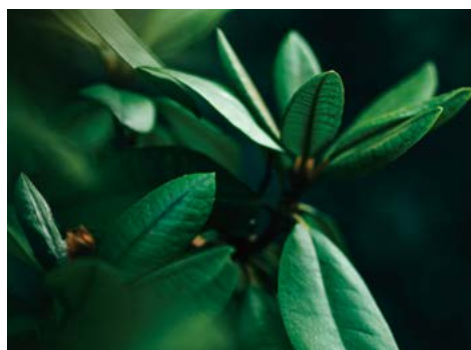


2023

**White Paper on  
Goldwind Climate Action**



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# Foreword

In recent years, the frequency and intensity of extreme weather events triggered by global climate change have increased, affecting the normal development of the human economy and society in different regions, at different levels, and to different degrees. It is urgent to address climate change. Since the 2015 Paris Agreement set the goal of net-zero emissions by the second half of the 21st century, more and more countries have proposed carbon neutrality targets. In September 2020, the Chinese government set the goals of "carbon peaking" by 2030 and "carbon neutrality" by 2060. Companies are implementing carbon reduction strategies, innovative practices, and green transformation-oriented production methods to support and promote carbon emission reduction and climate change response in enterprises, the country, and the world.

Wind power has significant advantages in addressing climate change. With the joint efforts of industry and society, onshore wind power has become a renewable energy source with the lowest carbon emissions and lowest cost among all power generation methods. Since its establishment in 1998, Goldwind has been committed to its wind power business and wind power-based energy transformation. It continues to pioneer and innovate, thus accelerating product upgrades and iterations, and promoting the development of the wind power industry. Focusing on energy load, Goldwind has adopted artificial intelligence, the Internet of Things, and other technologies to develop and promote products for distributed energy, energy storage, and energy saving, it also provides energy asset management, green electricity trading, carbon-neutral consulting, and other services. It offers enterprises diversified solutions for carbon neutrality and boosts the carbon-neutral process of enterprises and the world. At the same time, Goldwind continues to explore its energy-saving and emission-reduction potential. It promotes the use of renewable energy and increases the proportion of green power usage internally. In terms of creating low-carbon wind power products, it improves the efficiency of raw material usage, recycles wind turbine components, develops low-emission wind turbine supporting components, and lowers the carbon footprint of wind turbine products.

In 2022, Goldwind achieved carbon neutrality for the first time. During the year, the Company's self-generated and self-used green power accounted for 53% of total electricity consumption. It participated in market-based trading of green power and the purchase of green certificates to further increase the proportion of green power usage. Ultimately, it achieved carbon neutrality at the operational level with the purchase of carbon credits. Goldwind sets an example with its exploration of carbon-neutral actions under the current conditions of global power market development. Goldwind's carbon neutrality goal at the operational level will be a new starting point. The Company will continue to sharply increase the proportion of the field renewable energy use, adopt various low-carbon operations, innovate low-carbon practices, and work together with upstream and downstream value chain partners towards a zero-carbon future.

The impacts of global climate change are wide-ranging, any organizations or regions may be affected by it. Tackling climate change takes time and effort, but we can make it with our actions. Coping with climate change requires the joint actions of the whole society. Goldwind will continue to stick to its wind power business and contribute to climate change mitigation and adaptation!



# Our Strategies

Climate change is seen as the most pressing challenge. We need to reduce greenhouse gas emissions, slow down the rate of global warming, and protect our homes. We also need to strengthen our climate adaptation capacity, which means enhancing our ability to cope with climate change risks, and being adaptive to the consequences of climate change.

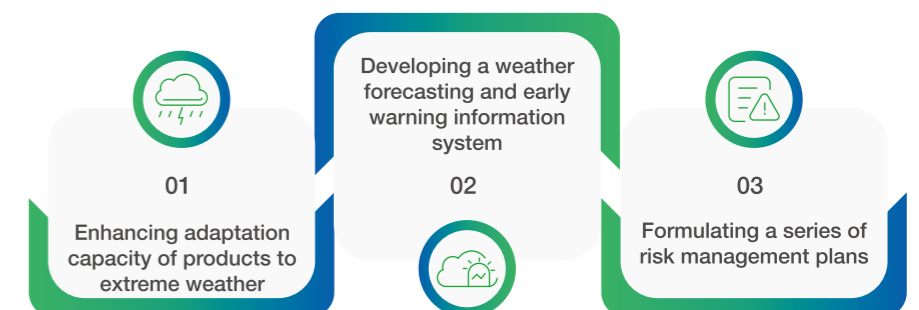
## Climate Change Mitigation

Goldwind is committed to contributing to the mitigation of global climate change. It promotes wind power globally and integrates low-carbon environmental protection concepts into its wind turbine research and development, production, and business operations. It works with partners across the industry chain to help society save energy and reduce carbon emissions with the green wind power industry.



## Climate Change Adaptation

Goldwind takes climate change adaptation as an important part of sustainable development. It promotes the research and development of climate change adaptation technology with scientific and technological innovation, improves the adaptation capacity of wind turbine products to extreme weather, enhances the ability of prediction and early warning, carries out risk management, and builds climate resilience.





# Report Highlights

▶ In 2022, company operation reached

## carbon neutrality



# 112

Suppliers used green electricity to produce Goldwind wind turbine products



The proportion of green power used by major suppliers in the production of Goldwind wind turbine products reached

# 46%



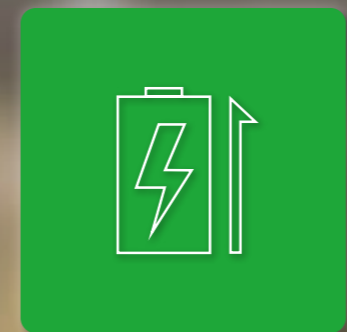
Compared to 2020, the weight of plastic packaging for large parts of wind turbines per kilowatt was reduced by

# 20%



Proportion of self-generated and self-used green power is nearly

# 53%



Waste magnet steel

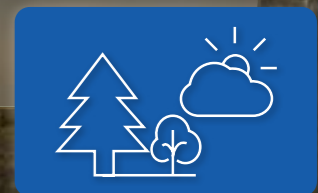
# 100%

recycled



CDP climate change management score

# B





# 1.

## About Us

Goldwind Science & Technology Co., Ltd. (referred to as "Goldwind", "the Company", or "we") was founded in Urumqi, Xinjiang, China in 1998, and was restructured into a limited company in 2001. The Company was listed in Shenzhen Stock Exchange (SZSE: 002202) in December 2007, and was listed in Hong Kong Stock Exchange (HKEx: 02208) in October 2010.

We are mainly engaged in the development and manufacture of wind power equipment, wind farm investment and development, wind farm operation and maintenance, water utility-related services, and other businesses. As the earliest enterprise to engage in the R&D and manufacturing of wind turbines in China, the Company undertakes the responsibility and mission of "Innovating for a brighter tomorrow". With the spirit of "daring to pioneer" and constant innovation, it has created one "Goldwind Miracle" after another in terms of wind power technologies, products, and business models. It can be said that Goldwind's development history is a microcosm of the development history of China's wind power industry. After more than 20 years of development, Goldwind has become the world's leading wind power comprehensive solution provider. By the end of 2022, the Company has accumulated 97GW of installed capacity worldwide, with business in 38 countries on 6 continents.

**6** continents **38** countries

Global business network



**2** IPOs

Dual listing



**97** GW

Global cumulative installed capacity



RMB **136.8** billion

Total assets



RMB **46.4** billion

Revenue



**11,200** people

Number of employees worldwide



With years of best practices in clean energy, Goldwind has been selected as:



"Corporate Climate Leader"

"Annual ESG Pioneer Enterprise"

"Most Respected Company in Asia"

"Best Investor Relations Company"

"Top 50 Most Innovative Companies in the World"

"Carbon Clean200"

"Top 500 Global New Energy Companies"

"New Fortune Best Listed Companies"

"Fortune Top 500 Chinese Companies"

RMB **2.9** billion

Amount of tax paid



RMB **46.2** million

Investment in environmental protection



\* All amounts in this report are expressed in RMB unless otherwise noted.



# 2.

## Climate Change Management Mechanism

Climate change has a tremendous impact on the survival and development of humanity in the present and future. It has become a global consensus to take active measures to cope with climate change. For Goldwind, climate change presents both opportunities and risks. The Company has established a sustainable development management system. The Board of Directors, as the highest management body for sustainable development, is responsible for the overall sustainable development work of the Company. Under the leadership of the Board of Directors, the Company has established a Sustainable Development Management Committee composed of senior management to manage sustainable development-related work, including climate change. The Company's sustainability-related objectives and requirements are integrated into its strategies, operational management, and business processes.

The Board of Directors deeply understands Goldwind's role and responsibility in addressing climate change and firmly supports the development of the wind power business. From strategic planning and resource allocation, it guides and guarantees the Company's continuous leading development in the field of wind power, maximizes the experience and advantages of the Company, and strives to limit global temperature rise to 1.5 degrees Celsius.

The Company has included climate change in "14th Five-Year Plan". Considering the global trend of low-carbon development and energy transformation as well as its own business operations, Goldwind has continued to innovate technologies related to wind power and relevant products and solutions, led the balanced development of industrial chains, and built a clean energy supply system. In addition, the Company has incorporated energy conservation and carbon reduction into its planning, requiring all business units to continuously carry out energy conservation and emission reduction. Goldwind's departments in research and development, procurement, manufacturing, installation, operation and maintenance have been working together in energy conservation and carbon reduction to promote the progress of green and low-carbon production.





### 3.

## Driving a Low-Carbon Transition in Society

### Developing and Manufacturing Stable and Reliable Wind Turbines Products and Building Low-Carbon Energy Infrastructure

As a technically mature and environmentally friendly renewable energy source, wind power has been developed and applied on a large scale worldwide. As its levelized cost of electricity continues to fall, its economic efficiency is close to that of conventional energy. Its share in the global electricity production structure is increasing year by year. Goldwind has continued to invest in technology research and development to explore the application of new technologies and materials in the wind power field. It builds wind turbines with high power generation rates, safety, and reliability. They can be applied in large-base, centralized, distributed, offshore, and other usage scenarios. By the end of 2022, the Company has installed over 97 GW of wind turbines worldwide, with an annual energy production about 210 billion kWh. Compared with coal-fired electricity, wind power helps reduce CO<sub>2</sub> emission by 178 million tons per year.

