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China Three Gorges Corporation

ANNUAL REPORT ON ENVIRONMENTAL PROTECTION 2022

China Three Gorges Corporation

About the Report

Time Frame

From January 1 to December 31, 2022. Part of the content may exceed the aforementioned time frame.

Scope

This report covers work on environmental protection related to the main business of China Three Gorges Corporation (hereinafter referred to as "CTG").

Interpretation of Environmental Protection

Environmental protection or eco-environmental protection in this report includes not only the management of eco-environment impacts generated during the business operations of CTG and the well-coordinated environmental conservation of the Yangtze River basin by CTG, but also the active efforts such as biodiversity conservation and energy & resource saving by CTG.

Terms

In this report, the terms "the Group", "the Corporation", "CTG" and "we" all refer to China Three Gorges Corporation.

Context of the Publication

The Corporation's *Annual Report on Environmental Protection* has been published for 18 consecutive years since 2006. Its electronic versions can be downloaded from the official website of CTG at https://www.ctg.com.cn/.

Data in the Report

The data referenced in this report is CTG's final statistical data for 2022.

Normative References

This report mainly uses the following standards as reference:

- *Environmental Protection Law of the People's Republic of China* (as amended on April 24, 2014)
- *Guidelines for Drafting on Corporate Environmental Reports (HJ 617-2011)*, a national environmental protection standard of the People's Republic of China
- *Disclosure Mechanism for the Assessment of the Environmental Impact of Construction Projects*, issued by the Ministry of Ecology and Environment of the People's Republic of China
- *GB/T 36000-2015, Guidance on Social Responsibility*, a national standard of the People's Republic of China
- *Global Reporting Initiative Sustainability Reporting Standards (GRI Standards)*, issued by the Global Sustainability Standards Board (GSSB) (GRI 101/102/300)
- *Hydropower Sustainability Standard*, issued by the International Hydropower Association (IHA)

Language Versions

This report is available in Chinese and English, and published in both print and electronic formats. The electronic version can be downloaded from CTG's website at http://www.ctg.com.cn/. If a print copy is needed, please send an email to hu_yang4@ctg.com.cn or call 86-027-85086299.

Read More

More content is available on CTG's website at http://www.ctg.com.cn/. Other relevant information on the Corporation's endeavor in eco-environmental protection can be found in the following documents:

- *CTG Annual Reports*
- *CTG Sustainability Reports*
- *CTG Biodiversity Conservation Reports*
- *Social Responsibility Reports of China Yangtze Power Co., Ltd.*

Goals for Improvement

CTG manages issues about eco-environmental protection deeply and comprehensively, optimizes the disclosure breadth and depth of the annual report on environmental protection continuously, and improves the transparency of environmental information and the disclosure quality of environmental information.

Contents

Message from Top Management

Lei Mingshan
Board Chairman

Han Jun
Board Director and President

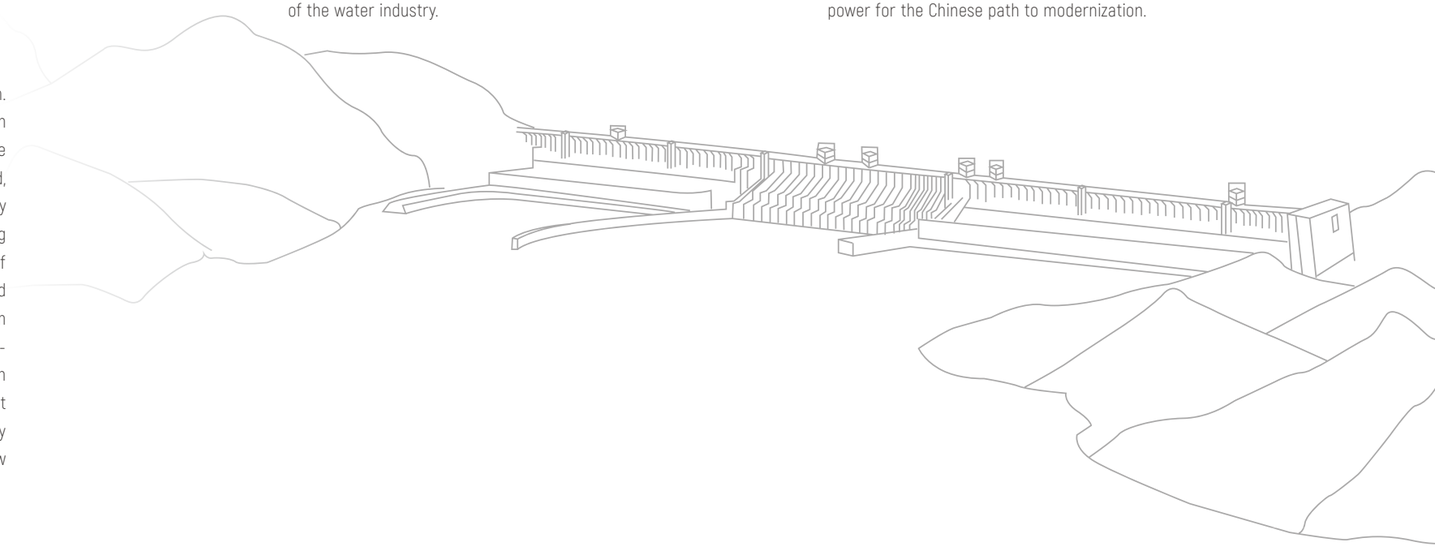
The year 2022 was extremely special, important and extraordinary for CTG. In the face of extreme climate, complicated international environment and other challenges, CTG firmly assumed the responsibility of ensuring energy and power supply, worked to ensure the security of water resources, water environment and water ecosystem in the Yangtze River basin, and put forth effort to promote the steady and sustained progress of the two-tracked development approach where clean energy development and environmental protection of the Yangtze River go hand in hand. As a result, CTG kept overall stability in production and operation, consolidated the foundation of high-quality development, and highlighted the underlying ecological connotation of the Chinese path to modernization.

In 2022, CTG continued to make efforts to build a new energy system. We always maintained our strategic focus on developing clean energy, and vigorously constructed a development pattern where hydropower is the base, wind and solar power are jointly developed, progress is made both onshore and offshore, and multiple energy sources complement each other, so as to serve the carbon peaking and carbon neutrality goals. Besides, we completed the building of the world's largest clean energy corridor, and operated and managed installed hydropower capacity of nearly 71.7 GW on the mainstream of the Yangtze River, thus further consolidating "China's world-leading position in hydropower and CTG's nation-leading position in hydropower". We also focused on the large-scale development of onshore bases and offshore wind power clusters, and actively promoted the differentiated and high-quality development of new energy business, with the installed capacity of renewables exceeding 30 GW, and offshore installed capacity of wind power ranking first in China. Meanwhile, we steadily implemented the strategy of "going global" with the Karot Hydropower Plant (HPP) in Pakistan being put into operation, and our clean energy businesses covered more than 40 countries and regions, promoting the construction of the green "Belt and Road". By the end of 2022, the installed capacity of CTG's renewable energy had exceeded 120 GW, enabling our power generation of renewable energy to rank first worldwide.

In 2022, CTG actively promoted the well-coordinated environmental conservation of the Yangtze River basin toward a systematical, sustainable and high-quality stage. We continuously optimized the layout of well-coordinated environmental conservation of the Yangtze River basin, vigorously promoted the construction of relevant projects, and successfully created the "Smart Urban Water Manager" in Lu'an, a systematic water governance benchmark across the river basin. The pipeline network construction gradually expanded from the first batch of pilot cities to all along the Yangtze River, and achieved the overall coordination and systematic water governance. In addition, we built new-concept benchmarking sewage treatment plants in Yixing (Jiangsu Province) and Fenghuangqiao (Lu'an City). Besides, we independently developed and promoted the application of China's first smart water regulation system with full coverage of water affairs and businesses, full monitoring of data, and full remote control of operation, leading the digital and intelligent transformation of the water industry.

In 2022, CTG unswervingly promoted biodiversity conservation. We insisted on conserving terrestrial and aquatic biodiversity in the Yangtze River basin, and implemented joint ecological regulation test of the cascade reservoir system on the mainstream of the Yangtze River to continuously improve the full-cycle biodiversity protection system. CTG's voluntary commitments on biodiversity endeavors and conservation of the Yangtze River was officially publicized on the official platform of the *Convention on Biological Diversity* of the United Nations, marking CTG China's first centrally administered state-owned enterprise (SOE) to make voluntary commitments, and showcasing its willingness of shouldering the responsibility of jointly building a clean and beautiful world.

The journey ahead may be long and arduous, but perseverance will take one to the destination. CTG will actively propel the coordinated development featuring a two-tracked approach for advancing clean energy and ecological conservation of the Yangtze River, work to achieve greener power generation, clearer water, and greater biodiversity, and contribute more to the construction of a beautiful China where man and nature co-exist in harmony, so as to usher in a new chapter in the coordinated development of clean energy and environmental protection of the Yangtze River. Focusing on the clean energy, CTG will fully implement the new energy security strategy, consolidate its strengths in hydropower, and develop wind and solar power. We also will expand the installed capacity, and strengthen the energy supply, with a view to providing safer and more reliable green power for the Chinese path to modernization.



About CTG

CTG is a solely SOE headquartered in Wuhan City, Hubei Province. Founded on September 27, 1993, it was formerly known as China Three Gorges Project Corporation, renamed "China Three Gorges Corporation" on September 27, 2009, and then restructured on December 28, 2017.

After nearly 30 years of continuous, rapid and high-quality development, CTG has developed into the largest hydropower enterprise in the world and a leading clean energy provider in China. As of the end of 2022, the main business of CTG had expanded to engineering construction and consulting, ecological protection investment and operation, power generation and operation, international energy investment and contracting, assets management and base service, capital operation and financial service, renewable energy development and operation management, cascade hydropower dispatching and comprehensive management, and so on.

At the new development stage, CTG strives to implement the new development philosophy accurately and comprehensively, build the new development paradigm, promote the high-quality development, and accelerate the implementation of the two-tracked approach for advancing clean energy and ecological conservation of the Yangtze River. During the 14th Five-Year Plan period (2021-2025), CTG will, to a large extent, build itself into a world-class clean energy group and a leading eco-environmental protection enterprise in China, aiming for achieving the carbon peaking and carbon neutrality goals and making greater contribution to the comprehensive green transformation of economic and social development.

- CTG is in overall charge of the construction and operation of the Three Gorges Project
- CTG is also responsible for the development, construction and operation of the four world-class mega cascade hydropower plants, i.e., Xiluodu, Xiangjiaba, Wudongde and Baihetan, in the lower reaches of the Jinsha River (the upper reaches of the Yangtze River).
- Own five of the world's 12 largest hydropower plants in terms of installed capacity.
- Over two-thirds of the world's hydro-turbine generating units with an installed capacity greater than 700 MW are run by CTG.
- Based on the large-scale development of renewable energy bases onshore and offshore, CTG aims for a leapfrog development of renewables, promotes the construction of a new power system dominated by renewables, and builds a more diversified green energy system.
- CTG follows the China-proposed Belt and Road Initiative, accelerates the implementation of the "Going Global" policy, and strives towards a new and improved approach to the overseas growth of China's hydropower industry. Overseas business operations have become an important growth engine for CTG's sustainable development.
- Well-coordinated environmental conservation of the Yangtze River basin is a top priority for CTG. To this end, we have fully leveraged our role as a pivotal and leading player to promote the green transformation of economic and social development in the 11 provincial-level administrative divisions in the Yangtze River Economic Belt.

2022 in Numbers

Well-coordinated environmental conservation of the Yangtze River — By the end of 2022

Estimated total investment (RMB billion)	>210
Sewage treatment plants (stations)	716
Designed sewage treatment capacity (tons/day)	5,120,000
Designed pipeline network length (km)	28,000
Actual sewage treatment capacity (tons/day)	4,260,000
Actual pipeline network length (km)	18,000

In 2022

CTG invested RMB **29.6** billion in total for the well-coordinated environmental conservation of the Yangtze River,

including RMB **24.58** billion for PPP and other eco-environmental protection projects,

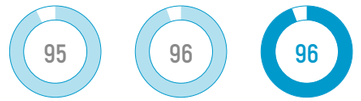
and RMB **5.02** billion for investment and merger projects.

The total investment for supporting environmental protection of construction projects (including conservation of water and soil) amounted to

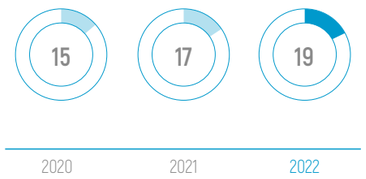
RMB **2.018** billion.

Six cascade reservoirs on the mainstream of the Yangtze River replenished **32.46** billion m^3 for the downstream in the dry season.

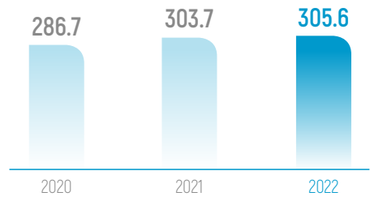
Proportion of renewables in CTG's total installed capacity worldwide (%)



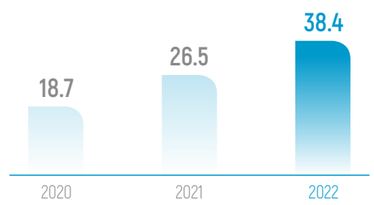
CTG's share in China's total installed hydropower capacity (%)



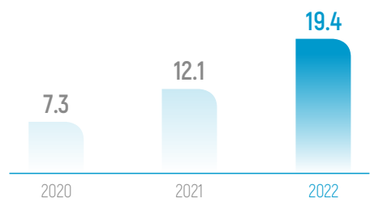
Total hydropower generated by CTG worldwide (TWh)



Total wind power generated by CTG worldwide (TWh)



Total photovoltaic power generated by CTG worldwide (TWh)



Replenishment for the downstream in the dry season by the Three Gorges Reservoir (billion m^3)

In 2022

4.06 billion m^3 of water was replenished for saline tide regulation.

