



2019

BUSINESS CLIMATE ACTION CASES



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### **Acknowledgement**

We thank the following partners for recommending corporate cases: China Federation of Industrial Economics, China National Textile and Apparel Council, China Chain Store & Franchise Association, Carbonstop, and SynTao Sustainability Solution. We also thank Vanke Foundation for the support.

### **Disclaimer**

The cases included in this collection is provided or recommended by members of CBCA. The CBCA Secretariat compiled and partially translated the cases, and is not responsible for the accuracy of the information and data in the cases.

## EDITOR'S NOTE

To further put into practice China's Intended Nationally Determined Contribution under the framework of the Paris Agreement, Vanke Foundation, SEE Foundation, C Team and 18 other organizations, officially launched a non-profit cooperation network – China Business Climate Action (CBCA) in September 2018 at the Global Climate Action Summit. CBCA is committed to driving carbon emission reduction, green transformation and green innovation in the entire industry chain and industry cluster, to promoting sustainable business models and solutions to climate change, and to mobilizing businesses to be models in addressing climate change.

CBCA advocates the following actions:

- Strengthen carbon management and carbon disclosure, and set greenhouse gas emission reduction targets in line with the Paris Agreement;
- Promote renewable energy technologies, and advocate the utilization of renewable energies;
- Promote the experience and technology of green manufacturing, low carbon and circular development to reduce waste;
- Promote sustainable development of the upstream and downstream industries for a green supply chain;
- Improve energy efficiency in construction, reduce energy consumption, and promote eco-friendly planning and design;
- Advocate green transport, such as new energy vehicles;
- Provide green consumption options for consumers;
- Promote carbon markets, carbon trading and green finance.

With support from Vanke Foundation, C Team and See Foundation set up the joint secretariat of CBCA to carry out projects to empower business climate actions. On the arrival of the 2019 United Nations Climate Change Conference (COP25), CBCA called for its members to recommend and submit business climate action cases to showcase China's corporate practices and innovations in addressing climate change during COP 25.

In total, 18 corporate cases shed light on several key sectors including renewable energy, green buildings, low-carbon transportation, green finance and sustainable supply chains. Carbon management solutions, information disclosure and behavioral changes are also featured.

Due to time and length limitations, the extensiveness and depth of climate actions in China's business sector has not been fully depicted in this case collection. However, the responsibilities and innovativeness that Chinese companies and industries demonstrated in the cases has raised our confidence to fight against climate change. CBCA will continue to work with its members and partners to support and promote climate actions in the business sector, while sticking to the path of green and sustainable development.

China Business Climate Action Secretariat

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SEE FOUNDATION

CHINA GREEN SUPPLY CHAIN ACTION IN REAL ESTATE INDUSTRY

PROJECT OVERVIEW

On June 5, 2016, SEE Foundation, China Urban Realty Association (CURA), China Real Estate Chamber of Commerce, China Vanke Co, Ltd., and Landsea Green Group jointly launched the “China Green Supply Chain Action in Real Estate Industry”. The Action promotes real estate companies to implement green procurement and urges upstream suppliers to make rectification. Technical support is provided by professional organizations, upstream suppliers with good environmental performance are selected to enter the recommended procurement list, the “White List”. Real estate companies will prioritize to purchase from the “White List” suppliers.

In 2018, five institutions were expanded to nine, with China Association of Building Energy Efficiency, the Foreign Environmental Cooperation Center, Ministry of Ecology and Environment, Beixin New Building Materials Group, and The Institute of Public and Environmental Affairs were invited to join. To date, The Green Supply Action involves 100 real estate companies and 3,669 whitelisted suppliers in 7 categories, and will further expand to include more procurement categories in the near future to facilitate the “Green Only Procurement” initiative.

PROJECT OUTCOME

The Action actively promotes the practical application of the White List and its standard through joint procurement. In 2018, we worked with the CURA to incorporate the White List standard of Using Legal Timber Sources into the joint procurement bidding document, which ensured approximately 28 million USD of wood flooring procurement came from legal forest land. In cooperation with ‘CURA 2019 joint procurement’, among the 160 suppliers that won the bid, 146 suppliers were promoted to enter the ‘environmental regulation compliance White List’, and reached 719 million USD of green procurement.

The Action has also received the following awards since its establishment. “Special Contribution Award for Promoting Green Supply Chain in China’s Real Estate Industry” was awarded by the Green Consumption and Green Supply Chain Alliance of the Ministry of Environmental Protection in 2017. At the 2018 Shanghai Summit Forum on Green Consumption, Beautiful China-Green Supply Chain, the “Industry Pioneer Award” was awarded by the Environmental Protection Department’s China ASEAN Environmental Cooperation Center. The “CEIBS Alumni Social Responsibility Selection Activity – Environmental Award” was awarded by the China Europe International Business School Alumni Association in 2018.

ORGANIZATION PROFILE

In 2008, SEE (Society of Entrepreneurs and Ecology) established the SEE Foundation, which was committed to supporting the growth of Chinese environmental protection NGOs, creating a social protection platform with the participation of entrepreneurs and environmental protection public welfare organizations. At the end of 2014, SEE Foundation was upgraded to a public fundraising foundation, with supporting the development of environmental protection public welfare industry as its base, working on desertification prevention, green supply chain and pollution prevention, ecological protection and nature education. In order to effectively promote the development of local environmental protection projects, SEE has established 28 environmental protection project centers with more than 900 entrepreneur members in total, directly or indirectly supports more than 550 Chinese environmental protection public welfare organizations or individuals.



PROJECT HIGHLIGHTS

The Action has been introduced at the United Nations Climate Change Conference for three consecutive years and has received recognition internationally. Erik Solheim, the former Secretary-General of the United Nations and Executive Director of the United Nations Environment Programme has exchanged many times with the Action working team and commented that this is the first international exploration of such a large-scale industry-based emission reduction that based on market mechanisms.