By the end of 2022

**97** GW

Global cumulative installed capacity

**210** billion kWh

Annual power generation exceeded

**178** million tons

Carbon emissions reduced by per year

#### Low levelized cost of electricity

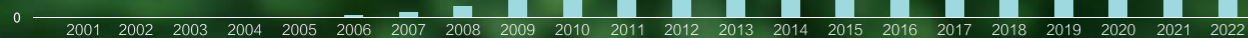


Wind power, one of the fastest-growing renewable energy sources, has a great cost advantage due to its increasing global power production share and falling levelized cost of electricity (LCOE). According to the International Renewable Energy Agency (IRENA), from 2010 to 2021, the LCOE of onshore and offshore wind power decreased by 68% and 60% respectively. Onshore wind power, now the cheapest electricity source, costs only USD 0.033 per kilowatt-hour. In 2021, the cost of onshore wind power in China dropped to USD 0.028 per kilowatt-hour, lower than the global average, with a decrease of 66% over the past 11 years, nearing or reaching the national average benchmark coal-fired electricity price. With the advancement of technology, the cost of electricity from wind power projects is further decreasing, making wind power one of the most economical green energy sources.



Since 2001, the total amount of green power generated by the installed capacity of Goldwind has reduced greenhouse gas emissions by 1 billion tons compared to thermal power.

**1** billion tons



Cumulative emissions reduction through green power generation by Goldwind wind turbines worldwide from 2001 to 2022



8<sub>g</sub>

The approximate life-cycle carbon emissions per kWh of the 4S units

6<sub>g</sub>

The approximate life-cycle carbon emissions per kWh of the 5S units

Low carbon emissions per kWh

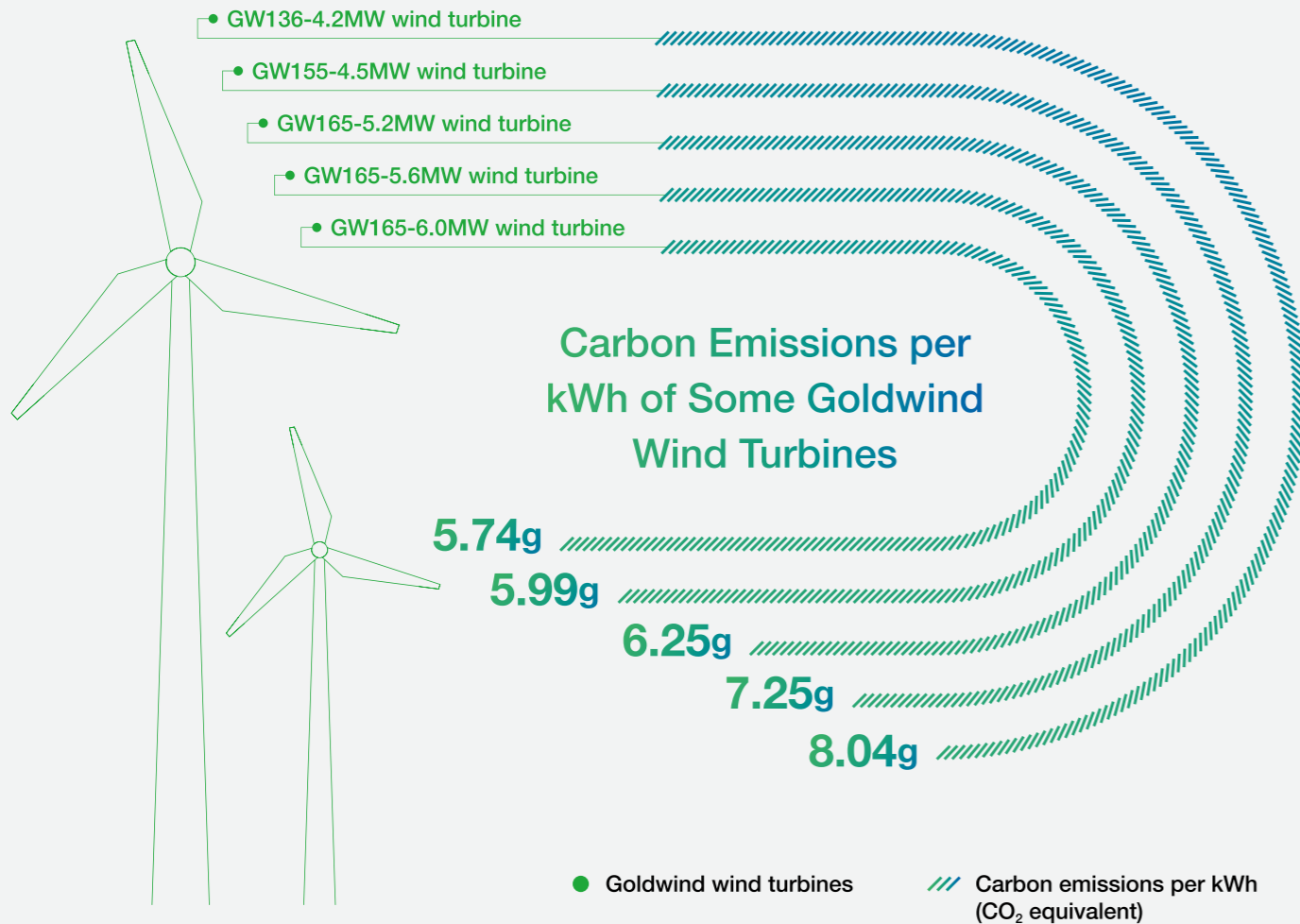


According to the Life Cycle Assessment of Electricity Generation Options released by the United Nations Economic Commission for Europe (UNECE), the greenhouse gas emissions per kWh emitted during the whole life cycle of onshore wind power and offshore wind power in different regions are 7.8 to 16 grams and 12 to 23 grams of carbon dioxide equivalent respectively, while crystalline silicon photovoltaic power is 23 to 83 grams of carbon dioxide equivalent and solar power is 14 to 122 grams of carbon dioxide equivalent. It can be seen that wind power has significant low-carbon attributes. Since 2019, the Company has conducted Life Cycle Assessments (LCA) on five wind turbines to analyze the environmental impact factors of wind turbines throughout their life cycle, identify opportunities to improve the environmental performance of wind turbines at different stages, and reduce the negative environmental impact of wind power. Data shows that Goldwind wind turbine products are becoming more and more low-carbon. The 4S units have a life-cycle carbon emission of about 8 grams per kWh, while 5S units certified in 2022 will have a life-cycle carbon emission of about 6 grams per kWh.

Environmentally friendly



The United Nations Economic Commission for Europe (UNECE) pointed out in its report that wind power is a renewable and sustainable energy that does not pollute air and water during power generation; it has significant advantages in terms of land use, low acidity, and low eutrophication. In recent years, the development of larger wind turbines has reduced the number of wind turbines required for wind farms and the land use area. The Company pays attention to and identifies the environmental impact of wind turbines. It eliminates or reduces the environmental impact on surrounding communities with devices for bird protection, noise reduction, speed control, and sector control. It customizes the painting of wind turbines and introduces painted turbines that blend in with local cultural and natural environments, continuing to improve the environmental friendliness of its turbines.





## Developing Wind Farms as a Source of Green Power and Environmental Rights

The Company uses its wind power industrial chain advantage to build and develop wind farms, enhance power generation efficiency, improve the stability and reliability of wind power generation, and build a new power system with new energy as the mainstay. By the end of 2022, the Company had more than 200 self-developed wind power projects and more than 100 photovoltaic projects, providing a continuous supply of green power to society.

The Company strengthens the internal wind farm carbon asset management and actively participates in market trading. The cumulative installed capacity of Clean Development Mechanism (CDM) projects developed and registered is close to 1,500MW. More than 3 million tons of carbon emissions reduction have been certified, providing green rights for users.

Since the launch of China's voluntary emission reduction pilot market in 2015, Goldwind has been actively engaged in China Certified Voluntary Emission Reductions (CCER) development and has achieved a project registration of 729.5MW. A total of 749,200 tons of China Certified Voluntary Emission Reductions (CCERs) have been issued to help key domestic emitters achieve compliance.

Green certificates, are an important way for enterprises to consume green electricity, including subsidized green certificates and affordable green certificates issued by the China National Renewable Energy Center and international green certificates. By the end of 2022, Goldwind has developed 1 million international green certificates and 30,000 domestic affordable green certificates to meet the needs of various customers for green power certificates.