The special water replenishment of **1.51** billion m^3 was used for the joint effort of resisting drought and ensuring water supply by the reservoir groups in the Yangtze River basin.

The joint ecological regulation of cascade reservoirs in the Yangtze River basin promoted the four major Chinese carps to spawn **8.9** billion eggs (according to monitoring data at the Yidu section).

Number of Chinese sturgeons released into the Yangtze River

2020	10,000 (Second filial generation)
2021	10,000 (Echelons of all ages)
2022	300,000 (Echelons of all ages)

01

Management of Ecological Environment

Building of CTG headquarters

CTG actively explores effective ways to promote harmonious co-existence between man and nature through the two-tracked strategy. It establishes a sound ecological environment management system, and achieves the full-industry, full-basin, and full-process management of eco-environmental protection in terms of organizational structure, management system, and process management.

Concept of Eco-environmental protection

In accordance with the medium- and long-term development plan for the economy, national major strategies, national industry policies, and the development plan and market demand of energy and power industries, CTG provides high-quality and clean energy for society, and plays a pivotal and leading role in well-coordinated environmental conservation of the Yangtze River. It has gradually built itself into a world-class multi-national clean energy group with international competitiveness, and promoted the achievement of the integrated development model featuring a two-tracked approach for advancing clean energy and ecological conservation of the Yangtze River.

Our Mission

Harmonizing development with conservation for greater public wellbeing.

Our Vision

Striving for clean energy and Yangtze River conservation and building a world-class enterprise.

Our Values

Innovation-driven development for a carbon-neutral and win-win future.

Our Motto

Empowering a greener world.

Management Guideline

Upholding green development and promoting ecological progress

During the full process of clean energy investment, construction and operation, CTG prioritizes resource conservation and eco-environmental protection, establishes a foundation for harmonious coexistence between man and nature through green development, and works closely with suppliers to ensure their equal attention and common commitment for promoting ecological progress.

CTG presents the sustainable development concept to the world

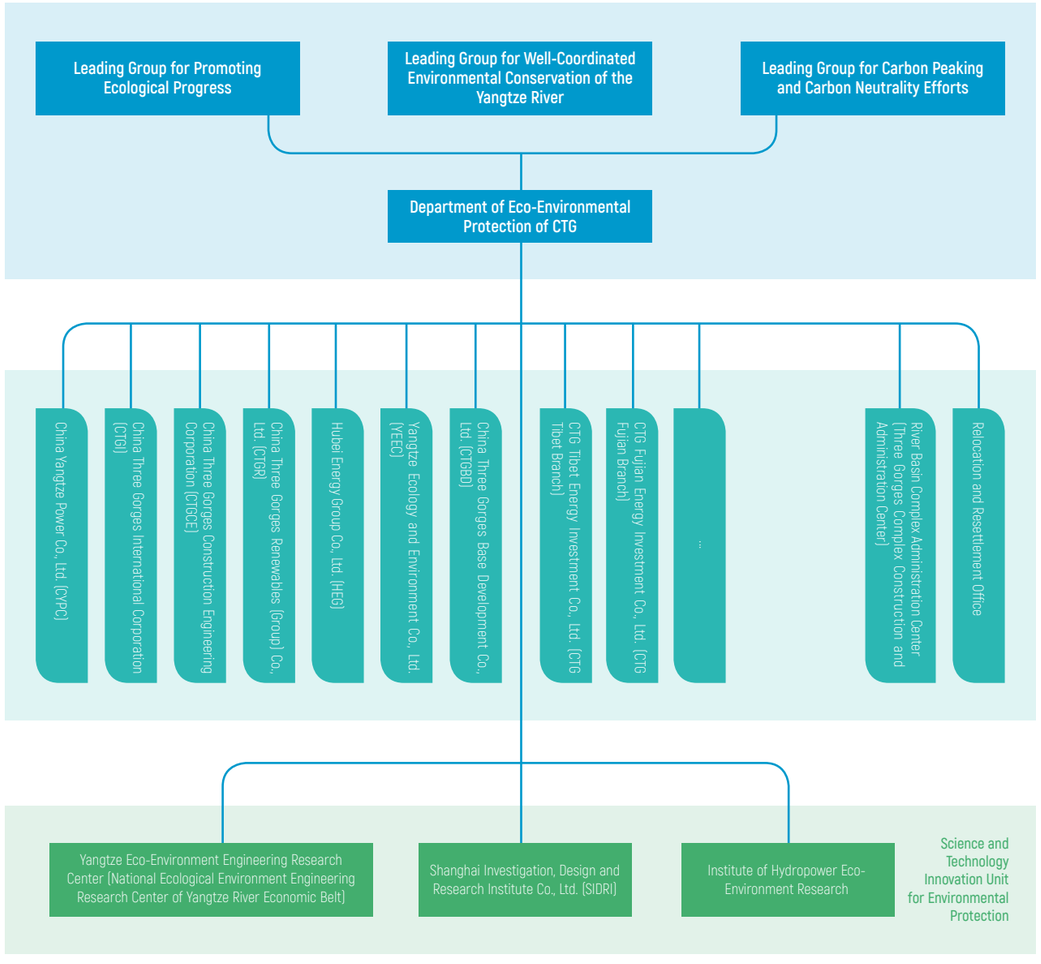
In November 2022, CTG declared its *Voluntary Commitments on Biodiversity Endeavors and Conservation of the Yangtze River* (hereinafter referred to as "voluntary commitments") to the Secretariat of the Convention on Biological Diversity (SCBD), and publicized the voluntary commitments on the official platform of SCBD, becoming China's first centrally administered state-owned enterprise (SOE) to make such voluntary commitments. Besides, CTG globally showcased and disseminated its sustainable development concept, and made its commitments to the goals and actions in the biodiversity conservation and the environmental conservation of the Yangtze River during the 14th Five-Year Plan period. These moves aimed to convey and reflect CTG's long-term and spontaneous efforts in biodiversity conservation, serve the ecological protection of the Yangtze River Economic Belt in the new era, and promote the sustainable and sound development of the Yangtze River, a mother river of the Chinese nation. Meanwhile, these moves drove more shareholders globally to contribute to a more sustainable future for Earth.

CTG's Voluntary Commitments on Biodiversity Endeavors and Conservation of the Yangtze River

Organizational Structure

CTG established the Leading Group for Promoting Ecological Progress, Leading Group for Well-Coordinated Environmental Conservation of the Yangtze River, and Leading Group for Carbon Peaking and Carbon Neutrality Efforts. CTG improves its organizational system for eco-environmental management, and exercises a management system, in which functional departments for eco-environmental protection are responsible for centralized management, and corporate subsidiaries are perform their division of duties. The headquarters and affiliated companies of CTG are carrying out hierarchical management according to their different authorities, realizing whole-process environmental management in the whole basin covering all businesses.

Organizational System for CTG Environmental Protection and Management



Management System

CTG has continued improving its environmental management system, which coordinates "QEOHS" system (Quality, Environment, Occupational Health & Safety), environmental management mechanism, comprehensive risk management, internal control and environmental emergency management, so as to manage environmental protection throughout the full life cycle of all its business activities.

Environmental Management System

CTG has established a sound environmental management system, and constantly improved and refined its management system and working process through uninterrupted inspections and timely rectification to realize dynamic improvement in environmental protection. In 2022, CTG's environmental management system passed the 2021-22 internal and external audits, and CTG was awarded the GB/T 24001–2016/ISO 14001–2015 Environmental Management System certificate.

Regulations on Environmental Management

The eco-environmental protection management system of CTG covers environmental management in the early stages and construction period of projects, acceptance management of eco-environmental protection facilities, eco-environmental protection management in the operation of river basin complex and power generation, eco-environmental protection research, monitoring and data collection, and oversight management. CTG has formulated a host of management systems of eco-environmental protection, including 1 first-level system, 4 secondary systems, 9 tertiary systems, and 1 guideline, which have facilitated its departments and units to establish their corresponding management systems of eco-environmental protection.

Environmental Risk Management

CTG carried out identification and analysis of environmental risk factors on a regular basis from multiple perspectives, as well as energy resource management and pollutant discharge management. CTG singled out key environmental risk factors and formulated risk management strategies in accordance with the enforcement of environmental protection laws and regulations, pollutant volumes and impacts, as well as energy resource consumption and conservation. In 2022, no major environmental pollution incidents have occurred within CTG, and environmental risks are under control.

Emergency Response Management System

CTG has made solid progress in modernizing the emergency response management system and capacity, formed a "regular emergency response mechanism", and coordinated to promote an emergency mechanism where each department and unit performs its own responsibilities and collaborates efficiently, with a view to attempting to build a "smart emergency management system". Besides, CTG has organized all units to prepare comprehensive emergency plans, special emergency plans, and on-site disposal plans, and actively carried out targeted emergency trainings and emergency drills, so as to continually improve the prevention and emergency response capabilities to major environmental risks.

Emergency drill for sulfur hexafluoride leakage of Hubei Energy Group Loushui Hydropower Co., Ltd.

Emergency drill for waste oil leakage of Hubei Energy Group Ezhou Power Plant

Emergency drill for water and land transportation emergencies at Three Gorges Hydropower Complex

Emergency drill for chemical and hazardous waste leakage of Yangtze Ecology and Environment Co., Ltd.

Process Management

CTG has established an environmental management process through full life cycle, covering aspects such as setting of environmental objectives, creation of sound environmental management systems, implementation of environmental protection measures and continuous progress in environmental performance, in order to achieve continuous improvements in environmental management.

Planning

Following the strategic arrangements of China's 14th Five-Year Plan, CTG has made solid progress in carbon peaking, and prepared the *Action Plan for Carbon Peaking of China Three Gorges Corporation*. In accordance with the *Business Plan for Eco-environmental Protection under the 14th Five-Year Plan* and the *Special Fund Plan for Eco-environmental Protection of Yangtze River hydropower under the 14th Five-Year Plan*, CTG developed the eco-environmental plan for 2022 and carried out dynamic tracking and management.

Supervision and Inspection

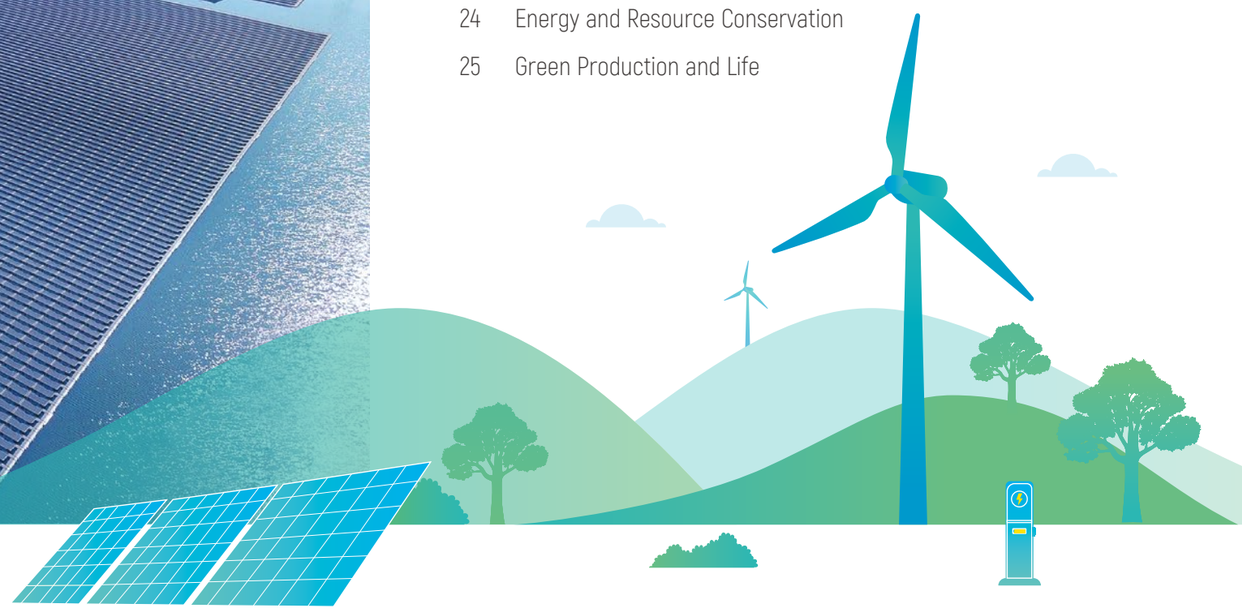
CTG established the *Management Measures for Supervision on Ecological Environment Protection*, according to which it carried out whole-process supervision and inspection of the ecological environment protection work during the production and construction projects under its administration. Through the combination of administrative supervision and technical supervision, CTG has formed a full coverage ecological environment supervision and management system. It actively promotes the construction of external supervision channels, accepted oversight and inspections by environmental protection authorities at various levels, and set up a platform for public feedback regarding environmental protection on our official website, placing our work under public scrutiny.

02

Actions for Addressing Climate Change

Huainan floating photovoltaic project of CTG (in Anhui)

"Striving to peak carbon emissions by 2030 and achieve carbon neutrality by 2060" (hereinafter referred to as "carbon peaking and carbon neutrality goals") is China's solemn commitment to building a community with a shared future for mankind. CTG, targeting at the above goals, continuously enhances its leading position of hydropower, and fully promotes the large-scale and high-quality development of renewable energy. In addition, it actively promotes the substitution, transformation and upgrading of fossil energy, and energetically cultivates new businesses and new business forms to support green transformation and development. Moreover, it further advances fine management of energy conservation, strictly controls energy consumption intensity, and comprehensively increases the efficiency of energy and resources. All these showcase to the world the firm determination of CTG to address climate change in an active manner.



