perspective of establishing insurance and liability mechanisms, Europe has introduced specialized energy storage insurance to drive manufacturers to internalize safety as a competitive advantage. For instance, Altelium partnered with MS Amlin Underwriting to introduce the world's first data-driven battery energy storage insurance and warranty program. In China, the National Energy Administration (NEA) and other departments jointly issued the Notice on Strengthening the Safety Management of Electrochemical Energy Storage to effectively implement safety management responsibilities for electrochemical energy storage. Insurance companies in China have also built a diversified portfolio of energy storage insurance products.

High Quality: The New Blueprint

In September 2025, in a series of press conferences themed "High-Quality Completion of the 14th Five-Year Plan", the Ministry of Industry and Information Technology (MIIT) stated that it had collaborated with relevant departments to curb irrational competition in key industries such as electric vehicles and PV in accordance



From Grid Following to Grid Forming: Exploring High-Quality Development Pathways for the Global Renewable Energy Industry

with laws and regulations, and had achieved initial results. The shift from accelerated expansion to high-quality development, and from large-scale deployments to a focus on application and quality, poses new challenges for the renewable energy industry. It is also the inevitable result of the combined action of global standards improvement, resource constraints, technological changes, and societal demand.

From the perspective of safety and reliability, increasingly strict global standards are building the quality baseline. The North American UL 9540A standard covers detailed thermal runaway test methods and full-scenario testing, including high-temperature sodium batteries. The European IEC/EN standard has refined core indicators such as voltage support and fault ride-through. These high standards and strict requirements stem partly from painful lessons of safety incidents, and partly from emerging markets simultaneously raising the entry threshold, pushing companies to accelerate the transition from "connecting to the grid" to "connecting to the grid safely."

Full lifecycle management is strongly advancing the efficiency revolution. The EU's new Batteries Regulation mandates producers to bear full chain responsibility, sets specific recycling rate targets, and further extends environmental responsibilities. Japan and South Korea use cascading technology to give retired batteries a second life in the energy storage sector, enabling effective resource recycling. Countries are continuously improving product quality and safety and advancing sustainable development through policies, mechanisms, and technological innovation.

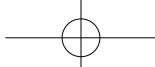
Digitalization and intelligent O&M will redefine the operational logic and pave the way for high-quality development. For instance, the application of "AI + energy storage" reshapes core aspects such as battery management, energy dispatch, and electricity trading, and drives the intelligent upgrade of the entire energy storage industry. Furthermore, many new energy storage projects

have introduced AI-driven predictive O&M to significantly reduce downtime risks and enhance asset lifespan and revenue stability. Technological upgrades have become the core drivers for quality improvement.

From an environmental and social responsibility perspective, leveraging renewable energy and new energy storage technologies significantly reduces emissions and substantially alleviates issues such as smog and acid rain. The widespread adoption of electric vehicles is changing driving habits, reducing reliance on fossil fuels, and lowering traffic congestion and air pollution. In Africa, AI-assisted hybrid power stations provide a stable power supply to hundreds of thousands of households. In Latin America, the deployment of energy storage projects has increased the proportion of women in employment. In Europe and North America, environmental, social, and governance (ESG) ratings directly influence corporate competitiveness. Environmental sustainability, social responsibility, and commercial value are no longer separate goals but a unified whole, mutually empowering one another.

In conclusion, high-quality development is the inevitable choice for the renewable energy industry to shift from a scale-driven mode to a value-driven one.

Huawei Digital Power's successful practices demonstrate that high-quality development does not slow progress; rather, it is the only path to ensuring industry sustainability. Huawei Digital Power has developed a comprehensive testing system that covers all scenarios, spans the entire R&D process, and encompasses all elements. The system improves quality standards, optimizes product and on-site deployment architectures, and enforces strict quality controls. Through modeling and simulation, the mark of "high quality" is imprinted on its products from the very beginning. Huawei Digital Power has developed ultra-high-precision models for Smart PV and energy storage equipment, achieving an error rate of 2% or less, far below the industry standard of 10%.



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For the testing phase, Huawei Digital Power has deployed five external test sites in Hainan, Gansu, Heilongjiang, and other locations to test in extreme environments, including extreme cold, heat, dryness, humidity, and high corrosivity. After launch, each product generation undergoes rigorous extreme-environment testing at these external test sites. For instance, to test performance in extreme cold, Huawei's testing department built a real -50°C environment for physical testing that maintained the extreme temperature for 3,000 to 4,000 hours.

Huawei Digital Power will continue to create high-quality, competitive products and services, enhance customer satisfaction and product quality, and accelerate the development of its digital power business.

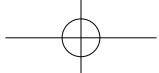
Business Model Innovation Accelerates Industry Transformation and Upgrade

When we examine the development trajectory of the global renewable energy market, it is clear that the early policy-driven model quickly spurred the industry. However, as the renewable energy industry continues to expand, a single policy driver is insufficient. The investment logic is bound to shift to a market-driven model, with the core focus on enabling renewable energy assets and achieving autonomous profitability through a diversified revenue portfolio. The combination of spot arbitrage, capacity market, green certificate/carbon market, and long-term power purchase agreement (PPA) is the optimal solution for this transition.

These four components are not isolated; they form a complementary, closed loop offering short-term to long-term revenues and basic to value-added returns. Spot arbitrage refers to capturing short-term revenue opportunities by flexibly adjusting generation/storage output to track real-time price differences between the peak and valley in the electricity spot market. It involves purchasing at low prices and selling at high prices to effectively increase an asset's short-term utilization rate. The capacity market primarily secures long-

term revenue safety. The grid pays a capacity fee to renewable energy projects to ensure supply reliability, offsetting the long-term revenue shortfall caused by the intermittency of renewable energy. The emergence of the green certificate/carbon market is to better activate environmental value. For example, EU Guarantees of Origin (GOs) and China's Green Electricity Certificates (GECs) are strong proofs of the clean attributes of electricity. They can be sold to enterprises with carbon-neutrality requirements. The carbon market allows monetizing a project's emission reductions. The Opinions on Promoting Green and Low-Carbon Transition and Strengthening the Construction of the National Carbon Market propose that by 2027, China's carbon emission trading market will essentially cover the main emission-intensive industries in the industrial sector. The national voluntary greenhouse gas emissions reduction trading market will cover all key sectors. Long-term PPA is the "anchor point" for revenue. Enterprises or the grid sign long-term agreements (5–20 years) with renewable energy projects, locking in basic electricity prices and generation volumes to mitigate the risk of long-term electricity price volatility, provide stable cash flow for the project, and eliminate the revenue uncertainty from early dependence on intermittent natural resources. In June 2023, Air Liquide Group in France signed a 9-year PPA with China Three Gorges Renewables and the China Three Gorges Jiangsu Branch, under which it trades 200,000 kWh of green electricity per year.

The core value of the preceding combination is to break the dependence of renewable energy on a single revenue source, and this has become the mainstream investment logic for renewable energy in various countries. This also means that renewable energy investment has entered the mature stage of market pricing and diversified profitability. Market mechanisms reshape revenue models, and cross-scenario integration unlocks ecological value. This requires enterprises to combine technological empowerment with ecological synergy to drive sustainable development in the renewable energy industry. ▲



Global Mobility Electrification: From Scaling Up to Quality Enhancement

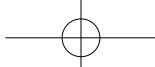
Mobility electrification still faces challenges, including insufficient charging infrastructure, fragmented standards, and high battery costs. Nevertheless, the industry is transitioning from pursuing scaling up to high-quality development driven by policy initiatives and technological innovation. This shift is being advanced through ecosystem improvements, strengthened full-lifecycle quality management, and business model innovation. These efforts herald the emergence of a new era of efficient, safe, and green intelligent mobility.

Did you know that 97 out of every 100 new cars on Norwegian roads are electric? In April 2025, the proportion of electric vehicles (EVs) in new registrations in Norway reached a record high of 97%. This is just the tip of an iceberg. According to a market research firm, global EV sales exceeded 1.7 million in August 2025,

up 15% year over year. Global EVs have entered a new stage of widespread adoption and mainstream acceptance.

Global EV Markets: Opportunities and Challenges

According to the International Energy Agency (IEA), global EV sales reached 17.5 million in 2024, a year-on-year



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increase of 28%, and market share exceeded 20% for the first time. Among them, the sales volume of battery electric vehicles (BEVs) was 11 million, accounting for 63% of the total EV sales; the sales volume of hybrid electric vehicles (HEVs) was 6.5 million, accounting for 37%. In leading markets such as Norway and Iceland, EV penetration has exceeded 30%, while it has reached 48% in China.

Despite challenges such as shifting government policies, economic downturns, and declining fuel prices impacting EV sales, their improving cost-efficiency ensures they will continue to grow at an impressive pace. According to the IEA's *Global EV Outlook*, EV sales worldwide will exceed 20 million in 2025, and global EV market share will surpass 40% before 2030. Markets in countries and regions reveal a "leading-mature-diverse" trend: China's EV sales overtook North America in 2015 and have since dominated globally. By 2024, China accounted for 65% of worldwide EV sales, solidifying its role as the primary driver of the global EV market expansion. Meanwhile, changes in subsidy policies have dampened growth in parts of Europe, while North America continues to see modest, steady increases in EV sales.

The rapid increase in EV sales directly drives battery demand (at the GWh level). In its December 2024 report *EV Battery Supply Chain Sustainability: Life Cycle Impacts and the Role of Recycling*, the IEA revealed that global battery demand surged to 850 GWh in 2023, a year-on-year increase of over 40%. EV batteries dominated this growth, accounting for a remarkable 90% of total demand. As technology advances, lithium iron phosphate (LFP) and nickel-manganese-cobalt (NMC) batteries have emerged as two major chemistries in the EV battery market. LFP batteries, known for their low cost and long service life, are increasingly used in passenger EVs and energy storage systems (ESSs).

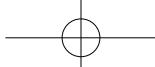
During the rapid adoption of EVs, electric buses for public transportation and electric heavy goods vehicles (HGVs) for logistics have been deployed on a large scale or at demo stations for promotion across Europe, China, and parts

of North America. Benefiting from strict environmental protection regulations, the penetration rate of electric HGVs in the European market keeps increasing. According to IEA's data, the global number of electric buses exceeded 820,000 in 2023. In 2026, the market will continue to demonstrate robust growth momentum. Shenzhen, China, has become the world's first city with a 100% electric bus fleet. It is projected that by 2030, over 10% of the global bus fleet will be electrified. As logistics fleets rapidly transition to electric power, their centralized charging needs as well as operations and maintenance (O&M) requirements differ sharply from those of traditional passenger vehicles. This shift demands special site design, energy management, and business models, presenting both opportunities and challenges.

Charging Infrastructure: Ongoing Efforts to Eliminate Range Anxiety

What is the greatest fear when you drive an EV? The battery is about to run out, but no charger is in sight. Reliable charging infrastructure is the "anchor" to relieve this anxiety. It not only powers your EV but also provides confidence for future trips.

As the global charging networks continue to expand, the number of public and private charging stations increases each year. Many countries have made substantial progress in DC fast charging and public network construction. According to the data from China's National Development and Reform Commission, by the end of October 2025, the total number of chargers in China reached 18.645 million, a year-on-year increase of 54%. China has built the world's largest-scale charging infrastructure system featuring the greatest number and variety of chargers and the widest service coverage. According to the EU's Alternative Fuels Infrastructure Regulation, a 150 kW fast charging station must be available every 60 km along highways by 2025, and HGV charging stations must exceed 350 kW. Japan plans to expand the total number of chargers to 300,000 by 2030. Southeast Asia has also begun accelerating the construction of charging infrastructure.



Global Mobility Electrification: From Scaling Up to Quality Enhancement

To effectively promote the rapid deployment of charging networks, challenges such as high construction costs, inconsistent technical standards, insufficient site resources, grid load pressure, complex operational management, and cybersecurity risks must be overcome. Charge point operators (CPOs) need to balance operational excellence and profitability while addressing hurdles such as diminishing policy and subsidy support, high operational expenses, low efficiency, and rapid technological change.

Huawei Digital Power is at the forefront of smart charging network innovation, delivering advanced solutions that empower CPOs and revolutionize user experiences through seamless integration of digital and power electronics technologies. The core strategy is to leverage liquid-cooled charging technologies, build a ubiquitous charging network with automakers and CPOs, integrate PV systems, ESSs, and chargers, and promote vehicle-to-grid (V2G) technologies, thereby enabling efficient energy utilization and global expansion.

1. Passenger Vehicle Market: Ultimate Experience Achieved by the Huawei FusionCharge Solution

The Huawei FusionCharge Solution is developed based on the levelized cost of electricity for charging (C-LCOE), delivering over 60% higher benefits than conventional systems in both highway and urban public charging scenarios. Huawei's liquid-cooled ultra-fast charging dispenser delivers a maximum output of 600 A, providing an ultimate charging experience.

The liquid-cooling design delivers unparalleled advantages: superior heat dissipation that extends device lifespan beyond 10 years; a wide charging voltage range from 200 V to 1,000 V, ensuring compatibility with existing and future EV models and supporting innovative technologies; quiet operation below 55 dB with robust device protection and high reliability; advanced triple protection for people, vehicles, and equipment through intelligent algorithms, precise current control, insulation design, key protection mechanisms, and safety control policies; and optimized

efficiency with power pooling and intelligent power scheduling that can double station turnover, alongside seamless AC or DC ESS deployment for peak shaving, eliminating the need for grid modernization and maximizing benefits for CPOs.

2. Commercial Vehicle Market: Ultra-fast Charging Achieved by the Huawei FusionCharge Megawatt Charging Solution

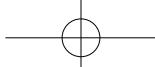
In 2025, Huawei released the FusionCharge Megawatt Charging Solution. As the industry's first liquid-cooled megawatt-level charging solution with a continuous, stable output of 2,400 A, it can charge HGVs at an ultra-fast speed. The liquid-cooling design meets the demanding environmental requirements of logistics and ensures high quality. Compared to traditional HGV solutions, Huawei's solution improves cargo efficiency by about 15%, and supports both commercial and passenger EVs. The integration of PV, ESS, and chargers enables time-of-use arbitrage, delivering significant benefits to CPOs.

EV Technology Evolution: Enhancing the Intelligent Driving Experience

Currently, EV technologies are advancing through breakthroughs across multiple dimensions, reshaping the industry. With megawatt charging now a reality, V2G and grid-to-vehicle (G2V) systems are being piloted in multiple regions. Cutting-edge advancements such as AI-powered smart charging networks and SiC-based powertrains are rapidly transforming the landscape. These innovations are driving the creation of a smarter, more efficient energy ecosystem for future mobility.

1. Battery Technologies

As EVs surge in popularity, solid-state batteries are emerging as future powerhouses, offering enhanced safety and superior energy density. Material innovation, structural optimization, and technology roadmap iteration are effectively increasing battery energy density. The laboratory energy density of all-solid-state batteries has exceeded



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400 Wh/kg. High-performance EVs now primarily rely on NMC or nickel-cobalt-aluminium (NCA) materials, which deliver high energy density and extended driving ranges. In terms of battery safety, stricter national and industry-wide standards have been consistently adopted, compelling companies to raise their technological benchmarks. More stable battery materials (such as high-nickel ternary and LFP) can be used, and battery pack structures are being improved to enhance protection against thermal runaway. Simultaneously, AI and big data analytics enable real-time battery detecting, automated fault isolation, and active safeguards against overheating, further improving overall battery safety.

2. Energy and Infrastructure

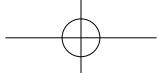
DC fast charging and ultra-fast charging technologies are evolving toward unified standards, higher efficiency, and broader applicability. To address range anxiety and accelerate electrification, the high-voltage, fast-charging platforms based on 800 V architecture are evolving rapidly. The global high-voltage fast-charging market thrives on rapid technological advancements, intense competition driven by standards, and substantial growth fueled by policy initiatives. Europe is planning a continent-wide "ultra-fast charging corridor," aiming for completion by 2030. Japan and South Korea are striving to capture next-generation technology opportunities through solid-state battery research and development (R&D). In the field of high-voltage fast-charging platforms, Huawei continues to demonstrate multidimensional technical breakthroughs and ecosystem integration capabilities, accelerating the adoption of high-voltage fast charging across all EV segments and redefining charging systems.

Charging infrastructure is evolving toward smarter, more advanced innovations. Smart charging infrastructure can accurately identify user requirements and provide customized charging services to ensure high safety and charging speed. The integration of smart charging, charging stations, and virtual power plants (VPPs) is

reshaping the energy ecosystem. It can optimize charging schedules, reduce electricity costs, and relieve pressure on power distribution networks. For example, through real-time interconnection between AI algorithms and V2G systems, charging stations can serve as flexible adjustment nodes for VPPs. Additionally, integrated PV+ESS+charger stations can prioritize PV power consumption and generate revenue through time-of-use arbitrage and ancillary services. The closed loop of "grid stability + green power consumption + user benefits" can upgrade standalone chargers into smart energy hubs.

Currently, V2G is becoming a competitive focus in global renewable energy technology. According to the *Notice on Promoting the Pilot Application of Vehicle-to-Grid Interaction* issued by China's National Development and Reform Commission, orderly EV charging will be fully promoted, and large-scale V2G projects will be expanded, guided by the principle of "innovation guidance and pilot first." For example, Guangzhou locals routinely benefit from charging during off-peak hours and discharging during peak hours. Automakers and energy enterprises are also intensifying cross-sector cooperation to jointly build PV+ESS+charger projects or participate in VPPs for peak shaving, advancing technologies beyond basic charge-discharge functions toward a vehicle-charger-grid-ESS ecosystem. Globally, core standards for bidirectional charging and discharging are taking shape and gaining momentum.

With full-stack self-development capabilities and an open ecosystem strategy, Huawei has achieved breakthroughs in technologies, products, and ecosystems through Smart Charging Network and DriveONE. The core value lies in innovation that transcends hardware—it redefines EV energy solutions and mobility experiences with groundbreaking approaches like "PV+ESS+charger microgrid" solutions and V2G interaction, establishing the "Huawei paradigm" for the worldwide shift toward mobility electrification. Huawei Smart Charging Network provides efficient charging support for all EV types, including



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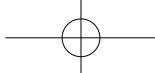
commercial and passenger EVs, across all scenarios. For example, the Huawei FusionCharge Solution and high-quality charging modules address the pain points of charging different EV models. Huawei's liquid-cooled ultra-fast charging dispenser delivers a maximum output power of 600 kW per charging connector, supporting commercial EVs such as heavy and light goods vehicles, as well as passenger EVs like sedans and sport utility vehicles (SUVs), eliminating range anxiety. High-quality charging modules support a wide voltage range to meet the charging requirements of different EV models (at different charging voltages), with an end-to-end system efficiency exceeding 96%. Potting and isolation technologies ensure long-term, reliable operation with an annual failure rate of less than 0.2%, reducing maintenance costs and enabling adaptation to various scenarios, including highway service areas and office parks. Huawei DriveONE enables automakers to

build better vehicles. Huawei offers three types of core solutions for automakers, which balance performance and user experience. The pure electric four-wheel drive system has a response time of less than 200 ms and supports precise power distribution, dynamically adjusting wheel-end torque during cornering to maintain stability. The DVP distributed drive integrates the motor and reducer near the wheels, saving chassis space, improving the transmission efficiency to 97%, and reducing energy consumption by 8%. The extended-range four-wheel drive system combines an extended-range generator and dual electric motors, offering substantial electric range, high efficiency, and strong power for an unparalleled driving experience.

3. Transportation + Intelligence

With AI, vehicle-infrastructure cooperation, big data, and





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other technologies as core drivers, the transportation system is transitioning from single-point intelligence to all-domain "vehicle-road-cloud-network-map" collaboration. A modern, efficient, safe, and sustainable transportation ecosystem is steadily taking shape. As large language models (LLMs) become the new normal, AI is shifting from cloud reliance to on-device deployment. Some manufacturers have launched mass production of vehicles with on-device LLMs, which deliver millisecond responses and seamless performance under a weak signal or without Internet connection. Multimodal interaction is the future. LLMs can integrate visual, voice, and graphical user interfaces to implement a "say what you see" paradigm.

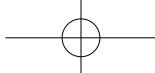
According to data from China's Ministry of Industry and Information Technology, the penetration rate of new vehicles with the L2 (partial driving automation) advanced driver assistance system (ADAS) reached 62.58% from January to July 2025. Morgan Stanley forecasts that the global market size for ADAS and autonomous driving (AD) software and hardware will reach US\$200 billion by 2030. In terms of intelligence, the automotive industry is advancing from intelligent cockpits and assisted driving to deeper integration with the vehicle motion domain, promoting a shift from localized to global intelligence. The collaborative development of powertrain electrification and motion-domain intelligence comprehensively improves user safety, energy efficiency, and driving experience. The motion domain provides a critical foundation for high-level automated driving and superior performance. Motion-domain intelligence is the foundation and cornerstone of vehicle intelligence.

Electrification of powertrain, the EV's "energy heart," has evolved from being a simple replacement for fuel engines to a full-link digital manager and controller. Currently, the powertrain in mainstream EVs is fully digital. Take Huawei Digital Power's ePowertrain for example. Its motor control unit (MCU) can implement microsecond-level current adjustment, and its battery management system (BMS) can check the voltage

and temperature of each battery cell in real time. This quantifiable and controllable digital capability enables power output to form a "command closed loop" with chassis control and intelligent driving path planning in the motion domain. The motion domain is the "controllable skeleton" of EVs. Previously, it mainly executed driving commands passively. Now, it has developed to support proactive perception, intelligent decision-making, and precise execution. Advanced intelligent driving requires the motion domain to provide millisecond-level response capabilities. Furthermore, user demand for customized driving experiences requires collaboration between the motion domain and the powertrain to adjust parameters, achieving a sense of unity between driver and vehicle. Therefore, the collaboration between powertrain electrification and motion-domain intelligence can effectively address the problem of "functional silos" in localized intelligence, enabling safety, energy efficiency, and driving experience in EVs to achieve a "1+1+1>3" effect.

Huawei Digital Power provides a solution that integrates hardware platforms, algorithm capabilities, and scenario adaptation to deliver a safer, more efficient, and smoother driving experience, reflected in the following three aspects:

- Precise protection: The core of Huawei Digital Power's safety solution is multi-domain sensor convergence and ultra-fast response of the drive-by-wire system. This approach shortens active response time from hundreds of milliseconds to just milliseconds, ensuring precise protection in diverse scenarios, including slippery roads, snowy conditions, and emergency braking. In snow or ice scenarios, vehicle posture is precisely managed through collaboration between the powertrain and motion domain. Upon detecting snow-covered roads, the powertrain engages torque-limitation mode, while the motion domain synchronously activates the electronic stability program (ESP) and steer-by-wire control to mitigate wheel slip and oversteer.



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• Long extended range: Huawei Digital Power reduces energy consumption across the powertrain and motion domain to achieve refined energy management, extending the vehicle range from 10 km/kWh to 12 km/kWh. On the battery side, the BMS ensures precise temperature control and electric charge management. On the motor side, the intelligent electric drive system leverages SiC power modules to achieve a motor efficiency up to 97.5%. At the vehicle level, the motion domain's active aerodynamic components work in tandem with the powertrain's efficient cruise mode, effectively reducing the vehicle's energy consumption per 100 km.

• Optimal driving experience: Huawei Digital Power refines the driving experience by seamlessly transitioning from individual component management to holistic precision control across the motion domain with integrated domain controllers and tailored parameters. For example, parameters can be customized for different drivers to achieve customized driving control. Through the linkage between the cockpit system and the motion domain, drivers can customize the steering feel, suspension stiffness, and power response speed in different modes, such as comfort, sports, eco, and snow modes, to meet requirements for various road conditions.

4. Business Model and Service Innovation

Driven by policies, technological iteration, and evolving demand, the operations and service models of mobility electrification are evolving from simple charging to multidimensional innovation in energy collaboration, scenario customization, and intelligent sharing. In terms of collaborative energy operations, V2G has become a core focus. For example, electric buses with V2G capability adopt a "charge at night, discharge by day" mode, boosting bus station energy utilization by 35%. Experts predict that annual sales of V2G-capable vehicles that will discharge power regularly in China will exceed 10 million by 2030. In scenario-based service customization, the integration of

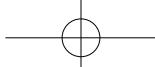
"mobility + service" has emerged as a new growth area. For example, an on-demand bus service in Hengqin, Zhuhai, uses AI to plan routes in real time and add temporary stops, achieving a ride-sharing rate of over 90% and reducing operating costs by 30% compared to conventional buses. Intelligent sharing and scheduling optimization can boost resource utilization. For example, intelligent scheduling algorithms can significantly improve bus punctuality. EV sharing helps build an operational ecosystem for on-demand allocation and efficient circulation.

Mobility Electrification: The Imperative for High-Quality Development

It is widely recognized that transportation is a fundamental, leading, and strategic sector within the national economy, essential for sustainable development. Governments are driving the shift toward green, low-carbon mobility, reinforcing the construction of sustainable infrastructure, and advancing intelligent, digital, and lightweight transportation equipment that uses renewable energy, thereby making travel cleaner and more sustainable. This outlines the direction for high-quality mobility electrification and injects strong momentum.

Governments worldwide continue to increase support for the EV industry and promote the development across the entire industry chain. Policies such as the EU Battery Regulation impose stricter lifecycle environmental requirements, pushing the industry to shift from scaling up to improving quality. China's *Opinions on Accelerating the Comprehensive Green Transformation of Economic and Social Development* calls for promoting low-carbon means of transportation, vigorously advancing EV adoption, and accelerating the electrification of urban public service vehicles.

Mobility electrification is no longer optional; it is imperative, as transportation remains a key driver of energy use and carbon emissions. Concept evolution, technological progress, and business model innovation will help resolve



Industry Outlook

key challenges, including high costs, battery safety concerns, inadequate charging infrastructure, and range anxiety.

To promote the high-quality development of mobility electrification, Huawei Digital Power has established a comprehensive advantage characterized by technology breakthroughs as the core, ecosystem collaboration as the driver, scenario implementation as the foundation, and quality and safety as the guardrail.

Through high-quality design, R&D, and testing, Huawei Digital Power has achieved full-chain technological innovation across vehicles, chargers, and grids. These advancements establish a robust technical competitiveness that enables seamless collaboration between on-board and off-board systems. Based on the liquid-cooled ultra-fast charging technology, Huawei Digital Power achieves ultra-fast charging for both passenger EVs and electric HGVs. The products can operate in extreme environments with temperatures ranging from -35°C to $+55^{\circ}\text{C}$. The innovative grid-forming PV+ESS+charger technology enables microgrids to operate in both on-grid and off-grid modes. In addition to reducing the impact of high-power charging on the power grid, the technology also increases revenue of charging stations through time-of-use pricing and green power consumption.

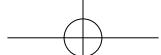
Huawei Digital Power is committed to building a win-win ecosystem for the entire industry chain and advancing industry development from fragmentation to unification. Huawei Digital Power collaborates with partners to expand the coverage of services from passenger EVs to commercial EVs. Additionally, Huawei Digital Power has initiated the Low-Carbon Freight Corridor Initiative for Electric Heavy Goods Vehicles to facilitate the transition of HGV charging infrastructure from limited, closed scenarios to comprehensive, all-scenario applications. Huawei Digital Power streamlines collaboration among vehicles, chargers, and batteries to promote an ecosystem

with unified standards, shared resources, and consistent experiences.

Huawei Digital Power is committed to large-scale deployment of customized, high-quality solutions. In the logistics industry, we have built the world's first 100 MW HGV charging station, the Beichuan station. In inter-city and highway scenarios, we have deployed ultra-fast charging networks to create ultra-fast charging circles with a 1 km radius. In urban and county scenarios, we provide charging for multiple vehicle models, including passenger vehicles, and light and heavy goods vehicles. In international markets, we have helped multiple countries implement liquid-cooled ultra-fast charging stations.

Huawei Digital Power always adheres to the fundamental principles of quality and safety, establishing a full-lifecycle assurance system that covers R&D, production, and O&M. For example, Huawei DriveONE features a three-dimensional quality system encompassing core quality, basic quality, and prime quality. By September 2025, Huawei had delivered more than 3.5 million DriveONE product sets for over 2 million vehicles. These vehicles experienced zero safety accidents after accumulating more than 30 billion kilometers. By deeply integrating digital and intelligent technologies, and applying image recognition and AI to enhance smart manufacturing capabilities, the Huawei Southern Factory has reduced the assembly defect rate by 56%. Furthermore, through a vehicle health report (VHR) warning mechanism, Huawei leverages data value, develops AI-based fault-warning capabilities, and achieves minute-level risk perception, facilitating a shift from passive maintenance to proactive service.

With the global EV market penetration rate steadily increasing, the coverage of high-quality charging infrastructure networks expanding, and the level of urban transportation intelligence continuously advancing, mobility electrification is entering a golden period rich in opportunities. ▲



Building a Fully Connected, Intelligent World

Huawei DriveONE High-Voltage SiC Distributed Power Platform

Enabling the Maextro S800 to Deliver Industry-Leading Performance

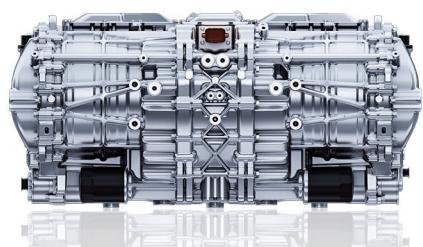
0-100 km/h in 4.3s
Powerful acceleration

Distributed vector torque control
Safe driving

800 V high-voltage extended range
Ultra-fast charging



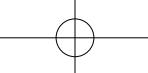
Huawei DriveONE: Built for Safety. Powered to Progress



DriveONE distributed motor



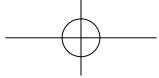
DriveONE extended-range 5-in-1 motor



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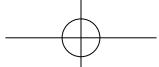
38 | Digital Power



Sichuan, China

In Ganzi Prefecture, the Kela Solar Plant features the world's largest installed capacity at the highest altitude (4,000–4,600 m). As the first phase of the hydro-solar hybrid project at the Lianghekou Dam on the Yalong River, the plant was successfully grid-connected in June 2023. With a solar installed capacity of 1 GW, it delivers an average annual energy yield of approximately 2 billion kWh. In December 2024, the 53 MW/106 MWh grid-forming energy storage system was commissioned as part of the hybrid project, significantly enhancing grid stability and renewable energy integration.