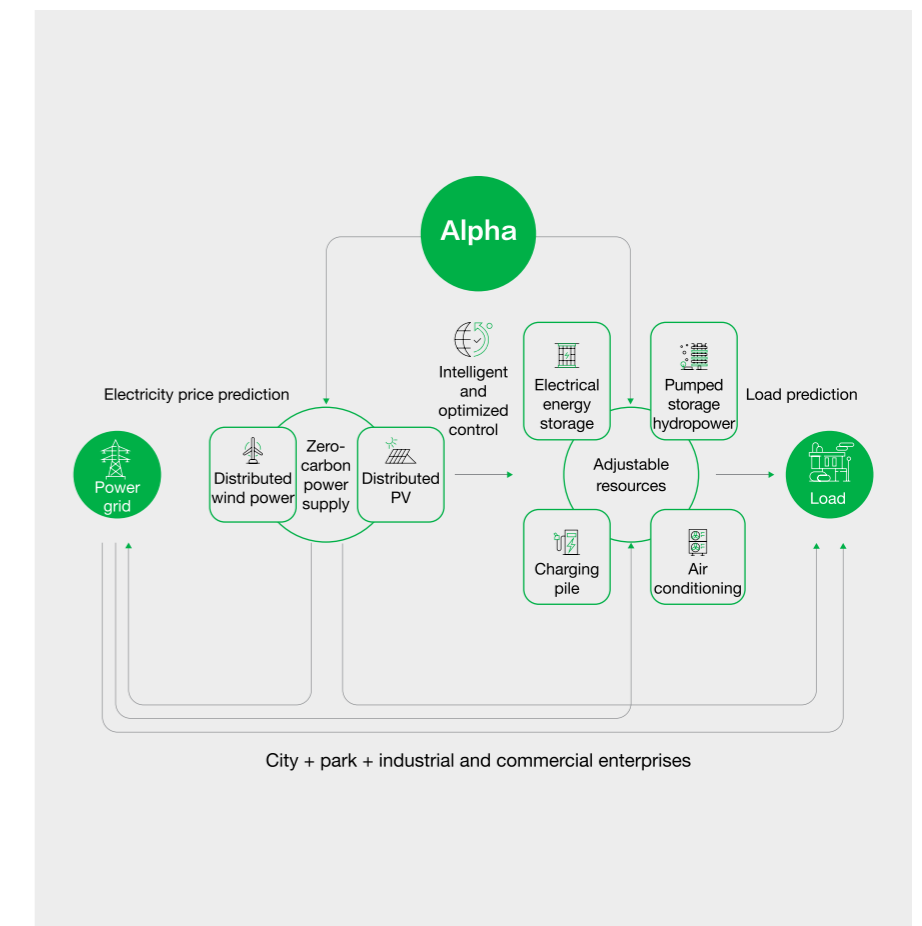


## Providing Integrated Energy Services, Innovative Low-Carbon Technologies, and Comprehensive Solutions

Faced with the rising demand for green power such as wind power from high energy-consuming and high-emission industrial enterprises, the Company uses its experience and advantages accumulated in the wind power field to develop customer-oriented integrated energy services, expand new energy application scenarios with wind power as the mainstay, and provide low-carbon technologies and comprehensive solutions based on green energy for industrial parks.

To help more enterprises reduce carbon emissions, the Company has integrated clean energy with digital technology and developed the Alpha Energy Aggregation Platform. The platform allows for overall energy management and carbon management regarding energy consumption, energy supply, and energy trading, providing the best path for enterprises to be carbon neutral. For example, for areas rich in new wind and solar energy, the Company provides new energy direct supply solutions, taking into account customers' green and low-carbon development demands. For the load side, the Company provides distributed energy solutions to increase the proportion of clean energy use; it also provides assistance in carbon emission credits and CCER trading to help enterprises accelerate the process of carbon neutrality.

### Goldwind Alpha Energy Aggregation Platform





▶▶▶ Case: Building a new carbon-neutral plant and research center

Goldwind provides a customized carbon-neutral solution for Forest Cabin based on the customer's characteristics and local resources. With the installation of photovoltaic and energy storage equipment, the brand now has stable green power production and supply.

Goldwind uses the Alpha Energy Aggregation Platform to integrate the dual indicators of electricity and carbon emissions, providing the customer with a low-cost, low-risk, and low-carbon-emissions system combining source, grid, load, and storage for the real-time monitoring of energy use and carbon emissions of the plant.

Based on the platform's monitoring, Goldwind provides recommendations for optimizing energy use in plants, workshops, and key equipment, thus improving production flows and process links, and creating a new carbon-neutral factory and research center.

▶▶▶ Case: Helping a well-known e-commerce logistics park achieve carbon neutrality at operational level

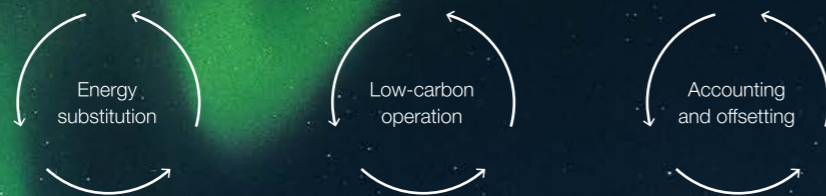
Goldwind provides wind and solar energy storage solutions and whole-process carbon-neutral consulting services for a well-known domestic e-commerce logistics park. The project involves one of the largest intelligent logistics centers in Northwestern China. Due to the use of a large number of three-dimensional stacking and warehousing technologies,

automated sorting systems, and other equipment, the average daily order processing volume exceeds 500,000 pieces.

Goldwind has guided the park to minimize carbon emissions at operational levels through three pathways: energy substitution, low-carbon operation, and carbon accounting and

offsetting, that is, using renewable electricity, improving operational energy efficiency and electrification, and accurately accounting for carbon emissions and achieving carbon offsets.

In March 2022, the park was certified by an authoritative third-party institution as the first "zero carbon" logistics park in China.



▶▶▶ Case: Building a smart green energy system for the world's first zero-carbon terminal

Goldwind provides smart energy solutions for the Tianjin Port Second Container Automation Terminal, making full use of the idle space in the terminal to build wind power and photovoltaic projects as renewable energy supply to the automation equipment in the park. Through precise micro sitting, Goldwind has built a 4.5MW wind turbine and 1.43MWp distributed PV panels. The project uses a microgrid technology originated by Goldwind and in line with IEC international standards.

The technology coordinates the various power sources, energy storage, and adjustable loads in the system, and ensures autonomous and reliable operation of the network based on intelligent prediction and algorithms to achieve a high percentage of renewable energy utilization. At the same time, the main energy-using equipment, transportation tools, and mobile machinery of the terminal are all electrified. Goldwind has used IoT to build a digital twin system and develop a customized low-code intelligent energy control platform for the terminal.

The platform realizes the data synchronization of the entire terminal energy system, the high integration of data visualization and business visualization, the optimal configuration and intelligent prediction of clean power generation and load, and the improvement of energy utilization. The implementation of the integrated zero carbon terminal smart energy solution ensures that the terminal is "100% electrically powered, 100% green, and 100% self-sufficient".



Electrically powered



Green power



Self-sufficient

▶▶▶ Case: Assisting COFCO Coca-Cola to create 'Low-Carbon Soda'

The Company has provided the COFCO Coca-Cola North China factory with 4.90 MW of distributed photovoltaic power, increasing the proportion of green energy use in the factory from the supply side and reducing its energy costs. The COFCO Coca-Cola North China factory was put into operation in 2017 and is an important factory for COFCO Coca-Cola in

the North China region. The factory produces 54,000 bottled and 120,000 canned colas per hour, which requires continuous electricity for the entire production process, from raw material handling to water treatment to disinfection to shipment. After grid connection, the photovoltaic project can annually generate over 5 million kilowatt-hours of electricity, with

almost 80% consumed locally. It can annually reduce about 2,300 tons of CO<sub>2</sub> emissions and nearly 500 tons of standard coal usage. The 'self-generation, self-use, surplus to grid' model saves approximately CNY 370,000 in electricity costs annually, providing environmental and economic benefits.



Estimated annual electricity output



Estimated annual reduction of CO<sub>2</sub> emissions



Estimated annual coal reduction





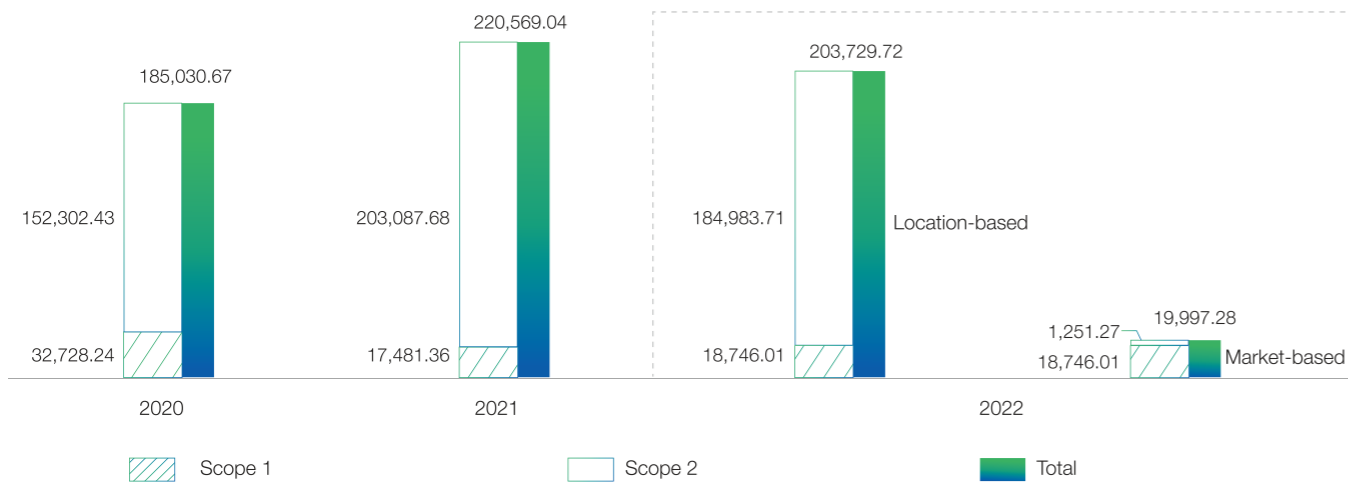
# 4.

## Reducing Carbon Emissions at Goldwind

### Emissions at Operational Level

Since 2016, Goldwind has been identifying the types of greenhouse gas emissions according to the types of business activities and carbon emissions, compiling working guidelines for energy consumption and carbon-related data collection, building a carbon emission accounting system, and conducting empowerment training to gradually improve data quality and reliability. In 2022, the Company established an internal carbon account system to manage internal carbon emission activities.