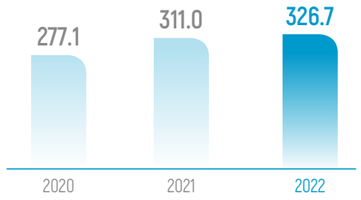
Action Plan for Carbon Peaking

Focusing on optimization of industrial structure and layout, green- and low-carbon-oriented transition of energy, and other key tasks, CTG actively improves industrial structure and business layout, and continuously enhances the competitiveness, creativity, control, and influence of green and low-carbon development. It also gives full play to the advantages of clean energy as its core business, strives to expand the effective supply of clean energy, and helps to promote the green and low carbon energy transition, so as to actively yet prudently promote carbon peaking efforts.

Green and Low Carbon Energy Development

As the world's largest enterprise for hydropower development and operation, and a leading clean energy group in China, CTG accelerates efforts to build a new energy system, unceasingly explores more development paths for green energy, and seeks green driving forces in lucid waters and lush mountains to promote high-quality social development.

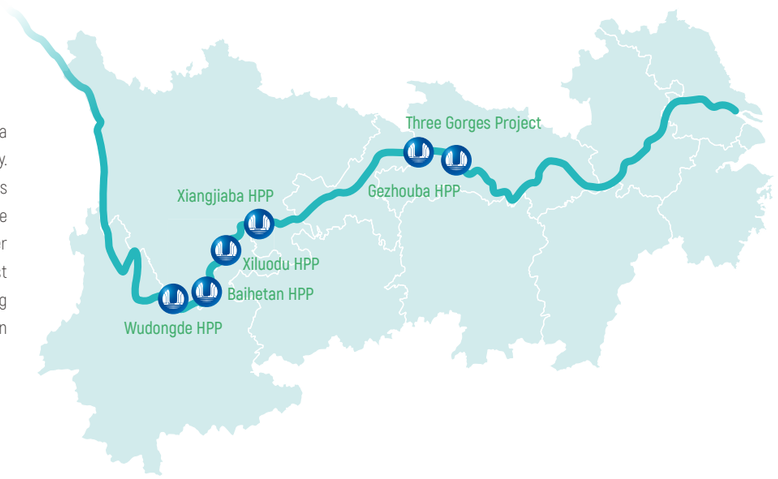
Total amount of clean electricity generated by CTG in China (TWh)



	Equivalent to saving standard coal (tons)	Equivalent to reducing in CO_2 emissions (tons)
2022	98,510,000	262,030,000
2021	94,820,000	258,750,000
2020	84,900,000	232,210,000

Focusing on hydropower development

Hydropower is globally recognized as a clean, high-quality, flexible renewable energy. Focusing on hydropower development, CTG has successively put into operation of Wudongde Hydropower Project and Baihetan Hydropower Project, and completed the world's largest clean energy corridor, marking a new starting point of the Chinese path to modernization where man and nature coexist in harmony.



By the end of 2022,

CTG had put into operation all generating units of 6 hydropower plants on the mainstream of the Yangtze River, with a total installed capacity of

71.695 GW.

CTG had achieved a total hydropower installed capacity of **88.164** GW overseas, while that in China had totaled

78.2517 GW.

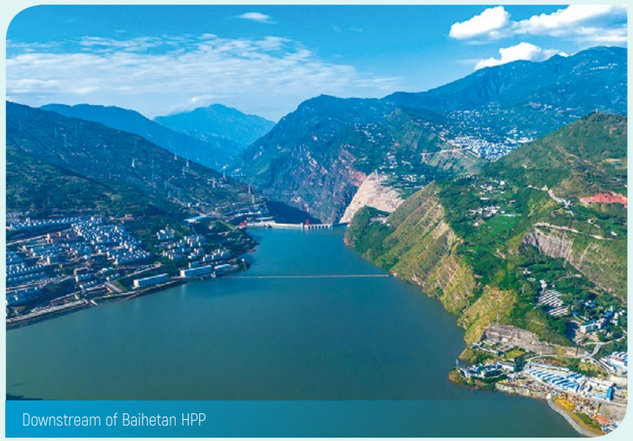
In 2022,

The flood control storage capacity of 6 cascade reservoirs on the mainstream of the Yangtze River reached

37.6 billion m^3.

Feature All generating units of Baihetan Hydropower Plant are put into operation, marking completion of the world's largest clean energy corridor

On December 20, 2022, all generating units of Baihetan HPP, which boasts the highest technical difficulty, largest single-unit capacity, and second largest installed capacity in the world, were put into operation, marking completion of the world's largest clean energy corridor. The hydropower plant connects with other 5 cascade hydropower plants (Wudongde, Xiluodu, Xiangjiaba, Three Gorges Project and Gezhouba) developed and built by CTG in a string, thus forming the world's largest clean energy corridor spanning 1,800 km. There are 110 hydropower generating units installed in the 6 cascade hydropower plants, with a total installed capacity of 71.695 GW and an annual generation capacity of nearly 300 TWh.


Downstream of Baihetan HPP

Annual generation capacity of nearly

300 TWh.

Scan to view the documentary *Dance with the River*

Expanding renewable energy business

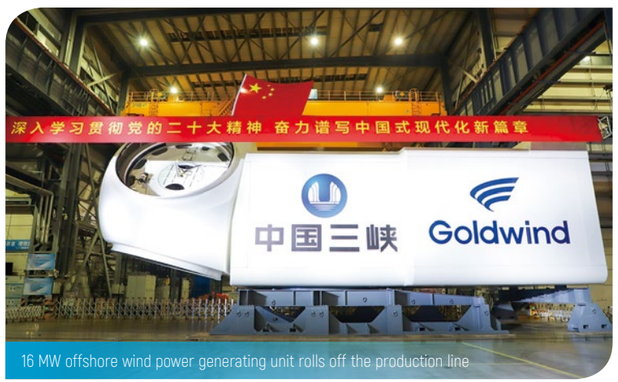
Upholding the concept of "jointly developing wind and solar power, and making progress both on onshore and offshore", CTG focuses on large-scale development of onshore renewable energy bases and offshore wind power clusters, so as to make its renewable energy business grow stronger.

Offshore wind power

CTG focuses on the large-scale development of offshore wind power clusters, with an installed capacity reaching 4.58 GW, ranking first in China.

The offshore wind power generating unit with the world's largest single-unit capacity of 16 MW rolls off the production line

On November 23, 2022, the 16 MW offshore wind power generating unit which was jointly developed by CTG and Goldwind Science & Technology Co., Ltd. rolled off the production line at CTG Fujian International Industrial Park of Offshore Wind Power. This unit is currently a wind power generating unit with the largest single-unit capacity, the largest impeller diameter, and the lightest weight per megawatt around the world. A single unit is able to generate clean electricity of over 66 GWh annually, which can meet the daily electricity needs of 36,000 households of three members for one year, therefore creating the latest benchmark for developing offshore wind power equipment globally.



16 MW offshore wind power generating unit rolls off the production line

A single unit is able to generate clean electricity of over **66** GWh annually,

which can meet the daily electricity needs of **36,000** households of three members for one year.

Onshore wind power

Focusing on UHV transmission facilities and large-scale base projects in central, eastern and southern China, CTG optimizes its strategic layout continuously. It places onshore wind power projects in 28 provinces and autonomous regions, including Inner Mongolia, Xinjiang, and Gansu, with an installed capacity reaching 11.42 GW.

The wind farm with the world's highest altitude provides clean electricity for central Tibet

On December 29, 2022, the wind farm with the world's highest altitude – Zhegu Wind Farm in Cuomei County, which was invested and constructed by CTG Tibet Energy Investment Co., Ltd., had been fully connected to the grid for power generation for one whole year, generating 75 GWh of electricity annually, and providing green energy for the economy and society of central Tibet.


Zhegu Wind Farm in Cuomei County

Photovoltaic power generation

CTG actively diversifies photovoltaic development, promotes large-scale centralized photovoltaic power generation in an orderly way, explores business development models such as "PV+", and forms a photovoltaic power development pattern from pilot cities to the whole country. The installed capacity of photovoltaic projects of CTG that had been put into operation reached 13.21 GW.

The largest onshore centralized photovoltaic project with an altitude over 4,000 m

Yari 500 MW photovoltaic project in Daofu County, Ganzi Tibetan Autonomous Prefecture is the largest centralized photovoltaic project of CTG in Sichuan Province. The planned installed capacity of the project is 500 MW, and it is the largest onshore centralized photovoltaic project under construction by CTG at an altitude over 4,000 m. Upon completion, the project can provide an average of 910 GWh of clean electricity for the power grid every year, which will effectively improve the local energy structure, and provide new paths for achieving rural revitalization and China's carbon peaking and carbon neutrality goals.

The project can provide an average of **910** GWh of clean electricity for the power grid every year.

Developing pumped storage business

CTG actively develops the pumped storage business, and forms a sustainable development pattern that features a rolling project development pattern comprising projects in the pipeline, projects approved, projects under construction and projects to be operated. This helps to build a new power system with renewable energy as the mainstay and a clean, low-carbon, safe and efficient energy system.

Changlongshan Pumped Storage Power Station, the largest of its kind in eastern China, is put into full operation

On June 30, 2022, all generating units of Changlongshan Pumped Storage Power Station were put into operation. Installed with six 350 MW pumped storage generating units, the station has a total installed capacity of 2.1 GW and a peak load capacity of 4.2 GW. As the largest pumped storage power station in terms of installed capacity in eastern China, it can generate an average of 2.43 TWh of additional electricity annually during peak hours, equivalent to installing a huge "power bank" and "regulator" on the power grid of eastern China. This intuitively showcases the practical achievements of CTG to create lucid waters and lush mountains.

It can generate an average of
2.43 TWh of additional electricity annually during peak hours.


Upper storage reservoir of Changlongshan Pumped Storage Power Station


Main power house of Changlongshan Pumped Storage Power Station

Global energy business presence

With the important vision of building itself into a world-class clean energy group, CTG steadily expands international businesses, constantly explores and promotes the construction of a green "Belt and Road", and extensively participates in global cooperation on clean energy, with a view of becoming an active practitioner, important promoter, and outstanding contributor in terms of building a clean and beautiful world.

Karot HPP (Pakistan) is fully put into commercial operation

On June 29, 2022, Karot HPP (Pakistan), the first hydropower project of China-Pakistan Economic Corridor invested and developed by CTG, was fully put into commercial operation. With a total installed capacity of 720 MW, the project has an average annual power generation of about 3.2 TWh after being fully put into operation, which helps to achieve the global goal of "carbon neutrality", in addition to promoting energy construction and economic and social development in Pakistan.

COD Ceremony of Karot HPP (Pakistan)

With an average annual power generation of about
3.2 TWh,

Karot HPP will provide stable, low-cost, and clean energy for approximately
5 million people in Pakistan.

Monthly power generation of Meerwind Offshore Wind Farm hits a record high

In February 2022, the power generation of Meerwind Offshore Wind Farm in Germany of China Three Gorges (Europe) S.A. reached 160 GWh, setting a new monthly record since its operation. Located in the German Bight in the North Sea, the wind farm has a total installed capacity of 288 MW, with the ability of providing approximately 1.2 TWh of green electricity annually for the local area, meeting the annual electricity need of approximately 360,000 households. It is another vivid miniature of CTG's determination and achievement to help China and Europe work together to ensure global energy security and promote sustainable development.

With a total installed capacity of
288 MW,
It is able to provide approximately
1.2 TWh of green electricity annually for the local area.


Meerwind Offshore Wind Farm in Germany

Energy and Resource Conservation

CTG upholds a concept of using resources in an efficient, intensive, and recycled manner, constantly optimizes lean production, and innovates energy-saving technologies to maximize the resource use efficiency.

Increasing power generation through high efficient water utilization

CTG actively gives full play to the strength of large-scale cascade hydropower plants, and deeply promotes the joint optimization and dispatching of cascade hydropower plants in the Yangtze River basin. Besides, it impounds water from autumn floods for energy storage to effectively utilize water resources while ensuring flood control, and achieves power generation increase through high efficient water utilization.

Feature Science-based joint dispatching of cascade reservoirs to efficiently utilize water resources

In 2022, the world's largest clean energy corridor was completed, enabling the intelligent dispatching system of CTG's Three Gorges Complex Cascade Dispatch & Communication Center to play an important role in flood control and disaster reduction along the Yangtze River and comprehensive utilization of water resources. A new pattern of joint dispatching of 6 cascade reservoirs was formed. During the ebb period in 2022, a total of 32.46 billion m^3 of water was replenished by the 6 cascaded reservoirs on the mainstream of the Yangtze River, of which 21.78 billion m^3 of water was replenished by the Three Gorges Reservoir.

By the end of 2022, CTG, relying on the intelligent dispatching system, had cumulatively increased power generation of 8.6 TWh through high efficient water utilization in the section from lower reaches of the Jinsha River to Three Gorges cascade hydropower plant (excluding Wudongde and Baihetan HPPs), with the hydropower utilization rate increased by 4.77%.

In the face of the historically lowest water inflow of the Yangtze River during the peak load in 2022 summer, the Three Gorges Reservoir takes active actions for drought resistance and water replenishment, as well as saline tide regulation.

Creating an integrated energy manager

CTG continues to strengthen the supply of clean energy, and innovatively proposes new energy service models such as Urban Integrated Energy Manager. With the goal of driving zero-carbon urban development with integrated smart energy, CTG promotes the construction of green buildings, low-carbon communities and zero-carbon societies, and helps to build a green, low-carbon and circular industrial system by providing services such as user-side multi-energy complementarity, combined cooling, heating and power, and smart energy utilization for mines, hospitals, schools and parks.

