A "CHAMPION" OF ECOLOGICAL CIVILISATION

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Eco-environment is irreplaceable. While it is easy to exploit the environment, it is hard to recover once lost. With a belief in the symbiotic relationship between humankind and the nature, and in adherence to the fundamental national policy of resource conservation and environmental protection, China Unicom takes eco-environmental protection seriously, and has implemented green management, green network and green operation to promote eco-environmental protection and bequeath the future generations with a beautiful homeland with blue sky, green land and clean water.

Measure adopted in 2019

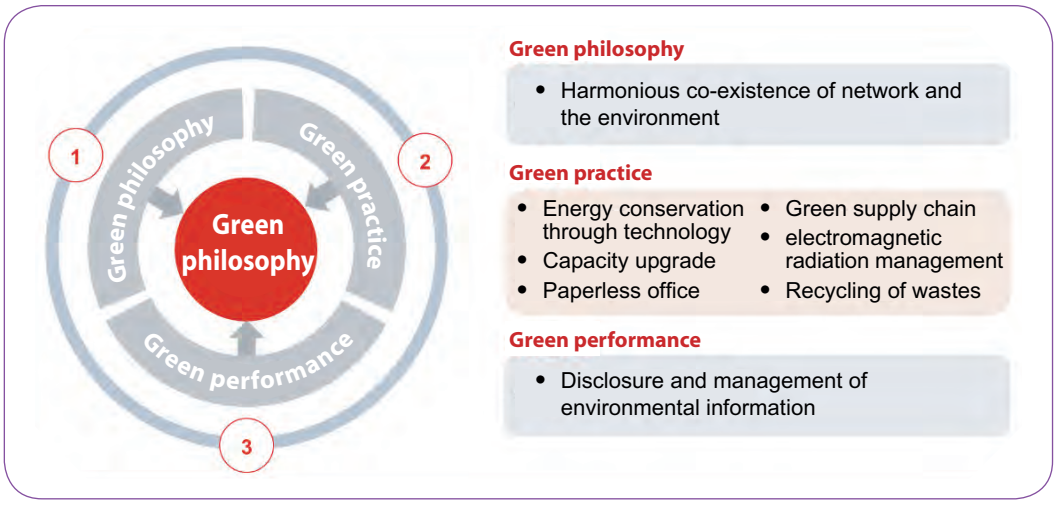
- Appropriated RMB104 million in special funding for energy conservation and emission reduction to promote low-carbon technology and upgrade legacy capacity. Energy-saving technology coverage reached over 70%.
- Enhanced the management of electromagnetic radiation, and established an electromagnetic radiation information platform.
- Developed green business outlets and strengthened green service supply. Upcycled assets amounted to RMB360 million.

Actions to be taken in 2020

- Continue to advance researches on energy conservation technology and apply proven energy conservation technology to the befitting equipment rooms of the whole network.
- Keep abreast of future network development trends, in particular in relation to network energy conservation, and develop 5G smart power monitoring system.
- Accelerate research on and application of new energy in communications network.

In 2019, in adherence to the environmental protection philosophy of "harmonious co-existence of network and the environment" as well as laws and regulations pertaining to environmental protection, such as the Environmental Protection Law of the People's Republic of China and the Energy Conservation Law of the People's Republic of China, China Unicom continued to promote energy conservation, eliminate inefficient production capacity, reduce network energy costs, and alleviate the impact of greenhouse gas emissions on the environment, thereby contributing to the prevention and control of pollution and bringing ecological benefits to people.

ENHANCING GREEN MANAGEMENT



"three-in-one" green management system of China Unicom

China Unicom has established a "three-in-one" green management system comprising green philosophy, green practice and green performance. It continued to execute the "Special Plan for Energy Conservation and Emission Reduction for 2017-2020", and formulated and implemented the "Special Action Plan for Cost Reduction and Efficiency Enhancement" and the "Special Plan for Implementation of Pollution Prevention and Control". It strive to improve environmental management capabilities, reduce greenhouse gas emissions, enhance refined management, establish a long-term mechanism for green development, and contribute to pollution prevention and control. The Company is committed to increasing the efficiency of water consumption as active efforts have been made to promote the recycling of water resources. The Company promoted awareness in water conservation, while conducting regular maintenance checks in each part of the water supply system to eliminate water resource wastage and leaking. The Company's water resources mainly comprise tap water in buildings or properties. During the reporting period, there was no issue in sourcing water.