2020-2022 Goldwind Operational Level (Scope 1 and 2) Greenhouse Gas Emissions (Unit: tons of CO<sub>2</sub>e)

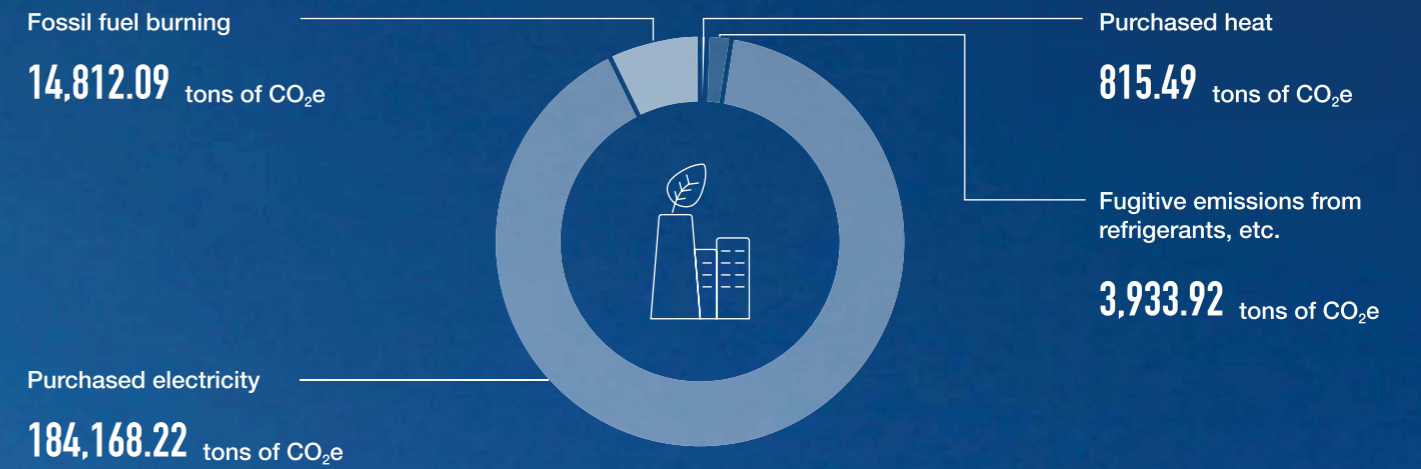


Goldwind adheres to the concept of high-quality development and takes the initiative to adopt innovative technologies and production process optimization to control carbon emissions while achieving steady business growth.

In 2022, the Company's total carbon emissions (location-based) was 203,729 tons of CO<sub>2</sub>e, with a 7.63% reduction from the previous year.

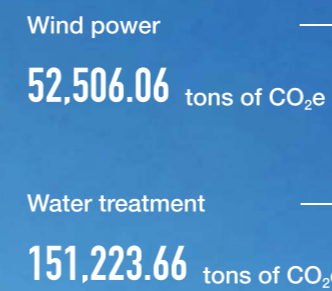
In 2022, Goldwind's Scope 2 emissions accounted for more than 90.80% of the total emissions at the operational level, and Scope 1 only accounted for 9.20%. Electricity consumption generated the largest proportion of carbon emissions, accounting for more than 90.40% of the total emissions. Next was fossil fuel burning emissions, accounting for 7.27%.

### Emissions from each source



Among the Company's various types of businesses, the wind power unit accounted for about 26% of the total carbon emissions. The water treatment unit accounted for about 74%, mainly due to its need for continuous power consumption and the relatively large business scale.

### Emissions by business units



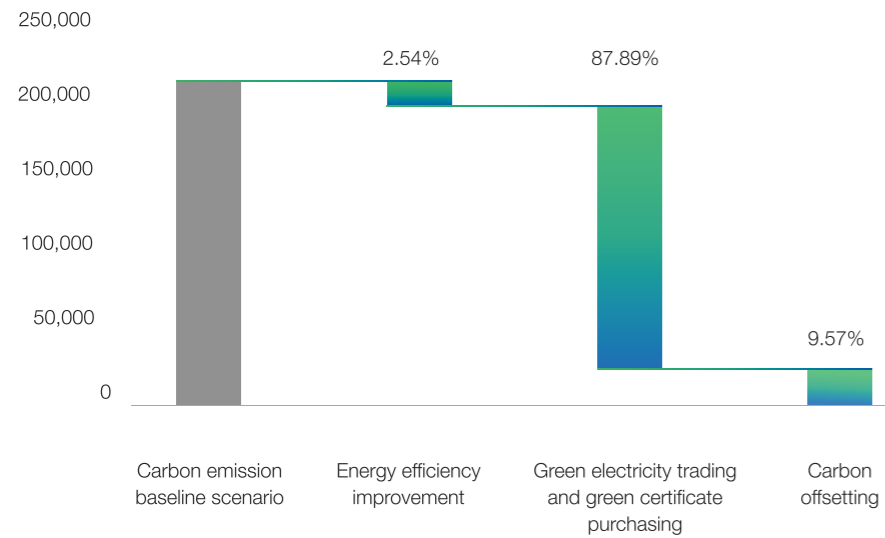


## Carbon Neutrality at Operational Level

In 2022, the Company's field self-generated green power usage accounted for 53% of the total power consumption. The proportion of green power was further increased through green power purchases and international green certificates. The overall green power proportion reached over 99%.

In 2022, Goldwind achieved carbon neutrality at the operational level (scope 1 and scope 2) through energy saving, green power, and the purchase of carbon offsets. The Company obtained a carbon-neutral certificate from the China General Certification Center at the end of March 2023.

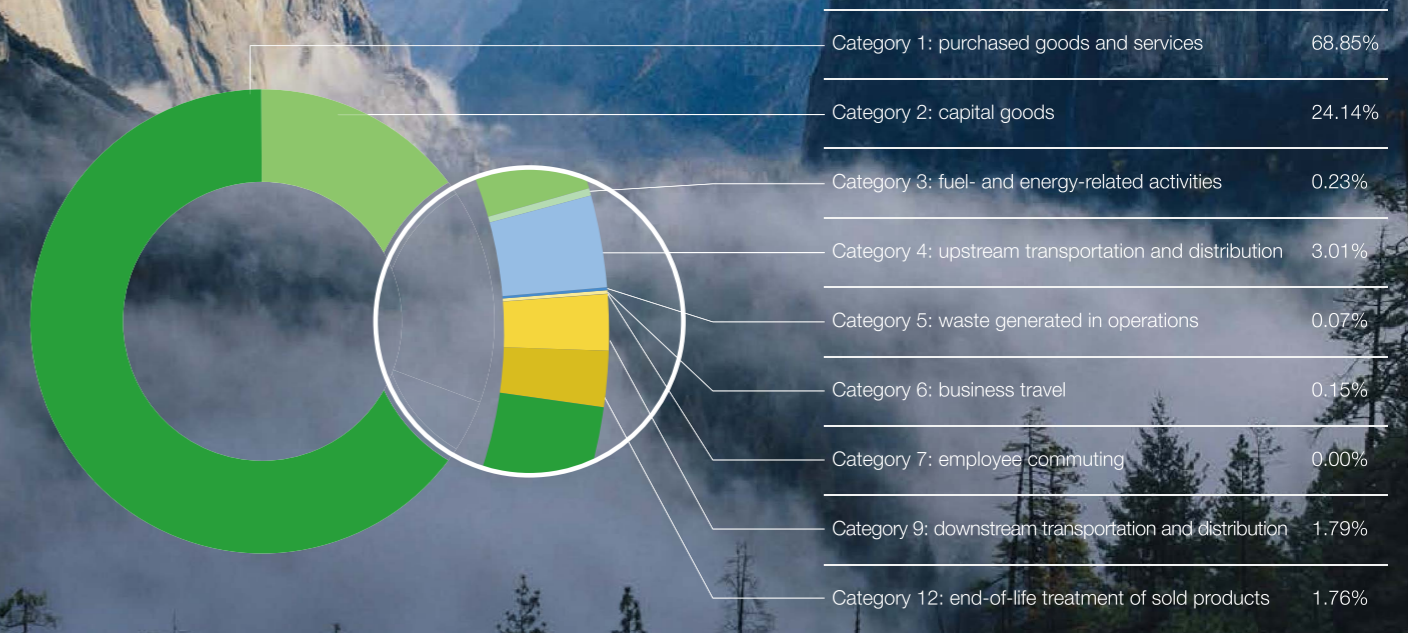
### Goldwind's 2022 Carbon Neutral Pathway at Operational Level (Scope 1 and Scope 2)



## Value Chain Carbon Emissions

Goldwind's Scope 3 GHG emissions were mainly from purchased raw materials and services, fixed capital, employee travel and commuting, logistics and transportation, and end-of-life treatment of wind turbine products. Goldwind's total Scope 3 GHG emissions in 2022 were 4.4058 million tons of CO<sub>2</sub>e, accounting for 95% of the total Scope 1, Scope 2, and Scope 3 carbon emissions.

### Proportion of Scope 3 Carbon Emissions by Category in 2022



\*Because of the rounding number to the nearest hundredth, some of small data results are displayed as zero.



# Reducing Carbon Emissions in Production and Operations

## Energy Efficiency

In recent years, Goldwind has explored its energy-saving potential in multiple dimensions including technology, process, equipment, and management, increased investment in energy-saving technical transformation, and carried out comprehensive energy-saving and consumption-reducing measures, achieving certain energy-saving and emission-reduction effects. In 2022, the Company implemented more than 60 energy-saving measures, which may reduce carbon emissions by 9,565 tons per year.

### Main Energy-Saving and Low-Carbon Measures Taken by Goldwind in 2022

#### Power saving

**Main measures**

- Wind farm SVG equipment transformation
- Water treatment process optimization (water distribution method, dosing method, equipment, etc.)
- Water treatment aeration method optimization (aeration modification, precision aeration, etc.)
- Optimized automatic lighting control and lighting fixture retrofit
- Optimized management of experimental projects and office energy consumption, etc.

**16.57 million kWh/year**  
Estimated power savings

#### Gasoline saving

**Main measures**

- New energy vehicles as a replacement

**39 tons/year**  
Estimated gasoline savings

#### Natural gas saving

**Main measures**

- Boiler waste heat recovery and utilization

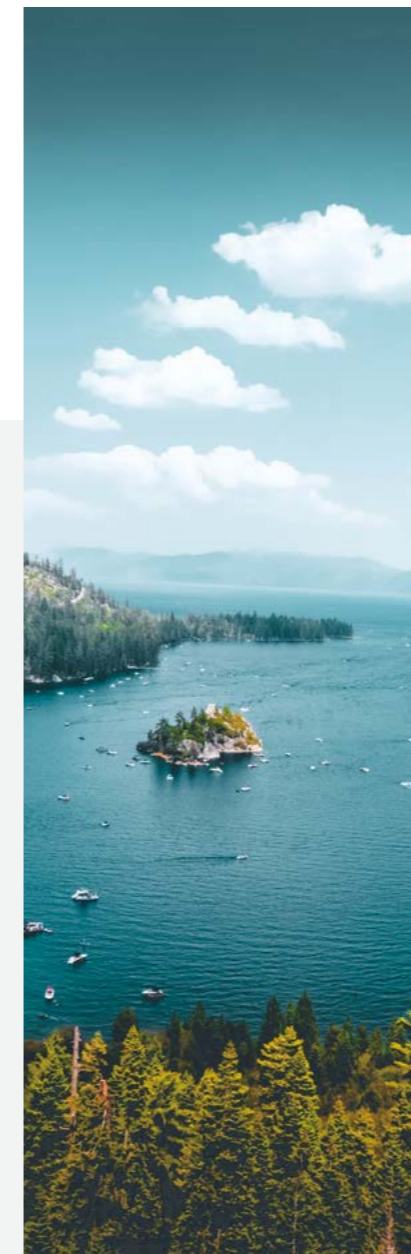
**20,000 cubic meters/year**  
Estimated natural gas savings

By the end of 2022, 8 plants of the Company had laid down energy management manuals and passed energy management system certifications; 4 plants had obtained the national certification for green plants, and 4 plants had obtained the provincial certification for green plants.