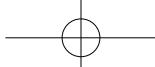


📍 Qinghai, China

The Golmud Solar Plant was the first utility-scale project to adopt string inverter technology and was grid-connected in 2014. Huawei inverters have since been rigorously tested in extreme environments, including severe cold and sandstorms, demonstrating an average annual failure rate of less than 0.3%. These inverters have operated reliably for over a decade.

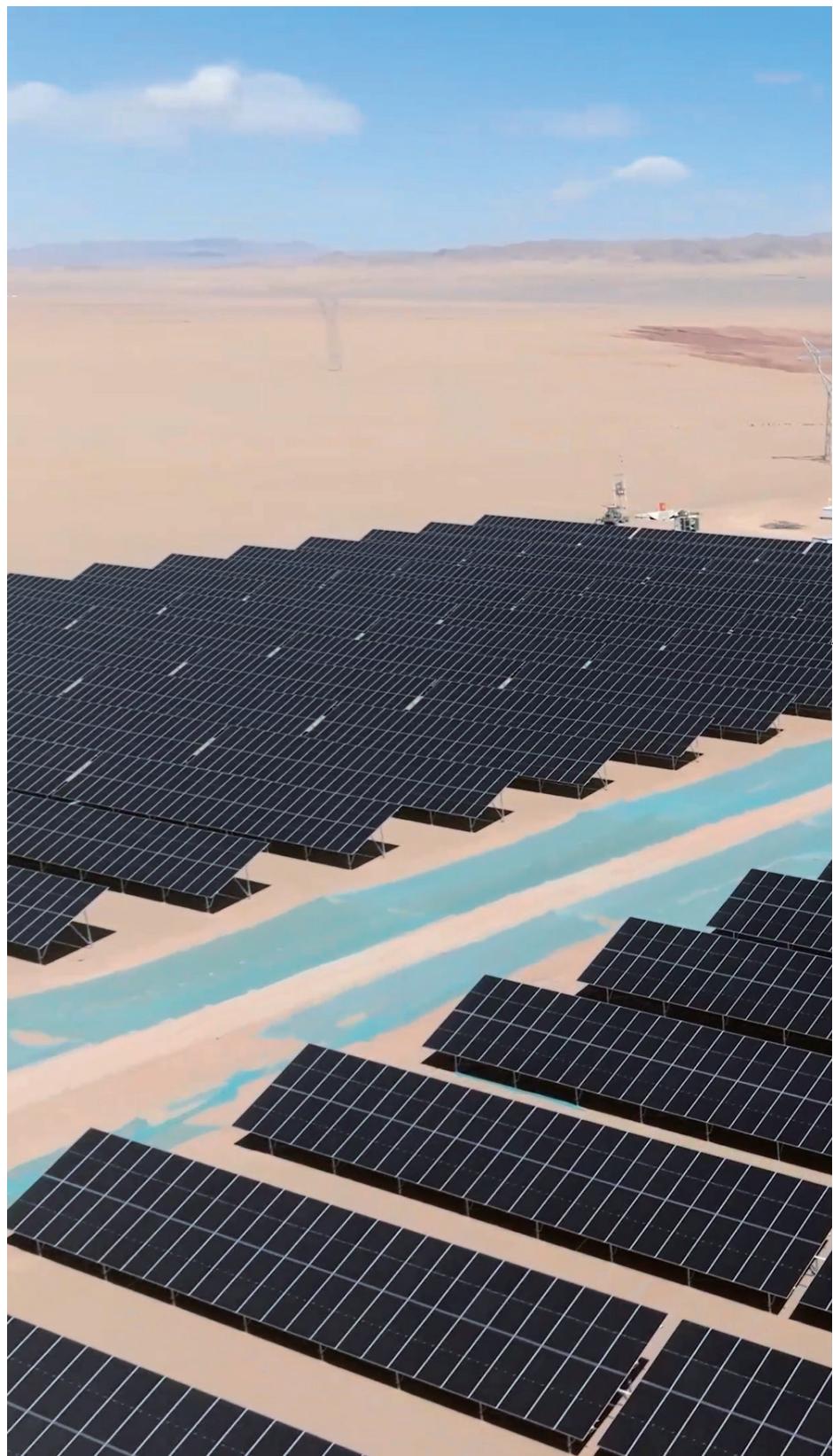


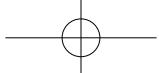


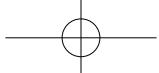


📍 Xizang, China

In November 2024, the 30 MW solar + 6 MW/24 MWh grid-forming energy storage project developed by ZDI in Gertse County, Ngari Prefecture, was officially switched from grid-following to grid-forming mode. In this high-altitude (approximately 4,600 m), low-temperature, and weak-grid environment, the solar output power has increased from 1.5 MW to 12 MW under full capacity in grid-forming mode. This significantly improves project owner revenue and ensures a stable, reliable power supply for residents during winter.





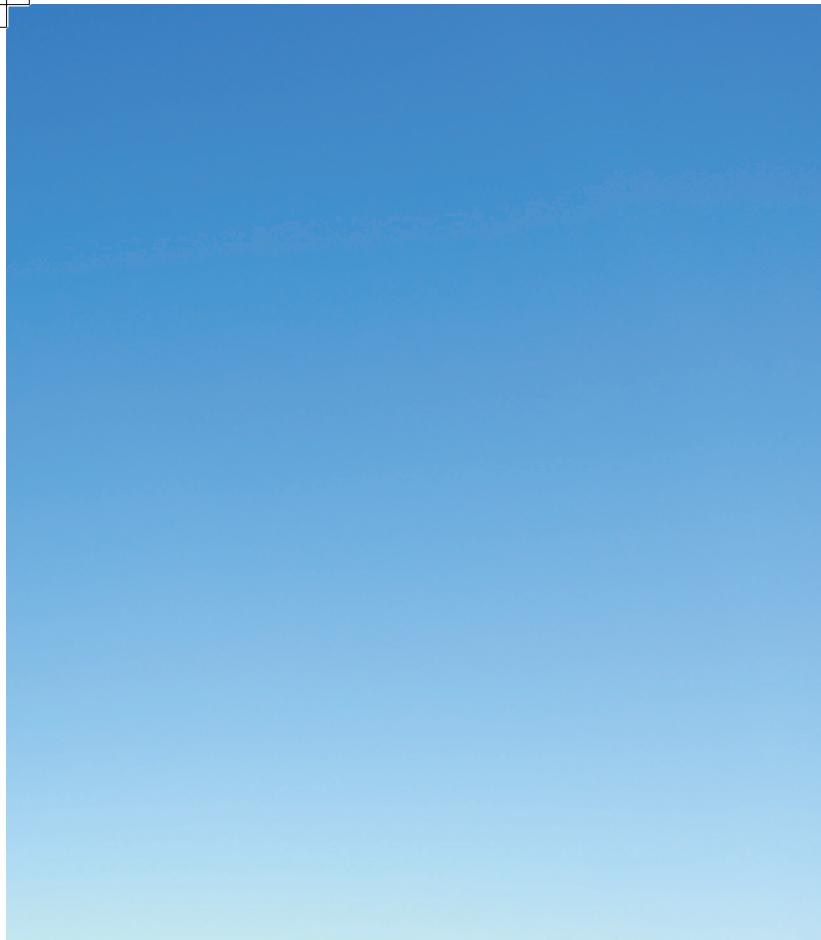
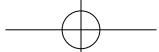


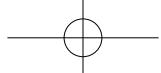
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📍 Shandong, China

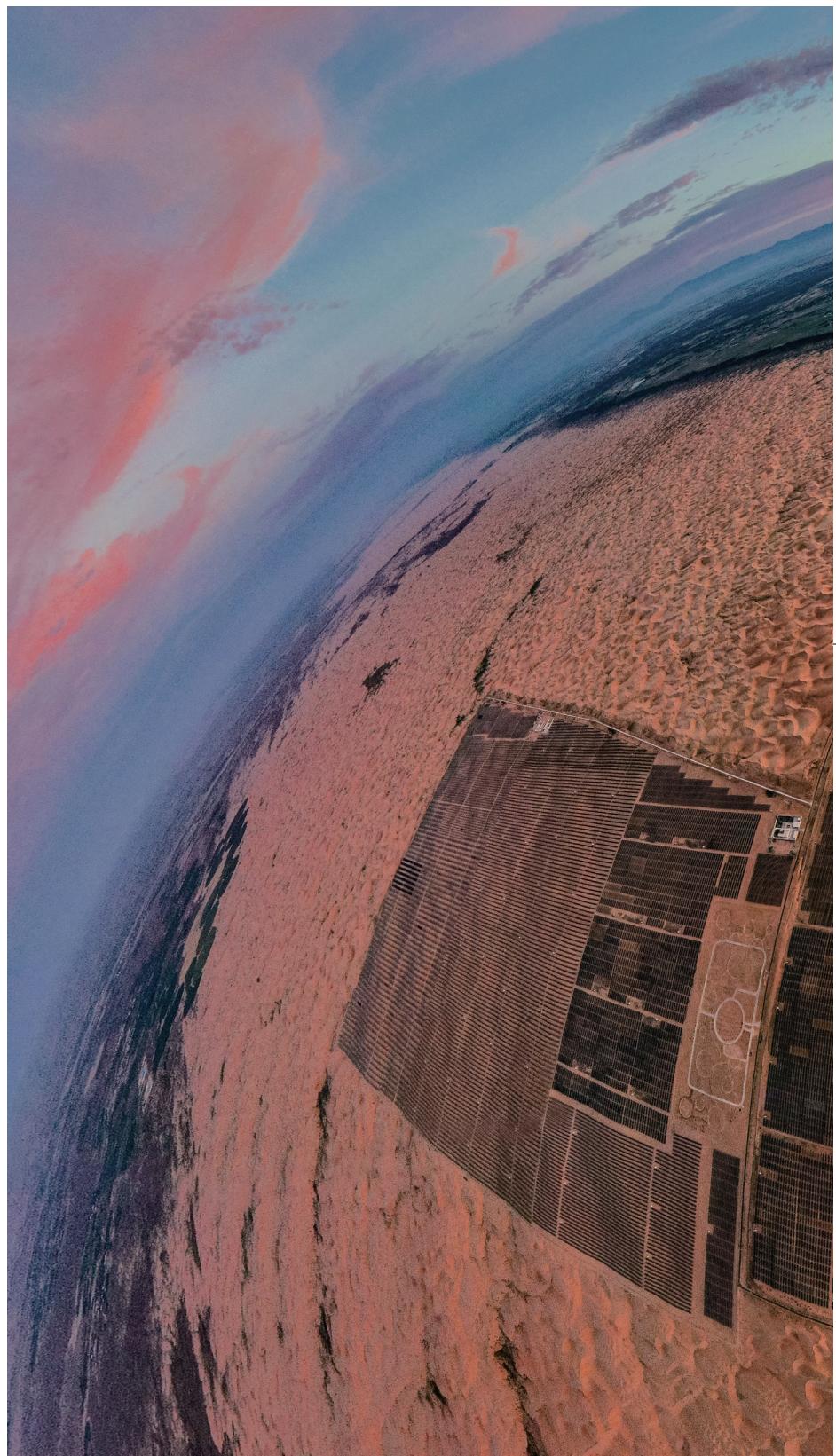
In Dongying, the 1 GW Guohua Investment HG14 Offshore Solar Project is the world's largest open-sea offshore solar plant, with an estimated annual energy yield of 1.78 billion kWh. By integrating fish farming and solar power generation, the project pioneers an innovative model of "upper solar generation, lower fish farming." With IP66 and C5 protection ratings, Huawei inverters withstand high temperatures, humidity, and salt mist, ensuring high-quality, stable operation of the plant.

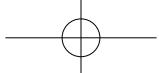


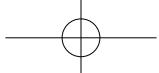


Inner Mongolia, China

The 300 MW Junma Solar Plant in the Kubuqi Desert, Inner Mongolia, uses Huawei inverters rated IP66, which are designed without fuses, fans, or other vulnerable components. The inverters can withstand harsh desert conditions, including high temperatures and sandstorms, ensuring reliable plant operation. By the end of September 2024, the plant had generated 3.8 billion kWh of green electricity and helped control desertification across 1,067 hectares of previously barren land.

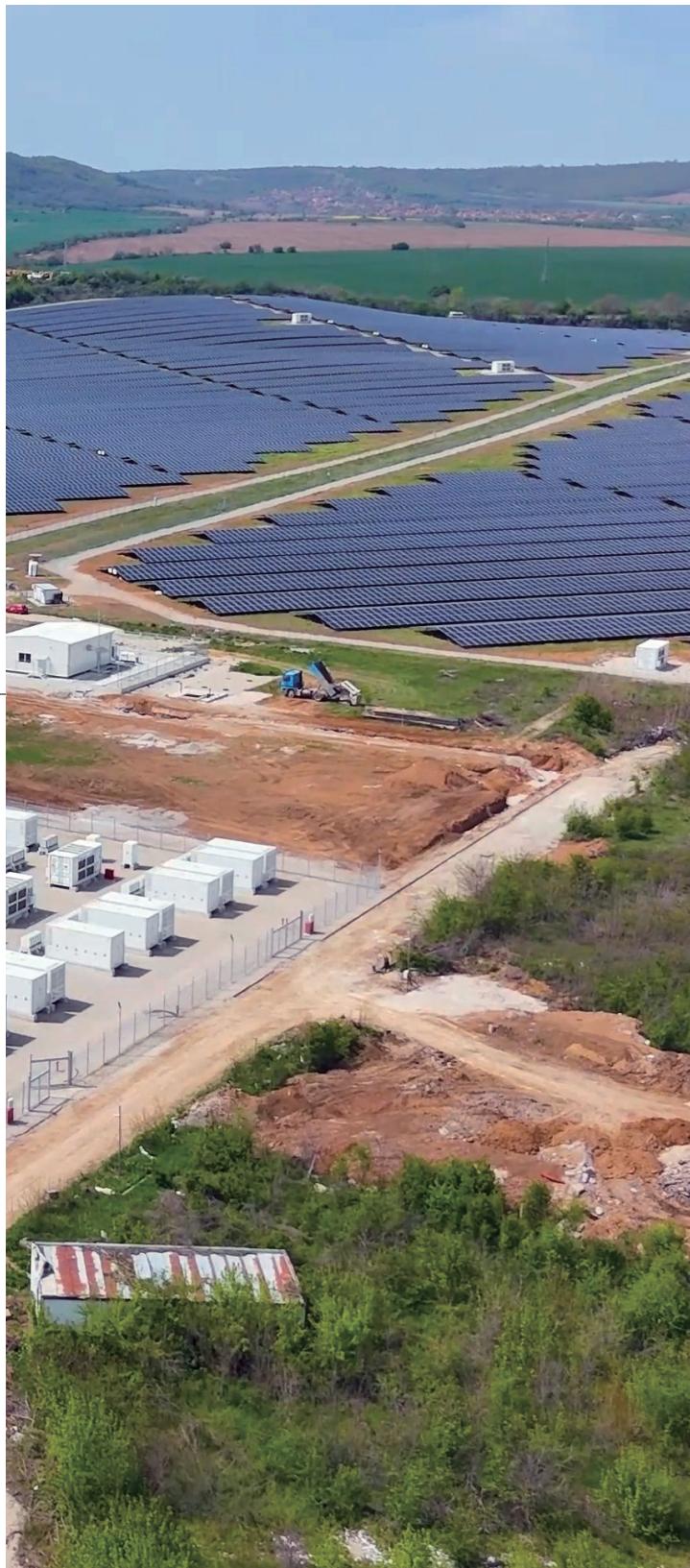
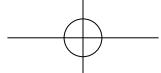






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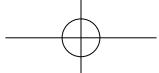




Bulgaria, Europe

In April 2025, Advance Green Energy successfully commissioned a 125 MW/500 MWh grid-forming energy storage project in Lovech. Leveraging solar-storage synergy, the project enhances grid stability and solar energy integration in the region. With an investment payback period of just three to four years, the project offers strong economic returns. Looking ahead, it can flexibly participate in multiple electricity markets—including frequency regulation, capacity services, and grid-forming support through software upgrades, unlocking even greater value.

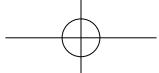




Austria, Europe

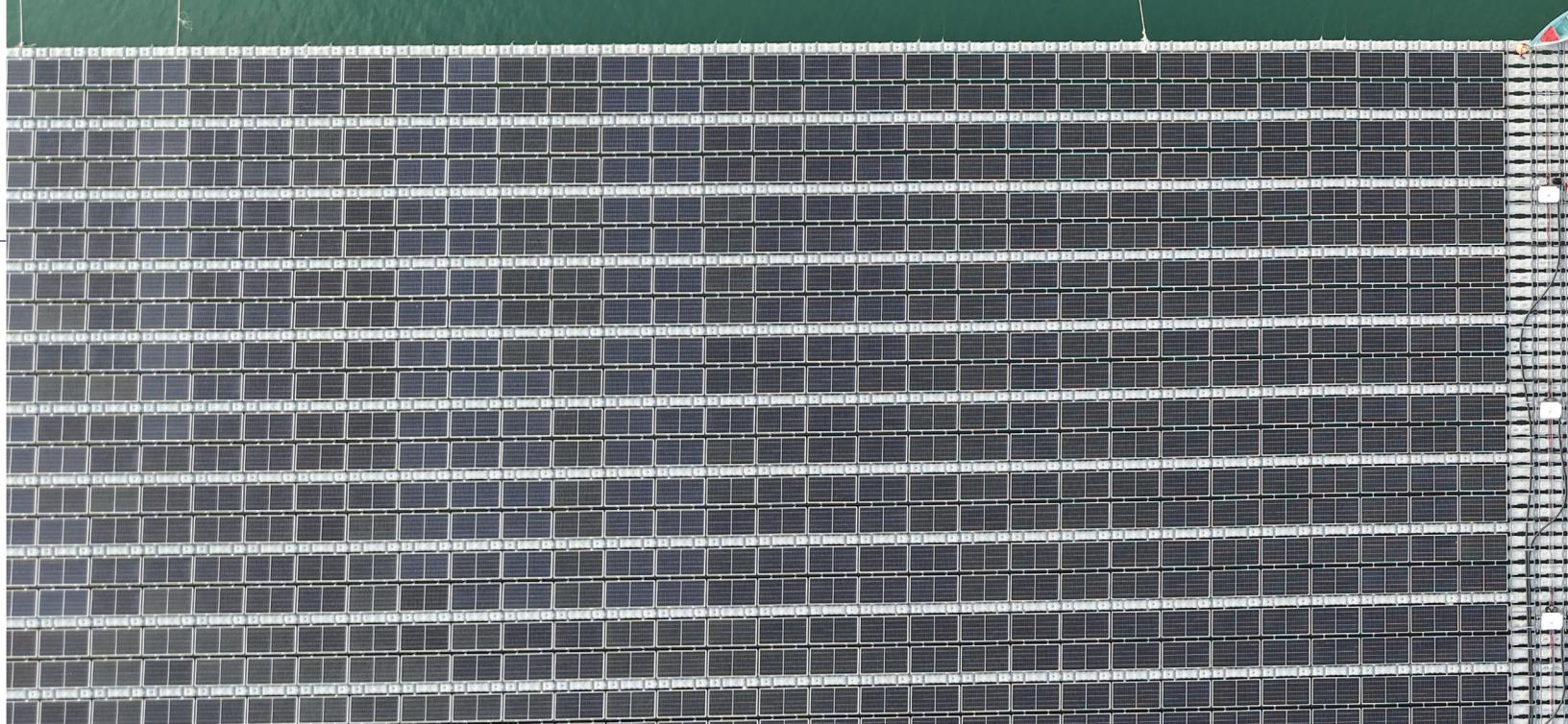
Near the Brenner Pass in Tyrol, PVO, in collaboration with Huawei, constructed a solar system in just six weeks. Covering nearly 15,000 m² of rooftop space, the installation delivers around 2 MWp of power. With a total capacity of 1.75 MW, it currently ranks among the largest of its kind in the region. This initiative marks a significant step toward Austria's goal of installing one million solar rooftops by 2030.





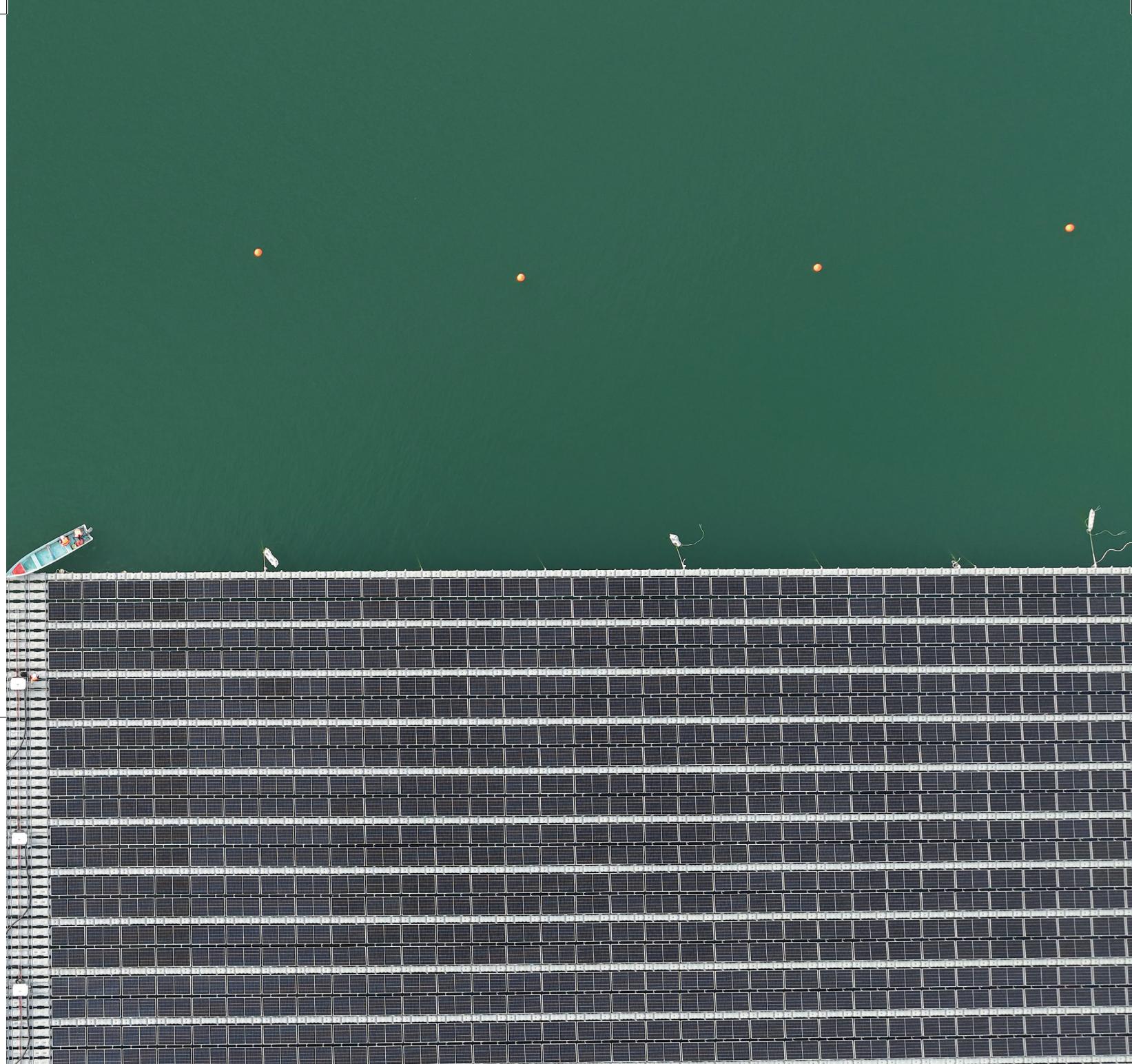


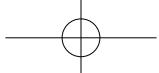
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📍 Malaysia, Asia Pacific

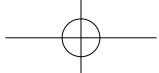
As the largest floating solar plant in the reservoir of a hydropower station in Malaysia, the 50 MW Batang Ai Project achieves efficient space utilization and ecological protection by integrating hydropower and solar generation, reducing annual carbon emissions by 52,000 tons. The project features remote O&M that is safe, reliable, intelligent, and efficient, thanks to IP66 protection and Smart I-V Curve Diagnosis.





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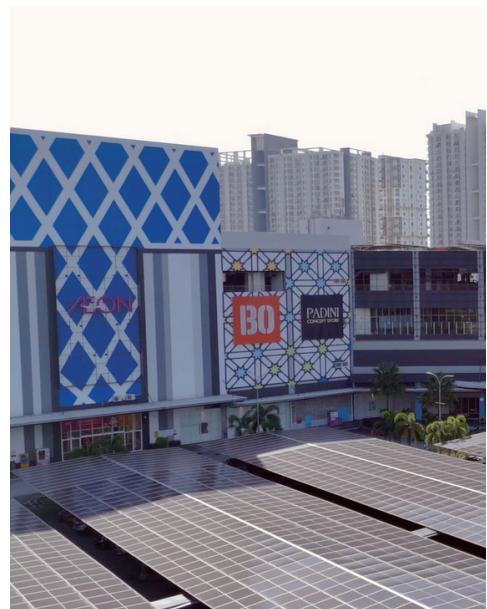
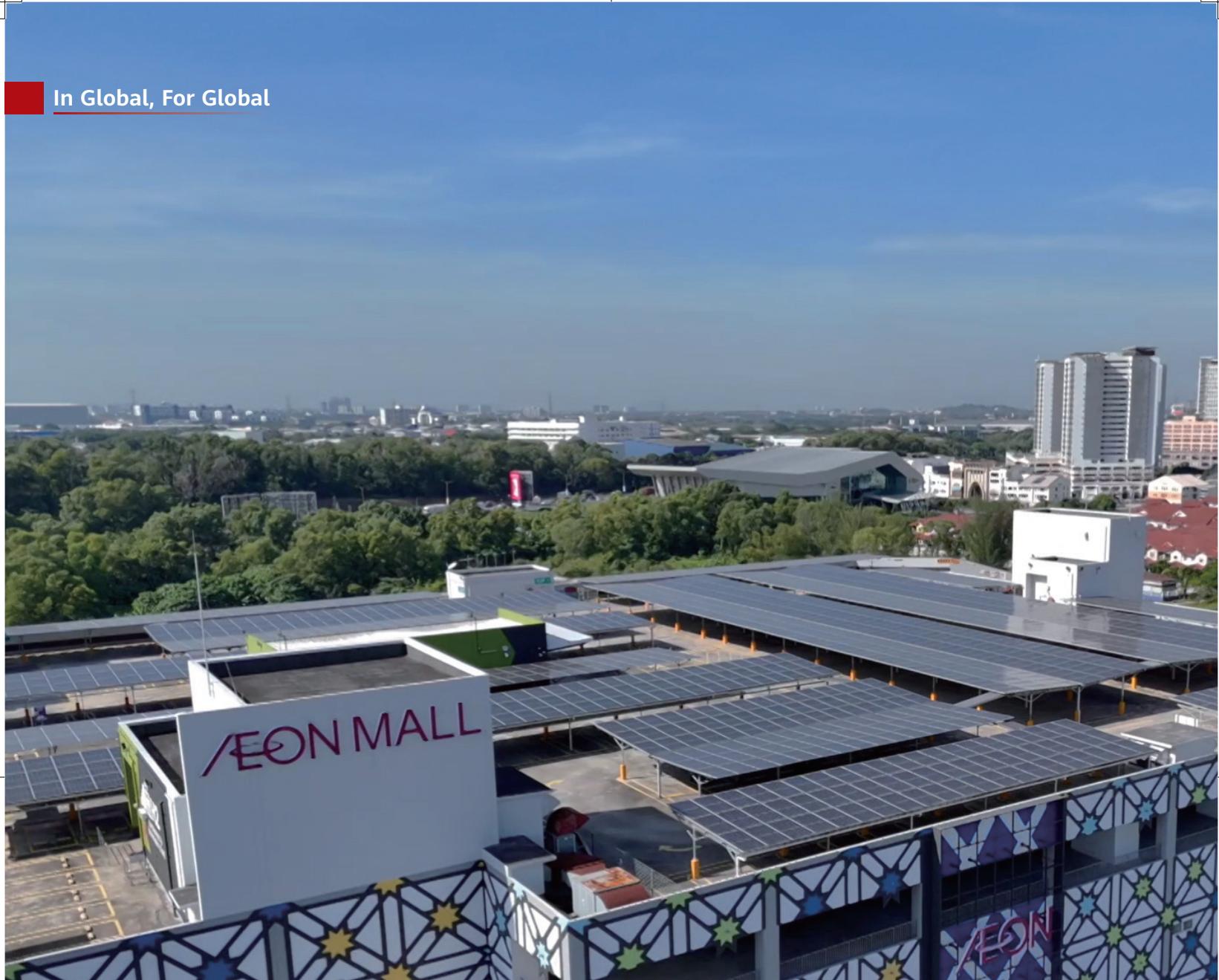
Vietnam, Asia Pacific

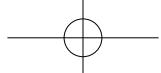
The 50 MW SP Infra 1 Ninh Thuan ground-mounted solar plant serves as an efficient, advanced, and large-scale hub for green electricity. By maximizing the use of solar energy resources, the plant plays a vital role in strengthening energy security and reducing carbon emissions.





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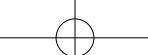




📍 Malaysia, Asia Pacific

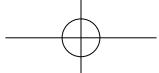
The 78 MWp rooftop solar project at AEON Mall Malaysia is a model of corporate sustainable development. It is expected to reduce operating costs by 50 million ringgit (approximately US\$11 million) and generate environmental benefits equivalent to planting 1.2 million trees.