## PROJECT IMPLEMENTATION

The Action takes real estate enterprises and their suppliers as the main body of action, and selects different product categories to promote green procurement according to the specific situation of the real estate industry. Third-party institutions such as NGOs, testing and certification organizations provide technical support and scientific rectification solutions for suppliers after collecting supply chain documentations and testing the required information. At the same time, the Promotion Committee and Working Group provide White List for real estate enterprises, coordinate and supervise the implementation of enterprises. The Promotion Committee and Working Group also urge suppliers with violations to carry out rectification plans and actions accordingly.



There are professional organizations and experts to provide technical support in the process of formulating Green Procurement Action Plans and the selective criteria of White List. Each green procurement category helps to address different environmental issues accordingly. For example, Environmental Regulation Compliance devoted to solve air and water pollution issues. Other environmental problem such as controlling the emissions of waste gas, dust, noise and residues, protecting primeval forest resources and ensuring a livable home for wildlife, protecting residents to live healthily and safely, have also been taken care of.



## IMPACT AND SUSTAINABILITY

The Action unites and leads enterprises to promote innovative solutions of real estate industry, promotes enterprises to actively and effectively fulfill their social responsibilities as well as generates greater social benefits. The launch of the Action has embolden the participation of companies, research institutions and NGOs. The Action has raised awareness of environmental protection, climate change, human settlements, and green buildings through public funding, and promoted benign interaction between real estate enterprises and the public. The Action protects the well-being of urban and rural residents and improves the quality of life through solving environmental problems. The seven green procurement categories aim to solve environmental problems, promote enterprise to actively respond to climate change and pay attention to the health of residents. The Action starts with the real estate industry which contains more prominent environmental issues. The Action combines national and international industry standards and promotes its practice through industrial influences.

This type of joint action can be applied to other industries as well. For example, the Action has supported the development of Green Supply Chain Action in home appliance industry in Shunde, Guangdong province. Real estate companies choose suppliers that meet environmental regulation compliance requirements can effectively control risks, and suppliers can also obtain economic benefits by being more sustainable.

Focusing on pollution reduction as its base, the Action has continuously promoted enterprises to actively respond to climate change, and has launched "Green List" program in July 2019. The project will select suppliers with outstanding performance in carbon reduction and energy efficiency to enter the Green List and promote actual procurement.



## CSF MARKET CHAIN (BEIJING) OUTLET COOLING SYSTEM RENOVATION

### ◎ PROJECT OVERVIEW

The Yuquan Road outlet of CSF Market Chain (Beijing) Co., Ltd. carried out renovation of its refrigeration system in 2018, pioneering the use of 100% eco-friendly refrigeration technology. The system upgrade was completed and launched into operation in early July. The refrigerant applied in the Yuquan Rd. outlet was changed into CO2 from the original Freon R22. The refrigeration system of the outlet—consisting of 66 refrigerators and 4 cold stores—adopts CO2 transcritical parallel compression and integrated cooling/heating technology to enable cooling, heating and comprehensive utilization of production water.

Sponsored by China's Multilateral Fund for the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer, the project received guidance and recognition from the Ministry of Ecology and Environment's Foreign Cooperation and Exchange Center, the China Chain Store & Franchise Association, and the German International Cooperation Agency (GIZ), becoming a demonstration project for the use of natural refrigerants in supermarkets.

### ◎ PROJECT OUTCOME

- 1000% increase in cooling efficiency
- Approx. 20% reduction in energy consumption
- Other environmental benefits:
  - 50% of the heat at the condensing end of CO2 recycled for 24/7 supply of 50 degree Celsius of production and domestic water in the outlet;
  - The renovated system reuses materials such as valves, control components, etc., that are commonly used in the original system.

### ◎ COMPANY PROFILE

CSF Market Chain (Beijing) Co., Ltd. completed its transformation into a joint-stock entity in October 1999, becoming the first state-owned retail chain operator in Beijing to complete such transformation. CSF Market is an established supermarket chain operator and one of the Top 100 enterprises in the retail chain sector of China. Under its "CSF Market" brand, the company's primary operations include retail and wholesale of fresh daily produces, foods, household goods and commodities of other brands it distributes, under five distinctive business formats: comprehensive supermarket, food mart, lifestyle market, groceries supermarket and community supermarket, as well as the CSF Lawson convenience store, community retail E center, 24-hour book bar, among other business models. The company currently operates more than 100 chain stores in the city of Beijing and Zhangjiakou area of Xuanhua with a retail floor space of 180,000 square meters. The company has wholly-owned subsidiaries that specialize in wholesale, logistics and distribution, and training centers. The logistics and distribution base covers a space of more than 30,000 square meters, with close to 6,000 square meters of thermostatic groceries storage and low temperature storage.



CSF Market builds its brand on the "home" culture, leads the lifestyle of communities, and disseminates modern consumer philosophy through its ongoing improvement and innovation of its brand structure, business function and consumer environment, creating a supermarket brand for community retail.

## PROJECT IMPLEMENTATION

The project replaces the original Freon refrigeration system and freezer unit with the state-of-the-art CO2 trans-critical refrigeration system: medium-temperature system has an evaporation temperature of -10 degrees and cooling capacity of 77kw, low-temperature system has an evaporation temperature of -35 degrees and cooling capacity of 30 kW; the unit adopts the CO2 trans-critical medium-low temperature integrated unit and has its own maintenance device to ensure zero pressure increase inside the tank during shutdown and enhance the safety of the system.

CO2 trans-critical refrigeration system traits:

- CO2 has good thermodynamic properties, has a heat transfer performance 3 times that of traditional Freon, a heat exchange temperature difference 1/2 that of Freon, and a system pressure loss 1/10 that of Freon. Current running evaporation temperature is superior than the original refrigeration system by 3°C.
- The refrigeration system is combined with the residual heat recycling system to reduce the compressor discharge temperature, lower the condensation temperature and improve the system efficiency; on the other hand, the high temperature exhaust gas of the compressor is used to heat tap water to above 50 °C to provide hot water for use in food cleansing and in the office area;
- Both the low-voltage and the high-voltage parts of the system are equipped with a compressor head to enable variable frequency control, which is available on all condenser fans. For this reason, the CO2 refrigeration system has a daily coefficient of performance (COP) 10% higher than that of a conventional Freon direct expansion system.