In 2023, the Company will review previous year's energy use and implement energy-saving measures in its final assembly plants, wind farms and water treatment plants, improving wind turbine R&D, adopting new energy vehicles, and optimizing energy management. The energy management system will be upgraded using energy management information platform technology and digital intelligent operation technology to improve monitoring and management, and to enhance energy efficiency.

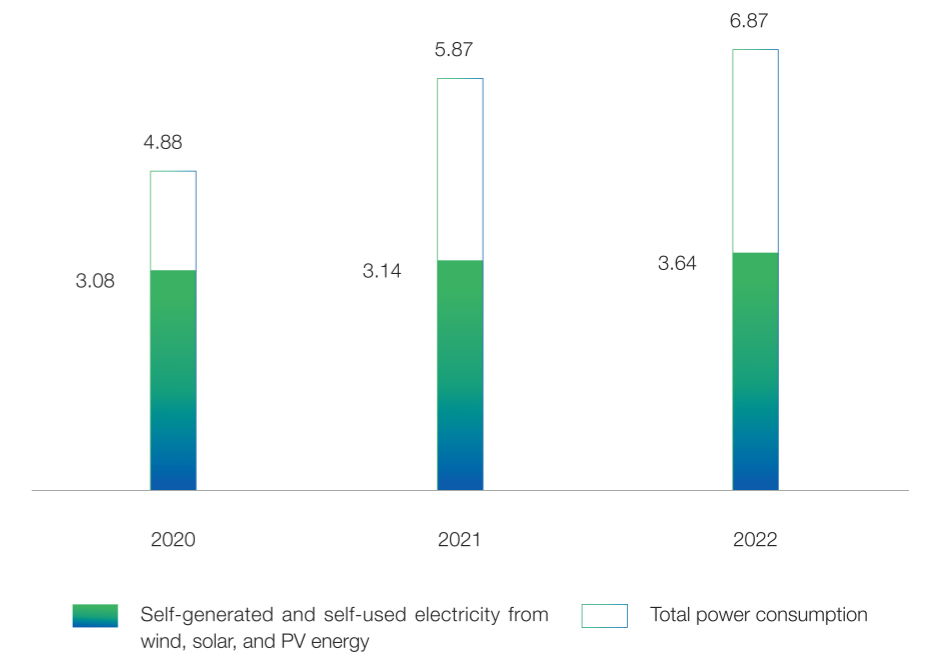
## Renewable Energy Use

As a comprehensive solution provider of clean energy, energy conservation, and environmental protection, Goldwind makes full use of its mature green power product and service system and rich practical experience to promote the construction of green wind farms and zero carbon plants internally and continuously increase the proportion of its green power usage.



## Goldwind's Self-Generated and Self-Used Electricity from Wind and PV in 2020-2022

(Unit: 100 million kWh)



In 2022, Goldwind's power consumption was 687 million kWh, with 364 million kWh from wind power, photovoltaic, and other on-site facilities. The Company's self-generated green power accounted for 53% of total power consumption. The proportion of self-generated and self-used green power in Goldwind's wind farms was over 90%.

The Company has taken into account the characteristics of each business unit and carried out planning according to local conditions to increase the proportion of green power usage in self-owned facilities of manufacturing & assembly plants and water treatment plants. By the end of 2022, Goldwind had installed photovoltaic power systems in seven manufacturing and five water treatment plants, with one factory also housing a wind power smart microgrid. From 2023 to 2025, the Company plans to enhance photovoltaic transformation in water and assembly plants, increasing the coverage of photovoltaic installations. This 'install where possible' policy for distributed photovoltaics aims to boost the use of self-generated green electricity and reduce energy costs.

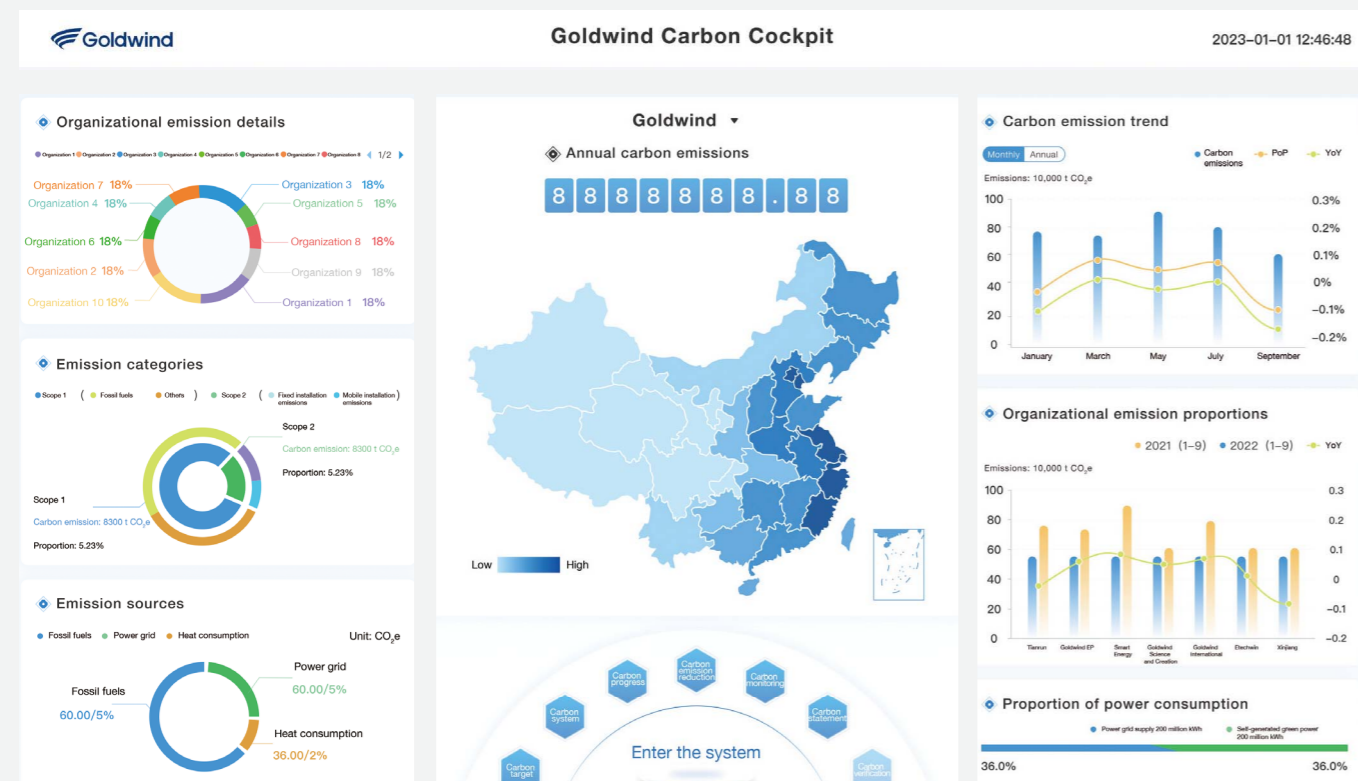
Take Goldwind's Yizhuang Smart Park as an example. The park covers an area of 136 mu, with a construction area of 139,000 square meters and annual power consumption of about 15 million kWh. The park adopts intelligent design, including six modules which are intelligent micro-grid, energy-saving, intelligent water service, intelligent operation and maintenance of the park, intelligent agriculture, and intelligent health, and builds a set of intelligent micro-grid integrating wind power, solar power, fuel, storage, and charging. Two wind turbines have been installed, and idle spaces such as the roof and carport of the park are used to realize joint optimal scheduling operation of multiple energy equipment on the load side. Energy storage devices including all-vanadium flow batteries, lithium batteries, and supercapacitors are configured for peak-shaving and valley-filling of the system, smoothing power fluctuations and greatly improving the quality of power supply in the park. With multiple energy sources such as wind power and photovoltaics, smart micro-grid, and Energy Internet, the park has managed to increase the proportion of clean energy usage, and became China's first carbon-neutral smart park powered by renewable energy.



## Boosting Low-Carbon Development with Digitalization

Goldwind incorporates information technology into R&D, production, and operations and deeply integrates digital capability with its businesses. In the fields of wind resource measurement and assessment, engineering construction, and operation and maintenance management, it replaces on-site wind survey, road planning, and manual operation and maintenance with digital modeling technology, effectively reducing vehicle fuel use and carbon emissions. In terms of production technology, it introduces digital technology and improves the proportion of intelligent equipment to realize technology iteration, enhance energy utilization efficiency, and improve product quality and performance.

Goldwind uses digital technology to build a carbon account system to collect, calculate and display key information such as electricity load, energy consumption trend, and clean energy use. The system clearly and intuitively displays the energy consumption, internal energy structure, and carbon emission status of the Company's business units, making internal carbon management real-time, concrete, and accurate, and providing data support for total carbon emission control and carbon emission target decomposition.



