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COVER TOPICS

# HUMAN AND ROBOT IN PERFECT SYNC

EDITOR'S WORDS

# CHINA'S GREEN:

## PUSHES THE LIMITS OF INNOVATION

This summer, China's new energy industry has made global headlines with a series of game-changing breakthroughs — first, generating over a million tons of green ammonia from wind power in Inner Mongolia; then, turning corn stalks into marine fuel in Taonan, Jilin Province. What do these two world-class green hydrogen, ammonia, and methanol projects signal? "These two green revolutions, launched just seven days apart, are like twin stars in the new energy galaxy, showcasing China's hard-core capabilities in carbon reduction," said one industry expert.

Who would've thought that corn stalks, once a headache for farmers, could be turned into "green crude oil"? With a unique "wind power + biomass" blend, Shanghai Electric has cut carbon emissions per ton of methanol by 65% and even secured EU certification. The first batch of green methanol is about to be loaded onto a French cargo ship. This "Made in Taonan, Fueled in Shanghai, Sailing Worldwide" model is a live showcase of Chinese Intelligent Manufacturing going global.

Built like Lego blocks, it shattered construction speed records. The process from signing to commissioning took just 16 months. Thanks to the modular design, construction time was slashed by 40%, leaving even experts astonished. But the real game-changer is the self-developed system behind it all. This "Green Power – Green Hydrogen – Green Methanol" setup functions like the "Transformers" of clean energy: it can absorb 220 million kWh of green electricity and process 180,000 tons of straw annually, turning the energy trilemma into a multidimensional win-win solution.

Once criticized for being "all hype, no market," green fuel is now rewriting the rules. Through technological innovation, the Taonan project has performed a kind of cost magic: its methanol is 20% cheaper than European equivalents and qualifies for carbon tariff exemptions. When ocean freighters begin fueling with China-made green methanol, it marks a turning point, a shift from reliance on subsidies to a self-sustaining, commercially viable green energy sector.

Standing before the towering methanol synthesis unit in Taonan, one can almost hear the tide of energy transformation rolling in. Shanghai Electric is already sketching a broader blueprint, from green methanol to green ammonia, from marine fuel to sustainable aviation fuel. Scenes that once existed only in sci-fi films are rapidly becoming reality. It is a new calling card for Chinese innovation. This is more than just factory construction; it's the writing of a new grammar for future energy.

Right now, cargo ships are sounding their horns, setting sail into open waters, fueled by Taonan's green methanol. This green revolution, which began in the rural heartlands of Jilin, is poised to reshape the global flow of energy. And at the forefront stands Shanghai Electric, boldly engraving a Chinese signature on this once-in-a-century energy transformation.

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# CONTENTS

# NEWS LETTER

## Shanghai Electric Wins Stock Star's "ESG New Benchmark Enterprise Award"

Recently, Shanghai Electric Group Co., Ltd. was honored with the ESG New Benchmark Enterprise Award by Stock Star, in recognition of its outstanding practices and achievements in the fields of Environment, Social Responsibility, and Corporate Governance (ESG). This accolade not only affirms Shanghai Electric's long-term commitment to ESG excellence but also underscores its dedication to empowering green development through technology and creating value through responsibility. The award is a prestigious ESG honor established by Stock Star under the guidance of the China Chief Economist Forum. It aims to identify and commend enterprises that demonstrate excellence across the three ESG dimensions, driving the deep integration of economic performance and social responsibility.

## Shanghai Electric Honored with Multiple Awards at the 20th Anniversary of China's Desalination Industry

The 2025 Qingdao International Water Conference was recently held at the Qingdao World Expo City. At the event, Shanghai Electric received multiple prestigious accolades in recognition of its innovation and contributions to the desalination sector. The company's self-developed Flash-Multi-Effect Distillation (F-MED) integrated desalination evaporator was selected as one of the "Top 100 Excellent Products & Equipment". Its world-first "waste heat utilization–thermal and membrane hybrid coupling technology" was named among the "Top **100** Technological Innovations". The Zhejiang Petroleum & Chemical Thermal Desalination Project, the world's largest thermal seawater desalination project utilizing waste heat and built with Shanghai Electric's participation, was recognized as one of the "Top **100** Engineering Case Studies". In addition, two of Shanghai Electric's experts in desalination, Li Haihong and Li Yan, were selected as part of the "Top **100** Distinguished Figures in China's Desalination Industry".

## Shanghai Electric's "12,000-ton Hydraulic Press" Listed as Shanghai Industrial Heritage

Recently, the "**12,000**-ton Hydraulic Press" of Shanghai Electric SHMP Casting & Forging Co., Ltd., the first of its kind in New China, was officially included in the Third Batch of Shanghai Industrial Heritage List after evaluation by the Shanghai Municipal Commission of Economy and Informatization. This recognition is not only a high tribute to a piece of legendary equipment but also a salute to the industrial spirit it represents. Since its debut more than six decades ago, the press has stood as a "strategic national asset" in heavy industry, continuously supporting major national projects and serving core sectors of strategic importance to the country.

## Shanghai Electric Wind Power Maintains Offshore Leadership for Six Consecutive Years

Recently, the China Electricity Council (CEC) released the Notice on the Publication of the 2024 Annual Benchmarking Results for Wind Power Operation Indicators. Shanghai Electric Wind Power saw a **19**% year-on-year increase in the number of award-winning wind farms, reaching a total of **38** across diverse environments including offshore, onshore plains, mountainous areas, sandy lands, Gobi deserts, wastelands, and plateaus. Among them, **9** wind farms achieved the highest 5A rating, which is a new record for the company. At the same time, Shanghai Electric was named the turbine manufacturer with the highest availability in six major regions nationwide, marking the sixth consecutive year it has held the top position. It is a testament to its strong capabilities as China's offshore wind power leader.

## Shanghai Electric Signs Key Belt and Road Power Project in Bangladesh

On June 24, Shanghai Electric Power Transmission & Distribution Group signed an EPC contract in Dhaka, capital of Bangladesh, with the Bangladesh Power Development Board (BPDB) for Package **1** of the Chittagong Phase II Substation Project. As a national-level project under Bangladesh's power development plan, the contract covers the construction, upgrade, and expansion of 16 substations, significantly enhancing the stability of electricity supply in the Chittagong region, an important coastal hub, and supporting local social and economic development. In recent years, Shanghai Electric has secured multiple EPC power projects in Bangladesh, earning consistent praise from BPDB for its solid performance and delivery capabilities.

## Fujian's First Coal Power Capacity Replacement Project Enters Operation

Recently, the No. **5** unit (**1×600**MW ultra-supercritical double-reheat project) of Xiamen Huaxia International Power Development Co., Ltd. successfully completed its **168**-hour full-load trial run, marking the official operation of Fujian Province's first coal-fired power capacity replacement project. Shanghai Electric Power Generation Group supplied the complete set of primary equipment, including turbines, generators, boilers, and auxiliaries. After commissioning, the new unit reduces coal consumption by approximately **17%** compared to the previous unit, saving about 90,000 tons of standard coal annually and cutting $CO_2$ emissions by around **250,000** tons, making a significant contribution to China's dual carbon goals.

## Shanghai Electric Turbine Plant Completes First "Mobile Factory" Order in South Korea

On June 16, the "Mobile Factory" team from Shanghai Electric Power Generation Equipment Co., Ltd. Turbine Plant successfully completed a maintenance service order for the Yulchon Power Plant in South Korea. Following the repair, the plant unit was restarted and synchronized to the grid, with all system parameters operating stably. Within just **13** days, the team repaired **8** valves, achieving a **100%** first-pass rate for valve seat welding and machining, delivering an excellent result for its first-ever project in South Korea.

## Sarawak 500kV Transmission Line Project Fully Completed

On June 24, the SIMILAJAU–BUNUT **500**kV transmission line project in Sarawak, Malaysia, undertaken by Shanghai Electric Power Transmission & Distribution Engineering Co., Ltd., achieved full-line completion. The final stage involved the successful live-line crossing of **275**kV conductors and ground wires.

Spanning a total length of **106** kilometers and featuring two **275**kV live-line crossings, the project will significantly enhance the reliability of power supply in northern Sarawak. It will also enable grid integration between Limbang and Lawas, laying a solid foundation for future interconnections with Sabah and Brunei.

## Fujian's First Coal Power Capacity Replacement Project Enters Operation

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## Broetje-Automation Wins Consecutive Core Automation Projects in the Aviation Industry

Recently, Broetje-Automation Equipment (Shanghai) Co., Ltd., a subsidiary of Shanghai Electric, secured significant contracts with Huarui Aerospace and Xizi Aviation, two leading domestic aviation manufacturers. Under these agreements, Broetje-Automation will supply a mobile heavy-load automatic drilling robot to Huarui Aerospace and core equipment for an automatic drilling and riveting production line to Xizi Aviation, supporting automation upgrades and efficiency improvements in their core component manufacturing processes. These collaborations reflect the accelerating adoption of domestically produced high-end equipment in China's intelligent aviation manufacturing sector, and serve as a testament to Broetje-Automation's commitment to deepening its expertise and meeting the localized needs of the domestic market.