System design:

- For the CO2 trans-critical system, control comes as a more complex issue than in the Freon system in that the former's control components include more control functions, so in terms of design of the overall unit, the compressor, the freezer, the heat recovery system, and cool air control of the high pressure part are integrated into one centralized control cabinet, making the overall control more coordinated.
- A remote online management platform has been developed to monitor the refrigeration system in real time, including the temperature, pressure, and power of the store's freezer and the day-to-day operations of each equipment. The data are updated every 30 seconds to provide real-time safeguards to the CO2 trans-critical systems installed in CSF market outlets.



Challenges in project implementation:

Challenge	Solution
High pressure resistance of the system: designed pressure of the CO2 trans-critical refrigeration system is 120 kg, which is 4 times that of the original regular Freon system.	Based on the design concept of evaporative condensers, adopt the air-cooling focused, high-mist spray supported cooling method to reduce pressure and ensure stable pressure in the high-pressure part;
Efficiency (energy economy) improvement: supercritical heat release difficulty at room temperature, and reduced theoretical efficiency due to HFC refrigerant	First-gen enhancement system that is relatively simple but has mediocre energy consumption performance is abolished, replaced with a second-generation parallel compression refrigeration system that performs better in terms of energy consumption during the hotter seasons.
Cooling stability: increased difficulty of stability control in the high-pressure system	Equip with an electronic expansion valve for higher adjustment accuracy.
System safety: high CO2 concentration constitutes a safety hazard	Install CO2 concentration monitoring probes in machine rooms, cold stores and outlets; install a shut-off valve with a single function in each cabinet to prevent CO2 accumulation;

In addition, the Yuquan Rd. outlet of CSF Market renovated its central air conditioning unit to reduce carbon emissions of its store. The air-conditioning functions in an area of approx. 4156 sqm. The main usages are: supermarket (L1 & L2), office and warehouse (L3). The renovated central air conditioning unit adopts centralized cold/heat source, Haier-branded magnetic levitation variable frequency centrifugal unit is used. Compared with the regular water-cooled screw unit solution, the Haier-branded magnetic levitation DC variable frequency unit saves about 21% of energy used.

## IMPACT AND SUSTAINABILITY

Adopting state-of-the-art CO2 trans-critical parallel compressor technology + residual heat recovery technology, the project is a typical example of the comprehensive cold and heat utilization. All in-store equipment is automatically controlled by one unit, with integrated medium and low temperature compressors, enabling variable frequency adjustment and reduces operating costs. As the condensing end adopts air-cooling automatic adjustment + water sprinkler-assisted cooling technology, year-round operation stability is guaranteed.

As a refrigerant, CO2 is highly eco-friendly. It has an ozone depletion potential (ODP) value of 0, and a significantly lower global warming potential (GWP) than that of Freon. CO2 is widely available and recyclable. It can greatly reduce the cost of refrigerant replacement, save energy, and fundamentally resolve the problem of compound pollution to the environment. CO2 is safe, non-toxic, non-flammable, has no irritating odor, is harmless to the human body, and does not decompose into hazardous gases even at high temperatures, and does no damage to food or the ecosystem. **It is therefore highly significant to the implementation of China's energy conservation and emission reduction policies and the promotion of low carbon and sustainable development by promoting the application of natural working fluid CO2 as a refrigerant.**





## CHENFENG GROUP

### CLIMATE LEADERSHIP PROJECT

#### PROJECT OVERVIEW

The entry into force of the Paris Agreement provides a clear climate vision for the Chenfeng Group to step up the commitment for limiting temperature rise below 2°C or even meet the 1.5°C goal. As the first Chinese textile manufacturer signing the Fashion Industry Charter for Climate Action under UNFCCC, Chenfeng launched Chenfeng Climate Leadership Project in 2018 under the Climate Stewardship 2030 framework of China National Textile and Apparel Council (CNTAC).

Chenfeng aims to promote greenhouse gas (GHG) emission reduction within the Group and its supply chain (i.e. become carbon-neutral in 2025, achieve zero carbon footprint production in 2030, and GHG emission reduction by 30% from supply chain in 2030) and provide low-carbon fashion textile and clothing to meet the general public's demand (i.e. extensive production of affordable zero-carbon textiles by 2030).

Chenfeng will also optimize the supply chain cooperation model with upstream enterprises, reduce the cost of contract fulfillment of environmental protection of upstream enterprises, and increase the operational competitiveness of the whole supply chain eco-system. Moreover, Chenfeng will support the long-term demand for GHG emission reduction in the supply chain of downstream cooperative brands (i.e. H&M supply chain and 2030 carbon-neutral).

This project supports Chinese government's commitment to strategically reduce GHG emission by 2030 and demonstrates Chinese textile industry's proactive attitude and outstanding results in response to climate change for global stakeholders.

#### PROJECT OUTCOME

Emission Reduction: Annually reduce 10,139 metric tons of carbon equivalent GHG on average

- Energy Saving: 10.33 GWh/year Power Consumption, 3,600 tons/year Steam Consumption
- Other benefits:
  - With Chenfeng's investment, dredging 400,000 cubic-meter silk near the plant area;
  - Reduce waste water discharge through waste water recycle and reuse and thus reduce GHG emission of downstream companies from waste water treatment process.

#### COMPANY PROFILE

Founded in 1967, Chenfeng Group, starting its business with production and processing of silk garments, adheres to the development strategy of "corporate grouping, production scaling, internationalization of operations and the integration of industry-university-research cooperation." Chengfeng has been focusing on garment manufacturing for 50 years. After five decades' development, Chenfeng firmly believes that the apparel industry is a traditional industry that deeply embedded in people's livelihood. In addition to passing warming and comfortable feel to its customers, this industry also leads the fashion trend.

Since 2005, Chenfeng has incorporated corporate social responsibility and sustainable development into its corporate strategy to convey its sustainable value to downstream brands, and successively joined Fair Labor Association (FLA), Sustainable Apparel Coalition (SAC), CNTAC Climate Stewardship 2030.