Promoting energy-saving renovation and application

CTG actively explores the application of new technologies and new devices, and optimizes energy-saving process, so as to achieve continuous improvement of energy efficiency. All plants in the section from the lower reaches of the Jinsha River to Three Gorges cascade hydropower plants keep improving lighting energy-saving renovation, Ezhou Power Generation Co., Ltd. vigorously carries out energy-saving measures, and a reclaimed water reuse system is adopted in the living camp of the construction area of Wudongde HPP.

Green Production and Life

CTG is committed to promoting green and low-carbon energy transformation and serving China's carbon peaking and carbon neutrality goals with a series of measures such as enhancing technological transformation, applying new technologies, strengthening carbon asset management, and carrying out carbon emission and green electricity trading.

In 2022,

CTG sold **9,378** parity green power certificates and **3.59** million international green power certificates.

CTG traded green electricity of about **2** TWh.

CTG achieved **100%** green electricity in offices.

A total of **6,039** green power certificates were subscribed by the CTG headquarters and all secondary subsidiaries, equivalent to approximately **6.04** GWh of electricity.

Feature 100% green electricity supply for venues of the Beijing 2022 Winter Olympics, the first time in Olympic history

As an official partner that provided electricity for the Beijing 2022 Winter Olympics and Winter Paralympic Games, CTG actively participated in the green electricity transaction. Part of CTG power plants in northern Hebei achieved green electricity trading of 51 GWh to venues of the Beijing Winter Games, thus ensuring a 100% green electricity supply for the first time in Olympic history. At the same time, taking into account measures of carbon emission reduction and carbon offsetting, CTG applied to the United Nations Framework Convention on Climate Change (UNFCCC) to offset 200,000 tons of carbon dioxide generated due to the Games with the same reduced by the wind power project in Quanyangou, Diaobing Mountain, Liaoning Province according to the certified emission reduction (CER) of clean development mechanism. This move aimed to offset the greenhouse gas emissions generated by the Beijing 2022 Winter Olympics and Winter Paralympic Games, and to make the Beijing Winter Olympics the first truly carbon-neutral Olympic Games.

Luz del Sur S.A.A builds the first public fast charging pile for new energy vehicles in the southern region of Lima

In March 2023, the first public fast charging pile for new energy vehicles which was built by Luz del Sur S.A.A (a power transmission and distribution enterprise in Lima, Peru, controlled by China Yangtze Power Co., Ltd.) in the southern region of Lima was put into use. In addition, Luz del Sur S.A.A introduced 22 new energy vehicles produced by China's automobile companies in its daily operations. It planned to electrify 13% vehicles in its logistics service fleet by the end of 2023 and achieve full electrification of the fleet in the future. The measure is expected to reduce carbon dioxide emissions by about 350 tons per year, reflecting CTG's determination to decarbonize its operations and utilize new technologies to support clean energy development.

The first public fast charging pile for new energy vehicles built by Luz del Sur S.A.A.

03

Ecosystem Protection

Phoebe zhennan planted by General Secretary Xi Jinping in the Rare and Endemic Plant Scientific Research Demonstration Area at the 185 Platform of Yangtze River Rare Plant Research Institute during his visit to the Three Gorges Project on April 24, 2018

CTG continues to strengthen efforts to protect ecosystems. From the perspectives of ecosystem and basin as a whole, it insists on the principles of basin-wide overall planning, regional coordination, and systematic protection, so as to provide its solutions and strengths in promoting harmonious co-existence between man and nature.

Aquatic Ecology

Through systematic plans for protecting aquatic ecological habitats, CTG continues to carry out fish proliferation and release activities and expand multi-objective ecological regulation. It also constantly builds and operates fish passage facilities, and carries out long-term scientific researches, monitoring and evaluation on aquatic ecological protection. These actions aim for protecting biodiversity of aquatic organisms in the Yangtze River, and promoting restoration of the ecological environment in the Yangtze River basin.

By the end of 2022,

- We had conserved more than **110** kinds of rare and endemic fish in the Yangtze River, accounting for over **25%** of the total fish species in the whole river basin.
- We had cumulatively released more than **21** million rare fish including Chinese sturgeon.
- We had carried out **53** ecological regulation tests cumulatively in cascade reservoirs in the Yangtze River basin, among which the ecological regulation tests for natural propagation of drift spawning in the Three Gorges Reservoir had achieved remarkable results. During the regulation period over the years, the total spawning of four major Chinese carps had reached **23.6** billion at the Yidu section.

In 2022,

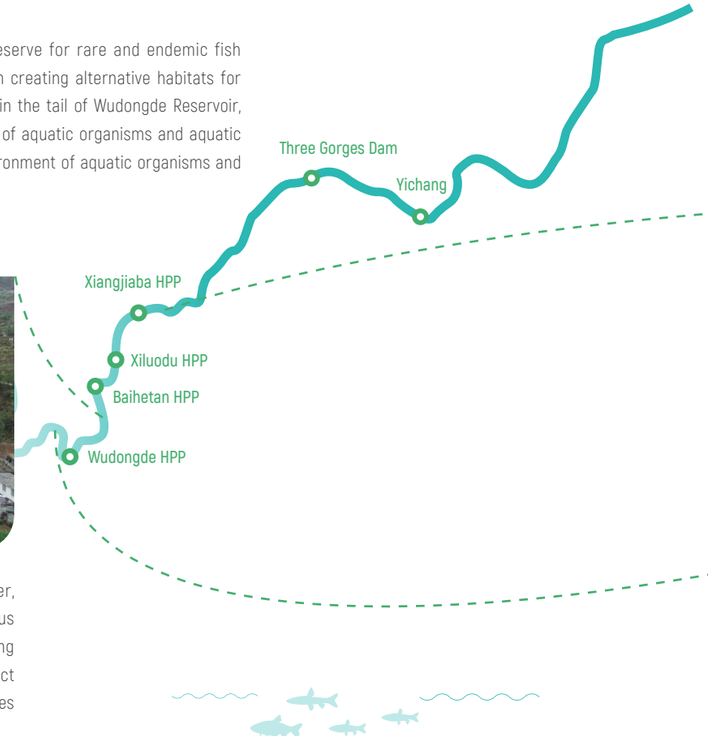
- More than **600,000** fertilized eggs were obtained by artificial breeding of Chinese sturgeon, and nearly **300,000** eggs were hatched.
- More than **2.2** million rare and endemic fish were released in the mainstream of the Yangtze River and the lower reaches of the Jinsha River, including over **300,000** Chinese sturgeons, **370,300** Yangtze sturgeons, **229,400** *Coreius guichenoti*, and **1,308,100** other rare and endemic fish.

Habitat protection

CTG funds and supports the construction of a national nature reserve for rare and endemic fish species in the upper reaches of the Yangtze River, and focuses on creating alternative habitats for fish in the Heishui River. It protects and restores habitats for fish in the tail of Wudongde Reservoir, and fully implements comprehensive strategies such as protection of aquatic organisms and aquatic ecological restoration, so as to continuously improve the living environment of aquatic organisms and protect their diversity.

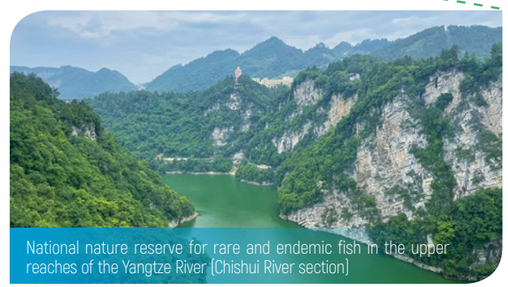
Ecological restoration project of habitats for fish in the Heishui River

The project spans 75 km of the mainstream of the Heishui River, involving Puge and Ningnan counties in Liangshan Yi Autonomous Prefecture. Upon completion, it will serve as an ecological testing ground for protecting habitats for fish, exerting the protective effect of Heishui River water habitats for endemic fish in the upper reaches of the Yangtze River.



Habitat protection project in the tail of Wudongde Reservoir

The project chooses two sites in the upstream of the confluence of the Jinsha River and the Yalong River in Panzhihua City for constructing artificial spawning grounds. It restores a habitat area of 57,700 m^2 in total, and gives full play to the protective role of water habitat in the tail of Wudongde Reservoir for endemic fish in the upper reaches of the Yangtze River.



National nature reserve for rare and endemic fish in the upper reaches of the Yangtze River (Chishui River section)

The nature reserve spans Yunan Province, Sichuan Province, Guizhou Province, and Chongqing Municipality, with a total length of 1,162.61 km and a total area of 33,174.21 ha. It protects many rare and endemic fish such as Yangtze sturgeon, *Leptobotia elongata*, *Coreius guichenoti*, *Myxocyprinus asiaticus*, *Rhinogobio ventralis*, *Procypris rabaudi*, *Megalobrama pellegrini*, and *Spinibarbus sinensis*.

Solving the problem of golden mussels and protecting aquatic habitats in Brazil

In response to the destruction of water quality, ecological balance and hydropower projects in major river basins in Brazil and the Americas caused by massive proliferation of golden mussels, CTG Brasil and Technical Center of the Bio Bureau Biotecnolgia inked a cooperative agreement to establish a scientific research team under the R&D project framework of Agência Nacional de Energia Elétrica (ANEEL) since 2017. The "Golden Mussel Treatment Project" was thus officially launched. Based on the gene drive technology that leads to changes in sexual characteristics, golden mussels with sterility are developed and released into natural populations after scientific verification. They can reproduce sterile offspring with natural populations, which can reduce the population size of golden mussels and further solve the problem of species invasion. This also effectively helps the protection of local biodiversity, receiving recognition and affirmation from the local government.

"Golden Mussel Treatment Project" in cooperation with Bio Bureau Biotecnolgia

Scan to view documentary on golden mussel treatment

Propagation and release

CTG builds and operates four breeding research bases for rare and endemic fish in the middle and upper reaches of the Yangtze River, and Chongqing Propagation and Release Station, which is a national nature reserve for rare fish in the upper reaches of the Yangtze River. The four bases are Yangtze River Rare Fish Conservation Center, Yichang Huangbai River Base, Xiluodu and Xiangjiaba Propagation and Release Station, Baihetan and Wudongde Propagation and Release Station. This is to say, CTG has fish breeding and rescue bases of more than 100,000 m^2. It also carries out biodiversity protection fully in light of the regional characteristics, and releases more than 20 million rare and endemic fish including Chinese sturgeon, effectively promoting natural population recovery.

By the end of 2022,

Chinese Sturgeon Research Institute had held more than **100** release activities,

with a total of nearly **6** million Chinese sturgeons released,

and more than **10** million of **20** rare and endemic fish species had been released to the Yangtze River.

Release of Chinese sturgeon

Ecological regulation

CTG has carried out multi-objective ecological regulation of cascade reservoirs from Three Gorges Reservoir to the reservoirs on the lower reaches of the Jinsha River for 12 consecutive years, creating suitable hydrologic conditions for fish reproduction. In 2022, a total of 17 ecological regulation tests were carried out, the highest compared with previous years, promoting spawning and breeding of fish in the mainstream of the Yangtze River, and effectively exerting the ecological functions of the cascade reservoir system.

According to statistics of monitoring data for ecological regulation tests in 2022,

the total spawning of fish eggs in the Yidu section of the Yangtze River reached **15.7** billion,

among which the total number of eggs spawned by the four major Chinese carps was about **8.9** billion, the highest over the years.

Operation of fish passage facilities

As an important environmental protection measure, fish passage facilities can mitigate the barrier impact of projects on breeding migration of fishes. By constructing and operating the fish collection and transportation system, CTG can solve the problem related to fish passing through high dams and large reservoirs, and effectively promote the aquatic ecological protection of Wudongde and Baihetan HPPs. To be specific, it constructs the Songxin Fish Passage on the Heishui River, which can meet the breeding migration need of endemic and important economic fish in the upper reaches of the Yangtze River, further promoting the continuous ecological improvement of the Yangtze River.

In 2022,

33,931 fish of **31** species were collected with the Wudongde fish collection and transportation system.

14,435 fish of **42** species were collected with the Baihetan fish collection and transportation system.

Terrestrial Ecology

CTG pays high attention to terrestrial ecological protection, and works to protect its diversity with a series of typical measures such as plant & animal protection and ecosystem restoration.

Plant protection

CTG has built three research bases for conservation of rare and endemic resource plants, namely, Yangtze River Rare Plant Research Institute, Jinsha River Xiangxi Rare Plant Garden, and Baihetan Rare Plant Garden. By force of the plant research laboratory of 4,500 m^2, the intelligent greenhouse of 15,000 m^2, and China's largest conservation base of rare and endemic plant germplasm resources that covers 2 million m^2 in the Yangtze River basin, CTG is able to effectively protect plant resources.

By the end of 2022,

the Yangtze River Rare Plant Research Institute had protected

29,800 rare and endemic plants of **1,380** species from **491** genera in **140** families,

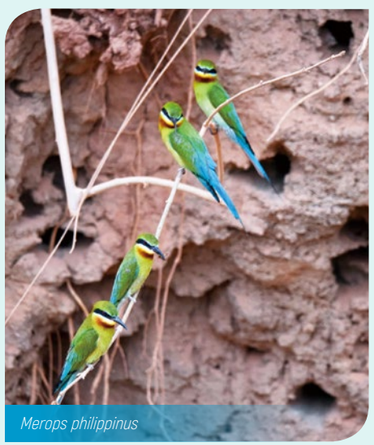
with the scale of plant resource protection reaching a new high.

Animal protection

CTG takes prevention, protection and comprehensive treatment measures before and after project construction and during project operation. It always pays attention to the impact on the survival and reproduction of surrounding animals to avoid threats to habitats of wild species, and actively participates in protecting rare species. These measures promote the harmonious co-existence between man and nature.