## Guoyue Shaoguan Phase II Project Completes Full-Load Trial Run

On July 1, the **1×700**MW ultra-supercritical circulating fluidized bed (CFB) unit of the Guoyue Shaoguan Phase II project successfully completed its **168**-hour full-load trial run. This milestone marks a major breakthrough, as China transitions from follower to leader in the field of large-scale ultra-supercritical CFB power generation. The project offers a valuable "Chinese solution" for achieving high-efficiency, clean, and flexible coal-fired power globally. As a demonstration project for the first-of-its-kind **700**MW ultra-supercritical CFB boiler, it received full system support from Shanghai Electric Power Generation Group, covering turbine, generator, boiler, and auxiliary equipment. Once operational, the project will significantly enhance Guangdong's power supply security, improve the operational efficiency and deep peak-regulation capabilities of coal units, and support the integration and local consumption of wind, solar, and hydropower in northern Guangdong, optimizing the regional energy mix.

## Guoxin Huai'an Salt Cavern Project Successfully Connected to the Grid

On July 1, Unit **1** of the Guoxin Huai'an Salt Cavern **300**MW Compressed Air Energy Storage (CAES) Project was successfully synchronized to the grid on its first attempt. All operational data remained within the design parameters, and vibration performance was excellent. Shanghai Electric Power Generation Group provided a full set of equipment for the project, including the air turbine, air-cooled generator, electric motor, as well as cold and hot molten salt storage tanks. As Jiangsu Province's first **300**MW-scale CAES demonstration project, it leverages a **980,000m³** salt cavern located **1,150–1,500** meters underground in Huai'an to build two **300**MW-level non-supplementary fired CAES units. The project features a globally pioneering high-temperature adiabatic compression technology with non-supplementary combustion, which integrates molten salt and pressurized hot water thermal storage, achieving **2,400** MWh of storage capacity and **71%** conversion efficiency, setting several national records and ranking among global leaders.

## Shanghai Electric Achieves Breakthrough in High-End Nuclear Forging Equipment

Recently, the project titled "First Breakthrough in Full-Set Large Forgings for High-Temperature Gas-Cooled Reactor (HTGR) Nuclear Island Main Equipment", led by Shanghai Electric SHMP Casting & Forging Co., Ltd., successfully passed expert acceptance organized by the Shanghai Municipal Commission of Economy and Informatization. This breakthrough resolves key technical challenges in meeting the high-performance and integrated manufacturing requirements of large forgings for **600**MW HTGR projects. It marks the first successful production of full-set large nuclear-grade forgings for HTGR nuclear island main equipment, including pressure vessels, reactor internals, and steam generators, filling a critical international gap. These forgings are now being applied in the manufacturing of equipment for the world's first **600**MW HTGR nuclear power unit, advancing China's capabilities in nuclear-grade material supply and the development of advanced nuclear technologies.

# Shanghai Electric Holds 2025 Mid-Year Economic Review Meeting


On July 11, Shanghai Electric Group convened its Mid-Year Economic Operation Analysis Meeting to comprehensively review and assess the Group's economic performance in the first half of 2025 and to plan key priorities for the next phase. Wu Lei, Chairman of Shanghai Electric, attended and delivered a keynote speech, while Zhu Zhaokai, the President, outlined the work deployment.

During the first half of the year, the Group's operations remained stable with steady progress. Efforts across all units to actively explore markets, ensure delivery, control costs, and optimize management have led to the achievement of both revenue and profit targets surpassing the halfway mark. Key indicators, including order intake, product delivery, profitability, and output value, have all shown year-on-year growth, laying a solid foundation for achieving the full-year goals.

Chairman Wu Lei opened the meeting by affirming the achievements made across various business segments in areas such as reform deepening, technological innovation, and operational performance. He emphasized the importance of deeply studying and implementing the spirit of President Xi Jinping's important speech during his visit to Shanghai, along with the guiding principles of Secretary Chen Jining's directives. Mr. Wu highlighted the need for a profound understanding of Shanghai's strategic mission in national scientific and technological innovation, the laws of innovation breakthroughs amid global technological shifts, releasing innovation vitality through deeper institutional reform, and systematic planning and coordinated promotion of Shanghai's international science and innovation center. He called for a stronger sense of mission, responsibility, and urgency in serving the nation's strategic goals, safeguarding national interests, and supporting national security through self-driven innovation. This, he said, is key to enhancing

China's sci-tech self-reliance and contributing to its transformation into a technology powerhouse.

Regarding the next phase of economic operations, Wu Lei stressed the importance of anchoring efforts around high-quality development, continuously deepening management improvement, enhancing strategic planning and R&D systems, innovating scientific research mechanisms and amplifying synergy across business units, and accelerating digital transformation. It is equally urgent to optimize industrial investment, market structure, and strategic layout, make steady progress in international expansion, uphold a firm commitment to safety and green development, and create a strong safety shield for sustained and healthy growth. To meet these objectives, leaders at all levels are expected to lead by example, benchmark against industry best practices, proactively plan for 2026, and seize current policy opportunities. Wu urged everyone to balance short-term execution with long-term strategy, process with outcome, and local actions with the broader Group-wide vision, all while contributing to Shanghai Electric's high-quality development.

While the mid-year results are commendable, the tasks ahead to meet full-year targets remain formidable. The meeting called on all employees to maintain focus on annual goals and the upcoming "15th Five-Year Plan", upholding their commitment to unchanged objectives, uncompromised standards, and unwavering intensity. With the courage to face challenges, the resolve to break new ground, and a pragmatic spirit, the Group aims to secure a successful conclusion to the 14th Five-Year Plan and lay a solid foundation for high-quality growth during the 15th Five-Year period, proudly carrying the banner of Shanghai manufacturing forward.

# Shanghai Electric Named to Forbes China "Sustainable Development Industrial Enterprises" List

Recently, Shanghai Electric was named to the 2024–2025 Forbes China Sustainable Development Industrial Enterprises list, highlighting the company's exemplary role in advancing sustainable industrial development in China. This prestigious list, launched by Forbes China, aims to spotlight the latest achievements in sustainable development within China's industrial sector. Targeting enterprises with annual revenues exceeding 20 billion RMB, the evaluation is conducted across multiple dimensions, including sustainable development management systems, technological innovation in transformation, practical sustainability initiatives, and long-term economic growth potential. Renowned for its objectivity and authority, the list has become a key benchmark for measuring the sustainable development levels of Chinese industrial enterprises.

# Shanghai Electric Deepens Global Fusion Energy Cooperation

## Group Leadership Visits ITER Organization and CNPE Consortium Project Team

On July 22 (local time), Wu Lei, Chairman of Shanghai Electric Group, led a delegation to visit the International Thermonuclear Experimental Reactor (ITER) Organization and the China Nuclear Power Engineering (CNPE) Consortium Project Team, where they signed a Memorandum of Understanding (MoU) to deepen collaboration in fusion energy technologies and advanced equipment manufacturing. ITER Deputy Director-General Luo Delong and Sergio Orlandi, along with Xu Pengfei, Chairman of CNPE, attended the meetings.

At the ITER Organization, Wu Lei highly praised the ITER team for its outstanding contributions to advancing global fusion energy technology. He emphasized that Shanghai Electric, as a leading Chinese high-end equipment manufacturer, remains firmly committed to technological innovation and international collaboration, actively participating in ITER as one of the world's most significant scientific endeavors. Looking ahead, Shanghai Electric will continue to leverage its strengths in extreme manufacturing and systems integration to provide solid support for the successful execution of the ITER project, jointly contributing to clean energy solutions for the global energy transition.

ITER senior management expressed high appreciation for Shanghai Electric's contributions and reviewed China's participation history and recent milestones in the ITER program. They noted that ITER represents a major milestone in humanity's pursuit of clean energy, laying the groundwork for sustainable, safe, and efficient fusion power with far-reaching significance for the global energy transition and the fight against climate change. The team welcomed Shanghai Electric's continued support and technical expertise to ensure the project's success.

During the meeting with the CNPE Consortium Project Team, Wu Lei thanked China National Nuclear Corporation (CNNC) for its long-standing support for Shanghai Electric and congratulated the team on its remarkable achievements and international recognition. He stated that ITER serves as a vital platform showcasing Shanghai Electric's capabilities in the construction of international and national large-scale scientific facilities. By drawing on the multinational collaboration mechanisms of ITER, Shanghai Electric looks forward to enhancing technical cooperation with CNPE, jointly exploring pathways for commercial fusion power plant applications, and promoting breakthroughs in global fusion energy technology.

Xu Pengfei provided updates on the CNPE Consortium Project Team's responsibilities and progress in the ITER project, including the vacuum vessel sector sub-assembly contract. He noted CNPE Consortium's strong technical capabilities and project management expertise in the nuclear sector, and highlighted Shanghai Electric's end-to-end manufacturing capabilities in core fusion equipment. Recognizing the complementary strengths of both parties, he expressed hope for continued collaboration to tackle the challenges of this highly complex scientific endeavor, and to jointly contribute to the advancement of fusion energy on a global scale.

During the discussions, Shanghai Electric Nuclear Power Group and CNPE formally signed an MoU to deepen cooperation in fusion-related business areas.

The meetings were also attended by Jin Xiaolong and Jia Tinggang, Vice Presidents of Shanghai Electric, as well as key representatives from all three parties.