At present, Chenfeng has successful business practices in four fields: circular economy, water resource management, climate change response and fair employment. In addition, Chenfeng has always integrated biodiversity and ecosystem services into its construction plan. For example, it conducted dredging, built islands and planted trees near its operation, providing a shelter for migratory birds.



## ◎ PROJECT IMPLEMENTATION

The economic value created by China's textile industry accounts for 36% of the global textile trade, making China the world's largest country of carbon emission in textile manufacturing. With the advent of performance of period (POP) of 2025/2030, Chenfeng realized that emission reduction should not be passive, instead, it need to be proactive, which is the rooting reason for Chenfeng Climate Leadership Project.

- Jointly developed Chenfeng Climate Leadership Action Plan and emission reduction roadmap with CNTAC.
- The mechanism of The Climate Stewardship 2030 brings latest low-carbon material, technologies, and facilities comprehensively to increase renewable energy usage, energy efficiency and green coverage.
  - Increase renewable energy usage to reduce scope II greenhouse gases emission: Obtain green energy through distributed photovoltaic panel and solar water heating systems instead of purchasing electricity and steam power outside
    - 6.43 GWh electricity are generated by distributed photovoltaic systems in plant area to reduce 4,726 tons of carbon equivalent GHG.
    - 3,600 tons of steam are saved annually (equivalence to reduce 1,046 tons of carbon equivalent GHG emissions) by purchasing advanced drain valves for the dormitory area and installing 5,000 square meters solar water heating system, funded by more than one million RMBs.
  - Increase energy efficiency: Reduce power consumption by 60%, using LED lightings. Additionally, saving 25% power using high-power variable frequency air compressors to decrease GHG emissions (scope II);
    - Reducing lighting power consumption by 60%, saving 2.9 GWh electricity, cutting down 2,132 tons of carbon equivalent GHG emissions every year by investing 3 million RMB to install 40,000 high-efficiency LED lamps
    - Reducing 25% power consumption and saving 1 GWh electricity and reducing 735 tons of carbon equivalent GHG emissions by employing high-power variable frequency air compressors
  - Increase ratio of green coverage: dissolve more oxygen in river water through dredging, thus increasing water storage and biodiversity; increase plantation to improve air quality and absorb CO<sub>2</sub> (one of the mains GHGs) (scope I); Enhance green information disclosure, participated in third-party audit of GHG emission and awarded National Green Factory. The green coverage of 1,500 mu area equivalent to the reduction of 1,500 tons of carbon equivalent GHG emissions.

## ◎ IMPACT AND SUSTAINABILITY

As the first native fashion clothing enterprise joining Climate Stewardship 2030, Chenfeng has developed and launched Chenfeng Climate Leadership Action Plan by working with CNTAC. Joint action has been conducted with the group's branches and upstream supply chain enterprises. Chenfeng Climate Leadership is a voluntary emission reduction plan, focusing on climate empowerment, measurement, innovation sharing and application, implementation of emission reduction and promotion of value chain partners to carry out low-carbon innovation.

### Follow-up Plans:

- Continuous application of low-carbon technology solutions
- Regular implementation of GHG verification
- Sharing of annual emission reduction results of Chenfeng Climate Leadership through information disclosure
- Planning implementation and feasible plan of carbon-neutral
- Planning implementation and feasible plan of zero-carbon products



## SHENZHEN POWER-SOLUTION IND CO., LTD

### AFFORDABLE SOLAR LAMP

#### ◎ PROJECT OVERVIEW

Nowadays, electricity cost is relatively low. However, there is still more than 11% (840 million) of the population (mostly are extremely poor) in the world that live in off-grid areas who depend on igniting candles and kerosene lamps that emit a large amount of carbon dioxide and other greenhouse gases. Helping the poor to solve their difficulties in accessing electricity and reducing carbon dioxide emissions become a critical topic. Shenzhen Power-Solution Ind Co., Ltd, has been committed to providing affordable clean solar energy for the poor from years ago, which means reducing pollution and emissions while solving the difficulties in electricity use. From March 2009 to December 2018, we have produced more than 4.22 million solar lamps, cut down carbon dioxide emissions for 3.3 million tons, changed people's lifestyles in off-grid areas. We significantly reduced the safety risks brought by using candles, kerosene lamps, and other dangerous lighting tools. It has successfully changed the world with science and technology and made outstanding contributions to slowing down the greenhouse effect, protecting the ecological environment, and helping to protect children from hurt by kerosene.

#### ◎ PROJECT OUTCOME

- Reduced 3.3 million tons of CO2 emission (The average lifespan of the lamp is 3 years, and the accumulated CO2 reduction is about 0.78 tons);
- Generated 37 million KWH through solar energy, saved \$7 million for consumers;
- Protected more than 15,000 children from to respiratory disease that caused by using candles and kerosene lamps.

#### Awards

- 2016: Certification of "National High-Tech Enterprise".
- 2018: Certification of "China Good Social Enterprise" certification
- 2018: "New Energy Leader " Award by Asia Development Bank
- 2019: China's TOP20 most promising social enterprises in 2019

#### ◎ COMPANY PROFILE

Shenzhen Power-Solution Ind Co., Ltd., is founded in 2004. We launched a project intending to alleviate poverty with green energy and reducing carbon dioxide emission with solar power in 2009, and the main target is the Bottom of Pyramid (BOP) people. Over the years, Power-Solution has developed and manufactured a variety of affordable solar energy products, including solar lamps, solar reading lights, multifunctional home lighting systems, and solar educational media, which are admired by the BOP people. We educated the BOP people the idea of using green energy to reduce the emission of greenhouse gas.



In 2012, Power-Solution established its own independent production line and became a high-quality enterprise that integrated R&D, production, and sales.

2016, rated as China's national high-tech enterprise and Shenzhen high-tech enterprise.

2019, stand out from the national 621 application companies, successfully obtained the Gold Social Enterprise Certification.