Feature Protection of *Merops philippinus*

CTG established a joint work team with the Research Center for Eco-Environmental Sciences of Chinese Academy of Sciences, Yunnan University and other organizations for the emergency protection project of *Merops philippinus* in the water storage areas of Baihetan HPP (in Qiaojia County of Zhaotong City and Dongchuan District of Kunming City). The project has prevented *Merops philippinus* from nesting near "dangerous areas" with measures such as manual repelling and slope covering with dense screens below reservoir inundation line (825 m in elevation); meanwhile, the project has also constructed and renovated nesting sites above 825 m in elevation to provide "new homes" for them. According to continuous tracking and monitoring, the water storage of Baihetan HPP does not affect the migration and reproduction of *Merops philippinus*, thanks to a series of protective measures. The clear-up and reconstruction measures for the cliff surface above the water storage elevation have made use of abandoned nesting area, increasing the number of nesting population. Besides, *Merops philippinus* have been adaptive to artificially constructed new nesting sites, which has attracted large populations, testifying to the remarkable protection effect of these sites.



Merops philippinus

Ecological restoration

CTG continues to strengthen ecological restoration. From the perspectives of ecosystem and basin as a whole, it improves the ecological environment of drawdown zones of reservoirs, and prevents and controls water and soil erosion and desertification, with a view to laying a solid ecological foundation for building a beautiful China.

Feature Chongqing Guangyang Island, a "Landscape Eye" in the Yangtze River

In order to fulfill its social responsibility of promoting the eco-environmental protection of the Yangtze River basin, CTG and Chongqing jointly carry out an ecological restoration project on Guangyang Island. Following the ecosystem logic, the project focuses on managing and protecting mountains, waters, forests, farmlands, lakes, grasslands and green belts, and makes coordinated efforts to restore and improve the ecosystems of mountains, waters, wetlands, and drawdown zones on both sides of the Yangtze River, so as to build a life community.

In 2022, the natural restoration area of the entire island reached 67%, and the vegetation coverage rate reached over 90%. Currently, the island is a habitat for over 600 species of plants and 500 species of animals. Chongqing Guangyang Island, the largest green island in the upper reaches of the Yangtze River, now becomes a veritable "Landscape Eye" along the Yangtze River.

Feature PV + sand control: CTG's way of combating desertification

On December 28, 2022, the pilot works of the renewable energy base in the Kubuqi Desert (central and northern part of Erdos) that is led by CTG and jointly built with Inner Mongolia Energy Group began construction. Guided by the carbon peaking and carbon neutrality goals, CTG has begun to transform the desert area into a renewable energy base. Since 2010, CTG has been engaged in sand control in the desert areas of Mongke Tengri and Mu Us, and built photovoltaic bases one after another based on the "PV + sand control" model, thus offering CTG's solution to desertification control in China.

PV "Front Runner" power plant in Golmud City, Qinghai Province

04

Environmental Pollution Control

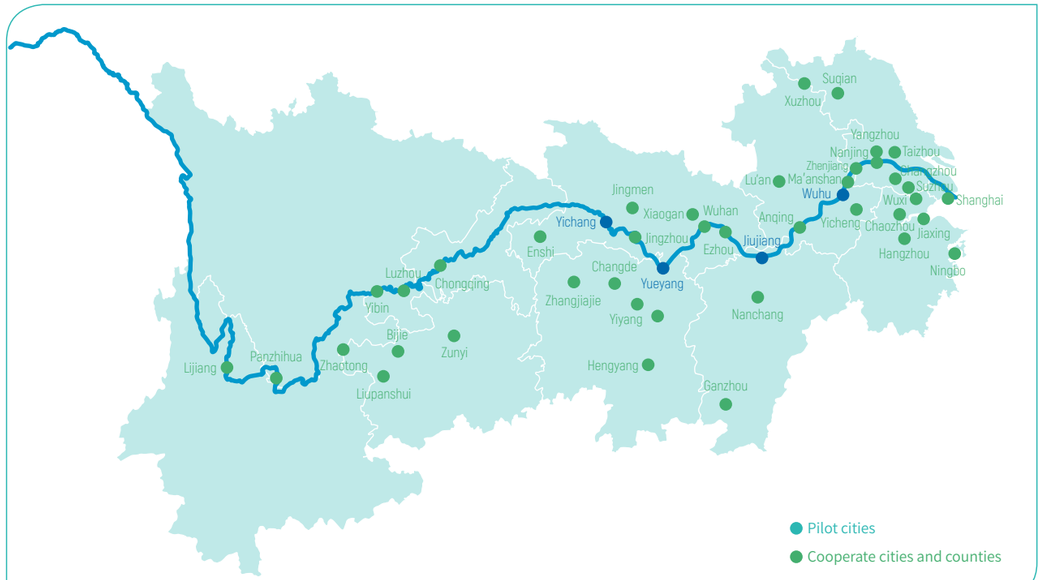
Yixing Concept Wastewater Resource Recovery Factory (in Jiangsu)

CTG adheres to the the "Three Simultaneities" environmental protection system, and works to ensure environmental pollution control with high standards during project construction and operation. It also explores a development model featuring well-coordinated environmental conservation of the Yangtze River basin integrated with clean energy business, and promotes the systematic treatment of water environment, water ecology, water resources, water safety and water culture. In addition, it incorporates the clean production philosophy into the whole process of operation and systematically promotes pollution control, with an aim to safeguard a clean ecological system and provide powerful support for the green development of the Yangtze River Economic Belt.

Sewage Treatment

By actively exploring new ways for integrating well-coordinated environmental conservation of the Yangtze River with clean energy business, and promoting the systematic treatment of water environment, water ecology, water resources, water safety and water culture, CTG has explored and introduced a "water manager" model with the pipeline network as the core. In 2022, its sewage treatment capacity increased by 1.47 million tons per day in total, along with 5,700 km of new pipelines, which has ensured consistently up-to-standard water quality. By innovating sewage treatment technologies and improving the sewage treatment facilities for project construction and operation, it has maximized water resource recycling and minimized sewage discharge, providing crucial support for the green development of the Yangtze River Economic Belt.

CTG participates in the well-coordinated environmental conservation of the Yangtze River basin



Acting as a good "urban water manager"

CTG has improved the top-level design of the "water manager" model, and established the governance framework, organizational structure, operation & maintenance system, and technical standard system for the "water manager" model. This has formed systematic solutions, helping to address the fundamental issues related to the water environment. It has demonstrated the exemplary role of the "water manager" model in Lu'an and achieved substantial results in promoting the model.

Feature **Advancing the demonstration role of the "water manager" model – The practice of promoting urban development through water management in Lu'an**

With the rapid urbanization and population growth of Lu'an City, the city's sewage treatment capacity has fallen behind its development, which significantly affects the residential environment. The pollution of inland rivers has affected the water quality and ecological system of the Pihe River, the mother river of Lu'an City, causing adverse effects on the downstream environment.

Since August 2019, CTG has been collaborating with Lu'an Municipal People's Government and implemented a systematic governance model featuring an integration of sewage treatment plants, sewage pipelines, and rivers (lakes). By adopting measures such as watershed planning, regional coordination, and comprehensive management of both wastewater and sludge, it has made significant achievements in the effective improvement of the overall water environment in Lu'an City.

To address issues such as the "failure of inter-connectivity and coordination among multiple sewage treatment plants", CTG proposed an approach that integrated urban and rural planning, water supply and drainage, and construction and management, which coordinated water-related work and helped to achieve cost reduction and efficiency improvement systematically. It has popularized the "water manager" model across the entire river basin, and realized the unified planning, construction, operation, management, and regulation of urban water-related facilities, such as water supply and drainage facilities, pipeline networks, flood control and drainage facilities, and river and lake facilities. Through overall coordination, science-based planning, precise investment, systematic management, and the establishment of a price adjustment mechanism linked to regulatory assets and water prices in collaboration with local authorities, it has gradually realized the market-based management of the urban water environment, addressed the fundamental issues related to the urban water environment, and achieved its long-term, stable, up-to-standard, and continual improvement, which empowers local green and low-carbon development. In the future, the "water manager" model will contribute to the fulfillment of goals of clearer lakes and rivers in cities, more beautiful wetland landscapes, a more rational water price mechanism, and a stronger sewage treatment capability.


Sudayan Wetland Park in Lu'an City


Fenghuangqiao Wastewater Treatment Plant

Improving the sewage treatment capability

With an aim to promote urban sewage treatment and improve quality and efficiency, CTG continues creating benchmarks for urban sewage treatment in pilot cities with the goal of achieving "full collection, full treatment, and full compliance". CTG focuses its investment on improving the pipeline network and remedying deficiencies. These efforts has continuously increased the drainage network density in the main urban areas of pilot cities. The sewage collection rate has improved, and the concentration of influent chemical oxygen demand (COD) in wastewater treatment plants has significantly increased, making greater progress in sewage treatment.

In 2022,

the cumulative sewage treatment capacity of CTG was increased by

1.47 million tons per day throughout the year,

and the length of the newly built pipelines reached

5,700 km.

By the end of 2022, the daily sewage treatment capacity had reached

360,000 tons in Jiujiang, Jiangxi Province.

390,000 tons in Yueyang, Hunan Province.

920,000 tons in Wuhu, Anhui Province.

320,000 tons in Yichang, Hubei Province.

Feature Future-oriented conceptual wastewater treatment plant in China

A remarkable wastewater treatment plant is located in Yixing, Jiangsu Province, the "Town of Environmental Protection in China". There, wastewater can be treated to a level suitable for direct drinking, biogas generated from wastewater treatment can be used for power generation, and biogas residue produced from the anaerobic digestion can be further processed through aerobic composting and then used directly as soil for planting. The wastewater treatment plant can collect and transform waste into valuable resources, allowing the resources to be recycled again and again for repeated use. As the country's first conceptual wastewater treatment plant, which is characterized by "sustainable water quality, self-sufficiency in energy, resource recycling, and environmental friendliness", it is jointly initiated by six academicians and experts, including Qu Jiuhui. Since 2021, CTG has actively participated in the plant operation through equity cooperation. By empowering the well-coordinated environmental conservation of the Yangtze River basin with technology, CTG is striving to seek more "green solutions" for the high-quality development of the Yangtze River Economic Belt.

Yixing Conceptual Wastewater Treatment Plant

Science education activity in the plant

Notable achievements in sewage treatment

In 2022, significant results have been achieved in water treatment models, including the integrated system of sewerage pipeline networks and wastewater treatment plants in Wuhu, integrated system of wastewater treatment plants, sewerage pipeline networks, and river network in Jiujiang, integrated system of wastewater treatment plants, sewerage pipeline networks, and lakes in Yueyang, and integrated management of water pipeline network and sewage pipeline network in Yichang, leading to a noticeable improvement in the sewage collection rate and urban water environment in pilot cities. Direct discharge of domestic sewage has largely been eliminated in the urban areas in Jiujiang City. Water quality of Shilihe River has significantly improved after river regulation. The network coverage gaps in built-up areas in Yueyang City have largely been eliminated. Water quality of Dongfeng Lake has gradually met the Grade IV standard, and quality of water in monitoring sections for surface water controlled by the state has consistently met the standard. Yichang City has effectively addressed the issue of ecological base flow shortage in the Bailin River basin, which enhanced the water environment capacity, and ensured the stable and up-to-standard water quality.

Wuhu Jiangdong Water Ecology Park

Yueyang Dongfeng Lake

Jiujiang Shilihe River

Yichang Bailin River

Air Pollution Control

CTG has formulated and strictly implemented measures for preventing and controlling air pollution. The main measures include installing water-spray systems in the project construction areas, sprinkling water on roads regularly to reduce dust, continuously improving and updating technologies and equipment for air pollution control, setting up windproof and dust suppression facilities, and strictly controlling and reducing air pollutants such as dust and smoke produced during construction. By implementing these measures, it has ensured stable compliance with air quality standards.

Installing windproof and dust suppression facilities to strictly control smoke and dust emissions

In order to further improve the dust suppression effectiveness of the windproof net, Hubei Energy Jingzhou Company installed a set of stationary, 360-degree rotatable dust suppression nozzles at regular intervals around the onshore coal stockpiles to ensure adequate coal moisture and reduce coal dust. It also set up a 25 m-high windproof net around the coal stockpile, and added three north-south windproof nets in the middle of the coal stockpile. The windproof and dust suppression nets were well combined with the spray systems. These measures have significantly reduced smoke and dust pollution, and promoted deep integration of environmental protection measures with project construction.

Spray systems in the onshore coal stockpile

Prevention and Control of Noise Pollution

CTG has strengthened whole-process management and control over the acoustic environment. The main measures include mounting soundproof barriers and setting up no horn and speed reduction signs in the project construction areas, and scheduling construction activities reasonably. In addition, it has effectively controlled system, construction, and traffic noise at the source, and minimized the impacts of noise on the surrounding areas.

Monitoring and prevention of noise pollution in the Chaglla Hydroelectric Plant project

In 2022, Chaglla Hydroelectric Plant, operated by CTG in Peru, entrusted a third-party institution to monitor noise indicators in the vicinity of the hydropower plant and along the 34.5 kV transmission lines on a quarterly basis, and to monitor noise indicators along the 220 kV transmission lines once every six months in accordance with the requirements of the Environmental Impact Assessment (EIA) report. The monitoring data consistently fall within the standard range.

Cleaning of Floating Debris

CTG removes floating debris in cascade reservoirs and near-dam areas. It explores intelligent and systematic methods to remove floating debris according to the geological and topographical characteristics of different areas to improve the efficiency of floating debris removal, which ensures the water quality in front of the dams while guaranteeing the safe operation of hydropower plants.