The ITER is one of the largest and most influential large-scale scientific projects in the world today. It aims to integrate the latest advances in magnetic confinement fusion technologies and build the first fusion experimental reactor capable of producing large-scale, controlled fusion reactions. ITER represents a critical step toward the practical application of nuclear fusion research, with the ultimate goal of achieving sustainable and controllable fusion energy output. The program is a multinational collaboration involving seven members: the European Union, India, Japan, South Korea, Russia, the United States, and China, representing over 30 countries globally. China officially joined the ITER program in 2006.

# Shanghai Electric and EDF Explore New Opportunities in Green Energy Cooperation

On July 21 local time, Wu Lei, Chairman of Shanghai Electric Group, led a delegation to visit the headquarters of Électricité de France (EDF). Wu held in-depth discussions with Bernard Fontano, Chairman and CEO of EDF, on further strengthening international cooperation in the field of new energy.

Wu Lei noted that Shanghai Electric and EDF have maintained smooth communication over the years, and their successful collaboration on landmark projects such as the Taishan Nuclear Power Plant has set a global benchmark for third-generation nuclear technology.

Bernard Fontano emphasized the strategic importance of EDF's partnerships with Chinese companies such as Shanghai Electric. In the context of Europe's evolving energy market, EDF looks forward to leveraging the complementary strengths of both parties. Building on their existing cooperation, EDF hopes to further expand its presence in China's renewable and new energy sectors, accelerate the progress of ongoing joint projects, and explore international clean energy initiatives with Shanghai Electric to achieve mutually beneficial outcomes.

# Shanghai Electric and Framatome Jointly Shape the Future of the Global Nuclear Industry

On July 21, Local time Wu Lei, Chairman of Shanghai Electric Group, and his delegation visited Framatome, where he met with CEO Grégoire Ponchon. The two parties reached broad consensus on nuclear technology innovation, industrial chain collaboration, and international market development.

Wu reviewed the solid history of cooperation between Shanghai Electric and Framatome and highlighted the vast potential of China's nuclear energy market. He stated that Shanghai Electric is actively responding to China's dual-carbon strategy by accelerating its global presence and striving to deliver green energy solutions worldwide. Framatome has been deeply involved in China's nuclear industry for decades. More than just business partners, the two companies are long-standing witnesses and promoters of Sino-French energy cooperation. Shanghai Electric has a complete nuclear equipment industry chain and strong technological R&D and manufacturing complementarity with Framatome. He proposed the establishment of a high-level exchange mechanism to deepen communication, leverage China's large-scale nuclear development scenarios, and jointly explore supply chain collaboration to expand into global nuclear markets and drive the efficient implementation of substantive projects.

Grégoire Ponchon welcomed the visit and spoke highly of Shanghai Electric's pivotal role in the global nuclear industry supply chain. He stressed that Framatome places great importance on China's nuclear energy development. Partnering with leading Chinese high-end equipment manufacturers like Shanghai Electric has always been a key strategy for contributing to global energy conservation and sustainable development. Looking ahead, Ponchon expressed hope that both sides will continue to strengthen communication and coordination. In addition to consolidating cooperation in traditional nuclear technology and projects, he encouraged joint exploration of emerging fields such as fast breeder reactors and fusion reactors. He advocated for deeper, broader, and more practical cooperation to enhance the resilience and security of the nuclear supply chain and to optimize the global layout, contributing significantly to the clean energy transition in both China, France, and globally.


# "Global Industrial AI Guidelines" Officially Released, with Shanghai Electric as a Co-developer

On the afternoon of July 26, at the International Cooperation Forum on AI Standardization during the 2025 World Artificial Intelligence Conference, the Global Industrial AI Guidelines (hereinafter referred to as the "Guidelines") were officially released. The initiative was guided by the Shanghai Municipal Commission of Economy and Informatization and the Global Alliance on AI for Industry and Manufacturing Center of Excellence, and jointly developed by the Shanghai Artificial Intelligence Research Institute together with Shanghai Electric, China Unicom, Siemens, and other leading enterprises and institutions. The Guidelines aim to establish unified global standards and accelerate the intelligent transformation of the manufacturing industry.

# Shanghai Electric and Johnson Electric Jointly Establish "Dynamic Intelligent Control"

On July 26, coinciding with the opening of the 2025 World Artificial Intelligence Conference (WAIC), the unveiling ceremony of Dynamic Intelligent Control (Shanghai) Technology Co., Ltd. ("Dynamic Intelligent Control") was held in Changning District. The new company is a joint venture between Shanghai Mechanical & Electrical Industry Co., Ltd., a subsidiary of Shanghai Electric, and JEA Limited. Located in Changning's "Shanghai Silicon Alley," the company will focus on core technologies for complete joint modules in humanoid robots. The unveiling ceremony was attended by Zhang Wei, District Party Committee Secretary, Liu Ping, District Mayor of Changning District, Wu Lei, Chairman of Shanghai Electric Group, Zhu Zhaokai, President of Shanghai Electric, and Patrick Wang, Chairman and CEO of Johnson Electric.



# New Hardware Module Launch! Revolutionary Robotic Joint Technology Unlocks New Possibilities for Precision Motion

On July 27, during the 2025 World Artificial Intelligence Conference (WAIC), Dynamic Intelligent Control (Shanghai) Technology Co., Ltd. ("Dynamic Intelligent Control") made its debut, unveiling a revolutionary humanoid robot and embodied intelligence hardware modules along with system integration solutions. It was one of the highlights of the event.

The company, a joint venture between Shanghai Mechanical & Electrical Industry Co., Ltd. (a subsidiary of Shanghai Electric) and Johnson Electric Co., Ltd., had just been officially inaugurated on July 26. Leveraging decades of expertise from both shareholders in precision manufacturing and motor R&D, it introduced humanoid robot rotary joints, linear joints, and dexterous finger joints designed to deliver precise, smooth, silent, and intelligent motion performance for the next generation of robots.

These products integrate multiple technological advantages, featuring high torque density to deliver powerful output within a compact structure. Their low-backlash, high-precision design ensures fluid and accurate motion, laying the foundation for lifelike, compliant humanoid movements.

The modules adopt a highly modular, all-in-one design, integrating the motor, reducer, encoder, driver, and optional brake into a single unit. Optimized for low-noise operation and high energy efficiency, the joints operate quietly and reliably, with a design life exceeding 10,000 hours, greatly reducing user operating costs and maintenance frequency.

They also offer smart compatibility, natively supporting mainstream industrial protocols such as EtherCAT and CAN, acting like a universal "key" for seamless integration and intelligent control with other devices.

During WAIC, Dynamic Intelligent Control expanded its collaboration network, signing its first set delivery agreement with the Shanghai National and Local Co-Built Humanoid Robotics Innovation Center (Qinglong Project) and a strategic cooperation MOU with Fourier Intelligence Co., Ltd.

Looking ahead, as robotics technology continues to advance and application scenarios broaden, Dynamic Intelligent Control's integrated joint actuators are poised to deliver value across more industries, making a greater contribution to the overall development of the robotics sector.

# No.1 World's First ITER Magnet Cold Test Dewar Ships from Shanghai Electric



On July 25, the world's first magnet cold test dewar for the International Thermonuclear Experimental Reactor (ITER) project was dispatched from Shanghai Electric Nuclear Power Equipment Co., Ltd. The successful development and delivery of this equipment mark a new milestone for China in the design and manufacturing of large high-vacuum vessels, providing crucial technical experience for future fusion reactor projects.

As a flagship international cooperation project for humanity's quest for clean energy, ITER includes a magnet cold test system as a core stage for verifying the reliability of superconducting magnets. The dewar, a large cryostat, is the key component of this system and is currently the largest single part of ITER. Its main function is to provide a critical testing platform for toroidal field (TF) and poloidal field (PF) superconducting magnets under ultra-low temperatures of 4K, enabling validation of their superconducting performance, mechanical stability, thermal load management, electromagnetic properties, and insulation performance. This ensures the safe and reliable operation of the ITER device.

To meet the stringent requirements of the project, Shanghai Electric formed a high-caliber project team together with the Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) and the ITER Organization, adopting a "nuclear intelligence co-creation" collaborative innovation model. Leveraging ASIPP's technical reserves and ITER's international standards, the team overcame multiple technical challenges in just 11 months, including: millimeter-level precision forming of large contoured surfaces, deformation control during large shell assembly and welding, large-diameter flat flange welding deformation control, ultra-large vessel vacuum pumping and helium leak detection. As a result, the main structure achieved millimeter-level deformation control and ultra-high vacuum sealing performance of $10^{-4}$ mbar, meeting the world's highest standards.

The successful delivery of the ITER magnet cold test dewar by Shanghai Electric not only stands as a model of collaboration between Chinese and international scientific institutions and enterprises but also showcases the speed and strength of "Made in China" in the field of extreme manufacturing. Looking ahead, Shanghai Electric will continue to leverage its technological expertise and collaborative strengths to deeply participate in China's key fusion projects, advancing toward the commercial application of the "artificial sun" and contributing to global sustainable development. D

# Huadian Wangting Phase II Gas Turbine Project Unit 6 Enters Commercial Operation

On July 20, Unit 6 of the Huadian Wangting Power Plant Phase II F-class gas–steam combined-cycle project successfully completed a 168-hour trial run and was officially put into commercial operation. Shanghai Electric Power Generation Group supplied the primary equipment for the project, including the gas turbine, steam turbine, generator, and condenser. Located in Suzhou, Jiangsu Province, the project is designed to host two F-class gas–steam combined-cycle generating units. Once fully operational, it will deliver an annual power output of 2.44 billion kWh, helping to strengthen the region's power supply capacity. The project will provide safe, stable, and low-carbon electricity and heat for the continued economic growth of the Yangtze River Delta region.