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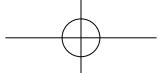




📍 Saudi Arabia, Middle East

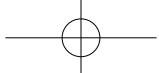
Located near the Red Sea coast, the world's largest solar + storage microgrid has a capacity of 400 MW solar and 1.3 GWh of grid-forming energy storage, helping The Red Sea destination achieve 100% renewable electricity. Key technologies, such as large-scale grid-forming and fault-ride-through, ensure stable and reliable microgrid operation. Since being commissioned in September 2023, the microgrid has operated stably and has supplied over 1.5 billion kWh of green electricity.





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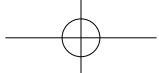




📍 UAE, Middle East

In Abu Dhabi, the grid-forming solar + storage microgrid project, co-developed by Shouguang Vegetable Industry Holding Group and Huawei Digital Power, provides a stable, green power supply to a desert farm. This project not only significantly improves the climate resilience of facility agriculture and provides more fresh vegetables for residents, but also offers innovative ideas for the green, low-carbon development of modern agriculture.

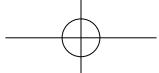


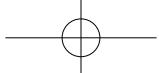


📍 Argentina, Latin America

On the plateau of Salta Province at an altitude of approximately 4,200 m, a gold mine faces thin air and challenging power supply conditions. To address these issues, Huawei helped the customer deploy a Smart Microgrid Solution with 6 MW solar + 12 MWh energy storage. This integrated clean energy system delivers stable and cost-effective power to the site, effectively resolving the power supply issue and reducing fuel costs by 50%.

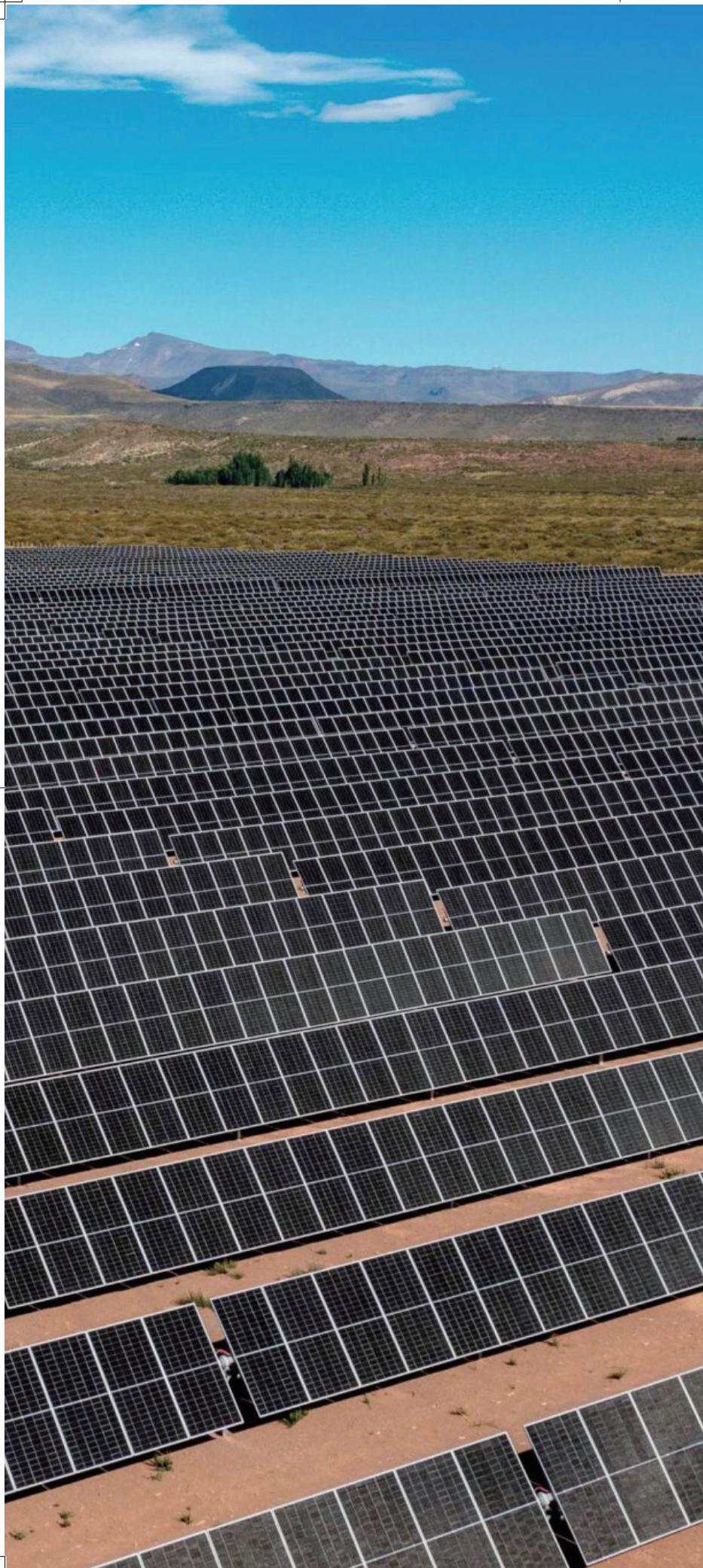
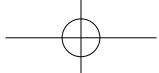






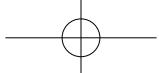
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Argentina, Latin America

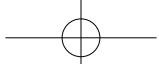
In Mendoza Province, Huawei's Smart PV Solution helps deliver clean energy to 125,000 households. The project generates 497 million kWh of electricity annually, equivalent to a reduction of over 220,000 tons of carbon emissions. It provides green energy for sustainable development in the region.

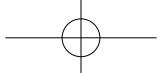


📍 Ghana, Africa

The 250 MW Bui Utility-Scale Solar Project is the largest solar plant in West Africa and the largest hydro-solar hybrid plant in the region. It continuously supplies clean electricity to the national grid and local enterprises in Ghana, reducing electricity costs, empowering industries, and enabling residents to benefit from green energy. The project also helps Ghana accelerate its transition to renewable energy.







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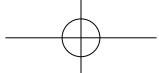




📍 Tanzania, Africa

Luxury Safari Lodge, Serengeti completed the largest off-grid solar + storage project in the country, integrating 990 kWp solar and 3 MWh energy storage. The project provides continuous, clean electricity for hotel operations and staff housing, reducing reliance on diesel generators by over 80%. This not only lowers operating costs and carbon emissions but also significantly minimizes noise pollution. By improving energy efficiency, the system creates a more peaceful guest experience. It helps preserve the natural serenity of wildlife in Serengeti National Park, achieving a harmonious balance between technological advancement and ecological conservation.



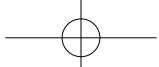


📍 Senegal, Africa

The Walo Solar + Storage Plant is the first project of its kind in Senegal, with an installed capacity of 16 MW solar and 26 MWh energy storage. With its high-quality and reliable design, the plant operates stably at 40°C, generating 32 billion kWh of electricity annually and reducing carbon emissions by approximately 13,061 tons per year. The successful implementation of the project is a key step in the country's energy transition and an important practice in promoting sustainable development.





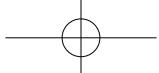


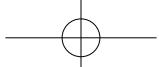
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📍 Mali, Africa

The NBB beverage factory has built the region's first benchmark solar + storage project, equipped with 750 kWp solar and 1.8 MWh energy storage. It provides a stable power supply at 40°C, ensuring production continuity and significantly reducing electricity costs.



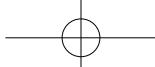


📍 Morocco, Africa

The Tangier Solar Plant covers 72 hectares and has an installed capacity of 30 MW. With smart O&M and stable, high-quality operation, the plant not only reduces the levelized cost of electricity (LCOE) for customers but also promotes regional green transition.







Power Story



World's Largest Open-Sea Offshore PV Project: A Green Model of Offshore Innovation

From land-based adaptation to marine ventures, the renewable energy sector is expanding into new frontiers. The world's largest open-sea offshore PV project in Dongying, Shandong, represents a significant leap forward, unlocking substantial solar potential at sea.

"I will ascend the mountain's crest. It dwarfs all peaks under my feet." Du Fu's poetic tribute to Mount Tai embodies a spirit of boundless ambition. A millennium later, along another stretch of Shandong's coastline, that same spirit finds new expression: Above the vast Yellow Sea, a pioneering energy installation harnesses solar power above the waves.

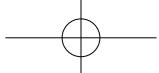
Located 8 kilometers off the eastern coast of Dongying, Shandong, extensive PV arrays shimmer with the promise of green energy. Here, the HG14 GW-level offshore PV

project—developed by Guohua Investment Shandong Branch of CHN Energy—is steadily progressing.

A Bold Energy Venture Across Blue Waters

Covering approximately 1,223 hectares of marine area, the project has a total installed capacity of 1 GW, making it the world's largest open-sea offshore PV project. What was once confined to imagination—a GW-level offshore PV plant—has now become reality in Shandong's waters.

This project emerged from a broader strategic context. In



World's Largest Open-Sea Offshore PV Project: A Green Model of Offshore Innovation

recent years, Shandong Province has advanced its vision of becoming a "marine powerhouse in the new era" while actively advancing its green transition. As a leading state-owned enterprise, CHN Energy recognized offshore PV as a promising new frontier early on. The HG14 project is among the first pioneering projects to achieve grid connection. It marks not only a strategic breakthrough for the company but also a milestone for Shandong Province, the renewable energy sector, and China's ongoing energy transition.

Compared to land-based PV installations, offshore PV construction presents significantly greater challenges. Engineering teams must contend with high humidity, high salinity, strong waves, large tidal variations, and even the threat of drifting sea ice. Every little detail determines the safety and success of the entire project.

Off the coast of Kenli District in Shandong Province, 2,934 giant PV platforms extend in a linear formation. Each platform measures 60 meters long and 35 meters wide, equivalent to the area of five basketball courts. Standing atop them, one feels as though they are on a floating continent—an immense expanse of steel and PV panels shimmering across the waves.

These platforms are not assembled at sea. Instead, the PV modules and supports are pre-assembled onshore, transported to designated locations by tugboats, and then precisely placed on the four embedded steel piles using cranes. Only two meters of each pile protrude above the water, but beneath the surface, they extend 23 meters deep—17 meters of which are firmly anchored into the seabed—like the four legs of a colossal marine creature, providing reliable support to the entire array.

To withstand the seawater corrosion, the outer surfaces of these steel piles are coated with anti-corrosion primer. Designed for a service life of over 30 years, they can withstand Beaufort Scale 11 winds and rare sea-ice conditions that occur once every 50 years. Each pile embodies the engineers' deep respect for the marine environment.

Technical Strengths from Huawei and Partners

If the steel piles and platforms form the "skeleton," then inverters and PV modules are the "heart and blood" of the project. In the HG14 project, the core equipment comes from China's leading technology providers.

Huawei Digital Power supplied more than 3,000 smart string inverters (SUN2000-300KTL) for the project. The project comprises 157 power generation units, each equipped with 22 inverters. The inverters efficiently convert the DC power generated by PV modules into AC power, which is then stepped up to 66 kV and transmitted to the onshore 220 kV booster station. This energy flow is like an "arterial system," ensuring that green energy is delivered reliably and efficiently to consumers.

Huawei's inverters offer distinct advantages.

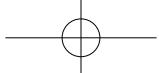
Enhanced energy yield: The system delivers over 1% higher energy production than conventional solutions, significantly improving overall returns.

Comprehensive safety: Innovative DC three-level safety protection effectively shields the DC system from harsh environmental conditions.

Intelligent O&M: Features including Smart I-V Curve Diagnosis, Smart Self-Cleaning Fan (SSCF), and Smart Connector-Level Detection (SCLD) ensure low O&M costs and near "zero-downtime" throughout the project lifecycle.

Moreover, this project pioneers long-distance transmission technology in China's PV sector, combining 66 kV submarine and onshore cables. Compared to traditional solutions, this innovative "sea-to-land relay" approach offers higher transmission capacity, greater efficiency, and lower costs, realizing the vision of an "offshore green power corridor."

In project construction, major engineering enterprises, including China Railway Major Bridge Engineering Group, CCCC Third Harbor Engineering, and China Construction



Power Story

Eighth Engineering Division, collaborated to ensure the safe and efficient implementation of this key project. This demonstrates a best-in-class partnership between state-owned enterprises, technology providers, and engineering contractors.

Dual Value of Energy and Fish Farming

Once fully operational, the HG14 project is expected to generate 1.78 billion kWh of electricity annually, sufficient to meet the electricity demands of 2.67 million urban residents. The project delivers significant energy-saving and emission-reduction benefits: It saves 503,800 tons of standard coal equivalent annually and reduces CO₂ emissions by 1.3447 million tons annually. These figures represent tangible progress in energy substitution and a solid contribution to achieving China's "dual carbon" goals.

Notably, the project adopts an innovative model that integrates PV power generation with fish farming. While generating PV power, the marine area also supports fish farming, creating dual revenue streams from a single maritime zone. The annual revenue from fish farming is expected to exceed CNY27 million (about USD3.8 million), making it a new engine for local economic development.

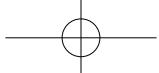
This multi-purpose utilization approach enhances the overall value of marine resources while offering new insights for future integration of offshore PV with other marine industries.

Blue Horizons, Green Ambitions

From land-based solar installations tailored to local conditions to ambitious advances in offshore PV projects, the renewable energy sector continues to push the boundaries of geography and technology. China has demonstrated its capability to deploy PV installations across both terrestrial and marine environments. These achievements are driven by national strategic guidance, sustained corporate innovation, and the expertise and dedication of engineering teams.

"A time will come to ride the wind and cleave the waves; I'll set my cloud-white sail and cross the sea which raves." Amid the boundless sea and sky, these PV arrays stand as the "cloud-white sail" of China's energy transition in the new era, supplying green power to Shandong and beyond. In the future, more "offshore PV fleets" will venture further into the deep blue. When that time comes, clean energy will illuminate a more sustainable future for humanity. ▲



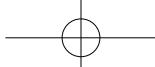


Grid-Forming ESS Powers the "Green Heart" at the Foot of the Balkan Mountains

At the foot of the Balkan Mountains in Lovech, Advance Green Energy has deployed a grid-forming energy storage system (ESS)—a "green heart" powering the future. It stabilizes the grid and converts variable renewable energy into reliable income. As night falls, the system gently releases the energy stored during the day, lighting up Lovech with brilliance.

April in Lovech, Bulgaria, finds spring lingering as the Balkan Mountains shimmer in gold. At the foot of the mountains, a 106 MW PV plant stretches across two square kilometers, where a vast blue ocean of PV modules sparkles under the sun, drawing power from its rays.

There are no rows of densely packed buildings, no thunderous roar of giant machines—only the faint hum of electricity coursing through cables. This is a place designed to harness sunlight, thriving on the energy it receives.



Power Story

Few would have imagined that behind this quiet harvest of energy once lay a dilemma: the aging local power grid, with its limited capacity, struggled to handle the sudden surges of solar energy. Was Advance Green Energy, the plant's owner, doomed to sigh over "a happiness forever beyond reach"?

Not at all.

A Power Grid Reinforced with "Muscles" and a "Nervous System"

Advance Green Energy, founded in Bulgaria in 2024, is an innovative company dedicated to developing and operating advanced energy facilities in alignment with the European Union's green transition strategy. Nestled in north-central Bulgaria, at the north slope of the Balkan Mountains and along the upper reach of the Osam River, the Lovech site receives 2,100–2,300 hours of sunshine annually—an ideal setting for solar energy projects.

The local potential for renewable electricity is significant: Bulgaria's peak-valley electricity price difference is as high as USD 0.09 per kWh, promising strong returns on investments. However, grid stability became a critical constraint; the existing infrastructure was too fragile to support further expansion.

So how could they maximize the returns on renewable electricity? The answer arrived in the form of a "green heart"—Huawei Grid Forming Energy Storage System (ESS) 2.0. In April 2025, the 125 MW/500 MWh ESS was officially connected to the grid, marking Huawei's first grid forming ESS project in Europe.

Unlike conventional ESSs that follow the grid, grid forming ESSs actively reinforce and stabilize it. In scenarios with a high penetration of renewable energy, grid forming ESSs use new technologies to provide the grid with "visible rigidity"—as if equipping it with "muscles" and a "nervous system"—thereby significantly enhancing system stability and safety.

At the Lovech site, the grid forming ESS adopted by Advance Green Energy consists of 111 ESS cabinets (4.5 MWh each), 16 transformer stations, power conversion systems (PCSs), a Smart Power Plant Controller (SPPC), and an energy management system (EMS). Together they form a complete "green heart" beating at the foot of the Balkan Mountains.

Six Core Capabilities of the Grid Forming ESS

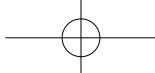
One of the most immediate benefits for Advance Green Energy is that the power plant is no longer "picky" about the energy it uses. The previous grid was like a frail body, unable to absorb power from renewable energy sources. Now, Huawei Grid Forming ESS 2.0 responds to short-circuit currents within 10 ms, completes primary frequency regulation within 200 ms, and even achieves GWh-level black start within 10 minutes. It has become a vigilant "grid guardian," always ready to act.

Huawei Grid Forming ESS 2.0 delivers six capabilities: (1) short-circuit support; (2) inertia support; (3) primary frequency regulation; (4) power oscillation damping (POD); (5) black start; and (6) seamless on/off-grid switching. These capabilities allow the power plant to deliver ancillary services, such as primary and secondary frequency regulation, which in turn amplify its economic returns.

The solution ensures stable performance around the clock and is designed to adapt to future energy architectures, regardless of the SOC and grid SCR. It offers reliable support for the power system and is suitable for various business models.

What truly stands out, however, are the concrete, measurable gains.

Certified by the German Association for Electrical, Electronic & Information Technologies (VDE), the power plant achieved an energy utilization rate of 98.93%, well above the contractual commitment of 90.3%. System efficiency also surpassed expectations, reaching 91.2%



Grid-Forming ESS Powers the "Green Heart" at the Foot of the Balkan Mountains

versus the guaranteed 87.71%. The payback period, once estimated at three to four years, will now be reached much sooner.

Launched in Bulgaria, Growing Toward Europe

There is no doubt that Grid-Forming ESSs are shaping the future of power grids. As renewables gradually become the main energy source, Grid-Forming ESSs serve as the core support for building new power systems. They enable the grid to shift from passively adapting to renewables to actively embracing and harnessing them, achieving green, stable, and efficient operation.

Huawei Digital Power remains committed to advancing high-quality industry development and pioneering future-oriented Grid-Forming ESS technologies under stricter standards. Across power generation, transmission, distribution, and consumption, Huawei's high-quality products and solutions not only meet demanding environmental requirements but also evolve flexibly to address emerging needs in technology, function, application, and even business model at different stages.

Five years ago, Bulgaria enacted key legislative reforms to allow its first licensed closed energy distribution area. The timely regulatory change, combined with the close collaboration between the government, Advance Green Energy, and Huawei Digital Power, laid the foundation for this large-scale, technologically advanced project.

For Bulgaria, this project is more than a power plant upgrade—it is an experiment exploring the future of energy. Here, solar energy is fully utilized, and the influx of renewables no longer burdens the grid. For Huawei, this represents an important step in deploying Grid-Forming ESSs in Europe, laying the groundwork for developing more business models in the years ahead.

Advance Green Energy's power plant in Lovech now stands as a vital energy hub for the Balkan region and Southeast Europe. As night descends, the plant's ESS gently releases the power captured from the sun, enveloping Lovech in a luminous beauty. This "green heart" beats ceaselessly, pulsing in harmony with the rhythm of Europe's energy transition. ▲





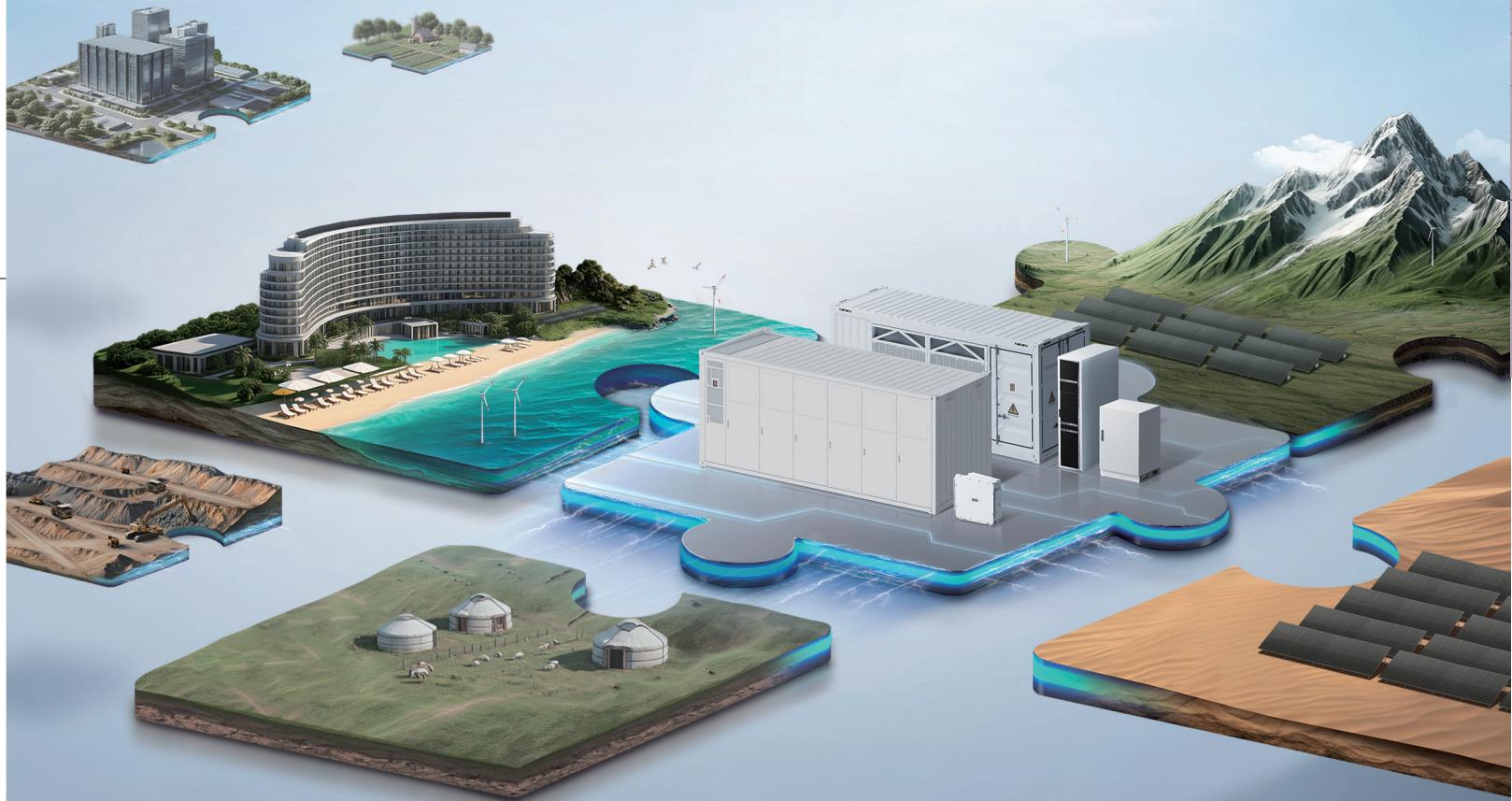
Building a Fully Connected, Intelligent World

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Smart String Grid Forming ESS Solution

Start a New Era of All-Scenario Grid Forming

· Cell-to-Grid Safety · All-Scenario Grid Forming · Full-Lifecycle Optimal Investment · Full-Link Digitalization



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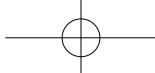
Roof of the World: World's First Grid-Forming Energy Storage Plant Built in an Extreme Environment

A grid-forming energy storage project was commissioned in an extreme environment characterized by thin air and freezing temperatures at an altitude of 4,600 meters in Gertse County, Xizang. This pioneering project has paved the way for the commercialization of grid-forming energy storage.

As the global energy transition accelerates, power systems are undergoing an unprecedented transformation. For more than a century, power grids have been designed around conventional energy sources. Now, as renewable energy sources such as solar and wind power become primary generation assets,

grids must transform from passively adapting to actively managing power flow, becoming more complex and intelligent in the process.

In this context, grid-forming technology has emerged as a cornerstone of new power systems.



Power Story

The 30 MW PV + 6 MW/24 MWh grid-forming energy storage project in Gertse County began operations in 2024. It stands as the world's first project of its kind in a high-altitude, extremely cold, and weak-grid environment. The success of the project marks the commercialization of grid-forming technology. It is not just a power plant, but a milestone of the energy revolution on the roof of the world.

Extreme Challenges on the Plateau

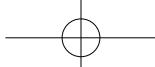
Gertse County is located at an altitude of 4,600 meters in the Ngari Prefecture of Xizang. Thin air and freezing cold make the area a lifeless zone. In winter, the temperature drops to -35°C or lower. Such an environment is extremely harsh for human survival, let alone the long-term stable operation of sophisticated renewable energy equipment.

A more significant challenge comes from the power

grid itself. The grid in Gertse County is inherently weak and becomes increasingly vulnerable as the proportion of renewable energy and power electronic devices increases. Consequently, the 30 MW PV system's output was limited to 1.5 MW, resulting in more than 95% of green power being curtailed. This reduced the utilization of renewable energy, negatively impacting local power supply and economic development.

In traditional power systems, grid stability depends on the inertia and regulation capabilities of large synchronous generators. However, in extreme conditions, such as weak grids and high altitudes, traditional approaches often fail. These conditions make Gertse an ideal test field for grid-forming energy storage technology. If the technology succeeded there, it would be capable of handling the most complex scenarios worldwide.





Roof of the World: World's First Grid-Forming Energy Storage Plant Built in an Extreme Environment

To address these challenges, Huawei Digital Power proposed its high-quality Smart String Grid Forming Energy Storage System (ESS). Unlike traditional centralized energy storage architecture, a string design makes energy storage units more flexible and intelligent. They can operate in a distributed manner, like individual cells, while collaborating to deliver significant performance.

In the Gertse project, the grid-forming ESS not only functions as an energy regulator for batteries and inverters, but also works as a grid stabilizer:

- Proactive inertia provision: When the grid frequency changes sharply due to fluctuations in wind and solar power, the ESS discharges energy instantly to prevent grid instability, similar to a traditional thermal power unit.
- Voltage support and damping control: The ESS rapidly adjusts reactive power to stabilize grid voltage and prevent system oscillations.
- Wideband oscillation damping: In grids with a high density of power electronic devices, complex oscillations are readily generated. Huawei ESS effectively damps oscillations across low and high frequencies.

These capabilities enable the ESS to evolve from a grid-following to a grid-forming role in a new power system.

Reliability Verification Under Extreme Testing

Regardless of how flawless a theory may be, it must be validated through practical application. During project implementation, the Xizang Electric Power Research Institute of the State Grid Corporation of China (SGCC) conducted rigorous tests on the ESS, including a 35 kV short-circuit disturbance test, a power conversion system (PCS) connection test, and a transient inrush current test.

The test results show that Huawei ESS can supply three

times the apparent current within 10 ms and remains connected to the grid even during large disturbances, demonstrating excellent resilience under extreme conditions. The Xizang Electric Power Dispatching and Control Center of SGCC certified that the upper limit of PV output increased from 1.5 MW to 12 MW after the ESS began operating in grid-forming mode, delivering exceptional performance. In other words, every 1 MWh of Huawei Grid Forming ESS enabled an additional 1.75 MW of PV output.

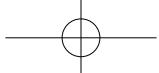
According to Yang Mingsheng, General Manager of the Gertse PV+ESS project, "During a 10-day obtain period, there were more than 30 major disturbances on the power grid. The Huawei Grid Forming ESS reliably supported the grid voltage and frequency every time." The data is more convincing than any appreciation.

The Gertse project does more than solve power supply challenges in a single region. It represents a replicable technical pathway: In weak grids with a high proportion of renewable energy, grid-forming ESSs can effectively enhance grid integration and resilience. This is especially valuable for regions rich in clean energy resources but with weak grids, such as western China, Africa, and Latin America.

If traditional ESSs are supportive tools for renewable energy development, then grid-forming ESSs are new engines for energy system transformation. They transform grids from passive bearers to active organizers capable of integrating a much larger share of renewable energy.

Commercial Breakthrough and Global Significance

The success of the Gertse project signifies that grid-forming technology is bridging the gap between research and commercialization. Previously, most ESSs were deployed in demonstration or policy-driven projects. Now, grid-forming ESSs are delivering distinct



Power Story

commercial value, generating benefits such as doubled PV output capacity and enhanced grid stability.

This concerns not only the profitability of a power plant, but also the advancement of the global energy transition. According to the International Energy Agency (IEA), more than 1.5 TW of wind and solar PV installations are expected to be added by 2030. Without ESSs and grid-forming capabilities, it would be impossible to integrate large amounts of renewable energy into power grids. The success of the Gertse project sets a feasible pathway for the large-scale integration of renewable energy globally.

It is noteworthy that a Chinese company achieved this technical breakthrough. It showcases Huawei's profound expertise in cross-disciplinary fields such as power electronics, digital control, and intelligent algorithms. More importantly, it establishes China's competitive edge in developing next-generation power systems.

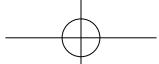
From the Plateau to the World

When renewable energy illuminates the roof of the world, it reveals the power of technology, perseverance, and foresight. The Gertse grid-forming energy storage project is more than a power plant in West China; it is a beacon on the energy landscape of the future. It demonstrates our ability to harness green energy in extreme environments to advance social progress.

As an ancient Chinese teaching goes, all good principles should adapt to changing times to remain relevant. The grid-forming journey from Gertse is leading to a broader horizon for global energy transition. As the successful experience is replicated in more regions, grid-forming ESSs will not just be a miracle on the roof of the world, but a shared foundation for global new power systems.

In the coming chapters of energy history, there will be this record: On the snowy plateau at an altitude of 4,600 meters, a new era of green power was inaugurated by a group of determined and insightful engineers. ▲





Zero-Carbon Revitalization in Kuma Village: A Pathway to Post-Disaster Recovery and Green Energy Transition

From post-flood recovery to being designated as one of the first decarbonization pilot zones, what has driven Kuma Village's green transition? How did Kuma Village achieve a win-win outcome for both economic and environmental benefits?