#### ◎ PROJECT HIGHLIGHTS

Product Manager Ricky: "after visiting customers on the spot, I realized the meaning of my job. What we offered is not only a lamp that provides lighting. We also illuminate the lives of poor people.

Sally from Uganda: "with solar lamps, my children don't have to study under a dark kerosene lamp, and they don't have to worry about reading alone at home, because there will be no more kerosene lamp fires, and my children won't get sick because of the bad smell."

## ◎ PROJECT IMPLEMENTATION

From 2009 to 2012, Power-Solution was only responsible for designing and selling products. The production was outsourced. However, it is hard to control quality and cost. To enable more BOP people to use clean and environmentally friendly solar products, we set up our production line in 2012, thus making a complete supply chain from product design to manufacture to sales, which not only reduces the price but also ensures the quality. From the initial establishment of a company with only ten employees, to at the end of 2018, a high-quality supplier integrating sales and manufacturing with more than 130 employees and a factory of 3,000 square meters, Power-Solution has proved our determination and perseverance in benefiting BOP people with ten years' efforts.

After many field visits to off-grid areas and market research, we have continuously improved our products, expanding the product category from solar lights to reading lights and solar lanterns with charging function. Our product design always adheres to meeting the actual needs of end-users as the ultimate goal. For instance, in the solar reading light field, the majority of the reading lamp design is complicated, which contains a bracket (The lamp body is set in a high place to increase the lighting area). It not only increases the production cost but also shipping cost and damage. To solve the problem, we have designed a popular product called Candles Killer. Compared with similar products, we creatively redesigned the lamp to the hook shape, which is smaller, more convenient, and can be safely packed. The packing capacity increases to 96 per box (verses 50 in each box for the regular ones).

Meanwhile, the hook design allows the users to set the lamp on the bottleneck of any abandoned water bottle. In this way, the lamp function of reading is not affected, and the shipping cost is reduced. Also, the discarded water bottle can be reused. The BOP families in off-grid areas can purchase the Candles Killer with the same cost of three month's supply of candles and kerosene, and the lamp's life span is over three years. Therefore, this is the ultimate in user experience and cost control.

After satisfied the user's demand for basic household electricity with years of effort, we began to consider how to improve the life quality of the BOP population further. Therefore, we developed value-added solar products, such as a multi-functional home lighting system that can drive solar fans and televisions.

However, most BOP families could not afford these value-added solar products. We introduced the Pay As You Go (PAYG) installment program, which allows customers to use these value-added products by making a 30%



## ◎ IMPACT AND SUSTAINABILITY

As a social enterprise, Power-Solution still insists on providing excellent service, world-class quality products at a reasonable price for BOP people without any external resources during its ten-year development history and has become the industry leader. We have served 30 million people from 4.42 million BOP households and reduced carbon dioxide emissions by more than 3.3 million tons through cooperation with more than 100 dealers in 63 countries.

As we all know, the root cause of poverty is the lack of education. We believe that if we want to achieve sustainable poverty alleviation, reduce the number of BOP population, and more importantly, give them access to education, to enhance their productivity and improve their life. Hence, we combined the energy supply with the literacy program, and it is called Solar Media. This product is equipped with a 7-inch display screen. Through cooperation with UN, WHO and other organizations, Solar Media can publicize the knowledge of disease prevention in the most simple and understandable way. By spreading knowledge with our product, we hope to reduce the infectious rate of high incidence diseases in Africa, such as Ebola, AIDS and malaria, and to enhance the awareness of disease prevention of BOP population.

Also, Solar Media can publicize environmental protection awareness, such as slowing global warming and reducing carbon dioxide emissions, popularize necessary production skills, improve productivity, and minimize illiteracy rate.

It is expected that by 2020, we will gradually start to carry out the "micro-after-sales & maintenance" project in Africa. By subsidizing and training local residents and setting up micro-after-sales service centers in small and medium-sized communities (villages), we can help improving the quality of our services and protect the environment through recycling while providing jobs and improving the living standards of local residents.

## STATE GRID HANGZHOU POWER SUPPLY COMPANY

### LOW-CARBON HOSPITALITY PROGRAM -- HOTEL ENERGY MANAGEMENT

#### PROJECT OVERVIEW

In April 2019, State Grid Hangzhou Power Supply Company officially unveiled the Low-carbon Hospitality Program especially designed for hotel energy management, representing a new model of comprehensive energy services. Based on in-depth cooperation with the Hangzhou Administration of Culture, Radio, Film, Television, and Tourism and Hangzhou Municipal Department of Data Resources, the program integrates operational data and power consumption data of star-rated hotels in Hangzhou to construct a comprehensive energy efficiency evaluation model that evaluates and ranks the hotels by comprehensive energy efficiency, and display the results on the “Green Hotels” section of the “Online State Grid” platform, providing a channel for hotels to improve energy management. Moreover, it provides guests with carbon emission bills, energy use rankings, and coupons via third-party platforms such as mini programs and apps, enhancing their low-carbon awareness.

Hangzhou Power Supply Company sponsored the pilot project of comprehensive energy consumption monitoring renovation of Yunqi Hotel, to collect energy consumption data of every single room and upload the data to Hangzhou City Brain to be viewed by the government, hotel manager, and guests. The program achieves “power supply + hotel” multi-dimension data integration and application, reducing energy consumption for win-win results through the involvement of the government, hotel, and guests.

#### PROJECT OUTCOME

- The Yunqi Hotel comprehensive energy consumption monitoring pilot was officially launched in April 2019. As of October 24, 2019, the hotel reduced energy consumption by 49.10% year-on-year, with energy savings of 35.16% on average; saved 7,514 kWh of power consumption in total and reduced CO2 emissions by 7.49 tons.
- 471 hotels participated in the “green hotel” assessments, and six hotels underwent energy consumption monitoring or energy saving renovation.
- The hotel energy consumption monitoring system was connected to Hangzhou City Brain to serve urban comprehensive energy management

#### COMPANY PROFILE

State Grid Hangzhou Power Supply Company is a large-scale power supply enterprise of State Grid Zhejiang Electric Power Co., Ltd. under the State Grid Corporation of China. Located in Hangzhou, the world’s first city to pilot the new standard ISO 37101:2016 sustainable development in communities, the company undertakes the mission of grid construction, operation, and development in the city and is dedicated to ensuring safer, more cost-effective, cleaner, and sustainable power supply, endeavoring to provide a “Hangzhou model” of sustainable energy development in communities. In 2018, the company was honored the 2018 Global Compact Network China “SDG Pioneer Enterprise” by the United Nations.