# Shanghai Electric Awarded National Key Demonstration Project for Coal-Fired Power Coupled with Molten Salt Thermal Storage

Recently, Shanghai Electric Power Generation Service Co., Ltd. successfully secured the CHN Energy Group Ningxia Electric Power Yuanyang Lake Phase I Coal-Fired Unit Coupled with Molten Salt Thermal Storage Deep Flexible Peak Regulation and Thermoelectric Decoupling Technology Research and Engineering Demonstration Project. This milestone marks a significant advancement in the company's innovation in clean energy technologies and flexible transformation of coal-fired power units. Upon implementation, the coal-fired units will be able to operate under heat supply conditions to meet both 20% rated load deep peak regulation demands and 100% full-load power generation, significantly enhancing their competitiveness in the electricity spot market and ancillary services. The project is expected to annually consume over 87 million kWh of new energy, reduce coal consumption by approximately 18,600 tons, and lower carbon dioxide emissions by about 118,000 tons per year. This initiative provides a quantifiable technical paradigm for low-carbon transformation of coal power, facilitating coal power enterprises' transition toward "clean, low-carbon, safe and efficient" development.

# Shanghai Electric Launches Two New Wind Turbine Models


Recently, Shanghai Electric Wind Power Group Co., Ltd. rolled out two new wind turbine models: the EW7.7-230 and EW11.0-230, respectively produced at the Jiangsu Binhai Base and the Inner Mongolia Xilingol Base.

Both models are developed based on the Zhuoyue Platform's modular technology, covering the full onshore megawatt range from 7 to 11 MW. They provide robust equipment solutions for both medium-high and medium-low wind speed markets, and have already secured multiple market orders. Within two years, the company has completed the development of more than ten models on the Zhuoyue Platform, forming a comprehensive product matrix that covers high, medium, and low wind speed scenarios.

# Shanghai Electric Wind Power Wins GWEC "Segment Champions Award"

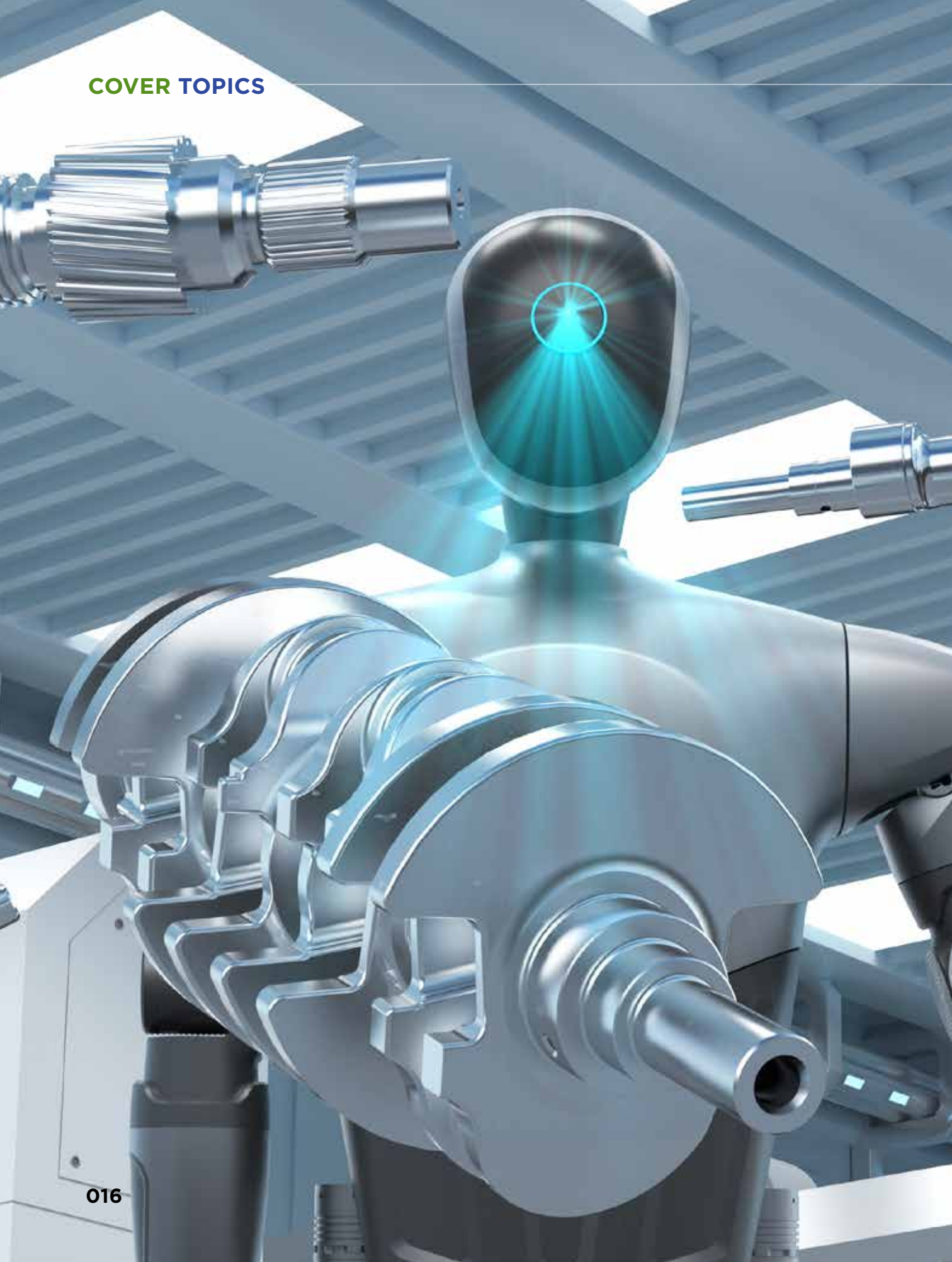
Shanghai Electric Wind Power Group Co., Ltd. was recently honored with the "Segment Champions Award" by the Global Wind Energy Council (GWEC), in recognition of its outstanding global market performance and continuous innovation. This international accolade underscores the company's deep expertise in wind power and affirms its strategic expansion and success in overseas markets.

# Shanghai Electric Wind Power Wins Multiple Bids from State Power Investment Corporation

Recently, the State Power Investment Corporation (SPIC) announced the results of its 2025 second batch large-scale onshore wind turbine procurement tender. A total of 21 projects were opened for bidding, with an aggregate capacity of 1,987.25 MW. Among them, Shanghai Electric Wind Power Group Co., Ltd. won bids for 9 packages totaling 814.2 MW, accounting for 41% of the total capacity, ranking first among all winning bidders. This marks a continuation of cooperation following the first batch of 2025 centralized procurement, where Shanghai Electric Wind Power secured 8 projects totaling 642 MW. It represents a significant further step in the collaboration between Shanghai Electric Wind Power and SPIC in the onshore wind sector.

# Multiple Shanghai Electric Wind Power Projects Featured in 2024 No-Fault Wind Farm Management Achievements List

The China Electricity Technology Market Association recently released the "2024 No-Fault Wind Farm Management Achievements List." Multiple onshore and offshore wind projects by Shanghai Electric Wind Power Group were included, covering diverse environments such as offshore, plains, mountains, sandy lands, Gobi deserts, wastelands, and plateaus. The total installed capacity of these projects reached 5,279 MW (2,126 MW offshore and 3,153 MW onshore), with a total of 1,683 turbines (480 offshore, 1,203 onshore). Going forward, Shanghai Electric will continue to optimize customized product design and build benchmark wind farms, offering replicable and scalable operational and maintenance experiences to maximize power generation efficiency for clients through high-quality services.



# HUMAN AND ROBOT IN PERFECT SYNC

## ——Shanghai Electric Leads the Way in Humanoid Robotics Innovation

Inside a climate-controlled laboratory, a robotic arm gently lifts a precision bearing that gleams with a cool metallic luster. The moment it is embedded into the dexterous hand of a humanoid robot, the joint clicks into place with a crisp sound, marking not only a key breakthrough for Shanghai Electric's self-developed humanoid robots, but also sounding the rallying call of a century-old industrial giant charging into the industries of the future.

From machine tools with positioning errors below 3.5Qm maximum over 300mm travel, to the humanoid robot "SUYUAN" boasting 38 degrees of freedom and 275 TOPS of edge-side computing power, and even to specialized machines capable of performing precision tasks in the high-temperature, high-pressure environment of nuclear power plants, this century-old industrial giant is reshaping the intelligent manufacturing ecosystem through a three-tier leap: core components - complete machines - scenario-specific customization. In the midsummer of 2025, as the global wave of artificial intelligence surges toward a new inflection point in embodied intelligence, Shanghai Electric is forging a new backbone for China's intelligent manufacturing, one built on a body of steel and sinew of technology.