- The Company updated the "China Unicom Infrastructure Construction Regulations", setting out the management targets of energy use efficiency ("PUE") and promoting the use of new green technologies and solutions in new and renovated projects as appropriate.
- The Company formulated and implemented the "Priorities for Energy Conservation and Emission Reduction in Equipment Rooms of China Unicom Cloud Data Company Limited in 2019", which set out quantitative assessment on energy conservation practices and PUE performance. Subordinate data centres then drew up work plans, optimised the operational procedures of major systems, further refined facilities' ledgers and carried out energy conservation measures.
- Aiming to improve network efficiency, guided by the "5K" indicators, the Company developed differentiated capabilities of low-cost network operation, improved the ability to control network cost and reasonably reduced unit resource maintenance cost.

- The Company continued to invest in energy conservation and emission reduction, for example, energy-saving renovation of heat-pipe air-conditioners, distributed photovoltaic power generation and replacement of outdated power equipment with high energy consumption.

- The Company joined the Climate Change Working Group established by GSMA to engage in network energy conservation and reduction of greenhouse gas emissions.

Special funds for energy conservation and emission reduction amounted to RMB **104** million in 2019

The Company released the "China Unicom Data Centre Construction Standards (V2.0)", which regulated the selection of air-conditioning systems and utilisation of outdoor chillers and specified the PUE performance requirements for different areas, taking into such factors as climate zoning, climate conditions, energy availability and air quality.

- In terms of energy conservation in mechanical and electrical engineering, the Company provided guidance on energy-saving equipment, circuit loss, quality compensation, direct supply of municipal electricity, new-type batteries, cold-water energy storage and utilisation of waste heat.

- In respect of energy-saving civil works, the Company provided guidance on forestation, prevention and control of light pollution, reuse of rainwater, water resources planning and utilisation of renewable materials.

China Unicom Global Limited actively carries out environmental protection and low-carbon operations, and practically adopts innovative environmental protection technology and green management. In April 2019, thanks to its high-standard equipment and innovative green management, it was honoured with a Merit Award in the "Hong Kong Environmental Excellence Award" organised by Environmental Campaign Committee together with nine other organisations including the Environmental Protection Department and The Hong Kong General Chamber of Commerce.

DEPLOYING GREEN NETWORK

Promoting green and low-carbon technology

Fully leveraging on technology innovations, China Unicom earnestly practices green development philosophy. In order to optimize total cost of ownership ("TCO"), it actively advanced the DC-oriented re-architecture of infrastructure, and vigorously promoted green data centres and energy-saving and low-carbon equipment rooms. By using high-efficiency power modules, intelligent dual-cycle air conditioning and self-developed cloud cabin closed channel technology in new communications system, the Company's infrastructure achieved an overall energy-saving rate of 50%. In addition, the cloud cabin closed channel technology was granted "utility model patent" by the National Intellectual Property Administration.

◎ Energy conservation in buildings

In building green equipment rooms, the Company uses thermal insulation rooftops and walls, green rooftops and heat-reflective glass to reduce energy consumption. Rockwool and other insulation materials are used for exterior walls and rooftop based on energy-saving calculation, and aerated concrete blocks are used for constructing the maintenance structure. In terms of lighting, the fluorescent lights have been gradually replaced by LED energy-saving lights which have luminous efficiency 50% higher than that of ordinary metal halide.

China Unicom's Ningxia Zhongwei Data Centre is the first data centre among domestic operators to adopt the fresh air free cooling systems. It combines various advanced energy-saving technologies such as fresh air, evaporative cooling, wind walls and hot channel closure, etc. As a result, refrigeration compressors were used for only 8 days throughout the year, and the PUE was only 1.28.

◎ Energy conservation in power transformation and distribution system

In the newly commissioned equipment rooms, modularised uninterruptible power supplies ("UPS") were adopted, which can increase the load rate of single set UPS on condition of underload and reduce wastage by approximately 10%. With the use of high-voltage direct current technology, 240V high-voltage direct current and direct supply of municipal electricity technology were introduced for the first time, and approximately 15% of electricity could be saved as compared to traditional UPS by switching off overly configured modules and foregoing excessive power supply systems. The Company employed the non-crystal alloy dry transformers, which are energy-efficient, biodegradable and recyclable in materials, pollution free and tainted with low noise.

Energy-saving technology coverage rate for access network equipment rooms: **73**%

Energy-saving technology coverage rate for communications equipment rooms: **71**%

Overall energy-saving rate of new communications infrastructure: **50**%

◎ Energy conservation in air-conditioning systems

The Company used the adaptive air-conditioning system, which can avoid the competitive operation of air-conditioners so as to prevent underheating or overheating in the equipment room, and help save energy by more than 10%. The energy-saving automatic control system was adopted to achieve optimum matching between the cooling system and the load volume, thereby reducing energy consumption. The Company adopted large-volume centrifugal water cooling units and variable frequency circulation pumps, and made full use of climate conditions for natural cooling, having saved approximately 33.6% of electricity during the year.