#### PROJECT HIGHLIGHTS

Yunqi Hotel Manager: “A lot of our guests scan the QR code to follow the Low-carbon Hospitality Program. Especially during this year’s Computing Conference, many internet enthusiasts came to our hotel to just learn about this program. This not only helped reduce our power costs but also boosted the occupancy rate.”

The Low-carbon Hospitality Program was covered by more than ten media outlets including the Xinhua News Agency and ecns.cn, with total visits of more than 500,000. During random interviews with Hangzhou Television, the hotel guests said that this program could increase public awareness of energy saving while giving the guests both physical and mental rewards, making it a great initiative to promote green living.

## ◎ PROJECT IMPLEMENTATION

### Innovative comprehensive energy services for hotels

Energy costs account for more than 30% of the total operating costs of large hotels; 8-12% of their energy losses can be attributed to the absence of proper energy consumption monitoring and guest participation mechanisms. Hangzhou Power Supply Company launched the Low-carbon Hospitality Program, collecting operational data of the city's hotels, including fixed data such as the area of hotels and number of rooms and dynamic data like occupancy rate and revenue, and combining such data with the hotels' power consumption data in its internal system to devise an energy efficiency evaluation system integrating energy data and operational data. Through the STIRPAT hotel energy efficiency model, Hangzhou Power Supply Company analyzes the energy efficiency of hotels by region, type, star rating, and other metrics, providing data support to the government to improve lean management and to hotels to better manage their energy efficiency. The high-frequency NILM technology is adopted for scheduled matching among power-based energy efficiency, steady-state energy efficiency, and transient-state energy efficiency, to check the status of loads to facilitate the hotels' access to energy consumption monitoring data and to support their energy efficiency management.

### Energy conservation for win-win results

For hotels, the "Green Hotels" section was launched on the "Online State Grid" platform to provide services including energy consumption factor analysis and comprehensive energy efficiency scoring and ranking for 471 star-rated hotels in Hangzhou, bringing hotel managers up to date with their energy consumption. The program also provides professional suggestions on energy saving for lower-ranked hotels. The low-carbon hospitality concept advocated by the program, in line with contemporary social values, can attract experience-seeking guests to hotels. Even if one such guest is attracted to a hotel per day, that can bring in an additional income of at least RMB300 to the hotel.

For individual guests, their privacy can be completely ensured as this program uses the non-invasive load monitoring technology for energy consumption monitoring. Moreover, the program has developed a display system that can provide carbon emission bills containing room energy use, comprehensive energy consumption scores, and energy saving suggestions for hotels and guests based on AI and big data algorithms, and can display hotel room energy use rankings to deliver a fun experience of carbon emission competitions and therefore increase guests' low-carbon and energy-saving awareness. In addition, the program has cooperated with hotels, restaurants, entertainment, and other businesses to provide coupons to guests whose energy consumption is at a lower level than average, creating a new win-win cooperation pattern where guests get tangible benefits, businesses obtain more traffic and attention, and the company increases its income by charging platform service fees.

For government agencies such as the tourism administration, environmental protection administration, and development and reform commission, the hotel energy consumption monitoring feature connected to Hangzhou City Brain enables them to go to relevant pages via the e-government site to view the data in real time, facilitating urban comprehensive energy management.

### Yunqi Hotel Pilot

- The pilot project helped the hotel save 1,263 kWh of power consumption just one month after it was launched a 13.89% reduction year on year. By October 24, 2019, the hotel's energy consumption decreased by 49.10% year on year, saving a total of 7,514 kWh;
- 25% of hotel guests scan the QR code to follow the program; By October 24, 2019, total visits to the Yunqi Hotel page of Hangzhou City Brain's tourism system had reached 3,528;
- Assuming a reduction of 1 kWh/night per room, the program can help a mid-sized hotel reduce electricity bills by more than RMB50 a day; Even though the renovation costs were relatively high for the first pilot hotel, it took just four months to recover the costs.

## ◎ IMPACT AND SUSTAINABILITY

Committed to exploring the internal and external data cooperation model, the Low-carbon Home-stay Program integrates data within and outside the hotel industry and develops a comprehensive hotel power consumption management service system:

- In response to the extensive energy efficiency management mode of the hotel industry, the program has launched the "Green Hotels" section on the "Online State Grid" and "State Grid Travel" platforms, so hotels can log in to the platforms to view their energy efficiency score, ranking, and energy consumption factor analysis, helping them greatly improve energy efficiency management.
- The program has made full use of the energy efficiency evaluation data of the connected hotels to develop energy efficiency profiles. On this basis, the power supply company can implement targeted marketing and provide targeted services such as energy saving consulting, intelligent appliance renovation, and energy efficiency management system development for hotels, thereby fostering new comprehensive energy efficiency businesses.
- The program, advocating the low-carbon concept, provides electric carbon bills to hotel guests based on independent energy consumption monitoring over each hotel room, so that guests can get a direct understanding of their energy consumption. It also offers energy conservation rewards to guests to encourage them to embrace low-carbon and energy-saving living and travelling.

As a next step, the program will expand cooperation with hotels and guesthouses in Hangzhou to help them with energy consumption monitoring renovation. It will also seek to cooperate with large travel agency platforms such as Ctrip and Fliggy and explore diversified community marketing modes such as electricity bill rebates, scenic spot coupons, and restaurant discounts in an endeavor to build an internet ecosystem of "power + travel".