The world's largest floating debris removal vessel is put into operation

In 2022, the world's largest floating debris removal vessel, CTG Debris Removal No. 5, was put into use. This vessel adopts 11 technological innovations in collecting and transporting floating debris, with a daily cleaning capacity of 2,000 m^3. It is also equipped with specialized cleaning devices for debris collection, salvage, cutting, and dual-line transportation. The vessel has the largest main dimensions and the most powerful cleaning capacity globally, making it the main force for cleaning floating debris in front of the Three Gorges Dam.

CTG Debris Removal No. 5

Cascade reservoirs in the river basin realize unified management of floating debris removal

In 2022, CTG expanded its floating debris removal work to the reservoir areas of Wudongde HPP and Baihetan HPP, preliminarily fostering a pattern featuring unified management of floating debris removal in the cascade reservoirs in the river basin. CTG dispatched the vessels for over 470 trips for multiple missions, with over 1,900 personnel involved in the missions. As a result, a total of 2,255 tons of floating debris in front of the Three Gorges Dam was cleared and underwent pollution-free treatment. After the impoundment of Wudongde and Baihetan reservoirs, the amount of floating debris in front of the Xiangjiaba and Xiluodu dams has significantly decreased. In 2022, approximately 410 tons of floating debris in front of the Xiangjiaba Dam was cleared, approximately 190 tons in front of the Xiluodu Dam, approximately 3,199 tons in front of the Wudongde Dam, and approximately 9,365 tons in front of the Baihetan Dam. The standardized, recyclable, and pollution-free disposal of floating debris in front of the dams of cascade hydropower stations has provided a strong guarantee for the operation of the hydraulic complexes, power generation safety, and health of the water environment.

05

Scientific & Technological Innovation and Monitoring

Fujian International Industrial Park of Three Gorges Offshore Wind Power

"Technological achievements represent the power of a nation." Over the past 30 years, the Three Gorges Project has achieved a large number of technological innovation achievements with independent intellectual property rights. In the new development stage, CTG continues to make efforts in implementing the integrated development model featuring a two-tracked approach for advancing clean energy and ecological conservation of the Yangtze River. Throughout the planning, design, construction, and operation stages of all businesses, CTG has been coordinating efforts in making breakthroughs in some core technologies in key fields such as eco-environmental protection to promote the application of scientific and technological innovation achievements.

In order to promote clean energy development and protect the ecological environment of the Yangtze River, CTG has established an ecological and environmental monitoring system that covers all the river basins and affected areas in China where its major projects are located, which has provided important support for scientific assessments on the effectiveness of eco-environmental protection in the river basins and improvement of eco-environmental protection measures.

Scientific & Technological Innovation

CTG makes intensive efforts to promote its eco-environmental protection and management capability through innovation. CTG, which plays a leading role in the deep integration into the Yangtze River Economic Belt and the well-coordinated environmental conservation of the Yangtze River basin, has gradually developed the core competitiveness in water environment management, protection of rare animals and plants, the ability to restore river ecosystems through cascade reservoir operation, the ability for comprehensive protection of complex water areas including rivers, lakes, and reservoirs, as well as the development of a complete system for eco-environmental protection using clean energy and technological innovation, and integrated technical capabilities in this regard. Besides, the Corporation has already mastered relevant key technologies and embarked on a path of independent innovation in science and technology with distinct CTG characteristics.

Scientific & technological innovation platforms

CTG accelerates the building of an autonomous scientific & technological innovation platform to support and promote the high-quality development of three major businesses, i.e., hydropower, eco-environmental protection, and new energy, and empower the eco-environmental protection initiatives. It also continues deepening scientific research in eco-environmental protection, and collaborates with governments, enterprises, and universities to form an alliance to promote scientific and technological innovation.

Self-owned platforms

- Yangtze Eco-Environment Engineering Research Center focuses on providing services to support CTG in the well-coordinated environmental conservation of the Yangtze River basin and the development of clean energy business. With a focus on the "4+1" pollution control projects (urban sewage and waste treatment, chemical pollution control, treatment of widespread pollution from the overuse of fertilizers and pesticides, ship pollution control, and tailings pond pollution control), it undertakes research and development of innovative technologies for the eco-environmental protection and further develops and applies practical, forward-looking, and key generic technologies.
- CTG carries the responsibility of operating the Hubei Key Laboratory for Protection of Fish Resources in the Three Gorges Project (self-owned platform) and the Conservation Base of Chinese Sturgeon Species under the Ministry of Agriculture and Rural Affairs.
- CTG is currently applying for the establishment of the Hubei Key Laboratory for Rare Plant Resources in Three Gorges Reservoir area and the Research Center for Breeding and Ex Situ Conservation under the National Forestry and Grassland Administration.
- Shanghai Investigation, Design & Research Institute, by leveraging its expertise in environment planning & design, and water environment protection, has developed the ability to provide comprehensive solutions for eco-environmental protection.

Joint platforms

- In collaboration with the Environmental Engineering Assessment Center under the Ministry of Ecology and Environment, Beijing Normal University, and China Renewable Energy Engineering Institute, CTG launched the establishment of the Institute of Hydropower and Eco-environment Research.
- CTG established the National Joint Research Center for Eco-environment Protection and Restoration of the Yangtze River in collaboration with the Ministry of Ecology and Environment, cooperated with relevant ministries to tackle key scientific problems, and mobilized the public to participate in the eco-environmental protection and restoration along the Yangtze River.
- CTG established the Joint Research Center for the Strategy of Climate Change & Management Mechanism and Green & Low-carbon Transition in collaboration with Tsinghua University to contribute its wisdom and strength to the overall transformation in social and economic development.
- It shows its wisdom and power by jointly setting up the Chongqing Technology Innovation Center of Three Gorges Ecological Environment and the National Key Laboratory for Water Pollution Traceability and Control in Environmental Protection.

External cooperation

- CTG has extensive cooperation for scientific research with universities and research institutions such as Wuhan University, the Chinese Academy of Sciences, and the Chinese Academy of Fishery Sciences.

Signing ceremony of the university-enterprise cooperation agreement between CTG and Wuhan University

Fund guarantee

- In the annual integrated plan and annual budget plan, CTG gives priority to the investment in scientific research & development according to the needs of the technical business department.
- CTG also allocates special funds to support scientific & technological innovation according to the key special tasks it undertakes. It has set up the Three Gorges Environment Fund (now the Special Fund for Eco-environmental Protection of Yangtze River Hydropower), Jinsha River Hydropower Fund, and Special Fund for Scientific & Technological Innovation for Offshore Wind Power Projects.
- CTG, in collaboration with the Ministry of Water Resources and the National Natural Science Foundation of China, jointly established the Joint Research Fund for Water Science of Yangtze River, and in collaboration with the Changjiang Water Resources Commission, established the Special Research Fund for Scientific Scheduling Project of the Three Gorges Reservoir to provide vital financial support for scientific and technological innovation.

Research activities and achievements

CTG steadily promotes scientific & technological innovation and therefore achieves a series of core technological breakthroughs. It has developed a set of technologies for introduction, domestication, and transplanting with independent intellectual property rights for some rare and unique plants in the Three Gorges region, such as *Davidia involucrata* and *Adiantum reniforme*, and many of its breeding technologies have reached a leading level in China. It has also overcome the technical difficulties in the full artificial breeding of Chinese sturgeon in fresh water, and realized the large-scale breeding of the second generation of Chinese sturgeon fry. Besides, it has developed an open-ended network for scientific & technological innovation by leveraging external resources and strengths. The Corporation has also accelerated its efforts to conduct special research in areas such as smart water management, pipeline network detection, sludge treatment and disposition, carrying capacity of the water environment in rivers and lakes, and building of a smart pipeline network.

Feature Breakthroughs in artificial breeding technologies for many rare and endemic fish species

Artificial breeding is one of the important measures for conserving fish species. It can realize the continuation of fish germplasm by employing technical means, and contribute to the sustainability of wild resources. Relying on the Chinese Sturgeon Research Institute, CTG has long been dedicated to the conservation and research of Chinese sturgeon and other rare and endemic fish in the Yangtze River. With successive progress in tackling key technical difficulties regarding fish domestication, induced breeding, and fry breeding, it has gradually acquired artificial breeding technologies for over 20 rare and endemic fish species in the Yangtze River, including Chinese sturgeon and Yangtze sturgeon. Some of these fish species have met the requirements for large-scale breeding and release.

Furthermore, CTG continues to increase its efforts in conserving Chinese sturgeon and other rare and endemic fish in the Yangtze River. It invested RMB 360 million to build the Yangtze River Rare Fish Conservation Center, and bred the largest artificial population of Chinese sturgeon in China. It is the first to achieve breakthroughs in the full artificial breeding technology of the second generation of Chinese sturgeon fry. With this technology, it has successfully achieved large-scale breeding of 250,000 fingerlings. These achievements have provided effective support for conserving Chinese sturgeon species and contributed a lot to the ecosystem restoration in the Yangtze River basin.


Circulating water culture pools in the Chinese Sturgeon Research Institute of CTG

It invested RMB **360** million in setting up the Yangtze River Rare Fish Conservation Center.

It has successfully achieved the large-scale breeding of **250,000** fingerlings.

Environment Monitoring

CTG has established an ecological and environmental monitoring system centered on the development of clean energy and protection of the ecological environment in the Yangtze River basin, which can help to achieve the long-term monitoring and assessment of the environmental conditions in all construction areas and basins, the ecological environment in river basins impacted by project operations, the effectiveness of eco-environmental protection measures, and the progress in the well-coordinated environmental conservation of the Yangtze River basin.

Water environment monitoring

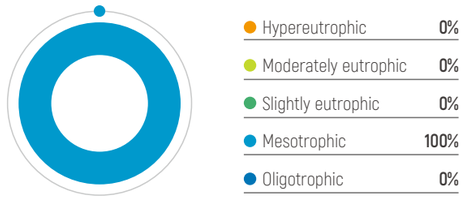
CTG has made intensive efforts in the water environment monitoring in the Three Gorges Reservoir area, Jinsha River Reservoir area, and other project areas of well-coordinated environmental conservation of the Yangtze River basin, with a focus on strengthening its independent monitoring and analysis capabilities, to propel the protection and restoration of the ecological environment in the basin to a new stage. The scope of water environment monitoring covers monitoring of water quality, algal bloom, water temperature, and dissolved gas in this basin.

Water quality monitoring in the Jinsha River

In 2022, CTG conducted routine water quality monitoring of the mainstream and important tributaries in the lower reaches of the Jinsha River to track the water quality conditions of the mainstream and the eutrophication status of key tributaries at different stages including construction, impoundment, and drawdown. The monitoring results indicate that in the Jinsha River reservoir area, all 22 monitored sections of the mainstream reached Grade I to Grade III in water quality, which is consistent with that in the previous year. All 16 monitored sections of tributaries reached Grade I to Grade III in water quality, which is also consistent with that in the previous year.

The monitored sections of 14 major tributaries in the Jinsha River Reservoir area were in a mesotrophic state, accounting for 100% of the total. Compared to the previous year, the trophic state remained unchanged.

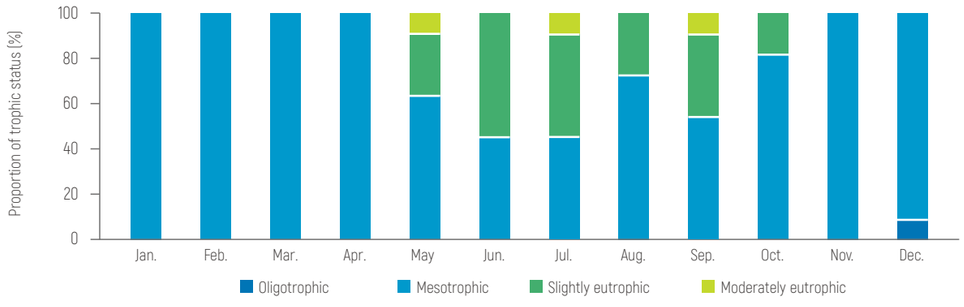
Water trophic status levels of main tributaries in the Jinsha River reservoir area



Water quality monitoring in the Three Gorges Reservoir area

In 2022, CTG carried out routine monitoring of water quality in the Three Gorges Reservoir area. The monitoring results indicate that from January to December 2022, the overall water quality of the Three Gorges Reservoir area was excellent, with all monitored sections reaching Grade II to Grate III in water quality. Within the monitoring scope, the water quality of the mainstream sections was predominantly classified as Grade II, accounting for 97.4% of the total. In 2022, the Yangtze River mainstream in the near-dam area was excellent in terms of water quality. The water quality of all 5 monitored sections (sampling points) either met or exceeded Grade III standards, among which 96.7% reached Grade II in water quality.

Histogram of trophic status proportions in the key tributaries of the Three Gorges Reservoir area in 2022



Monitoring of aquatic ecosystem

Monitoring of rare and endemic fish species

In 2022,

A total of **105** fish species were monitored in the lower reaches of the Jinsha River.

A total of **82** fish species were monitored in the protected area.

10 fish species were mainly caught in the entire river basin, i.e., silver carp, carp, *Spinibarbus sinensis*, catfish, bighead carp, *Pelteobagrus vachelli*, crucian carp, *Schizothorax prenati*, *Silurus meridionalis*, and *Culter alburnus*.

There were **2** rare fish species in the upper reaches of the Yangtze River,

and **21** endemic fish species in the upper reaches of the Yangtze River.

Out of the 20 monitored river sections, endemic fish species unique to the upper reaches of the Yangtze River were detected in 16 sections. The river section with the largest number of endemic fish species was the estuary of the Yalong River, with a total of **10** species.

Test station for conservation of rare and endemic fish species unique to the upper reaches of the Yangtze River and ecological observation of the Chishui River

Covering an area of 12.42 mu (approximately 2.05 acres), the station primarily focuses on the research of artificial breeding technologies for rare and endemic fish species in the Chishui River. It aims to overcome the technical difficulties in fish population restoration, and promote the conservation and restoration of fish species with technical research on juvenile fish rearing, adult fish culture, broodstock cultivation, fertilized egg incubation, seedling cultivation, etc.