# A Steel Backbone

## Breaking Barriers in Core Components

Developed by Shanghai Machine Tool Works, a subsidiary of Shanghai Electric, the 200 Series high-precision screw grinding machine sculpts planetary roller screws to P0-grade (nanometer-level) precision. P0-grade precision means a travel error of no more than 3.5Qm over a 300mm stroke, that is, about one-thousandth the diameter of a human hair. This machine tool, the result of over a decade of dedication, has now become the master craftsman behind the joints of humanoid robots.

Meanwhile, at the Songjiang Bearing Base, Tian'an Bearing's dedicated bearings for the "dexterous hand" are rolling off the production line in batches. "Every joint is a fortress of technology," says a technician, proudly displaying the self-developed electric joint module. As the main end tool of the humanoid robot, the internal structure and joint design of the "dexterous hand" must meet stringent technical requirements for flexibility, high load capacity and corrosion resistance. Relying on its profound accumulation in precision manufacturing and material science, as well as its continuous innovation capabilities, Tian'an Bearing has tailor-made high-precision, high-reliability and low-noise bearings for the "dexterous hand" for customers in need, endowing robots' fingertips with the power of steel.

Behind this achievement lies a tightly knit industrial collaboration: Shanghai Electric's Shanghai Prime Machinery Co., Ltd. has signed a cooperation agreement with Nanjing University of Science and Technology on humanoid robot core components. The two sides will jointly advance R&D and technological innovation, while accumulating valuable industrial know-how in frontier fields.

In this project, in order to enhance the R&D strength in this field, stimulate the innovation vitality within the enterprise, and accelerate the transformation and application of scientific and technological achievements, Shanghai Prime Machinery gathered the best talents and technological resources in design, thread machining, heat treatment and cold forming in the affiliated enterprises, to carry out the integrated planning and collaborative research.

Meanwhile, Shanghai Zhenhua Bearing Works Co., Ltd., a subsidiary of Shanghai Electric, has delivered its first set of domestically produced special crossed-roller bearings, achieving localization replacement. With this, Shanghai Electric has established both production capacity and an integrated industrial chain for humanoid robot core components.

# Soul of Intelligent Manufacturing

## Industrial Evolution in Vertical Scenarios

On July 26, Shanghai Electric officially launched its self-developed humanoid robot, "SUYUAN", at the 2025 World AI Conference and High-Level Meeting on Global AI Governance. Guided by the development philosophy of "Industrial DNA · Scenario Customization," the debut of SUYUAN marks a significant milestone in Shanghai Electric's progress in humanoid robot applications.

SUYUAN stands 167 cm tall and weighs 50 kg, with an ergonomically optimized body suitable for agile movement across diverse industrial environments. Its 38 degrees of freedom enable both high flexibility and coordinated motion, allowing it to handle precise industrial operations as well as large-scale movements. SUYUAN can walk at 5 km/h, carry a total load of 10 kg, and lift 2 kg per arm, making it capable of performing demanding tasks such as transportation and assembly. Equipped with LiDAR sensors and stereo cameras, the robot prototype features autonomous navigation and walking capabilities. Its edge-side computing power reaches 275 TOPS, enabling rapid processing of large data volumes and deployment of large language models for human–machine interaction and task comprehension. This allows SUYUAN to efficiently perform tasks such as object recognition, grasping, and handling.

SUYUAN has already demonstrated autonomous box-handling capabilities. By combining visual recognition algorithms with multi-joint coordinated control, it can identify, locate, and transport boxes of various sizes independently, significantly improving warehouse operational efficiency. Shanghai Electric plans to further expand intelligent solutions for diversified industrial scenarios, emphasizing human–machine and machine–machine collaboration, and continuously driving industry upgrades with innovative technologies to provide safer and more efficient robotic services.

# Extreme Testing

## Trial in Nuclear Power Scenarios

Earlier this year, the high-radiation area of the Nuclear Power Plant welcomed a unique "new employee." Under 40°C heat, a humanoid robot performed valve maintenance tasks: it held a radiation-shielding panel with its left arm, precisely rotated bolts with its right arm, while special bearings maintaining 0.01° joint precision in high-radiation conditions. "This is the first time a humanoid robot has entered the core area of the nuclear power plant," said the engineers. The robot had undergone 3,000 hours of digital twin training, mastering emergency skills such as operating a welding torch to seal steam pipe ruptures.

Under the guidance of the Ministry of Industry and Information Technology, which prioritizes humanoid robots for specialized applications, the National and Local Co-Built Humanoid Robotics Innovation Center and Shanghai Electric Group Co., Ltd. Central Academe will begin exploring practical applications of humanoid robots in extreme and high-risk nuclear power operations starting March 2024. Centered on three demonstration application scenarios within Shanghai Electric Nuclear Power Group, the project aims to replace traditional high-intensity and hazardous repetitive tasks, thereby enhancing the efficiency and safety of nuclear power manufacturing and injecting strong impetus into the intelligent transformation of the nuclear power industry.

After extensive technological research and joint testing, the first humanoid robot tailored for nuclear power production was successfully deployed on December 1, 2024. This robot features a unique structural design and force control technology, excelling in data collection and training while efficiently handling industrial tasks such as inspection and material loading/unloading. It significantly reduces workers' labor intensity and safety risks.

At the control hub of the training ground, streams of skill data flicker across the screens: from precision grasping to disturbance-resistant walking, each module has undergone millions of scenario validations. Shanghai Electric is transforming a century of industrial expertise into callable skill APIs, building an "industrial Android" for the era of embodied intelligence.

# Market Synergy

## The Chinese Solution for New Quality Productive Forces

The significance of humanoid robots lies not merely in replacing human labor, but in liberating workers from hazardous, repetitive tasks, freeing them to create greater value for the future. According to available data, Shanghai Electric has achieved two major breakthroughs in humanoid robot technology for the nuclear power sector. Firstly, the company's robots have undergone extreme trials at the Shidaowan High-Temperature Gas-Cooled Reactor in Shandong, performing precision pipe-cutting tasks under conditions of 360 °C and 24 MPa. Secondly, in January 2025, Shanghai Electric led the completion of embodied-intelligence key technology research at a nuclear power training site, achieving breakthroughs in core capabilities such as dual-arm force control and advanced data collection.

At the 2025 Hannover Messe in Germany, as the global industrial landscape is quietly reshaped by the AI wave, Intelligent Manufacturing in China is stepping out from the fringes into the spotlight. This grand industrial event, themed "Shaping the Future with Technology", reflects the profound shift from single-point breakthroughs to holistic system reengineering. On this new track of AI + green energy transformation, Shanghai Electric has delivered an impressive answer sheet.

At the center of the exhibition hall, the company's booth draws constant attention. A massive naked-eye 3D screen shows an industrial robot dynamically recreating the typesetting process of China's ancient Movable Type Printing — type blocks swiftly assembled, precisely aligned, each motion smooth and fluid. This process symbolizes Shanghai Electric's system solutions: no longer mere replication, but flexible recombination and on-demand adaptation to different regions and industries, embodying both systematic intelligence and cultural heritage.

From "System Intelligence" at Hannover Messe to "Embodied Intelligence" at the World Artificial Intelligence Conference, Shanghai Electric is using humanoid robots as a fulcrum to drive intelligent manufacturing from isolated breakthroughs toward a full industrial-chain ecosystem. When "SUYUAN" interacts naturally with visitors at the exhibition booth, it reflects the collaborative innovation of multiple enterprises across the entire industrial chain.

The future industrial map of Shanghai Electric unfolds in full: the wall-climbing robots on the coking furnace can withstand 80°C high temperatures while detecting cracks; in the logistics area, multi-functional robots holding 2-meter steel plates with precise positioning; while other robots carrying out autonomous inspections in the hazardous materials storage. "We are building a robotics ecosystem matrix." Like a symphony orchestra in perfect coordination, the 36-DOF humanoid robot plays the role of concertmaster, while a fleet of general-purpose humanoid robots form the harmonies, together performing the grand Industrial 4.0 Concerto.

On this intelligent manufacturing journey toward the stars and the seas, Shanghai Electric is laying the foundation with steel and forging wisdom with its industrial soul, building the industrial engine of a new era for the great rejuvenation of the Chinese nation. As the global industrial map is redrawn in the tide of AI, Shanghai Electric steps into the arena with resolve, crafting a steel ark to carry Chinese manufacturing into the intelligent age.

# FIVE PIONEERING HUMANOID ROBOTS

By Qin Si

From laboratories to public awareness, and from proof-of-concept to real-world applications, the evolution of humanoid robots embodies decades of exploration by nations, institutions, and companies worldwide. The following five robots mark key milestones and trends in the history of humanoid robotics.

## WABOT-1

### BIG FEET, 45 SECONDS FOR A SINGLE STEP

In 1973, the "Bioengineering Group" at Waseda University completed the world's first full-scale humanoid robot — WABOT-1. Built through the collaboration of four laboratories, it featured two arms, two legs, cameras, and auditory sensors. It could perceive the distance and direction of objects and engage in simple conversations in Japanese.