◎ Exploring clean energy

The Company actively carried out trials of photovoltaic energy power supply system, which resulted in substantial energy savings. A 3.3KWP solar power generation system in a single base station could save approximately 4,253kWh of electricity in a year. The Company actively conducted research on the use of clean energy powered by the aluminium-air battery, which is seen as a low-carbon and eco-friendly alternative to lead-acid battery for communications backup power.

China Unicom has built its Deqing Data Centre Base Project into a nationwide leading green and eco-friendly cloud data base. It is the largest data centre in China that uses the combined cooling, heating and power technology, and is also the first distributed energy project among domestic operators. 20,000 tons of standard coal can be saved for each year.

The Urumqi core equipment room of China Unicom Xinjiang branch was equipped with the first full evaporative cooling air-conditioning system in China, which can reduce the PUE value to 1.17. The project was awarded the "Best Energy-Saving Project Award" for energy-saving innovation in respect of ICT infrastructure by China Association of Communications.

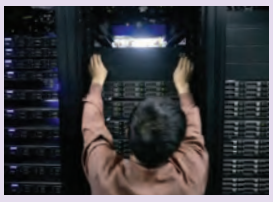
Promoting capacity optimisation and upgrade

A lot of ageing equipment, which is bulky, noisy and energy-inefficient, consumes excessive social resources. China Unicom earnestly implemented cost reduction and efficiency enhancement following the lead of supply-side structural reform. It continuously streamlined 2/3G networks and retired ageing equipment to drive scenario-based energy conservation for base stations and continuously improve economic and environmental efficiency.

- Mobile network: the Company completed the full retirement of 2.6 GHz TD-LTE base stations as scheduled. Compared with 2016, the 2G carrier frequency of the whole network decreased by 1.064 million units, representing a decrease of 52%. The proportion of 3G single-carrier base stations reached 83.7%, signalling a further streamlined and optimised network.
- Core network: the Company completed the retirement of 21 sets of DC1 switches, 4 fixed-line HSTP switches, and replaced 6 outdated and suspended mobile HSTP switches.
- Transmission network: 23,000 terminal equipment were retired.

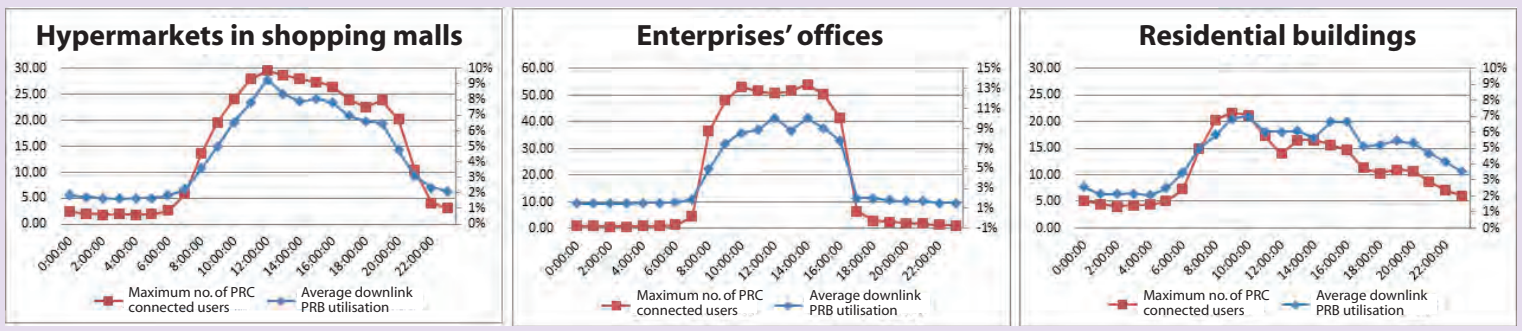
Committed to energy conservation, environmental protection and facilitating the sustainable development of enterprises, China Unicom Shandong branch spared no effort to streamline network and eliminate legacy capacity. In 2019, it completed the retirement of 9,404 sets of 2G independent ageing equipment and 4,594 WLAN hotspots, saving RMB34,447,000 in electricity cost for the year, a win-win for the Company's operating efficiency and the environment.