In 2022, Kuma Village in southern Kumamoto Prefecture, Japan, was hit by torrential rains and devastating floods, leaving the entire village on the brink of destruction. Infrastructure, including houses, schools, public facilities, and forestry processing plants, was destroyed by the floods, and residents faced severe living challenges.

The first major challenge in post-disaster reconstruction faced by the local government and residents was clear: Should they continue relying on traditional energy models, or explore a sustainable, low-carbon, and resilient

development path? Without much hesitation, Kuma Village chose the latter and launched a pioneering low-carbon recovery model.

This led to a zero-carbon village initiative, rooted in the dual vision of decarbonization and creative recovery. The project focused on rebuilding public housing and facilities. It integrated a self-consumption distributed PV+energy storage system (ESS) into post-disaster planning, successfully achieving multiple goals: energy localization, a shift to renewable energy, and enhanced disaster resilience.



Power Story



In 2022, Kuma Village was designated by Kumamoto Prefecture as one of the first decarbonization pilot zones. Through an innovative power purchase agreement (PPA) model, Kuma Village deployed distributed PV and grid-forming ESSs across the entire region, emerging as a national benchmark for zero-carbon revitalization in Japan and attracting widespread attention from the industry and global community.

Broad Application of Huawei FusionSolar Smart PV+ESS Solution

As one of the key project partners, Kuma Village's KUMAMURA Shindenryoku Inc. implemented Huawei FusionSolar Smart PV+ESS Solution. The project deployed the PV+ESS solution from Huawei Digital Power across 23 post-disaster public housing sites, rooftops of public facilities, abandoned farmland, and forestry processing plants, establishing a village-wide, self-sufficient energy network.

With a forest coverage rate of 88%, forestry is one of the main economic pillars of Kuma Village. By deploying Huawei FusionSolar Smart PV+ESS Solution, Kuma Village ensured post-disaster livelihood and industrial recovery. This solution enabled the production of "zero-carbon building materials," providing green energy support for its forest resources and core industries.

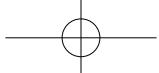
Nakajima Takafumi, CEO of KUMAMURA Shindenryoku Inc., recalled, "We had previously used Huawei inverters

in our projects, and deeply appreciated their multiple advantages, including high conversion efficiency, easy installation, and high reliability. Thanks to Huawei's consistent focus on high quality, its ESSs offer excellent multi-scenario adaptability backed up by technical consulting and after-sales services. This is the reason we implemented Huawei FusionSolar Smart PV+ESS Solution for this revitalization project without hesitation."

Modular deployment capability is one of the unique features of Huawei FusionSolar Smart PV+ESS Solution: It can be flexibly adapted to a range of scenarios, from residential rooftops to MW-scale power plants, enabling comprehensive distributed energy coverage. Nakajima Takafumi emphasized, "This is not just about installing PV and ESS devices. Through the PPA model, we have integrated energy cost reduction, industrial revitalization, and enhancement of disaster resilience into a complete value chain, enhancing the village's overall resilience and capacity for self-sustaining development."

Post-Disaster Resilience and Energy Self-Sufficiency

Previously, the power system in Kuma Village had limited capacity, restricting the grid integration of PV power. Even with the introduction of PV devices for self-consumption, surplus electricity could not be fed into the power grid. Huawei FusionSolar Smart PV+ESS Solution adopts a local generation and local consumption model, enabling the village to meet 70%–80% of its electricity needs through



Zero-Carbon Revitalization in Kuma Village: A Pathway to Post-Disaster Recovery and Green Energy Transition

self-sufficiency. For Kuma Village, which has endured severe torrential rains and urgently needs to strengthen its disaster resilience, this distributed PV system (independent of external power grids), together with ESS technology, enhances the village's resilience and provides a solid foundation for secure, stable living for its residents.

Following the project's implementation, Kuma Village underwent a fundamental transformation in its energy mix. PV installations across public facilities, residential buildings, and forestry processing plants are equipped with ESSs, significantly reducing electricity costs for residents. Data shows that energy consumption at timber mills has decreased by approximately 30%–40%, substantially lowering carbon emissions and achieving a win-win outcome for both economic and environmental benefits.

Huawei FusionSolar Smart PV+ESS Solution not only addressed Kuma Village's urgent post-disaster needs but also provided green momentum for industrial upgrade.

Green Energy for Every Village Resident

Matsuno Shogo, Director of the Kuma Village Revival Support Team, said, "From the village office, seniors' center, and school, to the hot spring resort and wood



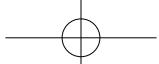
processing plant, PV installations are now everywhere in Kuma Village. This village is accelerating decarbonization and improving its disaster resilience. As the benefits of green energy reach everyone, more young people are choosing to move here."

Through Huawei FusionSolar Smart PV+ESS Solution, Kuma Village has achieved balanced development across economic, social, and environmental dimensions: reduced living costs for residents, improved public service resilience, and accelerated green transformation of local industries. The village has gradually become a model for integrating post-disaster recovery with green energy, offering a replicable zero-carbon rural development experience for Japan and the world.

Smart Village and Low-Carbon Lifestyle

Looking ahead, KUMAMURA Shindenryoku Inc. in Kuma Village plans to introduce Huawei's commercial and industrial (C&I) Hybrid Cooling Grid Forming ESS Solution and Smart String Grid Forming ESS Solution to develop renewable energy supply models aligned with regional power demands. The revenue generated from Huawei's PV+ESS solution will continue to be invested in rural digital infrastructure, positioning Kuma Village as Japan's first energy self-sufficient and digitally managed smart village. Nakajima Takafumi said, "I believe that, with Huawei's support, Kuma Village's efforts toward zero-carbon revitalization will continue to advance."

Kuma Village's experience demonstrates the deep integration of post-disaster reconstruction, green energy, low-carbon living, and smart rural development. Against the backdrop of global climate change and extreme weather, this project is an innovative model for zero-carbon rural development in Japan and a valuable example for the world in disaster response and advancing sustainability. Through technological innovation, social engagement, and policy support, Kuma Village is steadily achieving a zero-carbon rebirth, transforming from the shadow of disaster to a model of green resilience. ▲



Power Story



From Sun to Soil: Where PV Meets Produce

No rivers, yet vegetables and fruits flourish. No power grid, but the electricity supply is stable and uninterrupted. Huawei Digital Power and Shouguang Vegetable Industry Holding Group have partnered to integrate PV systems, energy storage systems (ESSs), and intelligent management, leveraging renewable energy to support modern agricultural production. This collaboration provides a replicable green model for arid regions and opens new possibilities for cultivating oases in the desert.

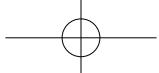
In the afternoon, the Abu Dhabi desert is scorching and dry. However, rows of greenhouses stand resilient amid the sand. Inside, vegetables thrive and fruits hang heavy on the vines. With a tap on their phones, farmers can remotely adjust temperature and humidity; irrigation and fertilization are handled automatically by the system with precision.

For centuries, deserts and agriculture were considered

incompatible. Now, technology is redefining that relationship. The desert farm, jointly developed by Huawei Digital Power and Shouguang Vegetable Industry Holding Group, is bringing life to the sands of Abu Dhabi. The fusion of smart energy and modern agriculture is transforming desert sunlight into abundant harvests.

Technology Rewrites the "Desert Equation"

Agriculture is humanity's oldest industry. For millennia,



From Sun to Soil: Where PV Meets Produce

crop yields have depended heavily on climate and water—a reliance often described as "at the mercy of the elements." As the saying goes, "Food is the foremost necessity of the people." In arid regions like the Middle East, achieving food self-sufficiency has long been a persistent challenge.

In recent years, innovative approaches such as greenhouses and vertical farms have been widely adopted across the Middle East, as in other parts of the world. These systems create optimal growing conditions for crops by artificially controlling light, temperature, humidity, and nutrients. Yet the greatest challenge remains energy. Energy costs often account for half or more of total production expenses. And with fossil fuels still dominating the energy mix, this drives up costs and raises concerns about carbon emissions.

However, within this challenge lies an opportunity. The Gulf region receives abundant sunlight—over 3,000 hours annually—making it one of the world's most favorable regions for solar energy development. Integrating renewable energy with modern agriculture could offer a fundamental solution to this dilemma.

Shouguang Vegetable Industry Holding Group possesses extensive experience in greenhouse agriculture, having successfully verified technologies and promoted models

across various climate zones worldwide. Huawei Digital Power, meanwhile, has built deep expertise in PV+ESS microgrids and intelligent energy management. Their collaboration has transformed the desert farm from an innovative experiment into a model of cross-industry synergy.

Solving the Desert Farm's "Energy Challenge"

If a desert farm relies on diesel generators, it faces significant drawbacks: disruptive noise, heavy pollution, and a constant need for fuel resupply—resulting in high operational costs. The project ultimately adopted the off-grid PV+ESS microgrid solution provided by Huawei Digital Power.

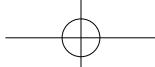
Zhou Wei, Director of Huawei Digital Power UAE, said: "The desert farm uses Huawei's high-quality Smart PV+ESS solution, including string inverters and hybrid cooling ESSs. Even in extreme heat and sandstorms, the solution ensures a stable and efficient renewable energy supply to meet agricultural power demands."

The solution offers three key advantages:

- PV+ESS Integration and Stable Grid Forming

Fruit and vegetable cultivation demands precise environmental control. Diverse loads—for lighting,





Power Story

temperature regulation, drip irrigation, and ventilation—require a continuous power supply. Thus, stability is the top priority.

Nine Huawei 215 kWh ESSs and eleven 115 kW inverters are deployed in the desert farm to form an integrated PV+ESS power supply system. The ESSs store solar energy during the day and release the energy at night and on cloudy days, ensuring a stable power supply year-round. This project is the world's first 215 kWh off-grid commercial and industrial (C&I) PV+ESS project implemented by Huawei.

- High Efficiency and Reliability

Huawei string inverters used in the farm deliver higher power generation efficiency. It is estimated that the annual energy yield can reach 3 million kWh, sufficient to meet the farm's energy demand. The IP66 rating ensures operational reliability in extreme environments, including high temperatures and sandstorms.

Additionally, Huawei's hybrid cooling ESSs support a 2:1 PV-to-ESS ratio, ensuring operational continuity and reducing energy costs. The 10-year coolant replacement-free design further minimizes maintenance frequency, reducing lifecycle costs.

- Intelligent Management and Streamlined O&M

Farmers can obtain the energy system's operating status in real time using the FusionSolar SmartPVMS. The voltage, temperature, and state of health (SOH) of each battery pack are clearly displayed, enabling timely issue detection and rapid resolution. This streamlined O&M approach significantly lowers the skill threshold, allowing farm operators to manage complex energy systems with ease.

This energy system not only addresses the operational viability of the desert farm but also provides a replicable model for other arid regions worldwide.

From "Going Global" to "Local Integration"

The significance of the desert farm extends far beyond turning barren land green. It represents an evolution in how companies expand internationally.

In the past, companies "went global" primarily by exporting goods or services in a one-way flow. Today, Huawei and Shouguang Vegetable Industry Holding Group are exporting entire industrial chains, technologies, and solutions through the integration of smart agriculture and smart energy, deeply embedding themselves in local economies.

The integration is reflected in several aspects:

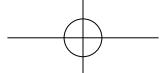
1. Industry integration: Agriculture and energy are developed together, forming a new model.
2. Talent cultivation: The project provides local training in agricultural and energy technologies.
3. Job creation: Local employment opportunities are generated, boosting regional economic growth.

This innovative model not only addresses food security challenges but also promotes the global adoption of green energy and intelligent agriculture.

The success of the desert farm offers three key highlights:

- Food security and energy transition are interlinked.
- Agricultural modernization and renewable energy are not separate paths. Their integration delivers powerful sustainability benefits.
- Technology transforms deserts into productive land.

Harsh environments are no longer off-limits for agriculture. The combination of PV+ESS microgrids and facility agriculture brings hope to regions like the Sahara and the Middle East.



From Sun to Soil: Where PV Meets Produce



- The global value of innovative solutions is demonstrated.

From the renewable energy microgrid in Saudi Arabia's Red Sea destination to the smart desert farm in the UAE, Huawei is promoting green technology practices worldwide, showcasing the responsibility and commitment of tech enterprises in sustainable development.

In the future, this model is expected to expand to more regions, offering technology-driven solutions to global food security challenges and accelerating the deep integration of green agriculture and renewable energy.

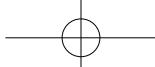
New Oases for Humanity's Future

Oases have long been seen as miracles of life in the desert.

Today, deep in the sands of Abu Dhabi, a new oasis nurtured by technology is emerging. The combination of smart energy and modern agriculture is not only transforming the landscape but also charting a new course for addressing global food security and the transition to sustainable energy.

Huawei and Shouguang Vegetable Industry Holding Group are sowing seeds of hope in the desolate sand sea with the power of innovation. In the near future, we may witness similar patches of green flourishing across deserts and arid regions worldwide—testaments to even greater possibilities. This is more than cross-industry innovation. It marks a new chapter in humanity's relationship with nature.

Deserts are being reshaped into new oases for humanity's future. ▲



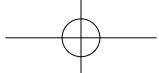
From Sunlight to Sustainability: A Pakistani Factory's Green Transformation

Pakistan stands at a pivotal moment in its energy transition. In Lahore, a factory has introduced Huawei's Smart PV system to reduce energy consumption and environmental impact. This move highlights the immense potential of PV power in alleviating energy challenges and driving industrial upgrades. Solar energy is emerging as a powerful force for economic, social, and environmental progress.

Amid the deafening roar of machinery, the air in Lahore often carries a lingering haze of smoke and dust. As Pakistan's second-largest city, Lahore is home to numerous plastic bag factories, many of which have long-running production lines relying on outdated devices. These devices emit black smoke, exacerbating the city's smog and burdening factory owners with hefty electricity bills.

Here, energy is not an invisible overhead—it's a daily, heavy expense. That was the reality until a new light began to shine from the rooftops. In partnership with its partner, Huawei helped install a 1.2 MW Smart PV system atop the factory.

Since then, sunlight has been precisely captured and



From Sunlight to Sustainability: A Pakistani Factory's Green Transformation

converted into clean energy to generate 5,000 kWh green electricity daily, totaling around 145,000 kWh per month. This has saved the factory approximately PKR6.4 million (about USD23,000) in electricity costs. The savings have been reinvested into upgraded devices, higher employee benefits, and better workshop environment. Pollution has decreased, productivity has risen, and profits continue to grow steadily.

This transformation is not just about abstract economic figures—it's reflected in the small, tangible moments of everyday life: workers breathing cleaner air, factory lights staying on thanks to a stable power supply, and children seeing less fatigue and more joy on their fathers' faces. More importantly, the PV system reduces CO₂ emissions by 1,200 tons annually: the equivalent of planting 57,000 trees.

The factory is doing its part to ease the burden of a city's polluted air. On the rooftops of Lahore, "light drives out darkness," which is true in the most literal way.

Energy Challenges and the PV Solution

Zooming out from a single factory reveals the broader complexities and challenges of Pakistan's energy landscape.

With a population of 240 million, this developing country has long relied on fossil fuels to power its economy. The country heavily relies on imports for coal, oil, and natural gas, while its power facilities and grid systems remain outdated. As a result, the electricity sector struggles to keep up. Power outages and load shedding are common in many regions, and more than half of the rural population lacks reliable access to electricity.

However, Pakistan is blessed with another resource: sunlight. Located on the South Asian subcontinent, the country enjoys rich solar resources, making it an ideal environment for PV development. As the global energy transformation gains momentum, Pakistan has set clear goals: By 2030, it will cease using

imported coal for power generation, source 60% of its electricity from renewables, and ensure that non-hydro renewables account for 30% of total renewable power generation.

Against this backdrop, Huawei Digital Power's solution offers a feasible path for Pakistan. The plastic bag factory in Lahore, for example, adopted Huawei's SUN2000-150K commercial and industrial (C&I) inverters, acknowledged in the industry for its well-rounded capabilities. It achieves a high conversion efficiency of 98.8%, millisecond-level proactive safety protection, a lifespan exceeding 20 years, and simplified maintenance—all while delivering better cost effectiveness.

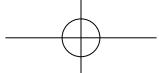
For a country like Pakistan—where grid stability and O&M capabilities are critical—these products are not just a set of devices, but are a key to the future. And they are unlocking new possibilities for countless similar factories and households: In the face of high electricity costs and inadequate power supply, sunlight becomes the most dependable "new fuel"; under economic strain and environmental pressure, PV power emerges as the most sensible "new solution."

On this sun-drenched land, the value of PV power is being redefined.

From a Single Factory to a Country's Future

Energy transformation is not some abstract national strategy—it's a series of real, unfolding stories. The plastic bag factory in Lahore is just one small example, yet it offers a glimpse into the broader future of Pakistan.

When factory lights no longer flicker out due to power outages, when production lines run steadily and efficiently, and when workers are more secure in their livelihoods, changes become visible. As rooftop PV panels begin to appear on rural schools and urban neighborhoods, energy equity and accessibility are no longer just slogans—they become the sunlight streaming through windows each morning.



Power Story

This is the living embodiment of Huawei Digital Power's vision: "Light that changes lives." As well as helping save money, PV power is vital to improving lives, restoring the environment, and advancing society. It serves as the catalyst for industry upgrades, guardian of air quality, and symbol of hope for a brighter future.

Huawei's Smart PV solution uses AI algorithms to analyze power generation efficiency, energy storage status, and loads in real time, enabling precise dispatching of power generation, storage, and consumption. Additionally, self-sufficiency in electricity has significantly increased, easing peak power gaps and reducing reliance on the external grid by over 40%. With more stable power supply, companies have confidence to expand investments and add shifts, creating new job opportunities.

In recent years, Huawei Digital Power has continued to collaborate with partners across Pakistan, igniting one beacon of hope after another in a land urgently in

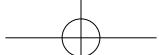
need of light. This is more than just the application of technologies—it's a shared journey toward sustainability, social responsibility, and a digital future.

It's easy to envision a tomorrow where more schools, hospitals, and agricultural hubs adopt similar solutions. That means classrooms can stay lit through the night, operating rooms can run reliably, and farmers can irrigate their fields whenever needed. Energy accessibility is quietly transforming every corner of daily life.

As Lahore's sky begins to clear, as workers labor in well-lit workshops, and as the country's energy mix is gradually reshaped by sunlight, a new chapter for Pakistan is quietly unfolding. This is the power of sunlight—it revives a factory, inspires a country, and reminds the world that energy transformation is not just a technological choice, but a shared human imperative.

Light is illuminating Pakistan. ▲





Lighting the Future: Empowering Lives in the Land of Samba

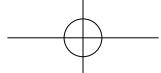
A stable power supply is vital not only for counties, cities, and factories, but also for every community and household. It is indispensable for Nicole, a Brazilian girl whose life depends on a ventilator and a pulse oximeter.

The greatness of technology lies not only in data processing capability and efficiency, but also in its thoughtful concern for human life.

Nicole, daughter of an ordinary Brazilian family, lives with a chronic disease that requires her to use a ventilator and a pulse oximeter around the clock.

Already burdened by steep medical expenses, her family faced constant anxiety over high electricity costs for powering these devices—bills exceeding 300 reais (about US\$56) forced them to reallocate their monthly living expenses.

This situation changed dramatically when Virtron Energia



Power Story

Solar partnered with Huawei to bring sunlight into their home. The solution turns sunshine into a stable power supply for Nicole's life-critical medical devices. Using a Smart Energy Controller, Huawei's residential Smart PV solution integrates an AI-powered active arc protection system that automatically cuts off abnormal arcs within 0.5s. The solution also features a three-level EMC protection design, ensuring that no electromagnetic interference affects household appliances and medical devices.

Thanks to Huawei FusionSolar, Nicole can now use her ventilator safely at home without fearing that a power outage would force her back to the hospital. Her family is relieved from day-and-night anxiety over electricity bills.

The family's story exemplifies technological implementation and reflects the far-reaching impact of Huawei Digital Power on social livelihood. PV systems are now more than just a power generation tool for industrial parks; they have become part of household life in a more meaningful way.

Value and Social Significance of Energy in Brazil

Brazil, known as the Land of Samba, is home to over 200 million people. Continuous changes in the Amazon rainforest have caused water levels of reservoirs in Brazil to drop below the 30% warning threshold in recent years. Consequently, power generation from hydropower stations has plummeted by 50%, plunging many villages into frequent darkness. Brazil is suffering from an invisible energy crisis.

During the dry season of 2024, water levels at major hydropower stations in Brazil dropped to their lowest in nearly two decades. Once-raging tributaries of the Paraná River exposed vast stretches of cracked riverbed, causing the country's hydropower contribution to the national grid to nosedive from a usual level of 65% to

42%. To fill the gap, the government had to urgently activate oil-fired power generation, driving Brazil's monthly energy import costs up by US\$1.2 billion.

Falling water levels at hydropower stations and rising fuel prices are placing a heavy burden on ordinary citizens. More distressing is the imbalance in energy distribution. In the economically developed southeastern region, power outages are controlled to one hour at most per day, whereas some indigenous communities in the northern Amazon state endure darkness for 4–6 hours each day.

As early as the 1990s, Brazil began to explore solar power generation at the regulatory level. However, constrained by technological costs and the dominance of hydropower, the PV industry failed to grow. Since 2015, the landscape has changed significantly. PV power has gradually become the second largest source of electricity in Brazil, accounting for 19% of the country's total installed capacity. By the first half of 2024, Brazil's cumulative installed PV capacity reached 44 GW, with





Lighting the Future: Empowering Lives in the Land of Samba

distributed PV generation accounting for 68% and residential PV for 33%.

Huawei FusionSolar inverters and residential solutions are well-positioned to play a significant role in this vast, diverse, and energy-hungry market. For households, they deliver reliable, cost-effective power and autonomy over electricity usage. For commercial and industrial (C&I) customers, Huawei FusionSolar SUN2000-150K inverters reduce system construction and maintenance costs, improve return on investment (ROI), optimize power quality, and ensure grid stability through the use of highly efficient, reliable, and intelligent operations and maintenance (O&M) tools.

More importantly, the application of Huawei FusionSolar in Brazil provides a replicable technical pathway. Whether for homes, hospitals, schools, or industrial parks, smart PV and energy storage systems ensure an efficient, safe, and stable power supply. This means that in Brazil and other populous countries, clean energy is not only a national strategy but also a powerful force for improving people's livelihood and enabling a better life.

Stable and Reliable All-Rounder

Energy is vital to modern civilization.

We have long believed that "knowledge is power." In the new era, energy itself has become a key force for social progress and improved quality of life. As the world advances toward clean and low-carbon solutions, PV energy is emerging as an indispensable force. In Brazil, a stable and reliable solution is critically needed for the country's shift toward renewable energy.

The Huawei FusionSolar SUN2000-150K inverter, hailed by the industry as an all-rounder, is a go-to choice for many C&I PV projects worldwide. It features higher yield, active safety, long-term reliability, simplified O&M, lower

balance of system (BOS) costs, and grid-friendliness. Each of these advantages addresses key pain points in traditional PV systems.

Its rated output power is 150 kW, with a maximum power of 165 kW. It is equipped with seven MPPTs, each supporting three PV strings. The maximum input current is 48 A. The SUN2000-150K is applicable to both large C&I parks and diversified PV module combinations.

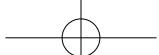
The inverter achieves a power generation efficiency of up to 98.8%. Powered by intelligent algorithms, it delivers a maximum dynamic MPPT efficiency of 99.839%. Its built-in PID recovery solution counters module degradation, improving energy yield by 3%, as verified by TÜV.

In active safety, the SUN2000-150K implements millisecond-level smart string-level disconnection, intelligent DC-to-ground protection, and terminal temperature checking, significantly reducing device failure risks. The intelligent arc protection technology automatically cuts off abnormal arcs within 0.5s to prevent fires.

For long-term reliability, Huawei adheres to the Integrated Product Development (IPD) process and joint component customization and conducts over 1,400 rigorous tests. This ensures that the inverter achieves 99.999% availability in extreme environments and that the service life of major components exceeds 25 years.

Furthermore, the inverter features simplified O&M and lower BOS costs. Module-level insulation detection and intelligent design tools make design, installation, and O&M more efficient and economical, maximizing ROI.

As the world moves toward low-carbon development and energy diversification, Huawei FusionSolar, through its technological innovations, paints a vision of clean, reliable, and smart energy for Brazil. ▲



Beichuan 100 MW Charging Station: Electrified Logistics Fast-Tracks the Shift to Zero-Carbon Transportation

The integration of green energy, megawatt charging, and grid technologies is accelerating transformation across application scenarios including mines, ports, and logistics lines. In Beichuan, zero-carbon transportation is becoming a reality.

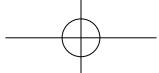
Across the mountainous terrain and mining roads in Beichuan Qiang Autonomous County, Mianyang City, Sichuan Province, fleets of heavy goods vehicles (HGVs) are constantly in operation. Historically, the rumbling of diesel engines and plumes of exhaust defined the backdrop of mining area logistics. Now, a new scene is unfolding, featuring electric HGVs powered by the world's first 100 MW charging station, supported by Huawei's megawatt charging technology.

This station was constructed by Sichuan Yuanqi Starlight Digital Power Technology Co., Ltd. and adopted Huawei's megawatt charging technologies to provide vehicle owners

with an experience of ultra-fast charging. The station has set a new benchmark for HGV charging infrastructure. It is more than just a charging station; it is an "energy engine" that carries the vision of green development and accelerates the logistics industry toward a fully electric future.

Beichuan Electrified: The Dawn of Megawatt Charging

Rich in gravel reserves, Beichuan faces a growing demand for efficient transportation solutions. Mining transportation has traditionally relied on diesel-powered HGVs, which are energy-intensive, polluting, and expensive to operate. The



Beichuan 100 MW Charging Station: Electrified Logistics Fast-Tracks the Shift to Zero-Carbon Transportation

emergence of electric HGVs has created an opportunity for green transformation, yet "range anxiety" and "charging efficiency" have remained critical bottlenecks.

The Sichuan Yuanqi Starlight Heavy Goods Vehicle Megawatt Charging Station was established to address this challenge. With a total investment of CNY150 million and spanning 46,666 square meters, the station is designed with a power capacity of 100 MW. It includes 18 megawatt charging spots, each with 1.44 MW of power, and 108 liquid-cooled ultra-fast charging spots, each with 600 kW of power. The facility can serve up to 700 electric HGVs per day. Since its launch, the station has supplied over 300,000 kWh of electricity daily, enough to power a small town.

Furthermore, the station uses an integrated PV+ESS+charger solution, featuring a nearly 1 MW PV carport and two 215 kWh hybrid cooling energy storage systems (ESSs). The station generates about 3,000 kWh of green electricity daily, reducing carbon emissions by about 27,000 tons annually and setting a new benchmark for the green and low-carbon transformation of Beichuan's mining sector. This is not merely a charging station; it is a zero-carbon energy facility.

Three Pillars of Megawatt Charging

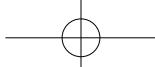
1. Ultra-fast charging

The concept of ultra-fast charging may once have seemed unattainable, but it has become a reality in Beichuan. Leveraging Huawei's megawatt charging technology, the station enables "15-minute" charging, solving a critical operational challenge for electric HGVs. For the logistics industry, this means a significant improvement in vehicle turnover efficiency, truly achieving "shorter stops, longer drives."

2. Superior quality

Unlike passenger vehicle charging, HGV charging demands higher standards of safety, stability, and reliability. Huawei FusionCharge Megawatt Charging Solution achieves the industry's first stable output of 2,400 A and earning the "Star of Megawatt Charging" certificate from the China Automotive Technology and Research Center (CATARC). With a service life of over 10 years, the solution is built with a fully enclosed, liquid-cooled design to withstand extreme environments, including high temperatures and dust common in mining areas, delivering reliable performance





Power Story

and operating with minimum energy loss.

3. Optimal return on investment (ROI)

The energy cost per kilometer for an electric HGV is approximately CNY1.5 lower than that of a diesel equivalent. This translates to annual savings of around CNY150,000 per vehicle. For fleet operators and charge point operators (CPOs), this represents an environmentally conscious design as well as a financially sound strategic investment. Through the PV+ESS+charger technologies, the station can also participate in time-of-use (TOU) arbitrage and maximize green energy consumption, achieving both environmental and economic benefits.

Cross-sector Collaboration for Electrified Logistics

A single charging station can power a mining area, while an ultra-fast charging network can propel the entire industry into a new stage of development.

At the project launch ceremony, Xuzhou Construction Machinery Group (XCMG) delivered the first batch of 200 megawatt charging tractors, as part of the Phase I order totaling 500 units. By the end of 2025, a total of 59 megawatt charging HGV models are expected to be launched, with 22 models already delivered with Huawei's partners.

In effect, the HGV industry is fostering a new ultra-fast charging ecosystem through full-chain collaboration, seamlessly integrating vehicles, chargers, and grid infrastructure. The Sichuan Yuanqi Starlight Heavy Goods Vehicle Megawatt Charging Station represents a benchmark and model for developing electric HGVs and the transition toward ultra-fast charging solutions. It also marks the continued advancement of the ecosystem, which unites partners including solution providers, HGV manufacturers, and CPOs. In the future, as more stations replicate the Beichuan model, China is poised to lead the establishment of a widely accessible, standardized, and ecosystem-supported megawatt charging network.

If the first wave of the EV revolution was led by passenger

cars, the next chapter undoubtedly belongs to commercial vehicles. Compared to personal mobility, logistics transportation forms the backbone of the industrial supply chain—making its energy transition critical for economic resilience and sustainable development.

According to the International Energy Agency (IEA), the global stock of electric HGVs is projected to reach several million units by 2030. Backed by a robust supply chain and early investments in ultra-fast charging infrastructure, China is well-positioned to lead the global shift toward electrified logistics. The 100 MW charging station in Beichuan is a microcosm of this broader strategy.