Monitoring of terrestrial ecosystem

CTG monitors vegetation greenness, vegetation density, plant phenology, and meteorology in the Xiangjiaba and Xiluodu reservoir areas with remote sensing technology. The monitoring results indicate that after the Xiangjiaba and Xiluodu HPPs were completed and put into operation, no significant change has happened in the overall land surface coverage pattern in the basins. The results also show that surface vegetation growth has been improved to different extents, with a general improvement in vegetation density in the central part of the basins. This is to say, the impact of power station construction on surrounding environmental factors is limited, with most effects occurring within a radius of 3 km.

Monitoring of water and soil conservation

	Wudongde HPP project	Baihetan HPP project
Soil erosion improvement	56.72%	90.32%
Soil erosion control ratio	1.01	1.12
Vegetation restoration rate	38.46%	61.13%
Vegetation coverage rate	15.98%	27.77%
Percentage of blocked dregs and soil	97.16%	99.21%

06

Popularization of Sustainability Philosophy

"Green hope, green future" themed tree planting day event

Along with its own development, CTG also shares its experience in eco-environmental protection with stakeholders, aiming to promote the spread of the philosophy of sustainable development among the public, and raise public awareness of eco-environmental protection.

Science Popularization

CTG organizes activities themed on disseminating ideas such as green and low-carbon development and eco-environmental protection, and actively shares its concepts and experience, with an aim to continuously raise public awareness of eco-environmental protection. In 2022, CTG held an online international communication event named "Daka China 2022 Exploring Magnificent Landmarks – Hello, Yichang and Splendid Three Gorges" and a series of themed activities such as "Guarding a Green Area, Protecting a River", fully demonstrating its achievements in eco-environmental protection.

Feature **Holding an online international communication event to demonstrate the achievements in ecological protection in the Three Gorges**

In 2022, an online international communication event named "Daka China 2022 Exploring Magnificent Landmarks – Hello, Yichang and Splendid Three Gorges" was held in the Three Gorges Dam area. Video bloggers from different countries demonstrated the achievements of CTG in ecological protection on social media platforms through livestreaming.

During the event, the guests visited the Three Gorges Project Museum, Chinese Sturgeon Research Institute, Yangtze River Rare Plant Research Institute, etc. Through immersive experience and an international perspective, they vividly introduced the multifunctional and multi-objective benefits of the Three Gorges Project in terms of flood control, power generation, navigation, and water resource utilization as a miracle in the water regulation history of humans and a super hydropower project, as well as the achievements of the CTG in biodiversity conservation.

By August 30, 2022, video bloggers from many countries including the UK, Spain, Italy, Guatemala, Brazil, Georgia, South Korea held three Facebook live broadcasts on the Three Gorges Dam area. The total viewership exceeded 4.3 million, with over 52,000 comments from overseas netizens in more than 40 countries, including internet users in regions such as Central America, Latin America, South Asia, and Europe. CRI Online's program "A Direct View on China" held two live broadcasts at the Three Gorges Dam and the Chinese Sturgeon Research Institute, which were forwarded through platforms such as Facebook, Weibo, and China Radio International (CRI Online). Their total viewership exceeded 20 million.

Photo of the online international communication event

A magnificent panorama of the "nation's energy giant" from the documentary *Dance with the River*

The documentary *Dance with the River*, co-produced by the CCTV Documentary and CTG, premiered on the CCTV Documentary Channel during the National Day holiday in 2022. Through multi-angle and segmented narrations, it presents a detailed account of the construction process of Baihetan HPP, the world's second-largest hydropower station located in the lower reaches of the Jinsha River. Upon its premiere, the documentary immediately sparked enthusiastic responses from the audience, reaching a viewership of over 450 million during its initial broadcast period.

Education and Training

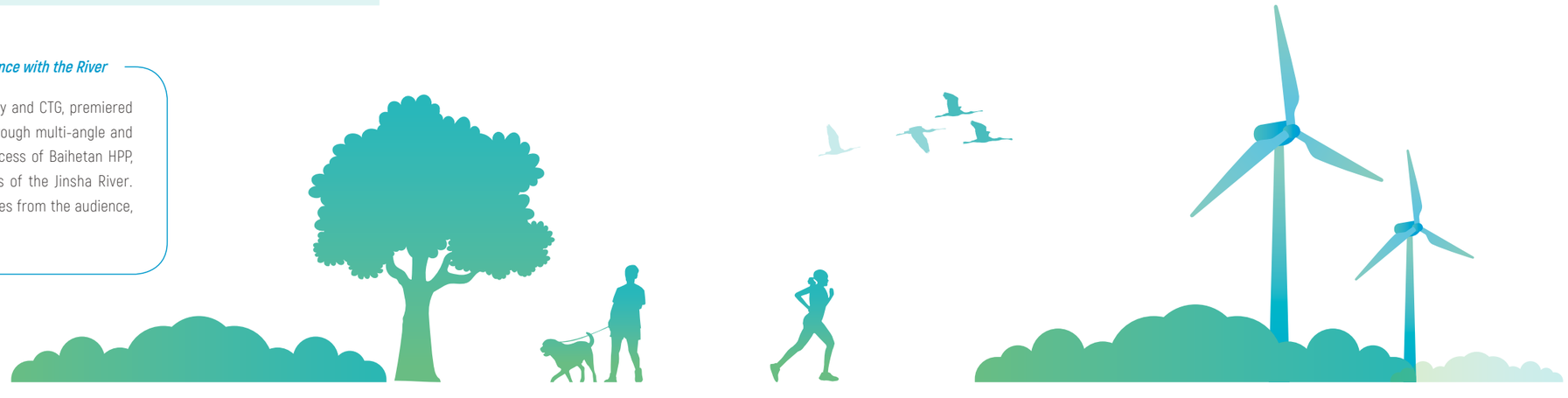
CTG holds many training and knowledge competitions on eco-environmental protection for its employees in its operation areas. Through these activities, it has deeply integrated the concept of eco-environmental protection into employees' daily work, and enhanced the sense of responsibility among all staff members to participate in the effort to promote ecological progress. In 2022, the Corporation organized training sessions on many topics including environmental factor identification, environmental risk management, ESG management, energy management, and the goals of carbon dioxide peaking and carbon neutrality.


CTG training session on environmental factor identification, environmental risk management, and ESG management

Education and training on environmental protection organized by Fuzhou Haixia Power Generation Co., Ltd.


Public welfare training on energy management and carbon peaking and carbon neutrality organized by Xinjiang Chuxing Energy Development Co., Ltd.


Environmental protection knowledge competition organized by China Three Gorges New Energy Corp.



Charitable Activities

CTG carries out diverse and colorful public environmental protection welfare activities to strengthen the promotion of eco-environmental protection and green development, and convey the concept of "prioritizing eco-environmental protection and green development" to the whole society.

Feature **Planting the Baihetan Public Benefit Forest to create a "hydropower station in the forest"**

Baihetan Reservoir is located in the dry-hot valley of the Jinsha River, where the ecological conditions are harsh and soil erosion is severe, which poses significant negative impacts on downstream cascade hydropower plants, reservoirs, and even the middle and lower reaches of the Yangtze River basin. In order to preserve soil and conserve water resources, CTG has implemented an afforestation project in the exposed or sparsely vegetated areas outside the red line on both sides of the Baihetan Dam reservoir area. As a pilot project, planting of public benefit forests has begun in Batou Village, Paoma Town, Nanning County. Based on the overall natural landscape and the existing vegetation conditions, CTG has selected suitable tree species and developed rational plans to implement the project in stages, with an aim to gradually create a "hydropower station in the forest", and progressively expand this concept to other villages and towns along the Jinsha River. After the public benefit forest project is completed, it will significantly increase the forest coverage in the reservoir area. At that time, lush green trees will be seen on both sides of the reservoir area. At the same time, it will create a forestry-based carbon sink industry, achieving a virtuous cycle of ecology-friendly development of the economy and economy-based development of the eco-environment.

Karot HPP holds the Public Open Day activity

On November 10, 2022, a "Public Open Day" activity with the theme of "Clean Energy from Karot HPP in My Neighborhood" was held at Karot HPP in Pakistan. The residents of surrounding communities and representatives of local teachers and students visited the facilities of Karot HPP, including the spillway, dam, powerhouse, and had interactive exchanges with project staff. Through this activity, they have gained a deeper understanding for the comprehensive benefits that the HPP brings in terms of providing clean energy, protecting the environment, and integrating into the local communities.

Karot HPP welcomes the first group of visitors

External Exchanges

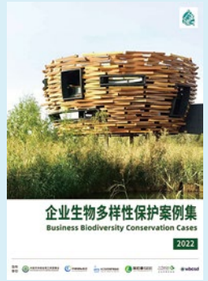
CTG actively collaborates with peer companies, industry partners, and other stakeholders in the field of environmental protection to jointly contribute to the realization of the carbon peaking and carbon neutrality goals and the sustainable development of the clean energy industry.


CTG attends the 6th China-South Asia Exposition (its exhibition booth themed "Empowering a Green World" was seen at the Green Energy Pavilion)

The event "Youth Scientists Salon: Building a Technological Innovation Hub for Clean Energy" hosted by China Association for Science and Technology and organized by CTG

The *Business Biodiversity Conservation Cases* of CTG is formally released during the 15th Meeting of the Conference of the Parties to the Convention on Biological Diversity

On December 9, 2022, during the second session of the 15th Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP15) held in Montreal, Canada, the case study named *China Three Gorges: Biodiversity Conservation and Expansion in the Operational Area* provided by CTG was included in the *Business Biodiversity Conservation Cases* and officially released at the China Pavilion side event named "Commercial Actions for Accelerating Biodiversity Conservation in China". The *Business Biodiversity Conservation Cases* includes 23 best practice cases from domestic and foreign enterprises in different industries with different scales, aiming to provide diverse conservation pathways and emphasize practicality for exchanges and mutual learning between enterprises.



Business Biodiversity Conservation Cases

CTG participated in the China Pavilion side event of the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change

On November 8, 2022, at the China Pavilion side event during the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27) held in Sharm El Sheikh, Egypt, the Center for International Knowledge on Development organized a side event titled Seminar on Clean Energy Development: Accelerating the Achievement of Affordable and Clean Energy (SDG7). As a partner of the flagship research project titled China's Strategy and Global Outlook for Carbon Dioxide Peaking and Carbon Neutrality led by the Center for International Knowledge on Development, China, CTG was invited to the seminar as a supporting organization. During the conference, the China Pavilion showcased the promotional video titled "We Care, We Share" produced by the Center for International Knowledge on Development in the exhibition hall through a rolling broadcast. With keywords of "Care, Commit, Create, Collaborate, and Contribute", the video introduced the green and low-carbon development experience of cooperative enterprises involved in the flagship research project titled China's Strategy and Global Outlook for Carbon Peaking and Carbon Neutrality, in which CTG participated, and shared the knowledge on green development, which attracted the attention of representatives from countries present at the conference.

Scan the QR code to watch the promotional video themed "We Care, We Share"

CTG is invited to the 2022 Ehai Forum on Global Ecological Civilization Construction and its representative delivers a speech at the meeting themed "Ecological Protection and Sustainable Development from a Global Perspective"

Baihetan HPP project is selected as an industry case for the Sustainable China Industrial Development Action in 2022

Goals and Commitments

CTG commits to achieving the following goals by the end of 2025: Preliminarily establishing leading capabilities in the eco-environmental protection industry, continuously playing a pivotal role in the well-coordinated environmental conservation of the Yangtze River basin, and developing into a world-class clean energy group and a domestic leader in eco-environmental protection; carrying out research on the conservation technology, breeding, and release of rare and endemic fish species such as Chinese sturgeon, Yangtze sturgeon, and *Coreius guichenoti*; gradually achieving the annual target of releasing 1 to 3 million Chinese sturgeons, 500,000 to 1 million Yangtze sturgeons, and 700,000 to 1.2 million *Coreius guichenoti*; supporting the conservation of natural habitats and restoration of the population of the Yangtze finless porpoise and implementing the conservation programs for germplasm resources of rare and economically important plants to promote their sustainable utilization.

In 2023, CTG will further participate in the well-coordinated environmental conservation of the Yangtze River basin, and continue increasing its investment in terms of human resources, material resources, and funds and playing a leading role in the well-coordinated environmental conservation of the Yangtze River basin. It will also make every effort to acquire approval for and accelerate the construction and implementation of a series of eco-environmental protection projects along the Yangtze River. We will adhere to systematic governance and promote the improvement of quality and the increase in efficiency in urban sewage treatment. We will also continue to deepen the practice and exploration of the "water manager" program in systematic governance over the whole basin, conduct further research and make improvements to the organizational, standard, technical, and operational systems for effective spread and promotion of the "water manager" system, and foster some benchmark cities for the "water manager" program.

We will further promote the synergistic development of clean energy such as hydropower, wind power, and solar power, and contribute to the overall green transformation of economic and social development. We will explore new project development models, stay true to our principles while exploring new ideas for development, and commence construction of new projects such as "photovoltaic power + desertification control" and "offshore wind farm + marine ranching" to provide more green solutions for high-quality development.

We will continuously strengthen eco-environmental protection in reservoir and dam areas, deepen the practice of joint ecological dispatch of cascade reservoirs, and expand the ecological benefits of cascade reservoirs. Focusing on the mission of safeguarding the biodiversity of the Yangtze River, we will continue to strengthen the research on the artificial breeding of rare and endemic fish species and the conservation of rare plants in the Three Gorges Reservoir area, and fully implement measures for the eco-environmental protection in engineering construction.