China Unicom Hangzhou branch innovatively carried out "one reduction and two increases" energy conservation sub-division reform for IDC equipment rooms. It promoted robust energy conservation and emission reduction in communications infrastructure by improving the cooling efficiency of external air conditioners, strictly controlling office power consumption, enhancing lighting efficiency in equipment rooms, etc. In the past two years, it has cumulatively saved 6.87 million kWh of electricity and reduced carbon emissions by about 6,849 tons, setting a successful model for the green operation of Internet data centre equipment rooms.



The "one reduction and two increases" energy conservation sub-division reform for IDC equipment rooms

With the increasing number of 4G base stations, energy consumption has been rising correspondingly, resulting in increasingly prominent energy consumption problems. Under such circumstances, China Unicom Suihua branch in Heilongjiang worked out differentiated energy-saving solutions based on the application scenarios of different base stations. While minimising the impact of energy conservation on user perception, it switched on the energy saving mode according to the application scenarios with a view to turning off unnecessary resources during idle time and reducing equipment power consumption.



Utilisation rate of network resources at different scenarios

Strengthening the management of electromagnetic radiation

In accordance with the requirements of the Ministry of Ecology and Environment of the PRC and the local ecological and environmental departments, China Unicom has formulated the "Regulations on the Management of Electromagnetic Radiation of Communication Base Stations for Environmental Protection of China Unicom (Trial)" to strengthen the management of electromagnetic radiation in the construction of mobile communication base stations and to ensure that the electromagnetic radiation of base stations meets the national standards.

In 2019, the requirement to file registration forms on the environmental impact of construction projects was fully implemented during the construction of mobile communication base stations. Upon completion of the construction, electromagnetic radiation tests were conducted on the base stations, and test results were disclosed on the Internet for public scrutiny. During the construction of base stations, the Company educated the public on electromagnetic radiation through various means such as SMS, WeChat and distribution of promotional materials.

Developing green solutions

Deeply engaged in the field of "intelligence + environmental protection", China Unicom makes comprehensive use of its technological advantages such as big data, Internet of Things, cloud computing, 5G, AR, etc., to continue its innovations in green products and applications, and put forward digital green solutions, aiming to drive the transformation and upgrade of the low-carbon and environmental protection industries.

China Unicom Dongguan branch in Guangdong Province uses the big data AR technology and data from real-time monitoring of pollution sources to create a visualised, full-process and remote platform, resulting in scientific and comprehensive environmental decision-making, precise supervision and convenient public service. Currently, more than 4,000 radioactive sources across the city are being monitored in an itinerant manner. The eco-environment data and service platform has greatly improved the daily environmental supervision and the ability to respond to environmental emergencies and major pollution accidents, and effectively reduced the losses caused by environmental pollution to the country as well as the safety of people's life and properties.

Comprehensive display of the eco-environment data through GIS

Data displayed on mobile Apps

In earnest implementation of the "green construction" requirements of the provincial government, China Unicom Jiangsu branch developed a cloud platform named "WO Cloud Construction Site Smart Supervision Platform" to provide paperless site environment supervision for regulatory authorities as well as vehicle management, equipment management, green construction and other services at construction sites. When PM2.5 or PM10 exceed safety standards, the platform can automatically activate dust reduction equipment to rinse dust and mud off vehicles entering and exiting the construction site, so as to relieve air and road pollution around the construction site and safeguard the environmental quality for the surrounding people. The platform was accredited as an "outstanding cloud and digital product" by Jiangsu Economic and Information Technology Commission.

China Unicom Tianjin branch and Tianjin University jointly developed the "Dolphin 5G Unmanned Surface Vehicle", which integrated measurement instruments such as atmospheric monitoring LIDAR and in-situ water quality analyser with unmanned USV technology and 5G technology to enable the collection of information on seabed terrain, pollutants discharged by watercrafts and water quality at the same time. The real-time transmission of images and monitoring data to the monitoring centre through the 5G network enabled real-time analysis of dynamic data on marine environment. This marked a first in the industry to experiment on multi-parameter intelligent stereo monitoring of the marine environment based on 5G.

With the belief that waters and mountains are invaluable assets, China Unicom Jiaxing branch in Zhejiang Province helped build the "Jiaxing River Chief Management Information System". It allowed static display, dynamic management and routine tracking of river management information, serving as a helpful tool for the goal management, task supervision and performance appraisal of river chiefs' work across the region. It effectively helped the construction of the aquatic environment governance system and the modernisation of the governance capability in Jiaxing.