## STATE GRID HUZHOU ELECTRIC POWER SUPPLY COMPANY

### “ECO-POWER” CITY PILOT

#### ◎ PROJECT OVERVIEW

Since 2015, State Grid Huzhou Electric Power Supply Company has deepened the integration of the development of the power sector and of urban ecological civilization in Huzhou and promoted the development of an “eco-power” city. Ongoing efforts have been made in coal (oil)-fired boiler renovation in Huzhou’s printing and dyeing industry, an urban-rural electric bus coverage project, the pioneering “all-electric logistics” model in China, power substitution in Moganshan Bed & Breakfast, and the rollout of power supply throughout canal embankment areas, so as to establish a new energy system featuring “electricity focus, integration of multiple energy sources, clean and efficiency”, and to promote green production activities and lifestyle across the society, yielding marked results in reducing the emission of air pollutants, playing an effective exemplary role in climate initiatives nationwide.

#### ◎ PROJECT OUTCOME

- Zhili coal (oil)-fired boiler renovation: CO2 emission reduced by 34,900 tons p.a., sulfur dioxide emission reduced by 1,050 tons p.a.;
- Urban-rural electric bus coverage project: CO2 emission reduced by 12,000 tons p.a., fuel consumption reduced by 4,462 tons p.a.;
- “All-electric logistics” project: CO2 emission reduced by 14,000 tons p.a., transport vehicle deployment reduced by nearly 3,000 journeys;
- Power substitution in Moganshan Bed & Breakfast: CO2 emission reduced by 5,230 tons p.a., sulfur dioxide emission reduced by 150 tons p.a., particulates by 1,415 tons p.a.;
- Huzhou canal embankment power project: CO2 emission reduced by 498.35 tons p.a., sulfur oxides emission reduced by 25 tons p.a., nitrogen oxides emission by 14.7 tons p.a., particulates by 4.8 tons p.a..

#### ◎ COMPANY PROFILE

State Grid Huzhou Electric Power Supply Company is a large-scale state-owned power supply company governed by State Grid Zhejiang Electric Power Co., Ltd. It undertakes the fundamental mission of providing the economy and residents of Huzhou with safe, reliable and ample power supply and services. As of the end of 2018, the company owned 130 35KV and above substations with a combined capacity of 17.2875 million KVA, and 323 35 KV and above transmission lines, with a total length of 4,981 km.



**国家电网**  
STATE GRID

**国网湖州供电公司**  
STATE GRID HUZHOU ELECTRIC POWER SUPPLY COMPANY

#### ◎ PROJECT HIGHLIGHTS

The objective is to establish a “eco-power” joint development platform with society-wide coverage under the leadership of the deputy mayor, supported by relevant government functions, involving stakeholders including power supply companies, businesses, retail outlets, neighborhoods, power equipment manufacturers, among others.

- Received written affirmation from the National Committee of the Chinese People’s Political Consultative Conference and the National Development and Reform Commission;
- Received strong support from State Grid, State Grid Zhejiang Electric Power Co., Ltd. and Huzhou Municipal People’s Government;
- The “eco-power” practices have been featured in New China Agency’s domestic developments highlight;
- The accomplishments of the “eco-power” initiative have been reported by CCTV, People’s Daily, New China Agency and Economic Daily;
- The international forum on “eco-power” model city development has been held in partnership with National Development and Reform Commission’s Energy Research Institute, Xinhua News Agency’s China Economic Information Service, attended by countries involved in the “Belt and Road” initiative.

## ◎ PROJECT IMPLEMENTATION

The city of Huzhou in Zhejiang province is the birthplace of Mr. Xi Jinping’s philosophy that “well-preserved natural environment is the breeding ground of material wealth and economic prosperity”. State Grid Huzhou Electric Power Supply Company has enlisted 55 local power companies to sign the “eco-power” green alliance initiative, with a view to jointly implementing new philosophies of green, circular and low-carbon growth, and jointly establishing a clean and low-carbon energy supply system. A project-based management approach is to be adopted and pilot programs developed in partnership with townships, villages, communities, businesses and clients, establishing a rollout pathway featuring “development focus, joint development efforts and shared outcome”.

### 1. “Coal-to-electricity” transition project

Huzhou’s Zhili township is home to more than 5,700 childrenswear manufacturers who have a combined share of 21% of the domestic market. The city’s Nanxun district houses over 470 wood flooring manufacturers, whose output account for around 35% of companies nationwide. The majority of such companies previously used coal-fired boilers in productions. Since 2015, State Grid Huzhou Electric Power Supply Company has developed a business model of “multi-party involvement, complementary strengths and shared benefits”, renovating in total more than 7,600 coal-fired boilers into electricity-powered boilers, fostering energy conservation and emission reduction in the industry.



### 2. 100% urban-rural electrical bus coverage project

Since 2018, State Grid Huzhou has been exploring a multi-party win-win mechanism and set up a government-business collaboration taskforce to foster 100% coverage of electrical buses in urban and rural areas of Huzhou. Joint ventures were set up for the operations and an organization model and management operation model enabling synergy between Huzhou’s natural environment and the power sector have been developed. As of August 2019, construction of 31 electrical bus hubs has been completed and bus companies have deployed 885 electrical buses.



### 3. “All-electricity logistics” project

In Zhejiang’s Changxing county, State Grid Huzhou offered an innovative “power in lieu of oil” solution. Clinker from all cement production areas are transported to transit warehouses via a 22 km-long fully enclosed electric conveyor belt, before being shipped out via logistics terminals. The new solution signaled an end to the original trucking approach. The facilities were completed and launched into operation in August 2018, becoming the first power substitution project in China to achieve “all-electricity transport, warehousing, loading/unloading and vessel berthing”.



### 4. Power substitution in Moganshan’s Bed & Breakfast

In Zhejiang’s Deqing county, Moganshan B&B sector has been growing fast, consuming extensive amount of conventional energy, causing increasingly serious pollutant emission problems. State Grid Huzhou took the initiative to joint efforts with relevant authorities, producers and State Grid malls to consolidate private-sector resources and innovate a one-stop services model, where air heat pump and other power-based heating technologies are used to replace coal and gas-fired heating facilities in bed & breakfast establishments. Power-based heating penetration reached a remarkable 95% in early 2018, yielding pleasing energy conservation and emission reduction results.