By the end of 2022,

**214,000**

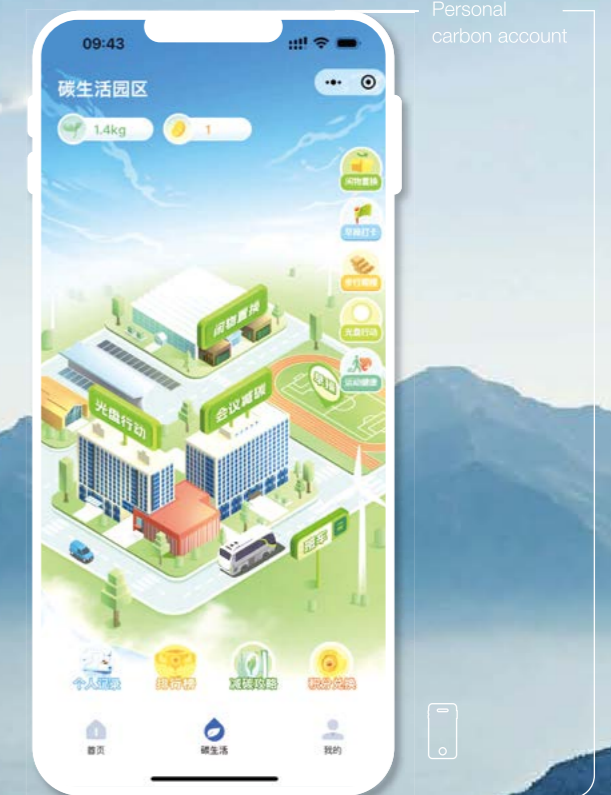
low-carbon activities by Goldwind employees

**355.0 tons**

Cumulative reduction of carbon dioxide emissions

Goldwind has launched a personal carbon account app for its second-phase park in Beijing. All employees' carbon emission reduction behaviors in their daily life and production scenarios are converted into carbon points. Accumulated carbon points can be used to exchange for corresponding rights and benefits. The Company hopes to guide all employees to form a green and low-carbon lifestyle and enhance their awareness of energy saving, emission reduction, and green development. By the end of 2022, a total of 3,869 employees reduced carbon dioxide emissions by a total of 355.9 tons through 214,000 low-carbon activities such as low-carbon shuttles, walking, food waste prevention, low-carbon meeting rooms, and unused stuff exchanges.

Specific application scenarios of personal carbon accounts:





## Designing Low-Carbon Products

The Company conducts product life cycle assessment (LCA) to explore the potential and opportunities for reducing carbon emissions during the design, procurement, and production of wind turbine products, using renewable resources or materials made with low-carbon energy sources, and prioritizing the replacement of materials and components that account for a large share of carbon emissions to gradually reduce product carbon footprint.

### Improving Material Utilization Efficiency

In recent years, influenced by the trend of larger wind turbines, the weight per megawatt of wind turbine components has decreased, somewhat improving raw material utilization efficiency and reducing product carbon footprint. To further reduce the carbon footprint of wind turbine products, the Company starts with R&D and design to explore new materials and efficient and environmentally friendly production processes. For example, in the design process, the Company considers the forming and machining processes of wind turbine components and transforms materials into the desired forms and shapes for better efficiency. The Company strives to reduce waste generated in the manufacturing process and improve the efficiency of raw material use.

In a newly developed wind turbine product, the Company uses an innovative process to reduce the weight of a key component, the nacelle cover, while ensuring product quality and reducing carbon emissions by more than 30%.

In addition, the Company encourages R&D staff to carry out projects with the efficient use of materials and resources and collaborates with suppliers to develop new materials and processes to maximize the use efficiency of raw materials. The reduction in the amount of material used for each wind turbine lessens the negative environmental impact caused by the production, processing, and transportation of materials while reducing the waste generated at the end of the product life cycle.

Wind turbine product packaging is also part of the product carbon footprint calculation. In 2020, Goldwind began an internal "partial packaging instead of full packaging program" for large wind turbine components, gradually reduced the use of plastic packaging for wind turbines, and designed and implemented a rigid packaging and recycling program. As a result, the Company achieved a 20% reduction in the weight of plastic packaging per kW of wind turbine components in 2022 compared to 2020.

Reduction in the weight of plastic packaging per kW of wind turbine components in 2022 compared to 2020

20%



## Using Renewable Materials

Waste materials are the "receptacle" of energy. Recycling waste materials can simultaneously recover the energy and carbon in product materials, thereby reducing the carbon footprint of products. Goldwind has gradually built a recycling system for used wind turbine components. With its wind turbine R&D and manufacturing capabilities and nationwide service network, the Company has gradually created a recycling network of old machine recycling and logistics transportation. It improves the level of processing and utilization of recycled wind turbine parts through whole machine value assessment, unit performance assessment and appraisal, innovative reprocessing, and manufacturing technology. At the same time, it uses internal and external resources to establish sales channels for refurbished equipment and form an ecological closed loop for old machine recycling and remanufacturing.

The Company has the ability to repair and remanufacture more than 200 types of wind power components. It has independently developed and designed more than 30 system-level inspection and repair platforms and

applied for more than 20 national patents.

For solid waste high residual value components (tower, cable, box-type substation), solid waste low residual value components (electrical components and structural components), blades, and other wind power components, the Company carries out green recycling as much as possible according to the principle of solid waste reduction, resource recovery, and environmental friendliness, and maximize the residual value.

Magnet steel is an important part of Goldwind wind turbines. The Company actively promotes the recycling and reuse of used magnet steel. After the disassembled waste magnetic steel is sorted and cleaned, it is re-processed and re-manufactured through nearly 20 processes to form a new magnetic steel and applied to wind turbines. The reuse of scrap magnetic steel significantly reduces the mining of magnetite and shortens the smelting process. It is estimated that the use of scrap magnet steel instead of natural ore to produce magnets reduces CO<sub>2</sub> emissions by about 60%.

Since 2015

Disassembled and recycled scrap magnet steel

1,800 tons

Re-production of magnetic steel

1,360 tons

Rare earth ore saving

640 tons







## Developing low-emission wind turbine components

Goldwind focuses on materials and components with a large proportion of the carbon footprint of wind turbine products. For castings, the company encourages suppliers to gradually replace coke smelting with electric furnace smelting to effectively reduce carbon emissions in the production and manufacturing of components.

Goldwind actively develops and promotes low-emission wind turbine supporting components. In general, the weight of the tower accounts for about 50% of the total weight of a wind turbine, and the carbon emission of the tower accounts for the largest proportion of the total carbon emission of the wind turbine. The Company replaces part of the steel structure in the tower with a low-emission concrete structure, which can effectively reduce carbon emissions while meeting the operational requirements of the wind turbine and ensuring the overall structural stability and safety of the concrete tower. Take the 140m steel-concrete towers of Goldwind's medium-speed permanent magnet 191/204 series 4X~6X as an example. The carbon footprint has been reduced by about 35% compared to steel towers of the same height.



## Reducing Carbon Emissions in Procurement

In order to reduce carbon emissions in the procurement process, Goldwind has implemented the "Green Supply Chain" <sup>1</sup> project since 2016. Based on the energy demand of suppliers and local clean energy resources, it integrates various types of distributed energy with scientific planning and reasonable allocation to help suppliers use green power. At the same time, it assists suppliers to carry out green power trading, green certificate trading, and carbon emissions trading to reduce carbon emissions in the procurement process. In 2022, the Company provided 8,545 green certificates for 16 suppliers, equivalent to 8,545,000 kWh of electricity. It conducted green power trading with 5 suppliers, with a total trading amount of 108,640,000 kWh. It developed photovoltaic projects for 16 suppliers, of which 6 suppliers had 8 MW connected to the grid. It provided smart energy and carbon management systems for 7 suppliers to help them effectively improve energy efficiency.

<sup>1</sup> The qualified suppliers who provide components, production and services, tools and consumables, equipment, packaging and other raw materials or (and) services in accordance with the Management Measures for the Development of Wind Turbine Component Suppliers, which have been evaluated and approved through over 100 strict indicators in business, technology, quality, service, and safety, among other dimensions.



In 2022, based on the original Evaluation Code for Green Suppliers, Goldwind upgraded the requirements for suppliers to use green power, encouraged suppliers to actively use green power, and increased the weight of "green power use" in the evaluation system. In the procurement of product orders, the Company focuses on suppliers with a high degree of greenness. The Company formulated the Supplier Green Power Usage Evaluation Specification and uses it to evaluate suppliers in terms of power usage, green power usage and amount, etc.

**In 2022,**

The number of suppliers who used green power to produce Goldwind products

**112**

The proportion of green power used by major suppliers in the production of Goldwind products reached

**46%**

Goldwind and its supplier partners launched a low-carbon development initiative to explore the pathways of low-carbon emission reduction, give full play to the advantage of the green energy industry, and contribute to the achievement of the national goals of carbon peak and carbon neutrality. By the end of 2022, nearly 300 core partners had signed the initiative to work with Goldwind to create more low-carbon and environmentally friendly wind power products and explore the road to zero-carbon development.





# 5.

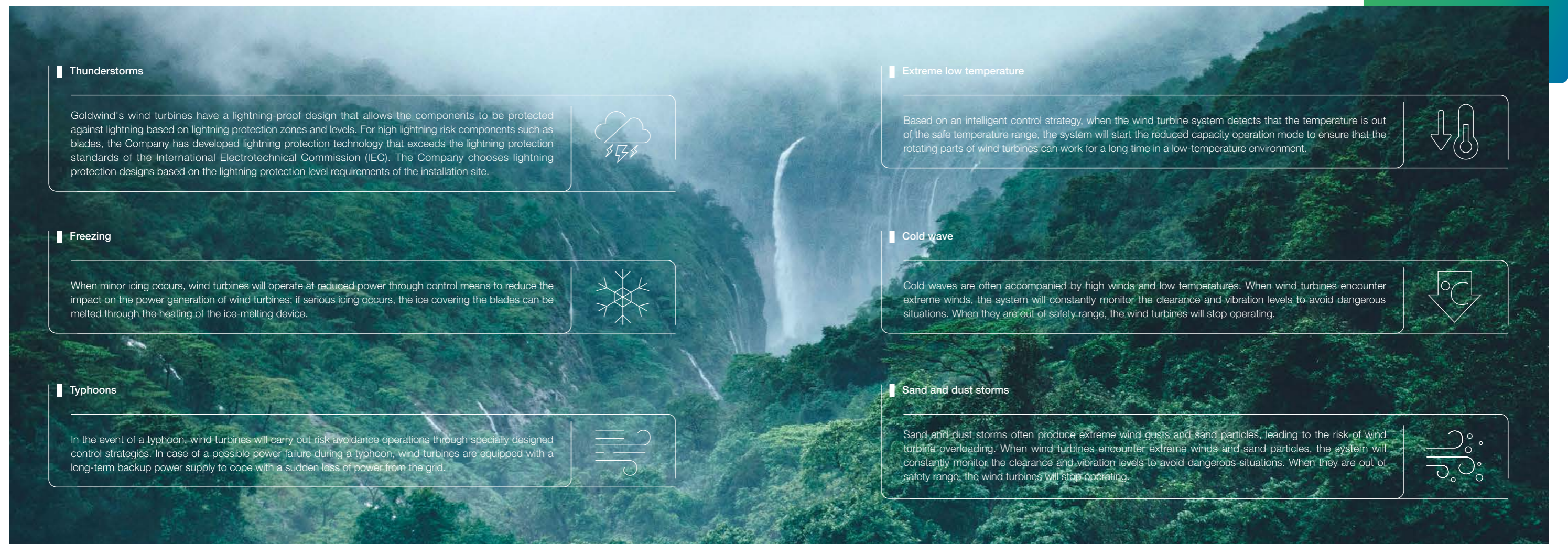
## Enhancing Adaptive Capacity to Climate Change

While developing its main wind power business, exploring the wind power market, and reducing carbon emissions, Goldwind is actively improving its climate change adaptation and resilience.