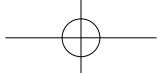
Electric HGVs not only reduce carbon emissions—they also improve logistics efficiency, transform operational models, and reshape the energy landscape. The integration of green energy, megawatt charging, and grid technologies is accelerating transformation across application scenarios including mines, ports, and logistics lines. Zero-carbon transportation is becoming a reality.

Driving Toward a Zero-Carbon Future

Some say HGVs are the steel backbone of industrial civilization. Today, that backbone is being reforged—cleaner and more efficient than ever. The megawatt charging station in Beichuan may be just one component of the zero-carbon logistics blueprint, but it offers a compelling glimpse into the future.

From the thick smoke of diesel to the clean power of green electricity; from long waits to ultra-fast charging; from the transformation of a single mine to the reshaping of an entire industry—this is more than a technological upgrade. It is a profound redefinition of how humanity interacts with energy, transportation, and the environment.

"As the time comes to ride the wind and cleave the waves, I'll set my cloud-white sail to cross the sea that raves." As electric HGVs surge across ultra-fast charging networks, we are not just accelerating logistics—we are steering toward a cleaner, more promising zero-carbon future. ▲

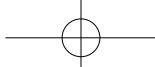


Building a Fully Connected, Intelligent World

Smart Charging Network

Jointly Charging the Road Ahead





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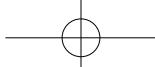
Huawei FusionCharge Powers Guiyang Quanhу Park, Advancing New Infrastructure in Guizhou

The completion of the Huawei FusionCharge Demonstration Charging Station in Quanhу Park has established two key benchmarks: It serves as a model for enhancing citizens' green travel experience through accessible and sustainable infrastructure. It also acts as a powerful catalyst for innovation and growth in the regional digital power industry.

Driven by carbon peaking and carbon neutrality goals, China's electric vehicle (EV) industry is developing at an unprecedented pace. As automakers continue to launch EVs with longer driving ranges and enhanced performance, the need for robust, scalable charging infrastructure is becoming increasingly urgent. Delivering efficient, intelligent, and green charging services in dense urban centers is now a critical focus for building the renewable energy cities of the future.

Embracing this green transformation, Guiyang Quanhу Park launched the Huawei FusionCharge Demonstration Charging Station, setting a new global benchmark for EV charging services.

On July 8, 2025, the launch ceremony for the charging station, themed "Ultra-fast Charging in China, Carbon Neutrality Tour in Guizhou" was held in Baiyun District, Guiyang. It is not only the first integrated PV+ESS+charger station in Guizhou, but also one of the largest demo stations in China supported by Huawei FusionCharge. The completion of the station marks a significant step in the deep integration of Guiyang's EV industry ecosystem and the digital economy. It also signals the beginning of a new era of innovative models that are both replicable and scalable for regional digital power development.



Huawei FusionCharge Powers Guiyang Quanhu Park, Advancing New Infrastructure in Guizhou

Policy-Driven Renewable Energy Development

Guizhou Province has released a series of policies, including the Three-Year Action Plan for New Infrastructure Construction in Guizhou Province (2022–2024) and the Electric Guiyang initiative, laying a solid foundation for the EV industry. As EVs gain popularity, building reliable charging infrastructure has become a key priority.

Against this backdrop, Baiyun District has partnered with Guizhou Power Grid and Huawei Digital Power to develop the charging station at Quanhu Park. The site was provided by the Guiyang Power Supply Bureau, with investment from China Southern Power Grid Guizhou Electric Vehicle Service Co., Ltd. and Hubei Shanxin Energy Technology Group Co., Ltd. The station is equipped with innovative Huawei FusionCharge Solutions.

The station is not merely a charge point, but China's first comprehensive demo that integrates the PV system, energy storage system (ESS), Huawei FusionCharge Solution, and a vehicle-to-grid (V2G) aggregation platform. The integration is managed by an intelligent platform with AI-driven prediction and multi-element system optimization and control to maximize the use of renewable energy, enabling green and low-carbon mobility.

Liquid Cooling Technology Enhances Charging Convenience

The station covers approximately 3,900 square meters at the northwest intersection of Yunfeng Avenue and Longjing Road, adjacent to Quanhu Park. It includes 130 charging spots powered by Huawei's integrated PV+ESS+charger solution. Among the charging spots are 20 liquid-cooled ultra-fast charging connectors, each with a maximum output of 600 kW, and 100 fast charging connectors, each with a maximum output of 250 kW. This combination of ultra-fast and fast charging enables high-efficiency charging for up to 120 vehicles simultaneously.

A highlight of the station is Huawei's liquid-cooled ultra-fast charging connector. Each connector delivers

a maximum output of 600 kW, achieving a charging efficiency 10 times higher than traditional air-cooled chargers. It offers an ultra-fast charging experience comparable to refueling a conventional fuel-powered vehicle.

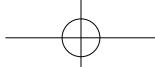
Li Xianlin, a resident, shared his experience at the demo station: "It takes only five minutes to add 200 kilometers of range. I can get a full charge in the time it takes to drink a cup of coffee. It's incredibly efficient!" Vehicle charging is convenient and the experience deeply reinforces the concept of green mobility. The station also incorporates an intelligent microgrid that integrates multiple power sources, including PV power, energy storage, V2G power, and grid electricity. This enables smart dispatch and optimization of charging loads, improving the charging experience for EV users while supporting operational reliability of the urban power grid.

Regional Demonstration and Industry Development

The successful completion of the project relied on the efficient coordination and multi-department collaboration of the Baiyun District Government. Since 2024, the district has established a project team to oversee all aspects, including land use, power supply, and cable reconstruction; held multiple progress meetings; and coordinated resources at all levels to ensure the project moved forward smoothly. In June, 2025, the station began trial operations, achieving full system coordination and ensuring high operational efficiency after the official launch.

This collaborative approach offers valuable reference for other cities promoting large-scale renewable energy infrastructure. The synergy of policy guidance, corporate investment, technological innovation, and government support has proven essential to the high-quality delivery of projects.

The station elevates the charging experience for EV users in Guiyang and provides a model for the innovative development of the regional digital power industry. The PV



Power Story

system, ESS, and chargers at the station are managed in a unified manner to maximize renewable energy utilization, enabling green and low-carbon mobility. This also facilitates the implementation of the "vehicle-charger-grid" interactive ecosystem.

Looking ahead, Baiyun District will use this project as a foundation to continue advancing carbon peaking and carbon neutrality goals, address challenges in EV charging, and enhance citizens' green mobility experience. Additionally, the success of the demo station is expected to attract more digital power and renewable energy enterprises, contributing to the growth of a comprehensive digital power industry ecosystem in Guiyang.

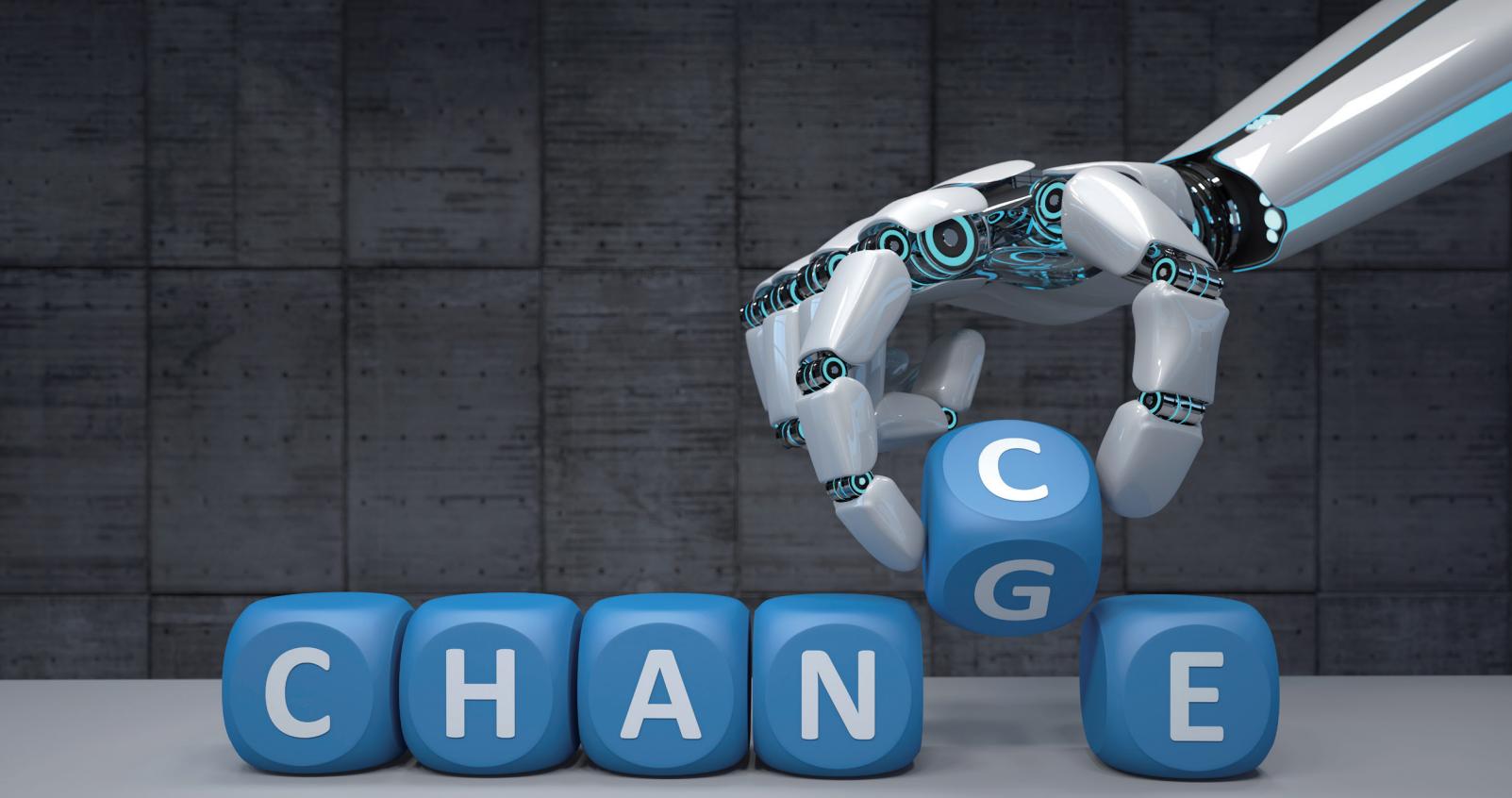
A Model for Digital Power and Green Mobility Integration

The Quanhu Park station exemplifies technological

innovation, policy support, and cross-sector collaboration. It redefines the EV charging experience—moving from waiting in line to seamless plug-and-charge convenience. At the same time, it helps transform the urban power grid from passive adjustment to active, intelligent optimization, establishing green energy as a dynamic force for economic and social progress.

Against the backdrop of rapid adoption of renewable energy across China and the world, the Quanhu Park station is a benchmark for innovation in Guizhou. Its pioneering application and operational model offer new insights and a reference for future energy infrastructure projects. As more similar projects are rolled out, the integration of digital power and green mobility will extend to more regions, accelerating progress toward carbon peaking and carbon neutrality goals and driving a wider energy transition. ▲





The 11-Month Journey: Building an AI Data Center at an Incredible Pace

A benchmark AI data center project in Johor, Malaysia, has achieved what many thought was impossible: completing a 60 MW high-density data center in just 11 months. This sets a new benchmark for AI data center construction in the Asia-Pacific region. The question is, how was all this achieved?

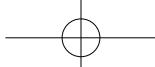
The answer lies in the philosophy that guides the project: time is the ultimate test, and innovation is the only possible response. Amidst the tropical sea winds of Johor, Malaysia, a new AI data center campus was built. The first phase of the project, with a total capacity of 60 MW, achieved service rollout within 11 months of construction.

This project was completed at a pace deemed nearly impossible in the data center field, setting a record for construction timeline and a new benchmark for AI data centers. This achievement was made possible by Huawei's data center facility solutions, which deliver reliability, agility, and sustainability, enabling customers to achieve a leap in benefits previously deemed unattainable.

Challenges

With the AI boom, computing giants and colocation operators are pouring into Johor, Malaysia, transforming it into a hotspot for data center investment. In the AI computing era, speed is critical, and time is money. The ability to rapidly deploy AI services and computing resources equates to tens to hundreds of millions of dollars in commercial returns. To gain a competitive advantage, the data center customers presented what seemed an impossible demand: deliver a 60 MW data center within 12 months, with power density exceeding 20 kW/rack and a power usage effectiveness (PUE) no higher than 1.4.

Conventionally, it was believed that deploying a data center of comparable scale would take at least 24 months. Making matters worse, located at the southern tip of the Malay



Power Story

Peninsula and close to the equator, Johor is known for its year-round high temperature and humidity. And due to the impact of municipal infrastructure, water resources are limited.

At the same time, the high power density of AI computing presents unprecedented challenges to system reliability, space layout, and cooling methods. The project had to be fast, stable, high-density, green, and low-carbon.

This was, without exaggeration, a high-stakes engineering game testing the limits of innovation.

Solution

• Modular Architecture and Prefabricated Delivery

Faced with the 12-month rollout timeframe, in response to this seemingly impossible mission, Huawei Digital Power worked with ecosystem partners to adopt an innovative solution—prefabricated modular construction. The data center's IT data halls and electromechanical facilities adopted a fully modular architecture, with the IT data halls decoupled from the power supply modules. The three buildings bearing 60 MW IT load were constructed using nearly 1,000 "Lego-like" prefabricated modules. The prefabrication of these modules proceeded in parallel with onsite civil construction. These modules were then quickly assembled upon delivery. By leveraging modularity for agility and decoupling for flexibility, the project reduced the traditional 24-month project duration to 12 months, shortening the rollout time by 50%.

This "building-block" data center construction mode not only significantly enhanced construction and delivery efficiency, but also ensured high quality through the in-depth integration of standardized design and industrialized production. Engineering productization means pursuing excellence and elegance in every detail. Each cable and bolt was optimally configured during prefabrication, reducing uncertainties during on-site construction and ensuring efficient delivery and excellent quality.

• Distributed Architecture, One Power System Per Container

Surging compute demands in the AI era introduce significant uncertainty: fast service changes, large load fluctuations, and enlarged failure domains. Ensuring security and reliability becomes essential. As the "heart" of the data center, the project's core power supply system adopted a distributed architecture and Huawei's FusionPower9000 outdoor PowerPOD. One power system was deployed per container, and the modules were decoupled. If any module failed, other modules could continue to operate independently. The solution prevented fault propagation, minimized the failure domain, and guaranteed uninterrupted business operations. This meant the "heart" of the data center would not fail due to local faults. To a certain extent, the data center is self-healing and provides dynamic resilience.

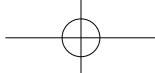
In addition, the outdoor PowerPOD incorporates a lithium battery backup system that was decoupled from the main buildings and deployed separately from the IT data halls. This design isolates potential failure domains outdoors, thereby minimizing service impact and enhancing the AI data center's resilience.

• High Density and Efficiency, Green and Low-Carbon Development

To address heightened energy concerns and accelerate carbon-neutrality goals, the customer, as a leading colocation provider, had to build a high-performance data center and champion green principles, positioning itself as a pioneer in low-carbon, sustainable development.

The project incorporated Huawei's FusionPower9000 outdoor PowerPOD to build a high-density, integrated power supply solution. The UPS, lithium battery system, and low-voltage power distribution system were integrated into a single POD. With a capacity reaching 2.7 MW, a single module occupied less than 50 square meters. This design saved about 40% of the power room area while also improving the power supply efficiency across the entire link, achieving "more with less."

Additionally, an innovative air-cooled fan wall solution was used for data center cooling. This solution requires no



The 11-Month Journey: Building an AI Data Center at an Incredible Pace

water consumption while providing highly efficient heat dissipation, achieving an excellent PUE of approximately 1.4 in Malaysia's hot, humid tropical climate.

Achievements

At the end of July 2024, three data center buildings with a total IT capacity of 60 MW were fully commissioned and operational. The project became one of the largest colocation data centers in Malaysia and a crucial high-density AI computing hub in the local region.

The success of the project not only enabled the customer to seize the opportunities in the booming AI data center market but also provided strong support for its subsequent business development. More importantly, the project set a new industry benchmark for the entire Asia-Pacific region. Reliability, agility, and sustainability have become the new standards for regional data center construction.

The project has become a benchmark for AI data center construction in Johor. Following this success, an increasing number of data center builders have adopted its approaches: modular design, distributed architecture, outdoor PowerPOD, functional area decoupling, and remote backup power deployment. This has rapidly emerged as a mainstream model in the Asia-Pacific region.

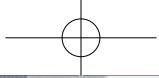
Benefits

This 11-month feat represents more than a technical triumph; it's also a breakthrough in our fundamental understanding of data center construction. From its architecture down to its physical implementation, the project demonstrated a new understanding of AI computing through technology: speed is not a compromise on performance, but rather a new dimension of efficiency; integration is not merely about reduction, but a deep synergy of efficiency and reliability; sustainability is not a slogan, but the essence of computing.

As a famous saying goes, "The only reason for time is so that everything doesn't happen at once." The story of this 60 MW AI data center demonstrates that when innovation is sufficiently profound, the very order of time can be redefined. Its success has led to a redefined understanding of "speed"—not merely compressing schedules, but achieving a harmony of speed and sustainability, and ensuring reliability through innovation.

In the midst of the surging AI wave, this landmark project stands as a beacon, illuminating the path toward a future of smart energy and green computing. It demonstrates to the world that when technology merges with energy, and when intelligence moves in harmony with speed, even the so-called "impossible" chasm can be bridged. ▲





Wuhan Supercomputing Center: A Historic City Embraces the Intelligent Computing Era

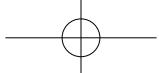
The completion of the Wuhan Supercomputing Center signifies more than the establishment of a new computing facility; it highlights computing power's role as a core production factor, now integral to the digital economy. The Wuhan Supercomputing Center has also pioneered a unique green development path characterized by high performance with low energy consumption.

Situated along the Yangtze River, Wuhan has been a major transportation hub since ancient times.

Today, this historic city is stepping into a new technological era. With the accelerated rollout of China's "East Data, West Computing" strategy and the deepening integration of artificial intelligence (AI) and high-performance computing (HPC), Wuhan has rapidly established a powerful "intelligent computing + supercomputing" dual-engine model. Built in just six

months, the Wuhan Supercomputing Center—China's largest prefabricated modular data center—has become a landmark presence on China's computing power map.

However, the flip side of computing power is energy consumption. The power, cooling, and management requirements of ultra-large computing clusters often pose a major barrier to further growth. The Wuhan Supercomputing Center delivers powerful computing capabilities for scientific research, industries, and



Wuhan Supercomputing Center: A Historic City Embraces the Intelligent Computing Era

society, while overcoming the challenge of high energy consumption through Huawei Digital Power's innovative solutions. It sets a new benchmark for green, reliable, and low-carbon data centers.

Intelligent Computing + Supercomputing

On November 23, 2022, the Wuhan Supercomputing Center officially commenced operations. Housed in a building shaped like a giant CPU, with a total floor area of approximately 4,400 square meters, the center has a total planned computing capacity of 200 PFLOPS, with an initial deployment of 54 PFLOPS. Its technological foundation is built upon tens of thousands of Kunpeng processor cores and thousands of accelerator cards, integrating both AI and HPC resources to establish itself as China's first "multi-purpose, cloud-based computing cluster."

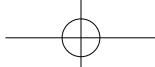
Together with the adjacent Wuhan AI Computing

Center, the Wuhan Supercomputing Center forms a "dual-engine" computing power configuration in Wuhan. The two centers jointly support cutting-edge scientific research in areas such as climate modeling, life sciences, and industrial simulation, and have incubated a series of world-leading technological achievements in heavy rain prediction, whole-cell genome sequencing, numerical wind-tunnel testing, and other fields. To date, the Wuhan Supercomputing Center has served over 100 enterprises, becoming a core engine for innovation and development in the middle reaches of the Yangtze River.

Building a supercomputing center typically involves long construction timelines, significant investment, and complex coordination. Yet, the Wuhan Supercomputing Center was completed in just 172 days, setting a new standard known as the "Wuhan speed."

The key lies in Huawei's FusionDC1000C prefabricated





Power Story

modular data center solution. Unlike the conventional "onsite construction and sequential setup" approach, FusionDC1000C adopts a parallel approach of "factory prefabrication + onsite installation." Core modules are standardized in the factory, then transported to the site for rapid assembly and installation. This approach not only enhances construction efficiency but also guarantees engineering quality and project delivery consistency.

On June 20, 2022, the first prefabricated container was hoisted into place. On July 19, the main structure was completed. On November 23, the Wuhan Supercomputing Center officially began operation. In just half a year, the center went from blueprint to reality. This speed accelerates AI big data services and sets a new benchmark for the construction of supercomputing centers in China and globally.

Intelligent Core of Green Computing

Behind the surge in computing power lies a challenge: soaring energy consumption. The power density of a single rack here reaches 66 kW, which is eight times that of a conventional IT rack. This places multiple demands on both power delivery and cooling systems. Achieving a high-efficiency power supply and low-carbon operation within a limited space became a central challenge in its construction and operation.

The Wuhan Supercomputing Center adopted the Huawei FusionPower6000 solution. Guided by the principles of "reliability, agility, and sustainability," this solution redefines the power supply and distribution link, providing one power supply per row. It uses AI to enable full-link visual management, predict high-temperature behavior of key nodes under low load, and forecast the lifespans of vulnerable components. This shifts maintenance from a passive to a predictive model, significantly improving system reliability. By replacing cables with prefabricated busbars and using prefabricated modules, this solution reduces the

delivery period from 2 months to 2 weeks, accelerating the rollout of supercomputing services. The use of high-density UPS and flapwing switches saves cabinets and reduces the footprint by 40%, thereby improving space utilization. Operating efficiently in double-conversion mode, the system saves approximately 1 million kWh of electricity annually compared to conventional solutions, equivalent to reducing carbon emissions by 600,000 kg. While ensuring a highly reliable power supply, it achieves significant reductions in both energy consumption and O&M pressure.

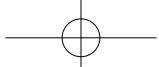
Cooling, along with power, is another major energy consumer. The Wuhan Supercomputing Center incorporates Huawei's iCooling@AI energy efficiency optimization solution. By collecting and analyzing large-scale operational data and applying AI algorithms for dynamic control, the solution reduces power usage effectiveness (PUE) by more than 8%. In effect, AI takes over the "cockpit" of the cooling system, enabling more precise and efficient temperature control and eliminating energy waste from overcooling.

Collectively, these measures have enabled the Wuhan Supercomputing Center to maintain exceptional computational power while balancing high performance and low energy consumption.

From City Landmark to National Node

The Wuhan Supercomputing Center is a landmark project for regional development and also a key node in the national strategy. In August 2022, it was officially connected to the China Computing NET, becoming an important hub in the "East Data, West Computing" project.

This achievement stems from collaborative innovation among the Wuhan Municipal Government, industrial partners, and Huawei Digital Power. From top-level design to implementation, and from hardware architecture to energy efficiency optimization, the Wuhan Supercomputing Center has integrated expertise



Wuhan Supercomputing Center: A Historic City Embraces the Intelligent Computing Era

from multiple stakeholders to build a reliable, agile, and sustainable computing foundation.

The completion of the Wuhan Supercomputing Center represents far more than the addition of a supercomputing facility. It signals that computing power has become a key factor for production, as essential as water, electricity, and coal. In the race for AI and the digital economy, control of high-performance, cost-effective computing resources is the key to prevailing in the competition.

Today, Wuhan, powered by its "intelligent computing + supercomputing" dual-engine model, is attracting a growing number of research institutions and enterprises, including the BGI Research Institute, PIESAT, Institute of Automation (Chinese Academy of Sciences), Shuimu BioSciences, Shenzhen Bosheng, and the Wuhan AI Research of Peking University. In the future, Wuhan will drive leapfrog development in fields such as biomedicine, smart manufacturing, smart cities, and climate prediction. The Wuhan Supercomputing Center

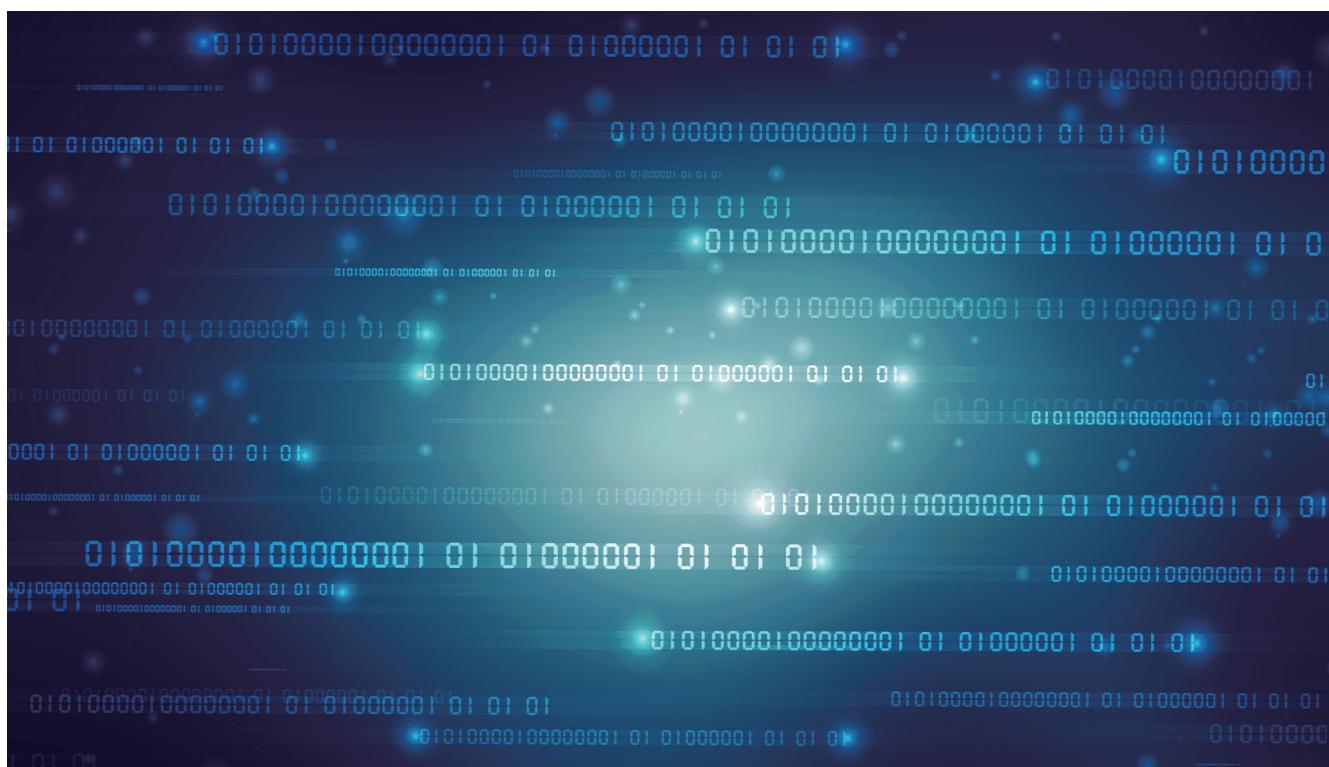
not only illuminates the city's night sky but also lights the path for China's computing power economy.

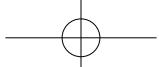
Summary

For centuries, Wuhan has built its history on openness and resilience. In the face of the AI revolution, the city is acting with speed and foresight.

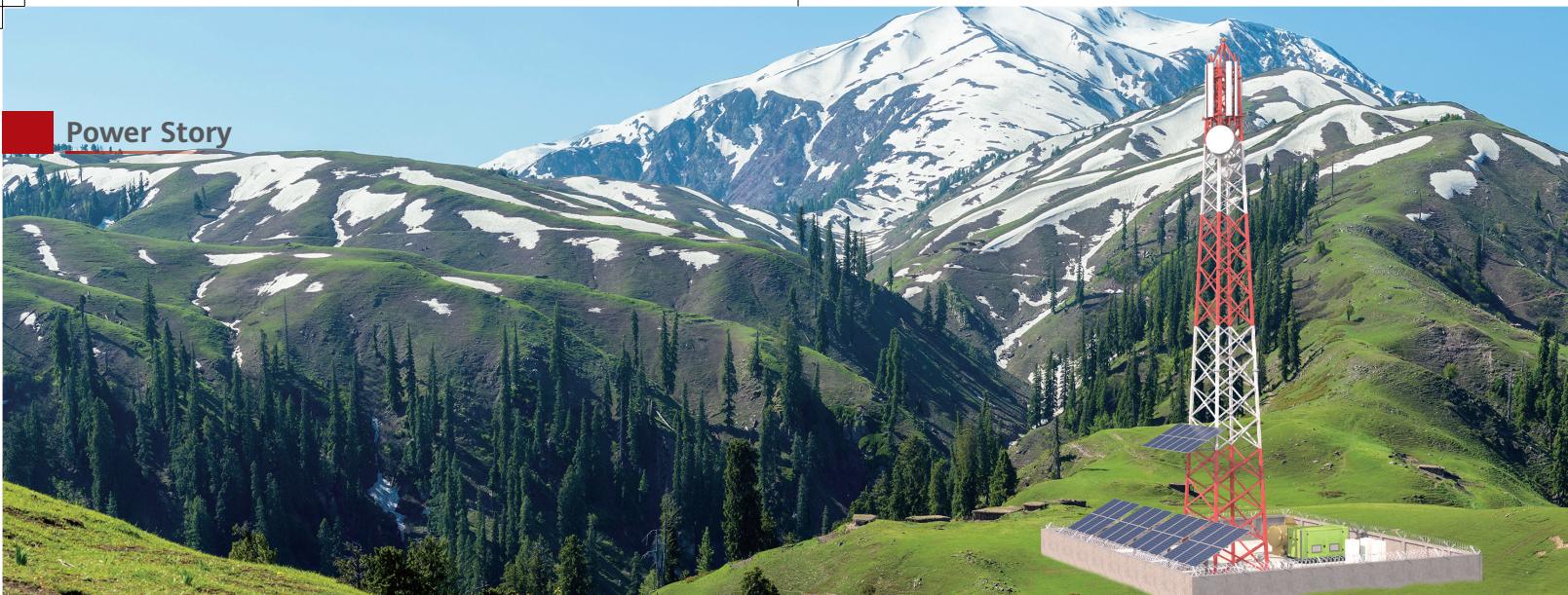
The Wuhan Supercomputing Center, a "steel brain" shaped like a CPU, not only delivers massive computing power to scientific research and industry, but also addresses the dilemma of high computing power and high energy consumption through its green, low-carbon design. Standing shoulder-to-shoulder with the Wuhan AI Computing Center, it forms a "dual-engine" configuration on the national computing map and embodies China's commitment to a sustainable computing future.