Dashboard of Jiaxing river chief management platform

Comprehensive map of Jiaxing river chief management platform

BOOSTING GREEN OPERATION

Building green business network

In adherence to the notion of "low carbon, emission reduction and green office", China Unicom has established a green and intelligent business network characterised by "regulated management, reasonable layout, modernised equipment, digitalised operation, comfortable experience, and paperless processing" by building green digitalised business outlets and smart living stores. The Company integrated various types of equipment in the business outlets into a single equipment, thereby reducing the cost of operation and maintenance. At the same time, the Company implemented digitalised operation, paperless processing and electronic promotion to save paper for work orders and promotional posters.

Strengthening upcycling of wastes

In order to promote the overall improvement of the energy conservation and eco-environmental protection management of central state-owned enterprises, China Unicom has formulated the "Guidelines for Revitalisation of Network Assets and Resources" to encourage inter-provincial re-allocation of idle resources among different branches, thereby saving investments and improving resource utilisation efficiency. The Group disposed of RMB965 million of assets by auction, comprising RMB620 million of scrap cables, RMB140 million of used storage battery and RMB205 million of general waste materials.

Assets upcycled were valued at RMB **362** million;

Assets disposed by auction totalled RMB **965** million.

Subscribers' network access agreements set forth the procedures for returning terminals when services are terminated. The Company further strengthened recycling and reuse of obsolete optical modems, including terminals returned from customers when services are terminated, faulty terminals and terminals returned due to service changes and refurbished for further use. In addition, recycling incentives and rewarding points, etc. were set up to encourage installation and maintenance personnel to recycle obsolete assets. In 2019, around 3 million sets of optical modems were recycled, saving terminal costs of about RMB300 million.

Building a green supply system

China Unicom implemented its energy-saving responsibilities from the source of procurement, and procured the suppliers to fulfil their green supply responsibilities throughout the service life cycle covering design, production, packaging, transportation and consumption. China Unicom has put forward, in its technical specifications for tender procurement of network equipment, clear standards and requirements for the power consumption and energy-saving technical parameters of equipment. Our future 5G network equipment procurement plan will include the power consumption of equipment as a key performance indicator in order to drive the green development of the value chain on a continuous basis.

◎ Green transportation

We actively promote self-pickup at business outlets for online orders to lower logistics and transportation costs and reduce emission of exhaust and pollutants. At the same time, efforts were made to improve the ability to process complex services at online platforms, boost the success rate in service delivery, and enhance the green operation of the Company.

◎ Green consumption

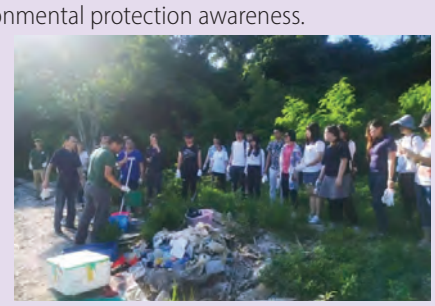
We actively promoted the use of electronic top-up cards to reduce the consumption of paper cards. We strong advocated the application of eSIM to replace physical SIM cards so as to reduce the consumption of raw materials by operators and telecommunication users in the production, transportation, storage and replacement of physical SIM cards and reduce environmental pollution.

Engaging in green charity activities

Centring on such themes as "energy conservation paving the way for green development" and "keeping the sky blue with low-carbon initiatives", and bearing in mind the guiding principles set out in relevant documents in relation to energy conservation and emission reduction jointly issued by 14 departments including the National Development and Reform Commission, China Unicom organised green energy conservation promotion and charity activities, taking into account the actual production and operation circumstances, in a bid to create a favourable atmosphere for efficient promotion of green corporate development.

In August 2019, Mentougou office of China Unicom Beijing branch organised a volunteer service activity called "see you around on clean ground", with the participation of over 20 employees and their children. Everybody benefits from a better urban environment. The office will continue to organize and carry out various voluntary service activities to pass on love, spread civilisation and contribute to the society in the future.

From September to December 2019, China Unicom Global, in cooperation with the World Wildlife Fund (WWF), successively held the "Yuen Chau Tsai, Hong Kong • Marine Debris Survey and Coastal Clean-up Volunteer Activities" and "Mai Po Nature Reserve Volunteer Activities - Removal of Invasive Plants and Climbers", etc., thereby vigorously advocating the concept of protecting the local natural ecology, and strengthening the employees' environmental protection awareness.



Volunteer activities of China Unicom Global

The "remembering original aspiration and creating forested landscape" themed tree planting activity of China Unicom System Integration

The "building a beautiful Tibet" tree planting activity of China Unicom Tibet branch