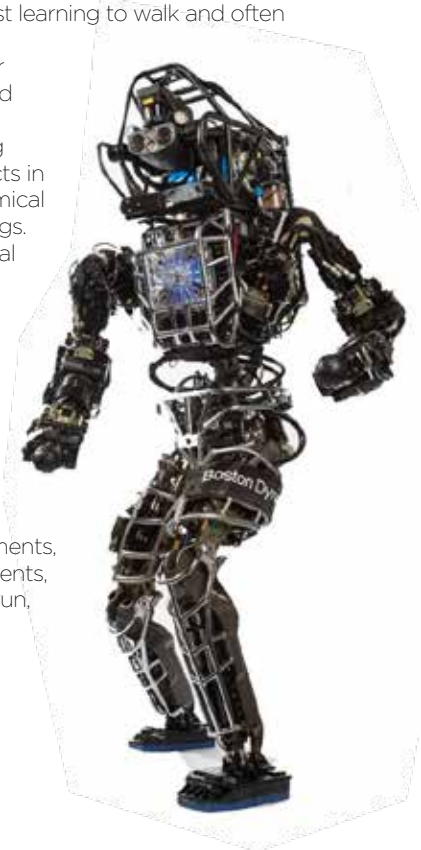
Covered in wires and moving on oversized feet, WABOT-1 took 45 seconds to complete a single 10-centimeter step. It was slow and clumsy. Yet its use of "static walking", primitive as it seemed, was then the key strategy for maintaining balance, marking the very first step in bipedal robotic locomotion.

## Atlas

### AGILE AND POWERFUL, DESIGNED FOR DISASTER SITES

In 2013, Boston Dynamics unveiled Atlas, a hydraulically driven humanoid robot that showed for the first time that robots could be both strong and agile rather than clumsy and slow. Atlas could run on a treadmill, jump, spin, and roll—though it initially needed thick cables attached behind it to prevent falls. A DARPA project manager compared Atlas to a one-year-old child: "It's just learning to walk and often falls."

Designed for disaster environments, Atlas aimed to perform tasks such as operating valves, opening doors, and carrying objects in hazardous areas like chemical leaks or collapsed buildings. It also served as the official robot platform for the 2015 DARPA Robotics Challenge, where teams could upload their own programs to control it and compete against each other. While early versions of Atlas moved somewhat stiffly and made loud buzzing noises during arm movements, after a decade of refinements, the latest Atlas can now run, backflip, and even dance



## Optimus
### "LEARNING" THROUGH NEURAL NETWORKS

In 2022, Tesla released the humanoid robot Optimus. Unlike traditionally programmed robots, Optimus is trained through robot learning. Tesla hired data trainers to wear motion-capture suits and VR headsets to collect movement data, which the robot then processes via neural networks to "understand" its environment and generate actions.

Tesla envisions Optimus as a general-purpose robot capable of entering factories or homes, handling monotonous, repetitive, or even dangerous human tasks. However, its practical performance remains limited. Currently, Optimus can operate only in slow-paced, low-precision workshop scenarios, such as moving boxes, picking parts from fixtures and assembling them onto new ones, or watering plants.


## Robonaut
### GOING TO SPACE, HANDLING EXTREME ENVIRONMENTS

On February 24, 2011, NASA and General Motors Company jointly launched the humanoid robot Robonaut aboard the Space Shuttle Discovery to the International Space Station, making it the first humanoid robot to work in space. Its mission was to take over simple, repetitive, or particularly hazardous tasks from astronauts.

The initial Robonaut had no legs but featured dexterous arms and human-like fingers, capable of using standard tools and assisting astronauts with tasks such as operating switches and replacing air filters. Although it occasionally required recalls to Earth for repairs, Robonaut demonstrated the potential of humanoid robots in extreme environments.

## ASIMO
### FLEXIBLE WALKING, CLIMBING STAIRS

In 2000, Honda released ASIMO, a humanoid robot resembling a backpacked astronaut. Unlike WABOT-1, ASIMO was no longer wrapped in wires or coldly boxy; its astronaut-like appearance aligned with human expectations of a friendly robotic companion, gaining widespread public attention.


Standing 1.2 meters tall, ASIMO featured advanced "predictive motion control" technology that allowed it to walk smoothly and flexibly at 1.6 km/h and to climb stairs. Its "eyes" were two cameras that could detect object positions, directions, and movements. ASIMO could understand voice commands, respond to its name, recognize gestures, and distinguish between waving, shaking hands, or pointing. Nearly 30 years after WABOT-1, ASIMO's success reflected breakthroughs across computing, sensors, materials, and control algorithms.

# INSIGHTS

## The 'Little Wrench' Powering Wind Giants

### The Story of Wu Daoxiang: National Model Worker at Production Department, Dongtai Base

# WU DAO XIANG

Stepping into the Dongtai Base of Shanghai Electric Wind Power Group, one is greeted by a bustling scene. Many epoch-making wind turbine units have been manufactured and assembled in this "National Green Factory", before setting off for mountaintops, deserts, and coastlines, delivering clean, green electricity to China and the world.

On the shop floor, production lines are running at full capacity as always. Workers, equipped with their full set of tools, are fully focused on crafting the next "miracle" turbine. Among them, a few workers from time to time gather around an experienced "master," observing, seeking guidance, and then applying what they've learned into practice. This "master" is none other than Wu Daoxiang, who in 2025 was awarded the honorary title of National Model Worker.

Wu Daoxiang, a member of the Communist Party of China, is a foreman in the Dongtai Base Production Department and a senior tool fitter technician. He joined the newly established Dongtai Base in 2010. Over more than a decade, he has grown from an ordinary assembly fitter into a foreman and senior technician. With his wealth of wind turbine manufacturing experience and outstanding professional skills, he has repeatedly solved production challenges, making significant contributions to the prototyping, mass production, and commissioning of key wind turbine models for Shanghai Electric.

In 2019, he was honored as a "Model Worker of Yancheng City, Jiangsu Province," and in 2021, he was elected as a delegate to the 14th Party Congress of Jiangsu Province. Now, carrying the title of National Model Worker on his shoulders, he is leading frontline employees at the base to strive for continuous improvement, driving Shanghai Electric Wind Power's reputation for "High Quality, Trusted Performance" to new heights.

# WU DAO XIANG

## PURSUING EXCELLENCE: FORGING THE "SHANGHAI ELECTRIC QUALITY"

In 2010, as China's wind power industry was gaining momentum, Shanghai Electric was taking bold strides to lead the development of offshore wind power. At that time, the Dongtai Base had just come online, and the first 2 MW wind turbine generator was in the midst of intensive assembly. As a brand-new facility, the base lacked production and assembly experience. Faced with the customer's requirement to have the first 2 MW unit roll off the line in just 10 days, it would have been difficult to achieve using a conventional production model. How could capacity be ramped up quickly without compromising safety and quality? Wu Daoxiang put his mind to it and worked with colleagues to develop a solution. After securing company approval, they finally adopted a segmented sub-assembly production method. In just 9 days, the first 2 MW unit rolled off the line, an astonishing demonstration of "Shanghai Electric Speed".

Speed and quality are two sides of the same coin in wind-turbine manufacturing. After successfully passing his first trial by fire following onboarding, Wu focused on the technical essentials. He not only rose to become a nacelle production and assembly team leader in just six months, but also began to codify his hands-on experience into practical methods and theory, contributing valuable know-how to the industry.

When Shanghai Electric Wind Power Group's Heilongjiang branch was officially established in September 2011, it immediately faced urgent and heavy production tasks. Wu once again stepped up, leading three workers to provide on-site technical support. In three months, they

"transplanted" Dongtai's team-management model to the far north, enabling local employees to master production skills quickly and improve both assembly quality and speed.

Three years on, early promise gave way to seasoned mastery. In the second half of 2014, a major Jiangsu provincial project, the R&D and production of a 3.6 MW wind turbine generator prototype, was undertaken at the Dongtai base, with Wu serving as the production lead. Drawing on years of fast-paced, full-spectrum frontline experience, he led his team from blueprint interpretation and process analysis to workforce organization—testing, summarizing, correcting, and closing the loop—ultimately helping the company secure Jiangsu provincial funding for the commercialization of scientific and technological achievements. In addition, the 2 MW wind turbine generator and the 2 MW ultra-low-temperature model he led into production were successively certified as Jiangsu High-Tech Products. It is precisely Wu Daoxiang's drive for in-depth exploration—rooted in the pursuit of excellence and sincere dedication—that has yielded one product achievement after another, giving concrete meaning to true "Shanghai Electric Quality".

## UNITY OF KNOWLEDGE AND ACTION: SCALING THE HEIGHTS OF WIND POWER

By 2024, Shanghai Electric had ranked No. 1 in China for cumulative offshore wind power installations for 11 consecutive years, building the nation's largest offshore wind power data repository and amassing a wealth of project experience. Offshore wind power has long been one of Shanghai Electric's core strengths. In 2016, the second phase of the Shenergy Lingang Offshore Wind Farm, one of Shanghai's key municipal projects, marked a pivotal moment in the company's "offshore wind" ascent. All 28 units of 3.6 MW offshore wind turbines for the project were manufactured at the Dongtai Base. Aware of the tight deadlines and heavy workload, Wu Daoxiang led the nacelle assembly team to overcome challenges: he took the lead in mastering assembly processes, interpreting technical drawings, driving innovation, and tackling technical bottlenecks. In just five months, the team completed the assembly of all 28 turbines while meeting stringent quality and delivery requirements. In shaping Shanghai Electric's reputation as the "No. 1 in Offshore Wind," Wu and his teammates made their own solid contribution.