In the era when AI and HPC converge, the Wuhan Supercomputing Center represents the ambitious rise of a city and China's readiness to embrace the future. ▲





Power Story



From Desert to Plain: A Green Revolution Under Telecom Towers

Amid the wave of global energy transition, the telecom industry is pursuing the path of low-carbon development. As 5G networks expand and the number of sites increases, operators face challenges in maintaining efficient, energy-saving, and eco-friendly network operations. Starting at the site level, Huawei is leveraging technology to explore opportunities for green development.

The telecom industry, an "invisible" digital infrastructure sector, is emerging as a key area for reducing carbon emissions. Advances in AI, 5G, and livestreaming technologies and applications increase power consumption at telecom sites. Renewable energy offers more cost-effective and environmentally friendly solutions than traditional energy sources. Operators must now prioritize energy savings and reduce carbon emissions while ensuring network reliability.

Using "green sites" as a starting point, Huawei collaborates with global operators to modernize their energy systems. Cases from Kuwait in the Middle East and Pakistan in South Asia illustrate distinct yet parallel successes, demonstrating that technology makes sustainability achievable.

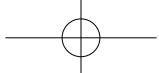
Green Network in Kuwait

In the Kuwaiti desert, under the relentless sun, the Zain and Huawei "green story" begins. Zain, a leading Middle Eastern telecom operator, established its "net zero emissions by 2050" target early, aligning with Huawei's objectives.

To achieve this, Zain embarked on modernizing its network energy infrastructure, transforming a traditional communication network reliant on diesel generators and air-conditioned equipment shelters into a simpler and greener network. Huawei proposed a solution: Develop a smarter, more efficient, and greener power system at each site.

In the remote desert areas, Huawei replaced traditional shelter-based equipment with a single outdoor cabinet. The power supply system and energy storage equipment were integrated into the cabinet, reducing energy consumption for air conditioning, increasing site energy efficiency from 55% to 90%, and significantly alleviating O&M pressure.

Furthermore, Zain adopted Huawei's iSolar site PV deployment solution. PV systems were used to replace diesel generators, implementing PV+energy storage synergy and intelligent scheduling. Operational data confirms that this solution lowers fuel consumption by 18,000 liters, reduces CO₂ emissions by 49 tons, and shortens diesel generator runtime by 73% annually per site. The significant improvement in



From Desert to Plain: A Green Revolution Under Telecom Towers

energy self-sufficiency allows the sites to operate reliably even in extreme high-temperature environments.

Behind these energy-saving metrics lies a core belief: In resource-constrained environments, digitalization and intelligence enable energy use to be more precise and sustainable, transforming the communication network from a mere technology carrier into an inclusive digital foundation.

Huawei has supported Zain in deploying Huawei's green network solution across several countries, including Kuwait and Saudi Arabia. Over 1,800 sites have been modernized and are projected to reduce carbon emissions by 150,000 tons annually, equivalent to planting 4.8 million trees.

This represents a quiet revolution, shifting from fuel-based to solar-powered operations. Empowered by technology, communication networks now thrive under the relentless sun, bringing service to unconnected areas and illuminating digital pathways in remote regions.

Low-Carbon Breakthrough in Pakistan

Unlike Zain in oil-rich Kuwait, JAZZ in Pakistan faces challenges of limited grid energy supply and high energy costs.

Pakistan's power grid infrastructure is underdeveloped, leading to frequent power outages and an unstable power supply. Diesel generators and rising fuel prices impose a heavy operational burden on telecom sites. JAZZ, Pakistan's largest mobile operator and a subsidiary of VEON, is committed to achieving VEON's goal of zero emissions by 2050 by pursuing practical and attainable sustainability approaches.

In 2024, after rigorous technical reviews, JAZZ finally chose to partner with Huawei and introduced the iSolar PV solution to modernize its sites. A key feature of this solution is that it enables self-sufficiency and energy savings, and reduces carbon emissions at existing sites by deploying PV modules. As PV power increases, so does the return on investment.

By deeply integrating PV, energy storage, and intelligent control, this solution ensures that over 92% of a site's power

comes from PV systems, substantially reducing diesel generator usage and saving 96% on fuel. This lowers energy costs while improving network stability.

JAZZ views this as more than just energy savings; it is about transforming the entire business model. The traditional business model required high operational expenses for fuel transport, maintenance, and backup power. Now, Huawei's solution empowers JAZZ to remotely obtain each site's energy consumption, automatically optimize charging and discharging, and implement automated O&M to enable long-term and sustainable operations.

In Pakistan, this green transition is spreading rapidly in a replicable and scalable manner. In the future, JAZZ will continue working with Huawei to deploy more PV-powered sites, jointly promoting the comprehensive low-carbonization of telecom power systems, and shaping a smarter, greener, and more inclusive future rich with opportunities of connections.

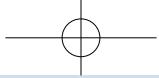
A Sustainable Future

Kuwait's intense heat and Pakistan's power constraints highlight one truth: The communication network is becoming a new frontline for the energy transition.

Huawei's value extends beyond its equipment and solutions; it includes a clear vision for sustainability: Transform each site into a "micro hub" of green energy, utilize intelligent scheduling as the "central nervous system" for energy efficiency optimization, and turn carbon reduction into a measurable operation metric rather than an abstract slogan.

As this vision gains global traction, more operators are evolving from energy consumers to energy prosumers. The cases of Zain and JAZZ exemplify the broader trend toward digitalization, intelligence, and sustainability.

Huawei advocates "Leading Site Energy Digitalization for Ubiquitous Green Connections and Computing." What flows under telecom towers is not only data signals, but also green energy and hope. ▲

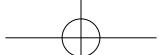


Building a Fully Connected, Intelligent World

Huawei High-Quality Safe Lithium Battery

E2E Lithium Battery Safety System for
Ultimate Network Reliability





Wattkraft: Partnering with Huawei to Shape a Pioneering Renewable Energy Ecosystem in Europe

Over the past decade, Wattkraft and Huawei Digital Power have deepened their partnership through technical collaboration and joint marketing efforts in areas such as PV inverters, grid-forming energy storage systems (ESSs), and charging solutions. Working closely together, they are shaping an innovative renewable energy ecosystem in Europe.

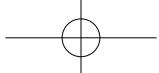
Allianz Arena in Munich, Volksparkstadion in Hamburg, and Deutsche Bank Park in Frankfurt are among Germany's most iconic stadiums. Football fans familiar with the Bundesliga know these venues well. This time, these world-renowned stadiums are not hosting football matches, but FusionSolar Stadiontour—a series of solar technology and solution exhibitions organized by Wattkraft, supported by Huawei Digital Power.

This is a proof to the close cooperation between the two companies as well as the renewable energy transition in Europe.

Fruitful 12-Year Partnership with Huawei

Founded in 2012, Wattkraft is headquartered in Hanover, Germany. Over the years, it has grown into a leading European provider of PV inverters, modules, and system solutions, with branches in Germany, Netherlands, Belgium, Italy, Spain, and Portugal. Wattkraft delivered more than 12 GW of PV projects within its first 10 years.

The company started cooperating with Huawei Digital Power soon after its establishment in 2012. According to Marco Lamsouquer, Chief Strategy Officer and Co-founder of Wattkraft, they established a connection with Huawei Digital Power through a European Huawei representative at the end of 2012, subsequently applying Huawei's 20 kW inverters in a



Since establishing a business partnership with Huawei Digital Power, Wattkraft has seen remarkable success by focusing on being a monobrand distributor exclusive with Huawei. The relationship between Huawei and Wattkraft became very robust, trusting, and solution-oriented, almost with a family feel.

Marco Lamsouquer
Chief Strategy Officer and Co-founder of Wattkraft



3.6 MW project for the first time.

At that time, 3.6 MW was a sizeable project. Both the customer and Wattkraft were impressed by the outstanding performance of Huawei's products. Since then, the cooperation between the two parties has gone from strength to strength. In 2015, Wattkraft started focusing solely on cooperating with Huawei Digital Power. The partnership went on to grow rapidly, and became a model of ecosystem cooperation in Europe's renewable energy sector.

Today, Wattkraft is a distributor and value-added partner (VAP) of Huawei Digital Power in Europe, with its business covering the residential, commercial and industrial (C&I), and utility markets. While engaging in distribution business, Wattkraft provides customers with integrated system solutions. And particularly in the area of system detecting and telecontrol technology, Wattkraft provides comprehensive services from planning and design to delivery and O&M.

Inspirational Success Stories

Over the past 12 years, Wattkraft has continued to deepen its partnership with Huawei. Wattkraft and Huawei consistently create value for customers in the solar energy sector by combining Huawei's cutting-

edge FusionSolar Smart PV and grid-forming ESS technologies with Wattkraft's expertise in distribution, technical support, and project implementation across Europe.

Marco Lamsouquer shared their typical success stories in the utility and C&I fields.

One of Wattkraft's customers, Vispiron, is a service provider specializing in renewable energy operations, offering comprehensive solutions spanning energy production, load management, energy storage, energy trading, and charging station management. (Source: <https://www.vispiron.solar/en/about-us/>)

In one of its utility PV plant projects, Wattkraft collaborated with Huawei to provide Vispiron with a secure supply of highly reliable PV products, a complete suite of offerings for solar parks, and project standardization. Wattkraft also provides the local service organization and implementation expertise. The electricity generated by the project is enough to power around 500 households. Also as part of the project, a grid-connected transparent charging park is being built, and a large battery storage system for energy trading is being implemented to manage grid connection limitations, ensure grid stability, and maximize energy usage.



Wattkraft: Partnering with Huawei to Shape a Pioneering Renewable Energy Ecosystem in Europe

This project set a valuable example for future initiatives and was covered by multiple media outlets. It helped to establish a positive brand image for both Wattkraft and Huawei Digital Power.

MHB Montage focuses on constructing and operating PV systems, including ESSs. Wattkraft and Huawei signed an agreement with MHB Montage for a 320 MWh grid-forming ESS project, showcasing their ability to provide large-capacity ESS solutions for C&I customers.

Huawei's product portfolio—the latest LUNA2000 215 kWh C&I grid-forming ESS paired with Smart PV Controllers—provides high efficiency and integrated safety standards for this project. As a certified VAP and regional certified service partner (RCSP) of Huawei, Wattkraft ensures sound technical advice, project logistics, installation support, and efficient handling of service requests.

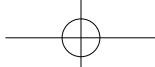
For C&I customers, this collaboration delivers scalable, secure, and future-oriented storage solutions for maximum energy yield and system reliability.

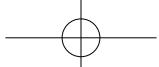
Through the partnership with Huawei, Wattkraft has built its core competitiveness: a well-established service network with highly trained employees, complemented by fast logistics solutions and a range of specialized services such as park control, system design, and professional training.

Distinctive Marketing Events

The partnership between Wattkraft and Huawei Digital Power is not restricted to product sales. They have also carried out a number of distinctive marketing events. In particular, Wattkraft holds more than 65 marketing events in Europe every year, including stadium tours and truck roadshows, with stadium tours standing out as the most iconic.







BayWa r.e. Solar Trade: A Decade of Innovation and Collaboration with Huawei

Over the past decade, BayWa r.e. Solar Trade and Huawei Digital Power have cultivated a partnership defined by trust, collaboration, and shared ambition. What began as a product-focused relationship has evolved into a strategic alliance - driving innovation, expanding distribution channels, and shaping the future of renewable energy. Rooted in mutual technological trust and shared success, this alliance is now a key contributor to Europe's renewable energy development.

Based in Germany, BayWa r.e. Solar Trade, a subsidiary of BayWa r.e. and a leading supplier to the global solar distribution market, has been partnering with Huawei Digital Power since 2015.

The collaboration has evolved immensely over the past decade—from mere product promotion to methodical channel distribution, and from project execution to pioneering co-innovation. United by a shared vision, mutual technological trust, and commitment to shared success, BayWa r.e. Solar Trade and Huawei Digital Power have built a strategic alliance that is driving renewable energy advancements across Europe.

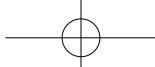
Huawei's Technical Excellence Unlocks Partnership

BayWa r.e. Solar Trade has risen to prominence as a global leader to the solar distribution market across 20 countries. The company offers a broad suite of products and services for its

B2B partners and installers, including PV modules, inverters, energy storage systems, charging stations, and accessories, as well as the in-house solar mounting system novotegra and PV-planning software Solar-Planit.

Back in 2015, during BayWa r.e. Solar Trade's quest for a reliable supplier, Huawei has distinguished itself through high product quality, advanced technology, and competitive pricing. This gave BayWa r.e. Solar Trade the confidence to add Huawei to their shortlist.

Frank Jessel, CEO of BayWa r.e. Solar Trade Holding GmbH, shared that they saw Huawei's immense potential right from the start. They were particularly impressed by Huawei's unwavering commitment to quality, unremitting investment in R&D, and unyielding dedication to service reliability. Amidst the profound shifts in the PV industry, BayWa r.e. Solar Trade



Huawei Digital Power's strong commitment to quality, substantial investment in R&D, and steadfast dedication to service reliability are the pillars of our enduring partnership. In the profoundly changing landscape of the PV industry, both companies remain deeply aligned in forward-thinking visions and pursuit of cutting-edge innovation.



Frank Jessel
CEO of BayWa r.e. Solar Trade Holding GmbH

and Huawei Digital Power were brought together by a shared vision for a sustainable future and a shared passion for technical excellence. Their aligned ambitions ignited a strategic collaboration between the two companies.

Thanks to professional and dependable support of Huawei Digital Power, the bond between the two parties has deepened over the past decade.

Partnership Evolves: From Mere Product Promotion to Methodical Channel Distribution

In 2018, BayWa r.e. Solar Trade and Huawei Digital Power took their partnership to the next level by venturing into channel distribution.

It didn't take long for BayWa r.e. Solar Trade to become a key ally in Huawei Digital Power's PV distribution business. Together, they introduced new products, tapped into new markets, and expanded their reach to offer top-tier solutions to clients around the world.

Today, BayWa r.e. Solar Trade stands as one of the most vital multinational partners of Huawei Digital Power in the European market, with the cooperation spanning nearly every country on the continent. In just five years, Huawei's presence within BayWa r.e. Solar Trade's business has surged, making it one of the most crucial strategic partners of the company.

What truly sets BayWa r.e. Solar Trade apart as a distribution partner of Huawei Digital Power is their focus on service

capabilities. As Frank Jessel points out, in today's highly competitive PV industry, offering reliable, premium services is more crucial than ever. It's not just about maintaining system performance; it's also key to fostering long-term client loyalty and a consistently positive customer experience.

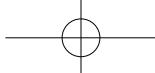
As a certified service partner of Huawei, BayWa r.e. Solar Trade offers comprehensive tech support, after-sales care, and intelligent diagnostics. It is always ready to jump in and help clients whenever needed. And it works closely with Huawei to set service standards, share technical expertise, and train teams, ensuring they stay ahead of the ever-changing market demands.

Customer Focus Builds Differentiated Edge

The past decade of collaboration between BayWa r.e. Solar Trade and Huawei has seen rapid shifts in the digital power market. They've seen a transition from supply shortages to oversupply, the rise of Chinese manufacturers, and a growing demand for more efficient tech. All these shifts have profoundly reshaped the business landscape.

In such intense market competition, it's paramount to position deep customer engagement as BayWa r.e. Solar Trade's core strength, according to Frank Jessel. They make it a point to listen carefully, understand client needs, and offer a wide portfolio of quality products to support clients every step of the way.

Here's how Frank Jessel breaks down their strengths:



BayWa r.e. Solar Trade: A Decade of Innovation and Collaboration with Huawei

- **Customer proximity:** They stay closely connected to clients, enabling fast responses and solutions that genuinely fit their needs.
- **Comprehensive product portfolio:** They offer a complete array of certified products and services—from PV modules and inverters to energy storage systems, electric vehicle solutions, and accessories—so clients can get everything they need from trusted channels.
- **Innovative self-developed solutions:** The in-house solar mounting system novotegra and PV-planning software Solar-Planit are designed to maximize efficiency, reliability, and ease of use.
- **Strong values and long-term partnerships:** BayWa r.e. Solar Trade believes in building strong, lasting relationships with clients and suppliers. Trust, transparency, and shared success are at the heart of these bonds.

These strengths form the bedrock of BayWa r.e. Solar Trade's ability to sustain its leading role in the dynamic global renewable energy market, helping them navigate the ever-evolving landscape with confidence.

Technology + Market: Creating New Value Through Collaboration

None of this would have been possible without the valuable support of Huawei Digital Power, one of BayWa r.e. Solar Trade's key partners. By combining Huawei's technical progress with BayWa r.e. Solar Trade's deep market expertise, the pair has developed a noteworthy collaboration that delivers tangible benefits to clients, including optimal system performance, lasting reliability, and seamless integration.

According to Frank Jessel, Huawei Digital Power's distinctive approach lies in its integration of innovative technology, product reliability, and visionary strategy. Here's why Huawei Digital Power stands out:

- **Superior product quality:** Huawei's Smart PV+ESS solution is renowned for its remarkably low failure rate and rock-solid performance, ensuring long-term reliability and client satisfaction.

· **State-of-the-art PV technology:** Features like I-V curve diagnosis and AI-driven fault detection mean systems stay detected and maintained proactively, minimizing downtime and maximizing energy yield.

· **Digital integration:** Huawei places high priority on smart energy systems, making sure that hardware and software work in harmony to deliver intelligent PV solutions.

· **Innovation leadership:** Continuous R&D investment keeps Huawei at the forefront of innovation, driving breakthroughs in areas like grid forming technology and string inverter design.

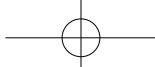
These advantages allow Huawei Digital Power to be more than just a supplier, but also a strategic ally in shaping the future of renewable energy.

The two companies have forged a strategic alliance built on mutual respect and a shared passion for innovation. Together, they deliver advanced products and solutions to clients, boost BayWa r.e. Solar Trade's service capabilities, and elevate both brands through robust technical support and after-sales care.

Building a Future Energy Ecosystem for Global Green Transition

Even as the market landscape keeps evolving, the shift to clean energy presses ahead in the pursuit of a sustainable future. Achieving these sustainability goals requires the involvement of policymakers, organizations, businesses, and broader public.

Frank Jessel is confident that the renewable energy sector holds immense potential for innovation. BayWa r.e. Solar Trade aims to collaborate with Huawei Digital Power to advance joint innovation in smart energy integration, grid forming energy storage, and electric vehicle infrastructure. This partnership will help foster a robust and efficient global energy ecosystem, paving the way for an even more fruitful decade ahead. Together, they'll not only deliver more future-ready energy solutions to clients, but also help to drive forward the global green energy transition. ▲



Creating Value Together



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Jinko

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elac

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THERMOS



Nabico: Collaborating with Huawei to Power the Renewable Energy Transition in East Africa

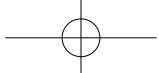
Nabico and Huawei Digital Power are partnering to advance PV and energy storage projects across East Africa. From resorts in the Serengeti grasslands to utility projects in South Sudan, they deliver stable, clean power solutions. By integrating innovative technologies with localized engineering expertise, Nabico and Huawei Digital Power are working together to promote the renewable energy transition and sustainable development in East Africa.

On satellite imagery, prominent resorts, including The Four Seasons and Meliá Lodge, are now covered with PV panels, creating a distinct landmark within the Serengeti grasslands.

The resorts are situated in the heart of the wildlife reserve, an area without access to a stable and reliable power grid. Adopting renewable energy technologies enhances

operational efficiency and demonstrates a long-term commitment to environmental protection—reducing carbon emissions and helping preserve one of the world's most iconic ecosystems.

The two Serengeti PV projects were deployed by Nabico Enterprise using Huawei's Smart String Energy Storage System (ESS). The projects received high praise from



Nabico: Collaborating with Huawei to Power the Renewable Energy Transition in East Africa



Huawei's proven reputation for high-quality, safe, and cutting-edge innovation aligns with our commitment to delivering long-term value for our customers. Huawei's robust global research and development (R&D) network enables us to deploy innovative solutions with our local technical expertise.



Biren Shah
CEO of Nabico Enterprise

the engineering, procurement, and construction (EPC) contractor and the end customers.

Protecting the Wildlife Reserve Ecosystem

Founded in 1989 and headquartered in Nairobi, Kenya, Nabico Enterprise is a recognized importer and distributor specializing in electrical and home appliances.

The company primarily serves Kenya and surrounding countries, providing comprehensive turnkey solutions for power distribution cabinets, building automation, fire and alarm systems, and PV systems.

With the rapid growth of East Africa's PV market, Nabico entered the PV market in 2018 and became a Huawei Digital Power Gold Partner in 2022. In 2024, it was elevated to a value-added partner (VAP). The collaboration focuses on regional PV and energy storage projects across the residential, commercial and industrial (C&I), and utility segments of the digital power business.

The two resort projects in the Serengeti grasslands were completed through close cooperation between the parties. Both resorts implemented Huawei's Smart String ESS solution. The Four Seasons Hotel project deployed a 3 MWh ESS solution comprising Huawei LUNA2000-1MWH and LUNA2000-2MWH. The Meliá Lodge project installed

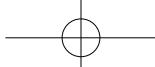
seven sets of LUNA2000-200KWH, totaling 1.4 MWh.

According to Biren Shah, the CEO of Nabico Enterprise, both projects were from the same EPC contractor. The contractor selected Huawei and Nabico based on requirements for highly reliable, intelligent systems. The projects were designed to significantly reduce reliance on diesel generators, lower operating costs, improve the guest experience, and enhance overall sustainability. Nabico's deep technical expertise and understanding of local conditions, combined with Huawei's leading product solutions, enabled the customers to achieve these objectives.

Selecting a Partner with Shared Core Values

Nabico has a broad business scope and deep collaboration with many leading international vendors.

Reflecting on the start of the partnership with Huawei Digital Power, Biren Shah noted that Nabico was seeking a partner that is a global industry leader and shares its core values and long-term vision. Huawei's distinctiveness lies not only in its highly reliable, safe, and continuously innovative products and technologies, but also in its clear channel strategy, which ensures transparent collaboration with partners and supports sustainable business growth.



Creating Value Together

As a key partner of Huawei Digital Power, Nabico places great importance on the comprehensive capability development of its own pre-sales, sales, and after-sales teams. Huawei experts provide ongoing training, professional certification, and hands-on commissioning workshops, ensuring the teams maintain the expertise required to deliver industry-leading energy solutions.

As Biren Shah said, Nabico's two core competitive advantages are its technical capabilities and financial strength, which enable it to deliver fully integrated end-to-end energy solutions to customers. Nabico's highly skilled technical team ensures the seamless integration of multiple energy sources, including the power grid, PV, ESS, and other power generation systems for both on-grid and off-grid applications. Its solid financial strength enables it to offer flexible credit terms, maintain sufficient

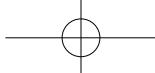
local inventory, and guarantee timely and reliable product delivery through an extensive logistics network.

Nabico is also strengthening its industry ecosystem while actively integrating into Huawei's ecosystem. Nabico regularly organizes solution training, technical update sessions, and onsite commissioning support to share digital power knowledge and best practices with EPC contractors, installers, financial institutions, and end customers. Improving the expertise of all parties advances the widespread adoption of safe, reliable, and future-oriented renewable energy solutions across the East African market.

Enhancing Brand Influence in the PV Market

The PV market in East Africa, with Kenya as a key example, is experiencing rapid growth. Both the on-grid and off-





Nabico: Collaborating with Huawei to Power the Renewable Energy Transition in East Africa

grid segments are expanding quickly and present diverse requirements. The local government is also providing positive supportive policy frameworks through initiatives such as Kenya Vision 2030 and Digital Economy Blueprint to increase the proportion of renewable energy in the energy mix.

Nabico is further strengthening its partnership with Huawei Digital Power. Biren Shah said that the collaboration with Huawei significantly enhanced Nabico's brand influence in the PV market and facilitated its successful expansion into new markets outside of Kenya. Leveraging Huawei's strong brand appeal and technological leadership, Nabico can undertake larger, more complex renewable energy projects, thereby improving its standing in the industry.

Biren Shah was also impressed during a visit to Huawei's headquarters in Shenzhen, China, where he observed the company's highly automated production lines and sustained investment in R&D, reinforcing his confidence in Huawei's commitment to innovation and partner success. Huawei is also helping partners improve their capabilities to stay current with leading technologies.

Huawei's Innovation Complements Nabico's Engineering Capabilities

Following the deployment of the first LUNA2000-200KWH Smart String ESS in East Africa, Nabico's collaboration with Huawei continues to grow, with projects rapidly being rolled out across both the C&I and utility sectors.

The Ezra utility project in Juba, the capital of South Sudan, was designed to address persistent challenges of unreliable, expensive electricity by delivering clean, stable power to the community and reducing reliance on diesel generators.

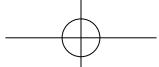
The project uses seven Huawei LUNA2000-2MWH ESSs, with a total capacity of 14 MWh. This storage capacity ensures a stable power supply to 16,000 households in the region, even when PV energy is insufficient, substantially improving grid reliability.

Solutions from Huawei and Nabico are preferred by customers for their advanced technologies, cost-effectiveness, and flexible finance and logistics coordination, which ensure high-quality project delivery with demanding timelines.

Additionally, Huawei and Nabico have recently completed a 1 MWh off-grid solution for a high-end resort in central Kenya. Nabico and Huawei co-designed an integrated solution that included PV modules, installation structures, low-voltage power distribution cabinets, energy management systems, and all auxiliary equipment, creating a fully self-sufficient clean energy system and achieving energy independence.

In these projects, Huawei's innovation and Nabico's engineering expertise are highly complementary. Huawei provides leading-edge products and solutions, while Nabico offers flexible credit terms, rapid delivery under tight schedules, and onsite technical support during commissioning. The two parties have co-developed efficient, reliable, and sustainable energy solutions.

Biren Shah said that Nabico hopes to further solidify its position as a preferred provider of sustainable energy solutions and that the partnership with Huawei is instrumental in achieving this goal. The two companies will continue to collaborate on implementing high-impact projects, exploring new markets, and developing solutions to create lasting value and drive customer growth. ▲



Creating Value Together



CETC Taili: Advancing "Dual Carbon" Strategies with Huawei

CETC Taili Communication Technology Co., Ltd. (hereinafter referred to as CETC Taili) has forged a deep partnership with Huawei Digital Power, achieving a breakthrough in the residential smart PV and commercial & industrial (C&I) PV sectors. This collaboration has opened up entirely new market opportunities. By actively developing showcase projects and innovating business models, CETC Taili is accelerating its transition to a technology-driven supply chain service provider.

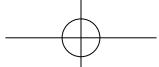
While most distributors opt for mature markets, CETC Taili chose a less-traveled path to enter the digital power sector—partnering with Huawei Digital Power to launch its residential smart PV business. In the Chinese market, this represents a breakthrough into a brand-new business domain.

After establishing a residential smart PV business model, CETC Taili expanded its cooperation with Huawei Digital Power into the C&I market. This includes Huawei Digital Power's products and solutions such as PV inverters, grid-

forming energy storage systems (ESSs), and charging facilities.

In the C&I PV business expansion, CETC Taili still adheres to its market breakthrough strategy. It creates showcases for specific application scenarios for clear demonstrations, as well as for replicating success to unlock new market opportunities.

From Mobile Phones to Digital Power, Embracing Huawei in All Scenarios



CETC Taili: Advancing "Dual Carbon" Strategies with Huawei

As a pioneer and leader in the digital power market, Huawei is focused on value creation, tirelessly delivering high-quality products and pushing safety standards to the highest level. This has provided a solid foundation for CETC Taili's emergence in the digital power sector, enabling us to confidently explore new market opportunities.

Lou Peishu

Special Assistant to the General Manager of CETC Taili and General Manager of the Digital Power Business Department



Founded in 1992, CETC Taili has specialized in marketing services for the smart terminal (IoT) business for over 30 years. By building three core platforms—a digital marketing platform, a supply chain assurance platform, and an industry collaboration platform—CETC Taili is transitioning from a traditional IoT distributor into a technology-driven supply chain service provider.

For more than two decades after its founding, CETC Taili primarily focused on acting as a distributor for both Chinese and international mobile phone brands in the Chinese market, spanning the eras of 2G, 3G, and 4G. Then in 2014, CETC Taili started to cooperate closely with Huawei and became a fulfillment distributor of Huawei's consumer business in the Chinese market. Since then, the cooperation between the two parties has continued to grow and strengthen.

Since 2019, CETC Taili has fully aligned its business with Huawei, expanding its product portfolio under cooperation from smartphones to eleven categories across Huawei's product lines. Its channel strategy also evolved from distribution to include experience stores and e-commerce, as well as enterprise and government channels.

In 2021, CETC Taili was incorporated into CETC, becoming a level-2 unit of the company. As a state-owned enterprise, CETC Taili is committed to taking on more

responsibilities in driving advanced productive forces and actively seeking opportunities to invest in strategic emerging industries.

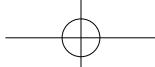
In the context of China's "dual carbon" goals—peaking carbon emissions before 2030 and achieving carbon neutrality by 2060—the digital power sector quickly emerged as a focus for CETC Taili. It was during this period that CETC Taili began its collaboration with Huawei Digital Power.

Breaking into the Residential Smart PV Market and Exploring Potential Demands

At the end of 2022, CETC Taili established contact with Huawei Digital Power, quickly reaching a cooperation agreement.

By that time, Huawei Digital Power had established a relatively comprehensive partner system. As a newcomer, CETC Taili did not choose a mature market, but became a Huawei Digital Power value-added partner (VAP) in the emerging residential smart PV market.