According to the IPCC Sixth Assessment Report, the occurrence of extreme events is unprecedented in the observational record and will increase as global warming intensifies. Wind power projects rely on energy generated by atmospheric circulation. Special meteorological conditions have an impact on wind power projects. Tropical cyclones, thunderstorms, freezing, sand and dust storms, and extreme temperatures can have varying degrees of impact on the operation of wind turbines, the construction of wind power projects, and the safety of project production. They affect the construction, operation, and maintenance of wind farms, the working environments of personnel, the safety and reliability of large components, and the safety of personnel and property. The Company continuously strengthens its capacity to reduce and mitigate disaster losses from extreme weather and climate events.

## Improving the Adaptive Capacity of Wind Turbines to Extreme Weather

As a wind power equipment developer and manufacturer, Goldwind has integrated traditional wind turbine technology with emerging technologies such as artificial intelligence, big data, cloud computing, and the Internet of Things to develop intelligent wind turbines that can detect the external environment and their operating status for analysis, control, and collaborative decision-making. At the same time, the Company has continued to enhance the ability of wind turbines to adapt to extreme weather. The differentiated design of Goldwind intelligent wind turbines gives them excellent environmental adaptability to extreme high and low temperatures, cold waves, freezing, and other severe weather.



### Thunderstorms

Goldwind's wind turbines have a lightning-proof design that allows the components to be protected against lightning based on lightning protection zones and levels. For high lightning risk components such as blades, the Company has developed lightning protection technology that exceeds the lightning protection standards of the International Electrotechnical Commission (IEC). The Company chooses lightning protection designs based on the lightning protection level requirements of the installation site.



### Extreme low temperature

Based on an intelligent control strategy, when the wind turbine system detects that the temperature is out of the safe temperature range, the system will start the reduced capacity operation mode to ensure that the rotating parts of wind turbines can work for a long time in a low-temperature environment.



### Freezing

When minor icing occurs, wind turbines will operate at reduced power through control means to reduce the impact on the power generation of wind turbines; if serious icing occurs, the ice covering the blades can be melted through the heating of the ice-melting device.



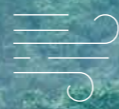
### Cold wave

Cold waves are often accompanied by high winds and low temperatures. When wind turbines encounter extreme winds, the system will constantly monitor the clearance and vibration levels to avoid dangerous situations. When they are out of safety range, the wind turbines will stop operating.



### Typhoons

In the event of a typhoon, wind turbines will carry out risk avoidance operations through specially designed control strategies. In case of a possible power failure during a typhoon, wind turbines are equipped with a long-term backup power supply to cope with a sudden loss of power from the grid.



### Sand and dust storms

Sand and dust storms often produce extreme wind gusts and sand particles, leading to the risk of wind turbine overloading. When wind turbines encounter extreme winds and sand particles, the system will constantly monitor the clearance and vibration levels to avoid dangerous situations. When they are out of safety range, the wind turbines will stop operating.







02

Pakistan

High temperature area

45 °C

01

Ecuador

Seismic zone

Magnitude 8.0 earthquake



03

Huangmaogeng · Sichuan · China

High altitude

3800-4000 m

04

Qinglong · Guizhou · China

Extreme weather

Freezing rain

06

Heilongjiang · China

Alpine region

-30 °C

05

Taohua Mountain · Hubei · China

Ultra-low wind speed

5.04 m/s





## Strengthening Meteorological Observation, Assessment, Prediction, and Early Warning Capabilities

Based on data from the European Centre for Medium-Range Weather Forecasting (ECMWF), an international authoritative forecasting agency, data from the 2.5km grid of the China Meteorological Administration, and the historical data of meteorological information in the wind sites, the Company has built a high-precision meteorological warning analysis model and developed a meteorological forecast and warning information system covering different threshold values, different time periods, and various dimensions such as administrative regions, terrain, and climate zones. The system can provide 24/7 monitoring and early warning. It can provide weather risk level indication in the whole cycle of wind farm construction, operation, and maintenance, which enhances the ability of wind turbines to prevent damages during disaster weather and protects the safety of equipment and personnel. The early warning information is visually and dynamically displayed on an online terminal, which is helpful for personnel to understand the situation of the wind farm production line.

In the event of severe weather such as freezing, blizzards, and extremely low temperatures, personnel can make preparations in advance and evacuate from dangerous areas.

In 2022, Goldwind innovated a freeze warning model using self-researched algorithms to provide freeze warning services for more than 100 wind farms. Combined with system control strategies, the model can identify the intensity of freezing suffered by wind turbines and accurately determine the timing of wind turbine shutdown, further enhancing wind turbines' ability to respond to freezing disasters. The wind farm freeze warning provides safety warnings for operation and maintenance personnel, allowing them to arrange operation, maintenance, and hoisting schedules reasonably, and keep an eye on the turbine operation, thus ensuring the safety of personnel and equipment. Based on the freeze periods indicated by the warning, the start and stop moments of wind turbines can be precisely controlled to minimize the power generation loss caused by freezing disasters.

## Enhancing Resilience to Climate Change Risks

The construction of wind farms has high requirements for weather: long-distance transportation of extra-long equipment such as blades and extra-heavy and extra-wide equipment such as generators, extra-high hoisting and fine installation of heavy equipment, field installation construction of electrical equipment, etc. In the context of global warming, the frequency of extreme weather events has increased. In response to this situation, Goldwind plans construction periods based on meteorological information, especially the prompt wind turbine hoisting and offshore operations in favorable weather windows. To prevent and mitigate risks, the Company establishes contingency plans related to meteorological disasters such as landslide prevention after heavy precipitation and working safely in extremely low-temperature or high-temperature environments. Through the supervision unit, the Company regularly supervises the implementation of relevant risk prevention and control and project management measures. The Company also purchases corresponding insurance, including equipment transportation insurance, project construction insurance, and personnel safety insurance, to mitigate the risk of climate disasters.

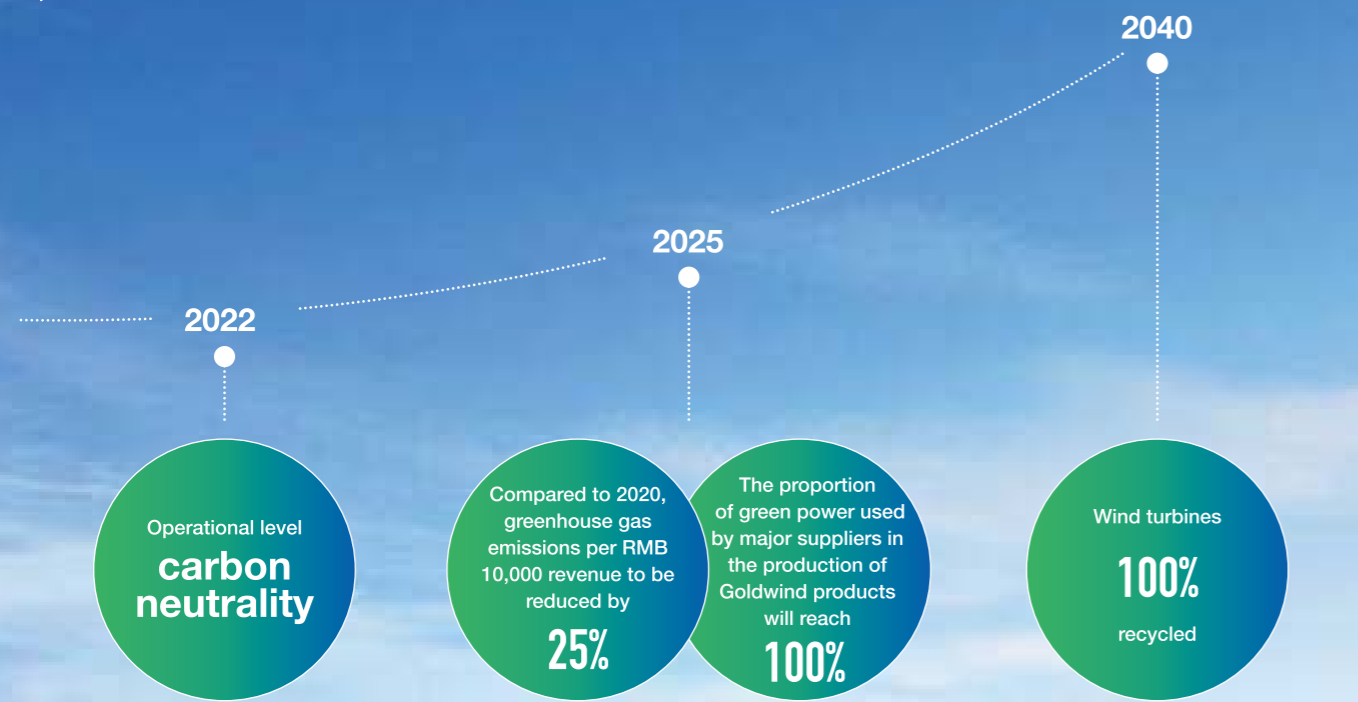




# 6. Future Action Plan

Addressing climate change is important for sustainable development and social responsibility for enterprises. However, climate change response is long-term and systematic work that requires arduous efforts. Goldwind has been in the wind power industry for more than 20 years and has been committed to its mission of "Innovating for a Brighter Tomorrow" through its actions. It gives full play to its experience and advantages in wind power equipment R&D/manufacturing and wind farm development/operation/maintenance while actively expanding its business scope of clean energy on the load side. The Company strives to become a global trusted strategic partner in clean energy and help the global community reach carbon peak and carbon neutrality as soon as possible.