Today, under the guidance and support of national policies, China's wind power industry is undergoing transformative change. "From China to the world" has become the path

chosen by most turbine manufacturers. The year 2024 marks the first year of Shanghai Electric Wind Power's overseas localized manufacturing projects, with numerous customized turbines for export entering production across various bases. Dongtai Base bore a particularly heavy task load. One such export project involved delivering a newly developed turbine model from the company's onshore Zhuoyue Platform within a very tight schedule. The model required continuous optimization and improvement throughout production. "I was practically on site every day, coordinating resources from all sides to ensure smooth production," recalled Wu. At one point, the turbine needed to undergo a hub–nacelle interface and commissioning test simulating wind farm conditions inside the workshop. It was the first time Dongtai Base had ever attempted such an operation, and no one had prior experience. Drawing on his extensive on-site expertise and solid practical skills, Wu led the production team in close coordination with the product line and engineering services teams. Together, they successfully completed the docking and testing, ensuring the premium quality of the Zhuoyue Platform products. This achievement not only safeguarded the delivery schedule but also provided Shanghai Electric with invaluable know-how for future export projects.

## INNOVATION AND CRAFTSMANSHIP: CARRYING FORWARD THE CRAFTSMANSHIP

Since 2011, Wu Daoxiang has served as production lead for multiple research projects at Dongtai Base. Under his guidance, the base successfully produced prototype units including the 3.0 MW direct-drive model, 2.5 MW, 3.45 MW, and 3.2 MW onshore models, the 4.0 MW offshore model, and the 0.6 MW tidal current model. These efforts have helped Dongtai Base become a key wind power manufacturing and R&D hub for Shanghai Electric. Research and innovation have also driven cost reduction and efficiency improvement. In recent years, Wu proposed practical projects focusing on the nacelle of the V4 turbine and the rear nacelle frame of 2.X–4.X models. These initiatives not only addressed real assembly issues and improved assembly efficiency but also contributed to measurable cost savings for the base. In addition, Wu represented Shanghai in the National QC Competition, earning a Second Prize for his contributions.

High trees do not cast deep shade alone; a single tree does not make a forest. Wu deeply understands the importance of "mentoring and passing on skills" on the production floor. Only by transmitting expertise can teams collaborate effectively and drive high-quality development. "Standardizing learning procedures and helping new employees quickly get hands-on experience is the responsibility of veteran workers—and it is also a duty of the base to improve workforce skills," Wu remarked. Many team leaders at Dongtai Base, who have trained under Wu, have become proficient in various processes. Some have even taken on apprentices themselves, forming a sustainable pipeline of skilled frontline talent.

With the full support of Dongtai Base, Wu established the "Wu Daoxiang Model Worker Studio", dedicated to creating a mentoring and skills-transfer system. He leads studio members to tackle challenges on the front line, collaboratively solving technical problems as they arise. Building on this platform, he also formed the "X2 10 MW and X3 6.25 MW High-Power Wind Turbine Task Force", ensuring the successful rollout of prototypes during a critical period of Shanghai Electric Wind Power's technological transition and contributing significantly to overcoming technical challenges. Under his guidance, numerous employees have won awards in labor skills competitions across Jiangsu Province, Yancheng City, and Dongtai City. One generation of high-skilled talent after another continues to emerge, laying a solid foundation for enhancing the company's technical core competitiveness through innovation and craftsmanship.

## EPILOGUE

Throughout his journey, Wu Daoxiang has remained rooted in the front lines, serving production and driving scientific innovation. To him, the turbine production lines in the workshop are like an ever-flowing river. The sweat, wisdom, and strength he and his colleagues pour in day after day continuously nourish this expanding river of green energy. "Devotion to doing one thing well for a lifetime, striving for excellence in your profession, and meticulous care down to the smallest detail—this, I believe, is the true spirit of a 'Model Worker,'" Wu said with a smile. Although his achievements have been featured in platforms such as Xuexi Qiangguo, Yangtze Evening Post, Yancheng TV, and Dongtai Daily, he remains humble, steadfastly committed to his original mission. Every honor and award serves to inspire him to continue assembling each turbine with care, setting the benchmark of "Shanghai Electric Quality," and injecting ever more excellence into the flowing river of green energy.

# SHANGHAI ELECTRIC: ACCELERATING GREEN AND LOW-CARBON DEVELOPMENT

On July 15, Shanghai Electric Group Co., Ltd. ("Shanghai Electric") successfully commissioned the first phase of its Taonan integrated wind power-coupled biomass green methanol demonstration project ("Taonan Project"). The project's first 50,000-ton batch of green methanol has officially gone into production, marking the industry's first large-scale coupling of wind-powered hydrogen production with biomass gasification for green methanol, filling a domestic gap and achieving an internationally advanced level.

The successful commissioning of the Taonan Project is a vivid embodiment of Shanghai Electric's recent efforts to accelerate the development of new quality productive forces and enhance core competitiveness. As a global leader in providing industrial-grade green and intelligent system solutions, Shanghai Electric is dedicated to reshaping the future of energy and industry. Guided by a vision of being high-end, intelligent, green, and global, we champion high-level self-reliance and strength in science and technology, and foster new competitive strengths. With core technologies, we support the optimization of energy structure and empower the transformation toward a green and low-carbon energy future.


## SETTING A GREEN BENCHMARK, EXPLORING NEW PATHS FOR RENEWABLE ENERGY UTILIZATION

In recent years, the use of green fuels such as green methanol has increasingly become a primary means for the international shipping industry to achieve carbon emission reduction. Since March 2024, Shanghai Electric has been constructing the Taonan Project in Jilin Province, pioneering a new model that couples biomass gasification with green hydrogen for large-scale green methanol production and renewable energy utilization. The project's first-phase commissioning represents a breakthrough in China's industrial application of green hydrogen-based fuels. The Taonan Project has also received ISCC EU certification, gaining official access to the EU market.

Its unique technical pathway couples wind-powered hydrogen production with biomass for green methanol synthesis, achieving efficient conversion of agricultural and forestry waste alongside renewable energy. With zero fossil fuel involved across the process, it not only promotes local renewable power consumption but also reduces methanol's carbon emissions by 65% per ton, delivering significant economic and environmental benefits.

## SERVING NATIONAL STRATEGY, POWERING THE GREEN ENERGY TRANSITION

At the 2025 Shanghai International Carbon Neutrality Expo in Technologies, Products and Achievements this June, Shanghai Electric unveiled its latest breakthroughs in green energy, industrial equipment, and digital "dual carbon" solutions.

At its 720-square-meter immersive exhibition booth, breakthrough technologies such as green methanol, "artificial sun" nuclear fusion, and deep-sea wind power were unveiled. These cutting-edge innovations drew significant attention from visitors, highlighting Shanghai Electric's strong commitment to energy transition and green transformation.

In recent years, Shanghai Electric has actively aligned with national strategies, taking green and low-carbon development as its core priority. We are accelerating the green transformation of its development model, with major investments in advanced nuclear energy, wind power, solar power, energy storage, and hydrogen energy—all to accelerate green and low-carbon development and contribute to the Beautiful China Initiative.

For example, since 2000, Shanghai Electric has been deeply involved in controlled nuclear fusion projects. Often referred to as the "artificial sun", controlled nuclear fusion is widely regarded as the ideal energy source of the future due to its abundant fuel resources, massive energy release, and clean, sustainable nature. At the same time, Shanghai Electric has been deeply involved in numerous pioneering and large-scale engineering projects both in China and abroad. With technologies reaching an international leading level, the company has become one of the most comprehensive equipment manufacturers supplying core systems for nuclear fusion in China.

In the wind power sector, Shanghai Electric has ranked first in cumulative offshore wind power installations in the country for consecutive years. In photovoltaics, it has fully mastered the mass production of high-efficiency N-type heterojunction solar cells. In energy storage, the company provides full-spectrum solutions ranging from seconds-level to hours-, days-, and even seasonal-level storage. In hydrogen energy, Shanghai Electric has established core equipment capabilities across production, storage, refueling, and utilization, forming an integrated hydrogen energy system solution.

## ACCELERATING R&D, DRIVING INDUSTRIAL INNOVATION

Shanghai Electric has achieved a series of key global and industry firsts: commissioning China's first green methanol project powered by green hydrogen coupled with biomass gasification, building the world's largest solar-thermal photovoltaic project, supplying wind turbine components for the world's first offshore floating wind power-fishery integration project, continuously setting new records for the world's lowest coal consumption in coal-fired units, and becoming one of China's most comprehensive suppliers of core equipment for nuclear fusion. Behind these milestones lies the company's commitment to technological innovation.

In recent years, Shanghai Electric has steadily increased its R&D investment, reaching RMB 5.665 billion in 2024, up 5.5% from RMB 5.369 billion in 2023. Focusing on the "dual carbon" goals and the demands of high-end equipment manufacturing, Shanghai Electric has initiated 823 core technology projects, with strategic emphasis on new energy, automation equipment, and advanced robotics.

Looking ahead, the company will continue to consolidate its leadership in traditional energy and industrial equipment while accelerating investments in frontier areas such as humanoid robotics. By cultivating new quality productive forces, Shanghai Electric aims to accelerate its pace toward high-quality development.