According to Lou Peishu, prior to this, residential PV systems in China were largely limited to rural homes. Among the country's 6 million urban villas, PV system coverage was virtually nonexistent, representing a blank space in the renewable energy market with significant



Creating Value Together

growth potential. CETC Taili aimed to help Huawei Digital Power tap into this new market and build a new business model.

Despite recognizing the opportunity, they faced a slew of challenges in launching the new business. At that time, many doubted the viability of residential smart PV and thought that high-income villa owners would not care about the revenue brought by PV power generation. However, Huawei and CETC Taili remained confident in their vision and committed to full-scale investment. Together, they developed business rules and models, laid out a top-level design, and began seeking downstream partners to expand into the villa PV segment—a brand-new track.

In March 2023, Huawei Digital Power held the first Residential Smart PV Partner Conference in Songshan Lake, Dongguan, officially releasing Huawei's residential smart PV development strategy and one-fits-all residential smart PV solution for the villa market. This marked the beginning of a new chapter in the partnership between the two companies.

Creating a New Business Model of Full-Lifecycle Services

The residential smart PV market is an ecosystem consisting of owners, equipment vendors, service providers, and grid companies. Recognizing the characteristics of this market, CETC Taili has introduced a full-lifecycle service model that offers villa owners comprehensive support, from initial interest, procurement, and installation, to O&M.

According to Lou Peishu, residential smart PV has both B2B/B2C and investment/consumption attributes. From a B2B/B2C perspective, it follows a project development approach, yet the customers are individual villa owners. From an investment/consumption standpoint, villa owners make a one-off purchase, but the products also generate long-term investment returns, and the payback period is long.

To support this model, CETC Taili has invested in building service platforms such as the Tmall, logistics and warehousing, and supply chain finance. With this as the foundation, the company actively develops sales and service partners to be responsible for customer acquisition and service delivery.

Throughout this process, the experience and resources accumulated by CETC Taili in the B2C business over the years played an important role. For example, its phone distribution channels span cities and counties, enabling rapid access to local users. Its tens of thousands of partners also become potential partners for the residential smart PV business.

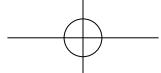
In just two years, the scale of CETC Taili's residential smart PV business is expected to grow from CNY30 million in 2023 to more than CNY200 million in 2025.

Comprehensive Cooperation to Expand the C&I PV Market

Building on the success of the residential smart PV business, CETC Taili's cooperation with Huawei Digital Power has gradually extended to Digital Power's other products and solutions such as PV inverters, grid-forming ESSs, and charging facilities, allowing the company to achieve outstanding results in the C&I PV market.

As a VAP of Huawei Digital Power in Henan, Hunan, and other provinces, CETC Taili is making efforts to find, select, and develop C&I PV distributors. Based on its highly standardized services and actual business requirements, CETC Taili is looking to work with top distributors in the industry and fostering distributors in the C&I sector, with the aim of further expanding the C&I channel coverage to the city and county levels.

CETC Taili is also continuously expanding C&I customer projects, bringing more new market opportunities to the Huawei C&I PV business. In the C&I ESS field, CETC Taili is committed to building a showcase for each scenario,



CETC Taili: Advancing "Dual Carbon" Strategies with Huawei

such as adding ESSs to existing plants and providing a generation-grid-load-storage synergy platform for energy-intensive enterprises. After achieving breakthroughs in showcase projects, demonstrations are provided to support replication and promotion across the province.

Lou Peishu noted that as a pioneer and leader in the digital power sector, Huawei provided unwavering support during the expansion into the new market, which was of vital importance to the company. In particular, the two parties' dedication and perseverance in the face of difficulties and challenges were truly commendable. He was also impressed by Huawei's unremitting pursuit of high quality. For example, Huawei achieved the ultimate safety of its products while adhering to high standards and strict requirements for technical specifications.

Breaking Boundaries to Cultivate a Second Growth Curve

Currently, the total cooperation scale of Huawei's business with CETC Taili has exceeded CNY500 billion, and CETC Taili has established digital distribution capabilities covering most of Huawei's businesses. Although the digital power business accounts for a small proportion of the total revenue, Lou Peishu values its demonstration of new products, new sectors, and new business models.

With the development of new businesses, CETC Taili is constantly breaking boundaries, powering the second growth curve of Huawei's business, and accelerating its transition to a technology-oriented supply chain service provider.

Lou Peishu refers to this transition as distribution 2.0. Compared with the game of interests in the distribution 1.0 era, in the distribution 2.0 era, distributors and vendors engage in long-term cooperation based on complementary values—each focusing on doing what they are best at to achieve collaborative development.

Finally, Lou Peishu emphasized the "two persistences" strategies of CETC Taili on Huawei Digital Power: persistence in selling only Huawei's products and persistence in comprehensive resource investment. In the future, he hopes to cooperate more deeply and broadly with Huawei Digital Power. After achieving this market breakthrough, he hopes to expand the scale further and contribute to the healthy development of the entire digital power industry.

This is not only a win-win for CETC Taili and Huawei Digital Power, but also an important step in the growing maturity of the digital power industry. ▲



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Zhongtai Energy: Aligned with Huawei, Shaping a Premium Brand

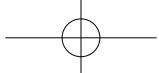
From a seasoned ICT player to an emerging force in digital power, Zhongtai Energy has scaled its annual revenue from millions to hundreds of millions of CNY in just three years, driven by precise strategic positioning and deep collaboration with Huawei.

"Maintain sharp insight and a sense of urgency when building a business. By following Huawei—a powerhouse of innovation—we stand on the shoulders of giants to go farther, faster, and with greater confidence." Huang Jinlong, General Manager of Zhongtai Energy Development (Jiangsu) Co., Ltd., not only shared his entrepreneurial journey but also revealed the driving force behind Zhongtai Energy's rapid ascent.

In just three years, Zhongtai Energy has grown its revenue from millions to hundreds of millions of CNY, expanding from Jiangsu Province to markets across China. It is now Huawei's Smart PV four-star certified service partner (CSP)

and value-added partner (VAP) in multiple regions. In addition, Zhongtai Electric Power focuses on engineering, procurement, and construction (EPC) contracting. Concurrently, Zhongtai Flash Charge, specializing in electric vehicle (EV) charging services, has become Huawei's Smart Charging Network VAP and five-star CSP in Jiangsu, Anhui, and Hubei provinces.

From a seasoned ICT player to an emerging force in digital power, Huang Jinlong has guided Zhongtai Energy, Zhongtai Electric Power, and Zhongtai Flash Charge into a close collaborative relationship with Huawei Digital Power. Through pragmatic execution and forward thinking, they have been telling an entrepreneurial success story



Zhongtai Energy: Aligned with Huawei, Shaping a Premium Brand

In the dynamic and opportunity-rich field of digital power, aligning with the right leader turns every step into a giant leap forward. Through our close partnership with Huawei, Zhongtai Energy has gained access to cutting-edge product technologies and enhanced our management capabilities. More importantly, it has positioned us at the forefront of industry transformation—in sync with the momentum of a new era.

Huang Jinlong
General Manager of Zhongtai Energy



that resonates with the momentum of the digital power industry.

Strategic Transformation: Aligning with Huawei's Vision

Huang Jinlong's partnership with Huawei began in 2013, initially in government and enterprise business. From server storage and cloud services to digital power in 2021, Zhongtai Energy has strategically aligned its development with Huawei's roadmap. As Huawei's recognized ICT partner and Data Center Facility five-star CSP, Zhongtai Energy embarked on its transformation guided by foresight into industry trends and a shared vision with Huawei.

"Huawei has provided systematic support across R&D, channels, talent, and even funding," said Huang Jinlong. "The key is to define our role in the digital power industry—by expanding into lower-tier markets and strengthening service delivery, we create strategic synergy with Huawei."

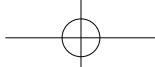
This strategic vision enabled Zhongtai Energy to invest decisively in the emerging digital power market. The company established a refined modular operating structure comprising three independent entities—Zhongtai Energy, Zhongtai Electric Power, and Zhongtai Flash Charge—focusing on distribution, EPC contracting, and EV charging services, respectively. This reflects the principle of

"professional teams for professional matters." This model sharpens each business line's focus while creating group-level synergy, delivering one-stop solutions for customers.

Huawei Digital Power's extensive product portfolio and robust channel policies have also provided Huang Jinlong with strong confidence. "Huawei Digital Power provides excellent products and solutions—including PV inverters, grid-forming energy storage systems (ESSs), and EV charging facilities—helping us build a comprehensive portfolio and strengthen our market presence. And thanks to Huawei's strict yet transparent channel policies, every investment we make yields significant returns."

Over the past decade, Zhongtai Energy accumulated solid industry experience and absorbed Huawei's advanced management concepts and methodologies. Huang Jinlong highlighted that his company has seamlessly integrated Huawei's mature management-by-objectives (MBO) performance system with its own partner system to maximize organizational effectiveness. As part of its talent development strategy, Zhongtai Energy hosts a "Weekend Classroom," where Huawei's technical and business experts offer targeted training and project reviews every week, empowering teams to iterate faster and achieve sustained growth.

Huang Jinlong concluded, "Leveraging Huawei's



Creating Value Together

management methods and enablement system, we grew from a dozen employees to over 100 professionals in three years, expanding our reach from Jiangsu to the entire country."

Market Breakthrough: A Leap from Millions to Hundreds of Millions

In 2022, Zhongtai Energy's revenue surged past CNY100 million, up from less than CNY10 million, and by 2025, its cooperation target with Huawei is set to approach CNY500 million. Huang Jinlong attributed this explosive growth to the powerful interplay of multiple factors.

The global wave of energy transition and strong market demand created the right timing; partnering with Huawei delivered strategic alignment and value; and Zhongtai Energy's distinctive market strategy and execution ensured success.

• Leveraging Targeted Strategies, Winning in Mid-Tier Markets

Zhongtai Energy chose not to pursue utility-scale benchmark projects, instead strategically focusing on key accounts (KAs), key customers (KCs), and mid- to long-tail markets—segments where, as Huang Jinlong emphasized, VAPs can fully demonstrate their value. "We manage markets through a structured hierarchy. For example, in Anhui Province, we cover 16 prefecture-level cities horizontally. Meanwhile, we focus on five sub-industries vertically—including zero-carbon campuses and energy-intensive enterprises—to systematically build our brand and drive value creation."

In 2022, Zhongtai Energy organized dozens of events to penetrate the Anhui market, achieving coverage across all prefecture-level cities. "We started at the district and county level, steadily expanded into cities, and continued to strengthen our frontline presence, integrating solutions into our core capabilities." This refined operations approach quickly established a channel network that reaches end users, providing a solid foundation for substantial business growth.

• Implementing Three Tactics, Building a Sound Cooperation Ecosystem

Zhongtai Energy drives customer development by strictly implementing Huawei Digital Power's proven three tactics—executive visits, showcase visits, and Huawei headquarters visits. By inviting customer executives to Huawei headquarters and facilitating in-depth technical exchanges, Zhongtai Energy effectively communicates Huawei's brand strength and technological advantages, fostering a sustainable, win-win partner ecosystem. Consistency in this standardized approach has propelled the company's performance to new heights.

• Prioritizing High Safety and Quality, Earning customers' trust

The renewable energy market is shifting from disorder toward refined operations, marked by significant changes in customer procurement logic. "Price was once the primary consideration, but safety has now become the top priority. Customers are increasingly attentive to product quality and after-sales service," said Huang Jinlong.

High safety and quality are no longer optional—they are now mandatory for renewable energy projects. For Huang Jinlong, unwavering dedication to ensuring quality and safety is the cornerstone of Huawei Digital Power and the key advantage that enables Zhongtai Energy to broaden its market reach.

For inverters, Huawei offers "replacement instead of repair" after-sales support. Huawei inverters' outstanding performance in extreme environments—from scorching heat to freezing cold—has secured a leading position in both technical transformation and new construction projects. Huang Jinlong cited a case in Bozhou City, Anhui Province. After comparison testing, a customer chose Huawei for 12 of 13 distributed sub-projects, reflecting deep trust in the superior performance and dependable services of Huawei products.

In grid-forming energy storage, Huawei ensures end-



Zhongtai Energy: Aligned with Huawei, Shaping a Premium Brand

to-end safety through multiple high-reliability designs, including the smart string architecture and lifecycle digital management. "Customers are willing to pay a premium for Huawei's products, which reflects their recognition of Huawei's superior performance and robust safety—particularly in system capabilities, including intelligent operations and maintenance (O&M), proactive warning, and multi-level protection."

In EV charging, Huawei's fully liquid-cooled ultra-fast charging solution, safeguarded by multi-level protection and consistent long-term reliability, has also gained customers' trust.

Benchmark Cases: Offering Professional Services, Creating Sustainable Value

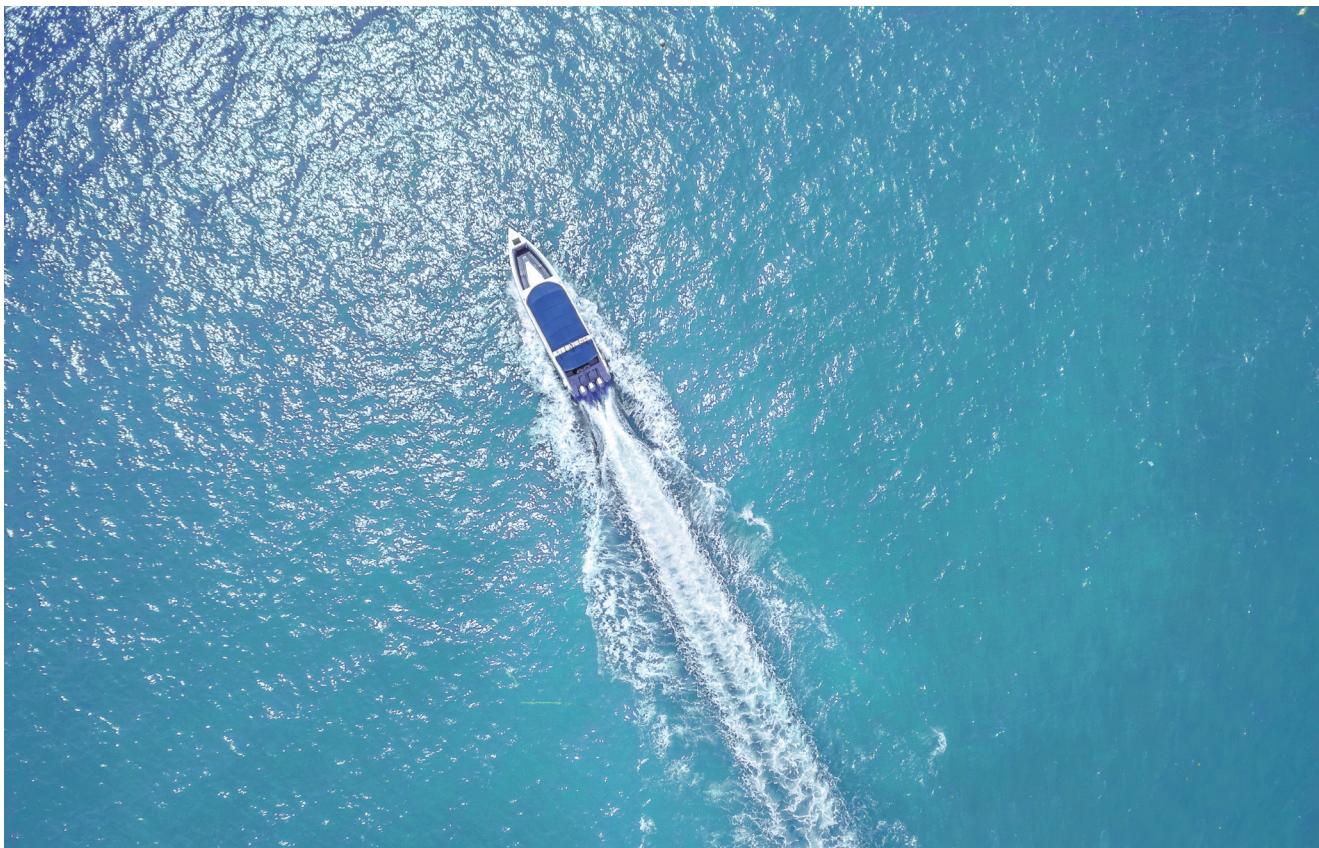
"Creating value through services" has been guiding Zhongtai Energy's development. This aligns with Huawei, whose market leadership, according to Huang Jinlong, is

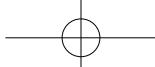
built on uncompromising quality, strong system value, and dependable services. As a partner of Huawei Digital Power, Zhongtai Energy has embedded these principles into project execution and demonstrated their enduring value through a series of benchmark cases.

- **Changshu Street Lights: Professional Services, Earning Deep Trust**

In recent years, pan-government platforms across many regions have looked to establish high-quality benchmark cases in the renewable energy sector. Customers are not looking for a mere aggregation of standard products, but for customer-centric, in-depth services—precisely the advantage that Zhongtai Energy offers. A typical example is the street lights project in Changshu City.

"Many small and medium-sized vendors lack sufficient pre-sales technical and service support, typically offering a standard solution directly upon customer request. By





Creating Value Together

contrast, our engineers remain onsite at all times to address any questions. We deploy drones for mapping and provide site selection and planning advice, and even ensure alignment with customers' civil engineering and steel structure solutions," said Huang Jinlong.

This customer-centric service approach earned the customers' trust, leading them to choose Huawei over multiple competitors. The Changshu street lights project began as a pilot with just two sets of chargers and energy storage devices. It has since expanded into an integrated PV+ESS+charger solution, comprising charging devices valued at over CNY10 million and energy storage devices worth over CNY1 million. Furthermore, the customer has expanded its business from Changshu to other regions, a major transition from single-project collaboration to all-domain system co-construction.

• Xinghua Urban Investment: PV+ESS+Charger Synergy, Showcasing System Value

In Xinghua City, Jiangsu Province, Zhongtai Energy, after 18 months of strong customer engagement, arranged for its customer to visit Huawei for in-depth discussions with executives. Finally, a framework agreement on PV+ESS+Charger integration was signed, valued at over CNY10 million.

Huang Jinlong said, "This case demonstrates the feasibility of charging-driven PV+ESS deployment. As a high-frequency, rigid-demand scenario, EV charging effectively bridges PV and ESS, highlighting Huawei's system competitiveness in the county market."

• Guannan Urban Development: Premium Quality, Winning Market Recognition

In the EV charging project in Guannan County, Lianyungang City, Zhongtai Energy and its partners adopted an "A+B strategy": premium stations use Huawei's liquid-cooled ultra-fast chargers, and other stations use products from partners. This strategy guarantees an optimal user experience and long-term

reliability at flagship stations while effectively balancing overall project costs, creating a win-win outcome for all stakeholders. The project's total investment exceeds CNY80 million, with Huawei's products accounting for 50%.

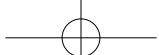
"During project development, the customer was impressed by the unmatched charging speed of the Huawei FusionCharge Solution and by the fully liquid-cooled technology that ensures reliable, long-term performance," said Huang Jinlong.

Looking Ahead: Providing Integrated Solutions, Opening a New Chapter of Green Energy

Huang Jinlong expects the renewable energy sector to enter a new competitive phase—one defined not by standalone products, but by integrated energy systems such as PV+ESS+charger, microgrids, and virtual power plants (VPPs).

"We are evolving from a product reseller to a PV+ESS+charger solution provider." To achieve this vision, Zhongtai Energy is accelerating innovation with its intelligent plant O&M platform, microgrid management system, and VPP energy management platform, continuously enhancing software-hardware integration and driving seamless synergy across generation, grid, load, and storage.

Huang Jinlong affirmed, "Zhongtai Energy is committed to aligning closely with Huawei, the industry's leading powerhouse, and to enabling all sectors to benefit from the advancement of renewable energy." Zhongtai Energy's journey powerfully demonstrates its collaboration with Huawei Digital Power—driven by shared strategies, co-built capabilities, and co-created value. In the sweeping trend toward green and low-carbon development, Huang Jinlong exemplifies how a visionary leader can rally a team to advance alongside the industry pioneer, together shaping the future of digital power. ▲



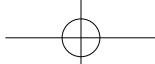
Leveraging Six Core Capabilities to Drive the High-Quality Development of Grid-Forming ESS

The growing proportion of renewable energy and power electronic devices is introducing unprecedented stability challenges to power grids. Huawei's Smart String Grid-Forming Energy Storage System (ESS) addresses these challenges by integrating six core capabilities with an end-to-end quality management system, facilitating high-quality development of new power systems and leading the energy storage industry into a new grid-forming era.

While the accelerating global energy transition is driving the adoption of renewable energy generation, it is also introducing unprecedented challenges to power systems. The increasing penetration of renewable energy and power electronic devices significantly compromises grid stability.

Grid-forming ESSs can proactively support grid voltage and frequency, making them a cornerstone of new power systems.

Huawei's Smart String Grid-Forming ESS delivers true grid forming while ensuring high standards of quality and safety. It addresses four major technical challenges facing



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the industry and opens up a new era of all-scenario grid forming.

Power Grid Dilemma: Stability Crisis Amid the Renewable Energy Transition

As renewable energy becomes more prevalent, power systems are facing growing risks in terms of random power fluctuations, inadequate frequency and voltage regulation, and oscillations. This has given rise to the emergence of grid-forming energy storage as a foundational technology for new power systems.

However, four major technical challenges hinder the large-scale application of this technology worldwide:

First, parallel operation stability is a primary challenge. Circulating current among multiple parallel-connected voltage sources reduces system stability.

Second, high-power, high-rate operation can induce wideband oscillations, which are difficult to suppress.

Third, overload current leads to significant power device losses, resulting in overheating, failure, and equipment damage.

Fourth, the current backfeed that occurs due to transient overvoltage from the power grid compromises ESS safety and reliability.

Six Core Capabilities: Driving the Advancement of Grid-Forming Energy Storage Technology

A grid-forming ESS simulates the operating characteristics of synchronous generators and proactively supports grid voltage and frequency. This is achieved by transforming a traditional ESS from a grid-following to a grid-forming role.

Huawei Digital Power spent over a decade advancing research in grid-forming technologies. By integrating strengths in hardware, architecture, and algorithms, it has established six core capabilities for utility-scale grid-forming ESSs.

Capability 1: Inertia response

Huawei's grid-forming ESS provides virtual inertia support within 5 ms. The inertia time constant can be adjusted from 0 to 20 seconds, enabling frequency control in diverse scenarios.

Capability 2: Primary frequency regulation

A quick power response is key to handling sudden changes in grid frequency. Huawei's grid-forming ESS excels in primary frequency regulation. It supports Smart Power Plant Controller (SPPC)+Power Conversion System (PCS) interaction and collaboration, and enables 200 ms plant-level rapid response and constant power output in the range of 0-100% state of charge (SOC). This ensures both stable frequency and higher plant revenue.

Capability 3: Short circuit capacity

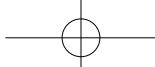
A robust short circuit capacity is key to maintaining grid stability. During low voltage ride-through, 3x reactive current can be released for 10s, providing powerful support. During high voltage ride-through, the two-stage architecture prevents backfeed and ensures stable control with active power deviation below 10%.

Capability 4: Power oscillation damping

Power electronic devices cause oscillations across a wider frequency range—an issue that involves more extensive and complex control loops. Huawei's grid-forming ESS ensures reliable grid connection across the full short-circuit ratio (SCR) range and provides 0.1-100 Hz wideband oscillation damping throughout the ESS lifecycle.

Capability 5: Black start

Black start is a critical capability for maintaining power system reliability during a power grid outage. The voltage ramp-up from zero of the entire plant is achieved within seconds for black start, and a capacity ratio of 1:1.5 prevents



Leveraging Six Core Capabilities to Drive the High-Quality Development of Grid-Forming ESS

system collapse during transformer energization without load. The capability of GWh-level black start restores power for the entire plant within minutes, rapidly bringing the power system back online and minimizing outage-related issues and societal impact.

Capability 6: On/Off-grid switching

Huawei's grid-forming ESS can seamlessly switch between on-grid and off-grid modes, prevents power interruption for users. In off-grid mode, the ESS independently establishes voltage and serves as a temporary supply for critical loads.

End-to-End Quality Management: Setting a Benchmark in the Energy Storage Industry

Huawei Digital Power prioritizes both high quality and safety and has established an end-to-end quality management system covering business planning, design, development, manufacturing, procurement, marketing, sales, delivery, and operations and maintenance (O&M).

During the simulation phase, Huawei uses a digital twin platform to simulate and verify systems, proactively identifying and resolving serious safety and operational risks to ensure product and solution reliability. For example, in the 100% renewable microgrid project for The Red Sea destination in Saudi Arabia, Huawei developed ultra-high-precision digital twin models for PV and ESS devices, with simulation errors controlled to within 2%—significantly better than the industry average of 10%. Huawei FusionSolar's modeling and simulation platform has delivered over 1,000 models for more than 60 countries and regions.

During the testing phase, Huawei conducts long-term testing of each new-generation product in labs and at five outdoor test bases designed to simulate extreme environments such as high humidity and salinity, high temperature and sandstorms, high altitude and strong radiation, and extreme cold. These rigorous tests ensure product quality and stability. To test the performance of ESSs in extremely cold environments, Huawei built

a lab capable of simulating -50°C temperatures—here, products undergo continuous operation for thousands of hours to verify stability. In February 2025, Huawei collaborated with DNV, an internationally recognized testing organization, to conduct extreme ignition tests on its Smart String Grid-Forming ESS. During the testing, thermal runaway was manually triggered and multiple cells burned for hours. Despite this, the ESS successfully achieved the goal of "no fire, no explosion, no fault propagation, and no injury." Temperatures of adjacent battery packs were controlled throughout the process, demonstrating the industry-leading safety of Huawei's ESS safety design.

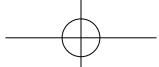
During the O&M phase, Huawei implements pack-level thermal runaway control and end-to-end, multi-dimensional intelligent diagnostics through the battery management system (BMS) to ensure active safety via both software and hardware. An AI algorithm accurately predicts more than 10 types of cell and pack risks one to seven days in advance, preventing potential hazards such as battery abuse and internal or external short circuits. This approach enables a fundamental shift from passive response to proactive prevention.

Safety Foundation: Five Layers of Defense Throughout the Lifecycle

ESSs are critical components of new power systems. Because any safety incident or fault has the potential to compromise the stability of the entire system, safety and reliability must be the top priority of the energy storage industry.

Huawei's grid-forming ESS features a five-in-one safety protection system that covers cells, packs, racks, containers, and the grid, implementing the following defense methods:

- Source control: Huawei enforces stringent control at the source, applying the world's strictest qualification standards and full-lifecycle quality management to cell suppliers. Comprehensive risk prevention establishes a solid safety foundation.



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- Mechanical safety and directional pressure venting: At the pack and rack levels, Huawei uses reinforced structures, positive-pressure oxygen barriers, and directional explosion venting designs to maximize safety. These designs physically isolate risks, making them controllable and manageable. In the event of cell thermal runaway, the system vents pressure in a controlled manner to effectively suppresses thermal and fire propagation. This ensures personnel safety, protects surrounding equipment safety, and minimizes the impact of faults.
- Refined management and intelligent warning: Huawei uses an advanced string architecture to independently manage and precisely control each energy unit, ensuring efficient and healthy system operation. Additionally, Huawei leverages cloud-based big data and AI diagnostics to build an intelligent safety protection mechanism that transforms O&M from passive protection to proactive warning. This mechanism enables early detection of potential risks and prompt intervention, improving system predictability and operational safety.

Huawei Digital Power has established "no fire, no explosion, no fault propagation, and no injury" as its foundational

safety principles, extending safety management from the initial design phase throughout the entire product lifecycle. Building on this foundation, Huawei Digital Power introduced a safety risk matrix and collaborated with customers and industry organizations to develop a full-lifecycle, quantitative safety assessment system for electrochemical ESSs. This system successfully passed an authoritative technical appraisal organized by the China Electricity Council on November 18, 2025.

The appraisal committee unanimously concluded that the system sets a new global benchmark, closing critical technical gaps in ESS safety both within China and globally.

Summary

Grid-forming energy storage is not only a technological innovation but also a cornerstone for new power systems. Huawei's grid-forming ESS overcomes industry technical barriers through its six core capabilities, while integrating five layers of safety protection and end-to-end quality management to establish a safety benchmark for the industry. Looking ahead, Huawei will continue to collaborate with more customers and partners to lead the energy storage industry into the grid-forming era. ▲





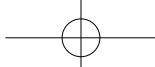
Beyond Fast: Huawei FusionCharge's Five-Dimensional Approach to High Quality

Huawei FusionCharge is defining a new standard for high-quality electric vehicle (EV) charging. Its five-dimensional verification system—spanning design, R&D, testing, certification, and all-scenario validation—establishes a new industry benchmark.

According to the International Energy Agency (IEA), global electric vehicle (EV) stock is projected to surge to 300 million by 2030. The booming EV market is creating massive demand for charging infrastructure. Despite rapid industry growth, trust remains under strain. Charging infrastructure faces persistent challenges: inaccessible charging, slow charging speeds, recurring failures, and safety concerns that can lead to fire

hazards. Furthermore, intense price competition is eroding user trust and hindering sustainable industry progress.

In response, Huawei Digital Power is prioritizing quality and safety to redefine high-quality EV charging. It has established a five-dimensional verification system—spanning design, R&D, testing, certification, and all-scenario validation—that is integrated into every stage of



development, setting a new industry benchmark.

High-Quality Design: Building a Foundation of Safety

Huawei FusionCharge begins its high-quality journey with design, infusing reliability and safety into every product detail. To address challenges such as insufficient heat dissipation, suboptimal protection, and a short service life, Huawei has adopted the complex yet promising liquid cooling technology.