We will continue to play a leading role in driving China's clean energy industry chain to go global, popularize green, environmentally friendly standards and best practices, and facilitate localized green and low-carbon energy transitions. We will actively participate in the development of international standards for green development, and strengthen the coordination with Belt and Road countries in this regard. In addition, we will also further deepen our cooperation with EDP Group in the field of frontier technologies for energy, strengthen international exchanges and cooperation, and conduct research on the development trends of new forms of businesses such as stored energy and hydrogen energy.

Expert Comments

In the face of unprecedented challenges to the world's sustainable development, Chinese companies are contributing to the world's sustainable development with concrete actions by demonstrating the Chinese model. The *Annual Report on Environmental Protection 2022* of CTG systematically discloses the Corporation's actions for environmental protection, and demonstrates its determination to promote sustainable development, so it is a high-quality report. I would like to share my views on this report in the following three aspects:

First, this is a forward-looking report focused on the hot topics concerning eco-environmental protection in this new era. The report covers a wide range of topics concerned both at home and abroad, including "combating climate change" "biodiversity conservation" "carbon peaking and carbon neutrality" "green Winter Olympics" and "well-coordinated environmental conservation of the Yangtze River basin". It reflects CTG's attention for and active response to focal points related to environmental protection in this new era, as well as its integration of these concerns into its own development process, and demonstrates its commitment to fulfilling its mission of "harmonize development with conservation for greater public wellbeing".

Second, it is a highly complete report which presents many practices contributing to the sustainable development comprehensively. With a focus on core topics in the field of sustainable development, such as clean energy development, ecosystem protection, environmental pollution control, and environmental technology innovation, the report provides vivid and detailed case studies and introduces a more diverse range of thematic presentations compared to previous reports. The report allows for a multi-dimensional and deeper understanding of CTG's practical measures and achievements concerning sustainable development issues, and deserves continual studies.

Third, this report provides ample information and utilizes graphical data, index indicators, etc. to enhance readability. In addition to vivid descriptions accompanied by illustrations, the report also includes extensive performance data in each section, such as the installed capacity of new energy at home, and the number of Chinese sturgeons released into the Yangtze River annually. By comparing data over the years, readers can truly appreciate the relentless efforts of CTG in the pursuit of sustainable development. The index of indicators presented in the conclusion of the report also clearly displays CTG's achievements in the field of environmental protection, along with the corresponding page numbers. This facilitates quick navigation and browsing of key content, making it an epitome of CTG's efforts in its annual work related to environmental protection.

As a whole, the report highlights new ideals while continuing the style of previous reports. It effectively displays the work carried out by CTG in the field of environmental protection in the previous year. We hope that CTG can progress steadily on its journey to build a world-class transnational clean energy conglomerate to contribute an enduring force to the sustainable development of human society.

Qian Xiaojun

Professor of the School of Economics and Management, Tsinghua University
Associate Dean of Academics at Schwarzman College, Tsinghua University
Director of the Research Center for Green Economy and Sustainable Development, Tsinghua University

This report is the 18th annual report on environmental protection issued by CTG, and it is also a high-quality specialized report on environmental protection. The report provides rich and detailed information, and vividly displays the practice and fruitful achievements of CTG in the field of eco-environmental protection in 2022. It has deeply impressed me with CTG's great commitment to respecting, adapting to, and protecting nature, as well as its relentless pursuit of promoting harmonious coordination between economic development and ecological protection.

Demonstrating CTG's role in combating climate change as a centrally administered SOE. As a clean energy group, CTG makes every effort to implement the integrated development model featuring a two-tracked approach for advancing clean energy and ecological conservation of the Yangtze River, and strives to make a greater contribution to achieving the carbon peaking and carbon neutrality goals and promoting the overall green transformation of economic and social development. The report includes a main section titled Actions for Addressing Climate Change, which presents the systematic layout and global thinking of CTG in continuing to strengthen its leading position in the hydropower industry, making every effort to promote the large-scale high-quality development of the new energy industry, and actively cultivating new business forms to advance green transformation. This fully demonstrates CTG's firm determination to take an active part in the battle against climate change and its sense of responsibility as a centrally administered SOE.

Continuously consolidating the foundation of eco-environmental protection management. CTG is working hard to deepen the concept of eco-environmental protection and continuously improve its environmental management system and capability. The report systematically presents CTG's mission, vision, values, motto, and management policy of eco-environmental protection, demonstrates the full life cycle philosophy, effective policies and measures, and executive force to ensure comprehensive implementation of these policies and measures for environmental management, and reflects the systematic, comprehensive and advanced environmental management concept of CTG.

Reflecting the global thinking of eco-environmental protection. While providing clean energy for society, CTG is also committed to achieving harmony and unity between energy production and the ecological environment. The report presents its major contents including the battle against climate change, ecosystem protection, and environmental pollution control through a clear logical structure, rich performance data, and diversified presentations, which shows CTG's efforts in environmental management covering all of its business operations, in the whole basin and whole process.

I sincerely hope that CTG can continue to fulfill the missions bestowed on it by the Party and the State, take the lead in development, and take the initiative to promote reform to become a good example of green development, so as to make more new contributions to global environmental governance.

Xue Dayuan

Professor of the College of Life and Environmental Sciences (CLES), Minzu University of China

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3.12	Major pollution accidents and violations of environmental law in production and operation in the last three years (including administrative punishment or orders related to environmental protection)	✓		
3.13	Measures and methods used by the Corporation to deal with environmental complaints	✓		
3.14	Environmental testing and evaluation	✓		P15
3.15	Contingency measures and plans for environmental emergencies (including the construction of emergency pools when necessary)	✓		P14
3.16	Environmental evaluation and approval for newly built, reconstructed and expanded projects of the Corporation and implementation of the principle of promoting eco-environmental protection simultaneously with project design, construction and operation	✓		P14~P15
	4. Environmental protection targets			
	Environmental protection targets, indices and performance			
4.1	Fulfillment of the previous year's environmental protection targets	✓		P8~P9
4.2	Main methods and measures adopted	✓		P14
4.3	Environmental protection targets for the next year	✓		
4.4	Environmental performance comparison	✓		P8~P9
	Material flow analysis			
4.5	Consumption of resources and energy during production and operation	✓		P44~P45
4.6	Product or service output and waste product recycling		✓	P40~P41
4.7	Environmental load during production and operation	✓		P40~P41
4.8	Greenhouse gas emissions	✓		P40~P41

Item	Index Content	Basic Index	Selected Index	Page No.
	Environmental accounting			
4.9	Corporate expenditure on environmental protection activities	✓		P8~P9
4.10	Environmental benefits of environmental protection activities	✓		P8~P9
4.11	Economic benefits of environmental protection measures		✓	P8~P9
	5. Measures for lowering the environmental load and their performance			
	Measures to reduce environmental load associated with products or services			
	Development of environment-friendly technologies and products			
5.1	Development of environment-friendly production techniques and service methods		✓	P18~P25
5.2	Application and implementation of life cycle evaluation		✓	
5.3	Definition of and standards for the Corporation's environment-friendly products		✓	P18~P25
5.4	Energy saving and consumption reduction, and replacement of poisonous and harmful substances in the process of production	✓		P44~P45
5.5	Examples of environment-friendly products or services		✓	P18~P25
5.6	Products having obtained environmental label certification		✓	
5.7	Output or sale of products with environmental labeling		✓	
	Recovery and recycling of waste products			
5.8	Total product output or total sales of goods	✓		P8
5.9	Usage of packaging capacity		✓	
5.10	Recycled volume of waste products and packaging containers	✓		
5.11	Product recycling		✓	P44~P45
	Environmental impact related to the process of production and operation			
	Energy consumption and energy conservation			
5.12	Total consumption	✓		P44~P45
5.13	Composition and sources	✓		P44~P45
5.14	Utilization efficiency and energy conservation measures	✓		P44~P45
5.15	Development and utilization of renewable energy		✓	P18~P25
	Greenhouse gas emissions and reduction measures			
5.16	Types and quantities of emissions	✓		P40~P41
5.17	Measures for emission reduction	✓		P40~P41

Item	Index Content	Basic Index	Selected Index	Page No.
	Exhaust gas emissions and reduction measures			
5.18	Types and quantities of emissions	✓		P40~P41
5.19	Processing techniques and standards reached	✓		P40~P41
5.20	Emissions of SO_2 and effect of emission reduction	✓		P40~P41
5.21	Emissions of nitrogen oxides and effect of emission reduction	✓		P40~P41
5.22	Emissions of pollutants such as smoke and soot and reduction measures	✓		P40~P41
5.23	Emissions of specific pollutants and reduction measures (including heavy metals)	✓		
	Environmental load during logistical operations and reduction measures			
5.24	Guidelines and targets for reducing environmental load during logistical operations	✓		
5.25	Total cargo transported and means of transportation	✓		
5.26	Generation of pollutants during logistical operations and reduction measures		✓	
	Consumption of resources (excluding water) and reduction measures			
5.27	Total consumption and reduction measures	✓		P44~P45
5.28	Consumption of various resources and their percentages	✓		P44~P45
5.29	Consumption of main raw materials and reduction measures	✓		P44~P45
5.30	Resource output ratio and measures for improvement	✓		P44~P45
5.31	Recycling rate of resources and measures for improvement	✓		P44~P45
	Water resource consumption and water-saving measures			
5.32	Sources, composition and consumption	✓		P44~P45
5.33	Recycling rate and measures for improvement	✓		P44~P45
	Total wastewater generated and reduction measures			
5.34	Total amount of wastewater generated and percentage of water discharged	✓		P40~P41
5.35	Processing techniques, water quality compliance and destination of water discharge	✓		P40~P41
5.36	Chemical oxygen demand, ammonia nitrogen emissions and reduction measures	✓		
5.37	Emissions of specific pollutants and reduction measures (including heavy metals)	✓		

Item	Index Content	Basic Index	Selected Index	Page No.
	Generation and disposal of solid wastes			
5.38	Total waste generated and reduction measures	✓		P41
5.39	Overall utilization and final disposal (including heavy metals)	✓		P41
5.40	Related management system	✓		P41
5.41	Management of dangerous wastes	✓		
	Management of dangerous chemicals			
5.42	Generation, use and storage	✓		
5.43	Discharge and exposure	✓		
5.44	Measures for controlling discharge into the environment and for reducing generation of poisonous and hazardous chemicals	✓		P40~P41
5.45	Environmental management measures for different stages including transportation, storage, use and disposal	✓		P40~P41
	Noise pollution and control measures			
5.46	Noise pollution in the plants	✓		P40
5.47	Main control measures taken	✓		P40
	Green procurement status and related countermeasures			
5.48	Policy, goals and plans	✓		
5.49	Related management measures		✓	P44~P45
5.50	Status and actual effect	✓		P44~P45
5.51	Procurement of environmental labeling products or services		✓	
	6. Relations with society at large and stakeholders			
	Relations with consumers			
6.1	Warnings and safety instructions related to information about products or services and environmental labeling		✓	
	Relations with employees			
6.2	Measures for improving workplace safety and hygiene for employees		✓	
	Relations with the public			
6.3	Guidelines and plans for participation in local environmental protection		✓	P28~P39
6.4	Environmental protection activities organized with local communities, social organizations and local residents	✓		P28~P39
	Relations with society at large			
6.5	Participation in public-welfare environmental protection activities		✓	P50

Index of *Plan for Mechanism to Disclose Information on the Construction Project's Environmental Impact Assessment*

Project	Index	Page No.
Pre-construction phase project information	Start date	
	Design unit	
	Construction unit	
	Environmental supervision unit	
	General information about the project	
	Actual selection of locations and routes	
	The list of measures to be taken for environmental protection and the implementation plan for such measures	
	List of measures for environmental protection to be taken by the local government or related departments and the implementation plan for such measures	
Construction phase project information	Progress of measures for environmental protection within construction projects	P40~P41
	Implementation of measures for environmental protection during the construction period	P40~P41
	Monitoring of the environment during the construction period	P40~P41
	Environment monitoring results during the construction period	P46~P47
Post-completion project information	Measures for environmental protection proposed in construction projects' environmental impact assessment and their implementation	
	The testing and survey result for the final acceptance for environmental protection	P46~P47
	Discharge of main pollutants	P46~P47

Readers' Feedback

In order to improve CTG's environmental protection work and enhance the Corporation's ability and level of green development, your comments and suggestions would be greatly appreciated. Please spare the time to give us your valuable opinions on our work and report. Thank you!

1. How would you evaluate the Annual Report on Environmental Protection of CTG in general?
◯ Great ◯ Good ◯ Average

2. How well do you think CTG has been doing in proactively serving government and customers?
◯ Great ◯ Good ◯ Average ◯ Bad ◯ I don't know

3. How well do you think CTG has been doing in protecting the environment and promoting sustainable development?
◯ Great ◯ Good ◯ Average ◯ Bad ◯ I don't know

4. How well do you think CTG has been doing in communicating with stakeholders?
◯ Great ◯ Good ◯ Average ◯ Bad ◯ I don't know

5. Do you think that the Report is able to reflect the major environmental influences CTG has had?
◯ Yes ◯ Maybe ◯ No

6. What do you think of the clarity, accuracy and completeness of the data and indices disclosed by the Report?
◯ Very High ◯ High ◯ Average ◯ Low ◯ Very Low

7. How the layout of the Report help your reading?
◯ Greatly ◯ Okay ◯ Badly

8. You are welcome to give your opinions and suggestions about environmental protection work of CTG and the Report here:

Note: Please tick (" ✓ ") the corresponding circles (" ◯ ") and mail this page to the following address:
Department of Ecology and Environmental Protection, CTG
No. 1, Liuhe Rd., Jiang'an District, Wuhan, Hubei Province, China. Zip code: 430014

For online opinions, please send them to hu_yang4@ctg.com.cn, or you can leave you valuable opinions on the official website of CTG at http://www.ctg.com.cn/hjnbdc/index.php.

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