With the recent commissioning of the Taonan Green Methanol Project, Shanghai Electric has once again pressed the accelerator on its "Dual Carbon" journey. From the Taonan project frontline to the Shanghai R&D hub, from strategic planning by management to meticulous execution by builders, the company's "green gene" is deeply etched into every growth ring, embedded in every step, every kilowatt of green electricity, and every drop of green methanol.

## THE PROLOGUE OF A HERO: THE LIGHT THAT ILLUMINATES A ZERO-CARBON FUTURE

Long before the spotlight shone on the Taonan project site, hundreds of unnoticed lights had already lit the Zero-Carbon Equipment Testing and Demonstration Center, illuminating the path for the entire project team rather than the stage.

To actively respond to the national "Dual Carbon" strategy and explore innovative modes of scientific and technological operation, Shanghai Boiler Works pioneered a zero-carbon innovation and R&D testing base centered on "equipment testing and demonstration applications." Covering an area of 21,000 square meters, the base houses four major R&D centers: cleaner coal low-carbon combustion and gasification experimental center, electrolyzer comprehensive testing and certification center, Power to X R&D center, photovoltaic and energy storage R&D center. These centers focus on the research and application of key technologies such as low-carbon fuels, carbon capture, green methanol, and solar thermal energy storage. Through technological innovation, the low-carbon fuel technology can reduce $CO_2$ emissions by 20%, oxy-fuel combustion increases coal-fired efficiency by 10%, $NO_2$ emissions are reduced by 30%, carbon capture regeneration energy consumption is as low as 2.1 GJ per ton of $CO_2$, electrolyzer tests support hydrogen production at 2,000 $Nm^3/h$, and green methanol development features $CO_2$-rich synthesis gas technology, forming a full-chain solution.

When the first barrel of green methanol slowly flowed out, applause filled the site, and media attention shone brightly, yet few noticed the quiet hydrogen flames and the aroma of methanol at Taonan. This moment marks how Shanghai Boiler Works has ignited the future ahead of time, kept unforeseeable risks contained within the laboratory, and delivered replicable, scalable, and commercial certainty steadily to the project site.

A zero-carbon future is never an overnight miracle; it is a series of persistent lights that burn steadily before the dawn when no one cheers, quietly turning the sky into a clearer and brighter realm.

# GIVING RETIRED "BIG WIND TURBINES" A SECOND LIFE

You might be surprised:

China's first batch of wind turbines is approaching retirement.

Burying a single 90-meter-long blade

requires 6 cubic meters of land,

roughly the volume of 3 city buses.

The real challenge:

these thermosetting composite materials are virtually indestructible.

They won't burn and won't decompose for thousands of years.

Faced with these "black tails" of green energy,

Shanghai Electric chose a different path.

Blades are transformed into walkways, and damaged components are refurbished for reuse,

writing a new chapter in circular, sustainable utilization of renewable energy assets.

## A PRESSING CHALLENGE: 440,000 TONS OF RETIRED BLADES ENCIRCLING THE INDUSTRY

According to the latest data from the International Wind Power Network (wind.in-en.com), by 2024, the global cumulative installed wind power capacity reached 1,136 GW, with China accounting for roughly 40%, ranking first worldwide. China is expected to face its first peak of wind turbine retirements between 2025 and 2030, with a total retired capacity of approximately 44 GW. The corresponding volume of decommissioned blades is projected at 440,000–660,000 tons. A third retirement peak is anticipated between 2036 and 2040, with an estimated retired capacity of 118 GW and blade volumes reaching 1.18–1.77 million tons.

As a result, the disposal of retired wind turbine blades has rapidly evolved from an environmental concern to an industrial challenge. Using traditional landfilling or incineration methods would cost thousands of yuan per ton of blades, causing massive resource waste and raising environmental issues such as dioxin emissions and land occupation. Disposing of retired blades has become even more difficult than managing ordinary waste.

## "ORGAN RECONSTRUCTION": 90% OF DAMAGED COMPONENTS REVIVED

Faced with a global headache, Shanghai Electric took a reverse-engineering approach and offered a novel solution. In Rudong, Jiangsu Province, the Shanghai Electric Wind Power Group Spare Parts Remanufacturing Center treats "retirement" like a surgical procedure. By integrating its Enterprise Asset Management (EAM) system with the Warehouse Management System (WMS), the center retrieves 100% of damaged pitch, converter, and main control modules from the field to the factory, where they are individually disassembled, inspected, repaired, and tested.

By the end of 2021, the center had independently developed and built 22 repair, testing, and remanufacturing platforms. Damaged components, such as converter modules, are refurbished through component replacement, re-selection, and domestic part substitution, then run at full load on the testing platforms. Their performance matches that of new components, allowing them to be reused in wind turbines. To date, the center has remanufactured over 1,000 components of the "three-electrical" system, saving the company more than 20 million RMB in procurement costs, with a reuse rate exceeding 90%.

## BLADE "REBIRTH": TRANSFORMING WASTE FIBERGLASS INTO PARK WALKWAYS

Wind turbine blades are primarily made of glass-fiber-reinforced unsaturated resin, a material that neither burns nor decomposes naturally. The Shanghai Electric Group Co., Ltd. Central Academe has turned this challenge into an opportunity. Waste blades are crushed and sieved, then proportionally mixed with new resin and hot-pressed into composite panels.

These panels exhibit strength and weather resistance superior to traditional wood-plastic materials and can directly replace conventional construction materials. Moreover, the formula can be adjusted according to different needs, making the panels suitable for a wide range of applications and markets. Currently, panels made from recycled wind turbine blades are used to pave sightseeing walkways within Shanghai Electric's campuses, allowing visitors to enjoy the unique experience of "walking on wind turbines." D

# THE ART OF "QUESTIONING" AND "UNDERSTANDING" IN THE WORKPLACE

By Kong Fan

The journey of learning in the workplace resembles a spiraling ascent up the peaks of knowledge. Active questioning and deep understanding act as two essential pillars supporting our progress, both indispensable. Yet, a thought-provoking trend has emerged: when we first enter the workforce, we are like explorers brimming with questions, curious about everything. Over time, however, as experience accumulates, we tend to favor directly obtaining conclusions, gradually neglecting the power of questioning. How, then, can we maintain a thirst for knowledge amid this shift?

In childhood, we view the world with innocence and curiosity, our understanding still forming, unshaped by fixed thinking patterns or values. At this stage, we are like dry sponges, eager to absorb everything around us. Asking questions is the most direct and efficient way to acquire new knowledge. Each question acts as a bridge connecting us to the external world, guiding us into the unknown. Moreover, the relatively free environment of childhood nourishes curiosity, allowing us to explore the world without restraint.

However, as we age and accumulate professional experience, a shift from a "question-driven" to a "conclusion-driven" cognitive mode becomes prevalent. On one hand, "we are the sum of our experiences." As knowledge and experience grow, the unknowns in our minds shrink, and we may feel we already possess enough knowledge and skills to handle work. On the other hand, the fast pace of professional life often leaves little time for exploration and reflection. Directly obtaining conclusions becomes an efficient way to quickly understand unfamiliar areas while saving time and energy. Consequently, in meetings, we may prefer to listen to summaries from leaders or experts rather than actively ask questions. When facing new challenges, we might search for answers online rather than engage in the process of reasoning through inquiry.

But does this approach truly enhance our cognition and capabilities? In reality, it reflects an over-reliance on instrumental rationality and a conscious abandonment of deep thinking. Questioning is not merely a means of acquiring knowledge; it is an honest acknowledgment of our own cognitive limits. It serves as a key to unlocking the treasure trove of knowledge, welcoming new possibilities and stimulating creativity and imagination. By contrast, directly obtaining conclusions, while efficient, can stifle imagination and reasoning. We become like diners swallowing food whole, taking in conclusions uncritically and overlooking the underlying logic and principles. A case from a Nordic country illustrates this vividly: a mother successfully sued a teacher for directly teaching her child the concept of "zero." By handing over the conclusion, the teacher had disrupted the child's natural process of discovery, stunting imaginative growth and holistic understanding. Similarly, in workplace learning, over-reliance on ready-made conclusions can hinder the development of independent thinking and innovation.

Yet, relying solely on questioning is not the ultimate solution either. The purpose of questioning is to reach valuable conclusions. Driven by our intrinsic thirst for knowledge, we ask questions, engage in dialogue, and explore with others, ultimately arriving at conclusions. Without the initial spark of inquiry, however, even the tallest tree of workplace knowledge cannot take root and flourish. Through the interplay of questioning and understanding, our professional capabilities grow. Like wheels rolling forward, they propel us along the career path, enabling us to become creators of infinite possibilities even within finite professional spaces.

Today, condensed readings, formula books, and online media provide convenient channels for learning but also deepen our dependence on ready-made conclusions. We must cultivate independent thinking, use questioning to guide workplace exploration, and maintain a thirst for knowledge. For every challenge we face, we must dare to ask, think deeply, and derive conclusions through our own effort. Only in this way can we leave a firm footprint on the road of innovation and achieve breakthroughs in our careers.

Ask boldly; let questions lead us to profound understanding. Through questioning, our steps in the workplace become lighter, surer, and more purposeful. D

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