In the future, we will intensify our climate change actions, boost adaptability, and incorporate energy-saving and emission-reduction into all our operations including product development and design, manufacturing and transportation, wind farm project construction and operation, and water affairs. Through technology and digital enablement, we will prioritize green, low-carbon development, enhance energy efficiency, and develop energy-saving and carbon reduction technologies, processes and products to improve energy and resource efficiency. To enhance the use of green electricity, we will expand green electricity use through self-generating and procuring green electricity. We will promote electrification across all our business areas to gradually realize our carbon peak and neutrality objectives.



Energy-saving and carbon-reduction action plan



# Appendices

## Appendix 1: Greenhouse Gas Accounting Boundary

### Reporting Period

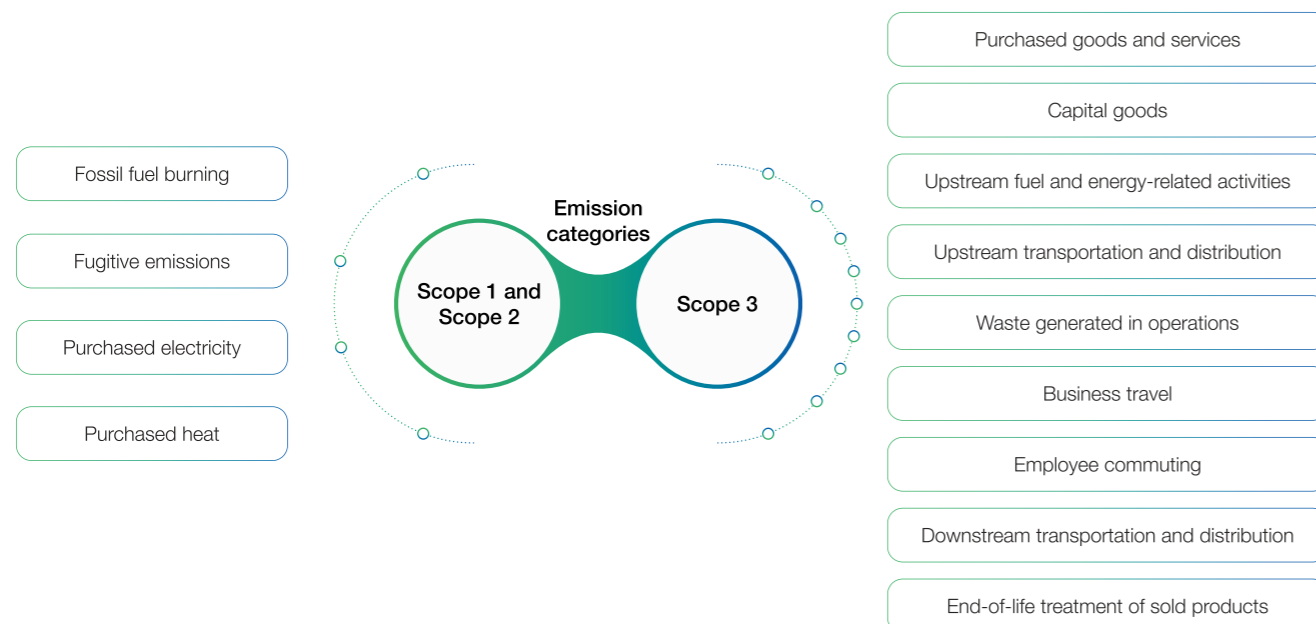
January 1, 2022 to December 31, 2022. To ensure continuity of data, some of the contents are outside the reporting period.

### Organizational Scope

The Company used the operational control approach to account for carbon emissions from business activities where it holds operational control, including Goldwind Science and Technology Co., Ltd. and its subsidiaries.

### Accounting Boundary

The Company's business activities produced five types of greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF<sub>6</sub>). According to ISO 14064-1:2018 Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals, the GHG Protocol Corporate Accounting and Reporting Standard, and the actual production situation of the Company, Scope 1 and Scope 2 emission sources included fossil fuel combustion emissions, fugitive emissions, purchased electricity and purchased heat, etc.; Scope 3 emission sources included 9 categories: purchased goods and services, capital goods, upstream fuel and energy-related activities, upstream transportation and distribution, waste generated from operations, business travel, employee commuting, downstream transportation and distribution, and end-of-life treatment of sold products.



The emission categories for Scope 1, Scope 2 and Scope 3 accounting are as follows:

Scope	Emission categories	Applicability	Reasons
Scope 1, Scope 2	Fossil fuel burning	<input checked="" type="checkbox"/>	
	Process emissions	<input type="checkbox"/>	No process emissions involved
	Fugitive emissions	<input checked="" type="checkbox"/>	
	Purchased electricity	<input checked="" type="checkbox"/>	
Scope 3	Purchased heat	<input checked="" type="checkbox"/>	
	Purchased goods and services	<input checked="" type="checkbox"/>	
	Capital goods	<input checked="" type="checkbox"/>	
	Upstream fuel and energy-related activities	<input checked="" type="checkbox"/>	
	Upstream transportation and distribution	<input checked="" type="checkbox"/>	
	Waste generated in operations	<input checked="" type="checkbox"/>	
	Business travel	<input checked="" type="checkbox"/>	
	Employee commuting	<input checked="" type="checkbox"/>	
	Upstream leased assets	<input type="checkbox"/>	No significant emissions from such activities
	Downstream transportation and distribution	<input checked="" type="checkbox"/>	
	Processing of sold products	<input type="checkbox"/>	No such activity involved
	Use of sold products	<input type="checkbox"/>	Data not available
	End-of-life treatment of sold products	<input checked="" type="checkbox"/>	
Downstream leased assets	<input type="checkbox"/>	No significant emissions from such activities	
Franchises	<input type="checkbox"/>	No such activity involved	
Investments	<input type="checkbox"/>	Data not available	



## Appendix 2: Summary of Greenhouse Gas Accounting Methods

Goldwind accounted for greenhouse gas emissions in accordance with international standards such as ISO 14064-1:2018 Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals, and the GHG Protocol Corporate Accounting and Reporting Standard.

Scope	Main Sources of Emissions	Methodologies
Scope 1	Gasoline	Calculations based on fuel consumption data and corresponding emission factors
	Diesel	
	Natural gas	
	Liquefied petroleum gas	
	Fugitive emissions	Calculations based on the rated fill, supplementary amounts, and relevant emission factors
Scope 2	Purchased electricity and heat (steam, hot water, etc.)	Calculations based on electricity and heat procurement data and corresponding emission factors
Scope 3	Category 1: Purchased goods and services	Calculations based on purchase volumes, financial data, and corresponding emission factors
	Category 2: Capital goods	
	Category 3: Fuel and energy-related activities	Calculations based on fuel consumption data and corresponding emission factor emissions
	Category 4: Upstream transportation and distribution	Calculations based on purchase volumes, transport modes and distances, and corresponding emission factors
	Category 5: Waste generated from operations	Calculations based on waste types, quantity, transport modes and distances, and corresponding emission factors
	Category 6: Business travel	Calculations based on the number of travelers, types of vehicles, travel distances, and corresponding emission factors
	Category 7: Employee commuting	Calculations based on commuting vehicles, fuel consumption data, and corresponding emission factors
	Category 9: Downstream transportation and distribution	Calculations based on product transport volumes, modes and distances and corresponding emission factor emissions
Category 12: End-of-life treatment of sold products	Calculations based on the volumes of products sold, end-of-life treatment methods, and corresponding emission factor emissions	

## Appendix 3: Sources of Emission Factors

Emission factor is a greenhouse gas emission coefficient that represents the amount of greenhouse gas emitted per unit of production or consumption, such as greenhouse gas emissions per unit of fossil fuel combustion and greenhouse gas emissions per unit of purchased electricity purchased. Goldwind prioritized emission factors calculated based on actual data, followed by internationally recognized databases and emission coefficients published by relevant government departments.

Scope	Main Sources of Emissions	Sources of Emission Factors
Scope 1	Gasoline	<ul style="list-style-type: none"> <li>China Energy Statistical Yearbook 2022</li> <li>The 2006 IPCC Guidelines for National Greenhouse Gas Inventories</li> <li>2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</li> <li>IPCC Sixth Assessment Report Working Group 1, Chapter 7</li> </ul>
	Diesel	
	Natural gas	
	Liquefied petroleum gas	
	Fugitive emissions	
Scope 2	Purchased electricity and heat (steam)	<ul style="list-style-type: none"> <li>Notice on the Management of Greenhouse Gas Emission Reporting of Power Generation Enterprises from 2023 to 2025</li> <li>Guidelines on Accounting Methods and Reporting of Greenhouse Gas Emissions of Enterprises in Other Industries (Trial)</li> </ul>
Scope 3	Category 1: Purchased goods and services	<ul style="list-style-type: none"> <li>Guidelines for the Preparation of Provincial Greenhouse Gas Inventories</li> <li>Notice on the Management of Greenhouse Gas Emission Reporting of Power Generation Enterprises from 2023 to 2025</li> <li>China Energy Statistical Yearbook 2022</li> <li>China Electric Power Yearbook 2022</li> <li>The 2006 IPCC Guidelines for National Greenhouse Gas Inventories</li> <li>2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</li> <li>GHG protocol transportation emission tool</li> <li>Gabi Database</li> </ul>
	Category 2: Capital goods	
	Category 3: Fuel and energy-related activities	
	Category 4: Upstream transportation and distribution	
	Category 5: Waste generated from operations	
	Category 6: Business travel	
	Category 7: Employee commuting	
	Category 9: Downstream transportation and distribution	
Category 12: End-of-life treatment of sold products		





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