- Coolant-electricity isolation: Huawei's liquid cooling design moves beyond the simple "sandwich" structure with an innovative top-down isolation approach, fully separating the cooling plate from electrical components. The liquid cooling system is validated to the most rigorous automotive standards, eliminating the risk of electric leakage at the source.
- Long service life: Huawei ensures the quality of core components by adhering to industry-leading standards. For example, the water pump is designed for a lifespan of 30,000 hours—twice the industry average. The structural elements of the charging connector balance heat dissipation and dustproofing. Huawei's specially formulated coolant is the first in the industry to deliver a 10-year service life.
- Strong resilience: Huawei has engineered every detail to withstand extreme environments, from freezing cold to high altitudes. For example, the liquid cooling port is sealed with a data-center-grade bidirectional shut-off valve, far surpassing industry standards and ensuring performance even in freezing conditions. The highly integrated design consolidates dozens of discrete parts into a single high-reliability component, reducing the risk of failures in high-altitude and high-radiation environments.

High-Quality R&D: Pooling Power to Maximize Value

Excellent design is built on advanced technologies. Huawei

FusionCharge is committed to delivering a premium charging experience for EV users while maximizing value for charge point operators (CPOs).

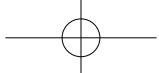
- Ultimate compatibility: Huawei has conducted extensive research and testing across a wide range of vehicle models. In full compliance with China's national safety standards, Huawei has built a vehicle-charger compatibility testing database and harnessed advanced algorithms to achieve a first-attempt charging success rate exceeding 99%.
- Power pooling: Traditional chargers operate at fixed power levels, often leading to idle resources. Huawei's innovative power-sharing matrix dynamically allocates power from all charging modules in a station, creating a flexible power pool. This ensures that each charging module is fully utilized, maximizing the return on investment (ROI) for CPOs.
- Charging ecosystem: Huawei has joined hands with industry partners to support sustainable industry growth. By collaborating with automakers and battery manufacturers, Huawei has standardized charging interface protocols and developed megawatt charging solutions for heavy goods vehicles (HGVs). This provides an ultra-efficient charging option for logistics fleets.

High-Quality Testing: Forging Reliability Through Relentless Trials

High-quality design and R&D define a product's potential, while rigorous testing forges its reliability. Supported by a comprehensive and precise testing system, Huawei FusionCharge delivers products that comply with the most demanding standards.

- Component testing: Cornerstone of uncompromising quality

Huawei FusionCharge has developed a comprehensive testing system that covers every component. Its battery-



Beyond Fast: Huawei FusionCharge's Five-Dimensional Approach to High Quality

emulation testing platform replicates more than 95% of real vehicle battery characteristics, ensuring stable performance under all typical conditions. The weak-grid simulation platform accurately models real-world scenarios, including voltage dips and harmonic distortion, to validate device immunity. The extreme-exception testing platform proactively triggers hundreds of faults—including air duct blockages, output short circuits, and even arcing—to ensure products do not cause personal injury, fire, or explosion under any circumstance. The automated performance testing platform rigorously verifies all key parameters, from voltage accuracy to current harmonics, ensuring every metric meets design expectations.

- System testing: Examination of integrated performance

In structural reliability testing, the liquid cooling pipeline undergoes 250,000 high- and low-temperature coolant channel pulses, and the charging cable is tested for 1,000 hours in an environment with 85°C temperature and 85% humidity. For environmental durability, the ultra-

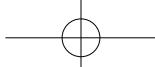
fast charger endures more than 1,300 temperature cycles from -35°C to +50°C, and the power module is tested for 2,000 hours under temperature cycles from -40°C to +70°C. In charging compatibility testing, vehicle-charger compatibility exceeds 99%, with a charging initialization time of about 15 seconds. To improve grid adaptability, over 230 libraries of abnormal grid waveforms worldwide is used, ensuring the charger's stable operation in extreme scenarios.

- Hardware-in-the-loop (HIL) simulation: Booster of efficiency

Huawei leverages the RT-LAB simulation platform to build a high-precision digital twin of the power grid, charging system, and battery, reducing testing cycles from months to days. For example, power dispatch testing efficiency is enhanced by more than 12-fold through the simulation of over 60,000 permutations of dispatch logic.

- Extreme environment field testing: The ultimate





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challenges by the nature

Huawei FusionCharge has established five core field testing bases in Wanning (Hainan), Xishuangbanna (Yunnan), Dunhuang (Gansu), Lhasa (Xizang), and Mohe (Heilongjiang). These sites span extreme environments including high salt fog, intense humidity and mold, scorching heat, heavy dust, high altitude with strong radiation, and severe cold. In these conditions, Huawei FusionCharge products are validated by nature's ultimate challenges.

· Reliability testing: Long-term quality assurance

To validate product performance over a decade, Huawei conducts rigorous salt spray tests to replicate the long-term erosion in marine environments and wet dust tests to simulate component wear in dusty environments. Additionally, a suite of high-temperature aging and thermal cycle tests—including highly accelerated life test (HALT) and temperature humidity bias (THB) test—proactively uncovers potential defects during the R&D phase, enabling design improvements and ensuring long-term reliability.

High-Quality Certification: The Mark of Excellence

High-quality products are defined by objective and impartial standards. Huawei FusionCharge has undergone rigorous testing by leading international certification bodies. Evaluations conducted by the China Automotive Technology and Research Center (CATARC), TÜV SÜD, and DEKRA have certified Huawei FusionCharge as a brand of excellence.

It has successfully passed CATARC's "charging safety test" (voltage dipping to a safe range within 10 ms upon grid failures) and "extreme environment test" (withstanding level-12 winds and operating continuously for 1,000 hours at 55°C), achieving excellent results. Certifications such as the CCTA Charging Compatibility Star and the

PREMIUM High-Quality Certification highlight Huawei's commitment to providing high-quality charging services to EV users.

Huawei FusionCharge leads the industry as the first to obtain certifications in five critical domains, from charging quality and safety to extreme environment performance, and is also the pioneer in achieving megawatt charging certification.

All-Scenario Validation: A Pledge to Excel on Any Road

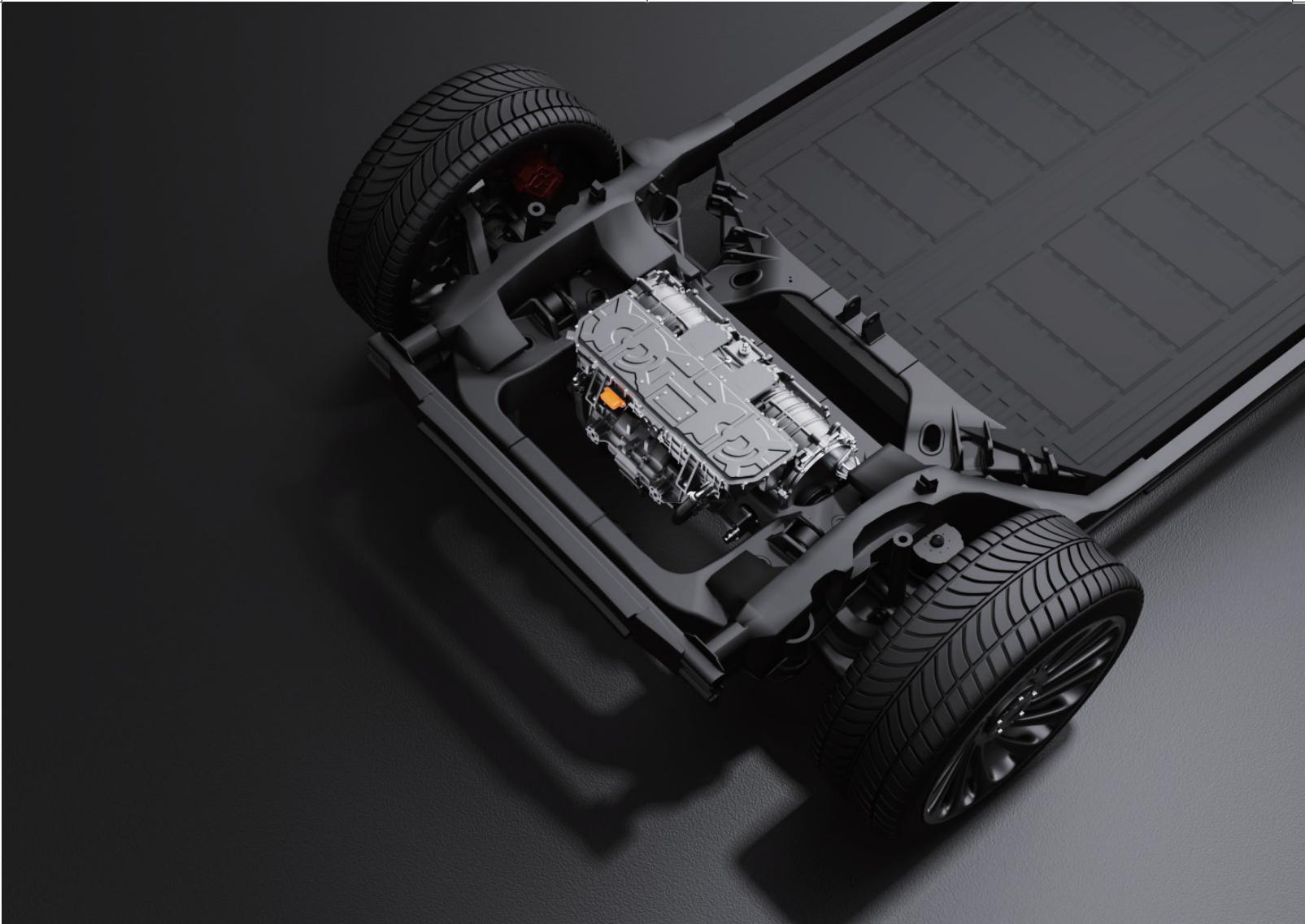
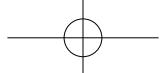
All-scenario validation completes the five-dimensional verification process, proving that Huawei FusionCharge delivers reliable, high-quality charging on any road, not just in the laboratory.

Over the past few years, Huawei FusionCharge has demonstrated outstanding performance in extreme environments. At Turpan's Flaming Mountains, it withstands the scorching heat of 45°C. In Yakeshi, it ensures reliable charging even at -35°C. At Mount Qomolangma's base camp, 4,300 meters above sea level, it operates smoothly under high-altitude conditions. Along coastal regions, it resists salty winds and salt fog, maintaining consistent reliability.

Summary

From meticulous design planning to groundbreaking R&D innovations, from rigorous validation to authoritative certifications, and ultimately through real-world trials in extreme environments, Huawei FusionCharge has set an industry-recognized benchmark of quality with its five-dimensional verification system.

This system is more than a product development methodology; it represents a core value that shapes the high-quality evolution of charging infrastructure. Huawei remains steadfast in its commitment to safety, relentless pursuit of quality, and dedication to customer experience—jointly charging the road ahead. ▲



Huawei DriveONE: Safeguarding Every Drive

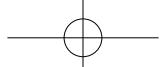
While many suppliers in the power domain of the automotive industry compete on specifications, Huawei DriveONE focuses on a more fundamental yet challenging goal: quality and safety.

Huawei DriveONE ranked first in the "Quality Performance of Mid-range and High-end Electric Passenger Vehicle Powertrain Suppliers" at the 2025 China Auto Quality Research (AQR) Award Ceremony on September 25, 2025. This marks its third consecutive year as the industry's top supplier. This award, based on user feedback, highlights Huawei DriveONE's outstanding achievement of "zero safety incidents."

As a leading supplier in the power domain, Huawei

DriveONE offers superior services and products compared to traditional component suppliers. It is committed to providing motion-domain solutions that feature convergence & simplicity, high safety & reliability, superior user experience, and cloud-based AI. Guided by the principle that "safety is the ultimate luxury," it elevates the quality benchmark for the electric vehicle (EV) industry.

By September 2025, Huawei DriveONE had shipped



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over 3.5 million units, supporting the delivery of over 2 million vehicles and accumulating a mileage of over 30 billion kilometers (equivalent to 750,000 circles around the Earth), while maintaining its record of "zero safety incidents."

This record is supported by a digital quality management system that spans the product lifecycle, along with technology convergence and innovations in the motion domain.

Digital Quality Management, Establishing a "Zero Incidents" Safety Benchmark

Huawei DriveONE integrates successful quality management practices from the automotive industry with its own quality system capabilities to build an advanced digital quality management system.

- Digital platform: Power Intelligent Operation Center (IOC) streamlining full-process data

The Power IOC digital platform streamlines the data flow between material suppliers and Huawei, significantly enhancing early warning management, AI-based analysis and optimization, and material specifications optimization.

Huawei DriveONE uses AI algorithms to identify quality risks and supply chain issues in advance, preventing potential problems. Furthermore, the platform intelligently optimizes material specifications and process parameters, continuously improving product design and manufacturing quality. Based on this digital platform, Huawei DriveONE consolidates full-process quality data from supplier incoming materials to product delivery, establishing a solid data foundation for quality management.

- Intelligent manufacturing: AI-based quality inspection and production line optimization

In the manufacturing phase, Huawei DriveONE

integrates digital and intelligent technologies to build advanced capabilities for intelligent manufacturing. Factories extensively use image recognition and AI algorithms for quality inspection and process control, thereby eliminating quality risks during manufacturing. For example, at Huawei's Southern Factory, the DriveONE production line achieved full automation of its key processes in 2024, reducing the powertrain defect rate by 56%.

- Vehicle health report (VHR): minute-level risk warning

Huawei DriveONE's VHR warning mechanism uses AI algorithms to analyze data and identify vehicle faults in minutes. It transforms passive maintenance into proactive services, significantly improving user safety and experience. Currently, the VHR warning mechanism has been deployed across more than 20 vehicle models, increasing the improvement rate for power-related issues in the market to over 90%.

Motion Domain Convergence, Redefining Driving Safety and Experience

In recent years, the EV industry has completed the power transition from engine to motor, achieving a





Huawei DriveONE: Safeguarding Every Drive

leap in acceleration performance. The next focus is the fully-electrified and intelligent motion control in all directions (longitudinal, lateral, and vertical), fundamentally enhancing vehicle safety and stability in braking, cornering, and over bumps.

Huawei DriveONE outlines three stages of technology evolution in the motion domain:

- Instinctive safety: Pursue breakthroughs in the performance of individual components, such as high-speed motors.
- Instinctive and redundant safety: Enable inter-component collaboration and local closed-loop control, establishing a dual-protection mechanism for instinctive and redundant safety.
- All-domain safety: Achieve deep convergence and distributed intelligence in the longitudinal, lateral, and vertical directions to develop system-level safety capabilities.

Following these three stages, Huawei DriveONE introduces the motion-domain convergence concept, which leverages collaborative control across the vehicle. This embeds safety into all aspects of vehicle motion rather than depending on the performance limits of a single component, embodying the principle that "safety is the ultimate luxury." To achieve this, Huawei DriveONE focuses on two key areas.

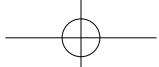
First, Huawei DriveONE optimizes the control architecture by systematically building local, self-contained closed-loop capabilities at the wheel side. The system can quickly adjust motion control in complex scenarios, such as on slopes, icy roads, and rough terrain, significantly enhancing the vehicle's stability and safety during dynamic driving.

Second, Huawei DriveONE improves system design

by replacing traditional "siloed" components with a unified control model for both human driving and intelligent driving. The model implements end-to-end integrated management that covers sensing, planning, and control, ensuring consistent control objectives and unified collaboration among all components to maximize overall system performance.

Based on these technical breakthroughs, Huawei DriveONE has enhanced driving safety and experience in four core dimensions:

- Safety boundary expansion: System synergy control improves key safety performance, such as safe speed for emergency obstacle avoidance and safe speed in the event of high-speed tire blowouts, by 20%. A test vehicle can avoid obstacles at 110 km/h on snowy roads after a tire blowout, pushing the boundaries of proactive safety further.
- Energy efficiency optimization: Precise power output and converged vehicle energy efficiency optimization drive the entire industry toward the goal of "10 km per kWh," effectively alleviating range anxiety. Actual vehicle test results demonstrate a range of 12.4 km per kWh.
- Driving experience enhancement: Microsecond-level sensing and millisecond-level torque adjustment enable features such as acceleration slip regulation, imperceptible braking, and active anti-jerk control, delivering a smoother, more comfortable driving experience.
- Control performance breakthrough: A vehicle can accelerate from 0 km/h to 100 km/h in just 2 seconds. The braking distance is reduced by 5%, and the curve entry speed is increased by 10%. The turning radius is reduced through torque vector control, and pendulum parking, previously available only on vehicles with three or four motors, is achieved using dual motors.



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The motion domain convergence solution from Huawei DriveONE is not only a technical upgrade but also a profound redefinition of vehicle safety: delivering safety protection as the ultimate luxury, shifting from passive protection to proactive prevention, and from single-point assurance to system-level protection.

Three-Dimensional Quality System, Building a Comprehensive Safety Defense Line

Huawei DriveONE aims to set a high-quality benchmark in the automotive power domain. It has established a unique three-dimensional quality system comprising core quality, basic quality, and prime quality to firmly secure product safety.



Core quality ensures no leakage, no fire, and no loss of control. This is the non-negotiable technical bottom line for Huawei DriveONE and the fundamental principle of its product design.

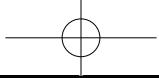
Basic quality prevents power degradation and abnormal noise. Huawei DriveONE uses all-scenario risk analysis to systematically identify and prevent potential risks during the R&D phase. In the manufacturing phase, it adopts a unique "red, yellow, and green lights" mass-production management system to dynamically evaluate and control key processes and quality metrics, ensuring consistent, stable, and high-quality product delivery across factories and supply chains.

Prime quality delivers a reliable travel experience that exceeds expectations. Huawei DriveONE partners with automakers to build a safety architecture for the motion domain, extending safety capabilities to the control dimension and improving vehicle stability in scenarios such as emergency obstacle avoidance and tire blowouts. The system also integrates cloud data and AI analysis capabilities to implement predictive maintenance of key components, shifting from passive maintenance to proactive protection and providing users with more convenient and valuable vehicle assurance.

Summary

Quality and safety are the highest priorities for Huawei Digital Power.

Huawei DriveONE redefines driving safety and experience through its robust digital quality system, innovative motion-domain convergence solution, and motion-domain intelligence. It also provides a replicable and evolvable quality management methodology, setting a high-quality benchmark for the power domain in the automotive industry and delivering safety assurance as the ultimate luxury in the EV era. ▲

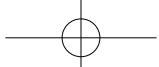


Underlying Logic and Value Reconstruction: The Evolution of Liquid Cooling in AIDCs from Coolant Distributor to Intelligent Core

As the safeguard for artificial intelligence data centers (AIDCs), Huawei Thermal Management Unit (TMU) incorporates four layers of safety protection for liquid cooling systems, eliminating failure risks.

A renowned AI research institute was training multiple leading foundation models in its AIDC. During a critical training phase, the liquid cooling system failed, causing coolant to leak across multiple critical servers. The servers immediately overheated, triggering alarms and emergency shutdown on some devices. Despite the staff's emergency measures, some chips sustained irreversible damage from overheating. This incident halted a critical model training project, wasting significant prior investment in computation and time.

This is neither an isolated incident nor an exaggeration. With the boom of AI and big data, demand for data centers and computing power has grown exponentially, driving a substantial increase in device power density. In this context, traditional air cooling is no longer sufficient, and liquid cooling technology has emerged as an industry solution. At the core of the liquid cooling system, the Cooling Distribution Unit (CDU) is at a pivotal point in its transition from a "passive distributor" to an "active controller." The evolution of the CDU from a basic "cooling system component" into an "intelligent core" with management



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and control capabilities is critical for the stability, efficiency, and safety of the entire system.

Challenges: The Urgent Need for Liquid Cooling System Evolution in the Era of Intelligent Computing

The computing power race is intensifying. User demands for greater computing power are driving chip thermal design power (TDP) consumption to soar. Traditional air cooling technology has been insufficient to meet the cooling requirements of scenarios with high power density. Therefore, the liquid cooling system is seeing rapid large-scale adoption.

As liquid cooling technology accelerates its penetration, the market has grown rapidly in recent years. The global data center liquid cooling market reached US\$870 million in 2024 and is expected to grow at a compound annual growth rate (CAGR) of 51.93% from 2024 to 2030, reaching US\$10.7 billion by 2030, according to Arizton, a market research firm. Among liquid cooling technologies, the cold plate liquid cooling system is a widely used and mature solution. However, as intelligent computing demands greater safety, efficiency, and cost-effectiveness, cold plate liquid cooling systems struggle to meet the requirements of large-scale operations due to their weaknesses.

- Safety: Emergencies such as coolant leakage and coolant supply interruption may directly cause device breakdown, jeopardizing the continuity of intelligent computing services.

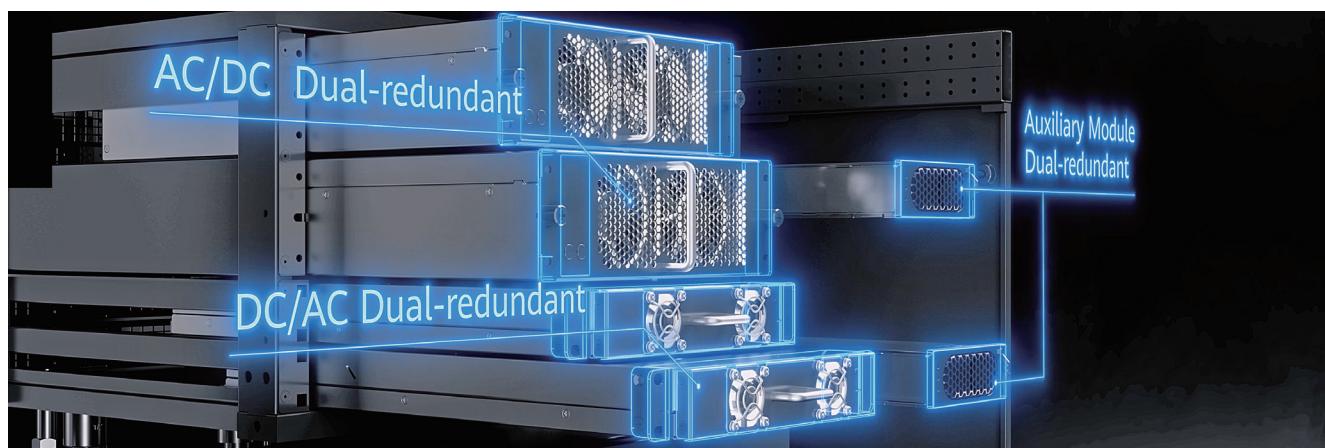
- O&M: The traditional mode of manual inspection and shutdown maintenance is inefficient. It also increases O&M costs and the risk of service interruptions.
- Energy efficiency: The heat-exchange efficiency of plate heat exchangers is low, and the device operation is inconsistent. Therefore, cooling efficiency is limited, and energy consumption remains high.
- Deployment: CDU cleaning and other preparations alone take 7 to 15 days. This significantly slows down the construction and capacity expansion of AIDCs.

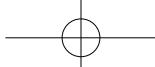
These core pain points hinder the large-scale deployment and efficient operation of AIDCs.

Key to Breakthroughs: CDU Transformation

A liquid cooling system consists of three core components.

- The primary-side system: It includes the cooling tower, hydronic module, and chilled water pipes. It is technologically mature and highly standardized, but with limited optimization potential.
- The secondary-side system: It includes the coolant pipe and cold plate. The cold plate is closely coupled to the server chip layout. It is highly customized, making standardization difficult.
- CDU: It acts as the hub connecting the primary-side and





Underlying Logic and Value Reconstruction: The Evolution of Liquid Cooling in AIDCs from Coolant Distributor to Intelligent Core

secondary-side systems. As the core of the entire system, it handles heat exchange and flow distribution. Notably, the CDU, as a core component that rapidly rises with the large-scale implementation of liquid cooling technologies, has a relatively short evolution period and remains in the stage of rapid technological iteration. Although it holds potential for standardization, there remains significant room for improvement in key technical dimensions, including product architecture integration, intelligent algorithm depth (such as multi-dimensional collaborative optimization in energy efficiency), and multi-scenario adaptability and flexibility (such as precise temperature control under extremely high-density computing power).

Traditional CDUs are used only as the distribution channel for a liquid cooling system. It passively distributes coolant and cannot make independent decisions or optimize. Huawei Thermal Management Unit (TMU) is not just an iteration of traditional CDUs, but an intelligent core that delivers safety, intelligent O&M, energy-efficiency optimization, and fast deployment. It proactively controls the entire liquid cooling process, representing a fundamental transformation from passive response to proactive prediction. Traditional CDUs are tools, whereas Huawei TMU is an intelligent hub. With its four core differences, the latter reshapes a liquid cooling system. It has emerged as the next-generation core device for the liquid-cooling upgrade of AIDCs, thanks to its groundbreaking capabilities.

Huawei TMU: Advancing CDU Evolution Toward an Intelligent Core

Based on Huawei's liquid cooling projects across multiple large-scale AIDCs, the following illustrates how Huawei TMU, unlike traditional CDUs in the industry, functions as an intelligent core across safety, O&M, energy efficiency, and deployment.

1. Safety core: from single-point protection to system-wide protection

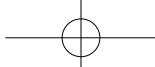
Due to their reliance on basic hardware protection, traditional CDUs are prone to system breakdown caused by single points

of failure (SPOFs). They are slow to recover from faults, and their coolant leakage and overpressure risks are unpredictable. Furthermore, they lack network security protection. Unlike them, Huawei TMU features a comprehensive safety system with four layers of protection.

- First layer: Dual AC/DC hot standby ensures seamless switching.
- Second layer: A 2N redundancy design for core components eliminates SPOFs.
- Third layer: Real-time, full-link (pressure, coolant quality, and conductivity) detecting and quick emergency response (20-second fast restart, 5-minute emergency coolant refill, and pumps directly powered by the mains supply to sustain cooling) ensure immediate fault recovery.
- Fourth layer: Public security product certification demonstrates the product's ability to prevent hacker attacks, fault propagation, and service interruptions, enabling it to achieve far higher security and reliability than traditional CDUs.

2. O&M core: from scheduled shutdown maintenance to intelligent and simplified in-service maintenance

Traditional CDU maintenance is challenging due to shutdown requirements, dependence on frequent manual inspection, and dedicated tools for coolant refilling, complex and time-consuming component maintenance, need for large room space, and high labor costs. Huawei TMU reshapes O&M through its modular, intelligent features. Core modules are hot-swappable and thus can be replaced without system shutdown. Flexible lifting casters and a front-and-rear access design enable efficient deployment and maintenance. The TMU also supports one-click self-diagnosis and intelligent coolant refill, eliminating the need for manual effort and dedicated tools. By upgrading O&M from scheduled maintenance requiring system shutdown to on-demand, in-service maintenance, Huawei TMU improves efficiency by over 50% and resolves all the pain points facing traditional CDUs.



Tech in Practice

3. Energy-efficiency core: from passive energy saving to full-link optimization

Traditional CDUs have low heat-exchange efficiency (approach temperature of 4°C to 8°C) and a fixed operating mode that cannot adapt to IT load fluctuations. Consequently, the energy consumption is high, and the power usage effectiveness (PUE) cannot reach the target of 1.1. In comparison, Huawei TMU achieves an energy efficiency leap through three core technologies. It uses a 304 stainless steel plate heat exchanger that reduces the approach temperature to 3°C, decreasing the energy consumption of the primary-side cooling source by 15%. With adaptive load adjustment, Huawei TMU enables the pump to stay efficient. Using AI-based collaborative optimization (flow precisely controlled within 5%, idle-unit hibernation and wakeup, and historical-data algorithm iteration), it maximizes system-wide energy efficiency. Huawei TMU has an annual PUE of less than or equal to 1.12 in real-world projects, whereas traditional CDUs struggle to break the 1.4 PUE bottleneck.

4. Deployment core: from complex and slow rollout to plug-and-play

A traditional on-site CDU requires creation of a low-impedance bypass path through dedicated connection tools, cyclic cleaning, and handover. Cleaning alone takes 7 to 15 days. The processes are complex, and the rollout period is long, significantly affecting the production efficiency of intelligent computing power. In contrast, Huawei TMU is pre-cleaned before delivery and can be put into use after on-site cleaning that takes just one to two hours. Through modular design and prefabrication, Huawei TMU shortens the deployment cycle by more than 90%. It addresses the issues of slow rollout and challenging implementation encountered by traditional CDUs.

Future Evolution: From Distributed Control to System-Wide Intelligence

The market for the CDU, a core component of liquid cooling, is growing rapidly. It has become a key technology

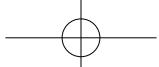
behind the high-density and green development of data centers. For example, the AIDC liquid cooling market in China reached CNY18.4 billion in 2024 and is expected to grow to CNY130 billion by 2029, according to the China Academy of Information and Communications Technology (CAICT). Expanding market scale, continuous technological advancement, and policy incentives are the key drivers of future CDU growth.

The CDU's evolution from a simple coolant distribution unit to the intelligent control center of a liquid cooling system is more than just a technological upgrade. It represents the leap in AIDC liquid cooling systems from distributed control to system-wide intelligence. Future CDU advancements will focus on three key directions:

- Evolving from a single function to system-wide intelligence;
- Shifting from passive to predictive maintenance;
- Transitioning from standalone operation into group-based collaborative autonomy.

As demand for intelligent computing power soars, the CDU's evolution into an intelligent core will be the key to the liquid cooling industry's competitiveness. Huawei TMU represents not just an upgrade over traditional CDUs, but a reconstruction of the AIDC liquid cooling system. As an intelligent core, it offers autonomous decision-making and intelligent optimization capabilities for a liquid cooling system, resulting in breakthroughs across safety, reliability, O&M convenience, energy efficiency, and deployment efficiency. It sets a new standard for liquid cooling control units, driving the high-density, green, and intelligent development of AIDCs.

The implementation of Huawei TMU demonstrates this trend. By upgrading from a coolant distributor to an intelligent core, the TMU resolves pain points of liquid cooling systems and, more importantly, enables high-quality AIDC development. ▲



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transforms passive alerts into
proactive warnings.



Agile

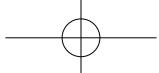
Prefabricated products
cut delivery time
by 75%.



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efficiency with 30%+
less footprint.





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