### 5. Huzhou canal embankment power project

Huzhou undertakes around 40% of total cargo shipment and transit load of the trucking and shipping sector of Zhejiang province. The city is a key waterborne transport hub on the Beijing-Hangzhou canal. Since 2017, State Grid Huzhou has engaged in strategic partnership with Zhejiang Energy Conservation Services Company and Huzhou Port and Shipping Administration for the “green transport terminal embankment power project”, heavily rolling out construction of embankment power facilities, enabling full coverage of embankment power in the water service area of the Huzhou section of Beijing-Hangzhou canal, generally eliminating the emission of hazardous gas and noise pollution while vessels are berthed to shore.



## ◎ IMPACT AND SUSTAINABILITY

As Huzhou rolls out its “eco-power” initiative, electric power has become a key focal point in dealing with climate change and fostering eco-friendly civilization. Huzhou’s eco-friendly index has risen significantly over the past years thanks to the city’s ongoing efforts in deepening the integration of development of the power sector and of urban eco-friendly civilization, in fostering clean power generation, optimizing the way energy is utilized across the society, enhancing clean power transmission and distribution capabilities and abilities of embracing renewable energy, and in advocating green lifestyle of the general public.

The city of Huzhou has published its official 3-Year Action Plan for Developing an “Eco-Power” Model City. Huzhou will actively explore innovative technologies (cloud, big data, IoT, mobile, intelligence), business ecosystem, financial products and business model, among other innovative applications, to take steps in rolling out model projects including the electrification of Anji countryside, Deqing’s green energy accumulation, Changxing green and smart-enabled manufacturing park, deeply rolling out the development of “eco-power” model cities from an overarching perspective, covering dimensions of city, model estate, industrial park and community. The ultimate goal is to, by 2021, further low-carbon emission, environment preservation, smart technology and efficiency in energy supply, power grid development, energy consumption, production and daily resident use, and establish a number of Huzhou’s “eco-power” model that can be rolled out elsewhere.





## STATE GRID ZHEJIANG CONSTRUCTION COMPANY GREEN CONSTRUCTION TO PROTECT “LUCID WATERS AND LUSH MOUNTAINS”

### ◎ PROJECT OVERVIEW

The 500 KV transmission project of Changlongshan Pumped Storage Power Station is a major project to ensure the power transmission from the Changlongshan Pumped Storage Power Station. The power station with an installed capacity of 6×350 MW is located at the Shanhe Harbor of Tianhuangping Town, Anji County, featuring good terrain conditions, high water head, large capacity and sufficient water resources. The power transmission from this station will optimize the power supply structure of the East China Power Grid, improve the voltage level of the Power Grid, improve the quality of power supply, ensure the safe and stable operation of the Power Grid, increase the consumption ratio of hydropower from the west of Zhejiang province in the East China Power Grid, and effectively relieve the peak load regulation pressure of the Zhejiang Power Grid and the East China Power Grid. It is expected to save 280,000 tons of coal consumption of the system and reduce carbon dioxide emissions by over 560 thousand tons.

The project line passes through Anji County, Deqing County, Changxing County and Wuxing District of Huzhou City, with a mountain area ratio of 97%. To protect the “lucid waters and lush mountains”, the State Grid Zhejiang Electric Power Co., Ltd. has put the vision for green development throughout the whole process of the project, effectively reducing the impact of power grid construction on the environment through green design, green building, green management and green construction. The project started to be planned from 2017 and designed from January 2018, and its construction was formally started in May 2019. It has successfully bypassed the Phoenix Reservoir Reserve and Xisaishan Tourist Resort, protected 212.36 square kilometers of water resources and more than 1,000 kinds of animals, reduced vegetation clearance and tree felling by more than 6,000 mu, and maintained terrestrial biodiversity and regional ecosystem balance.

### ◎ PROJECT OUTCOME

The project will, by increasing the consumption proportion of hydropower from the western part of Zhejiang Province, annually:

- save 280,000 tons of coal consumption
- reduce CO2 emissions by more than 560,000 tons

Green infrastructure will be implemented for the project

- 212.36 square kilometers of water-source areas will be protected.
- More than 1,000 kinds of animals will be protected.
- Vegetation clearance and tree felling will be reduced by 4.29 square kilometers
- Earthwork excavation will be reduced by more than 50,000 cubic meters

### ◎ COMPANY PROFILE

State Grid Zhejiang Electric Power Co., Ltd., a wholly-owned subsidiary of State Grid Corporation of China, which undertakes the mission of constructing, operating and developing the Zhejiang Power Grid and is committed to ensuring safer, more economical, cleaner and sustainable power supply. The Construction Branch of State Grid Zhejiang Electric Power Co., Ltd. is a professional agency for power grid project management of State Grid Zhejiang Electric Power Co., Ltd., which undertakes the responsibilities for project site management, control and coordination; and the whole process consultation, construction management, engineering supervision, power grid equipment supervision and other engineering consultation services of power transmission and transformation projects. Taking building a first-class modern power engineering management enterprise in China as its strategic goal, the company fully supports the high-quality development of Zhejiang power grid construction, and strives to ensure energy security, serve local economic and social development and ensures that the people live a better life.



### ◎ PROJECT HIGHLIGHTS

- Explore the path of sustainable development based on "green infrastructure" with green design, green building, green management and green construction as focuses of implementation, and strictly follow the relevant provisions of environmental protection and water conservation.
- Initiate the “one foundation, one policy” model to minimize the impact of a single foundation on the ecological environment.
- Reduce vegetation damage and protect the land eco-system through “zero slope protection, 0 retaining wall” residual soil treatment and full-cableway transportation.

## PROJECT IMPLEMENTATION

The project actively follows the vision for “green development and environmental protection”. The project started planning in 2017 and designing in January 2018, and the construction was started in May 2019. The vision for “green development and environmental protection” has been integrated into the whole process of project planning, project design and project implementation to explore the ecological mode of “green infrastructure”.

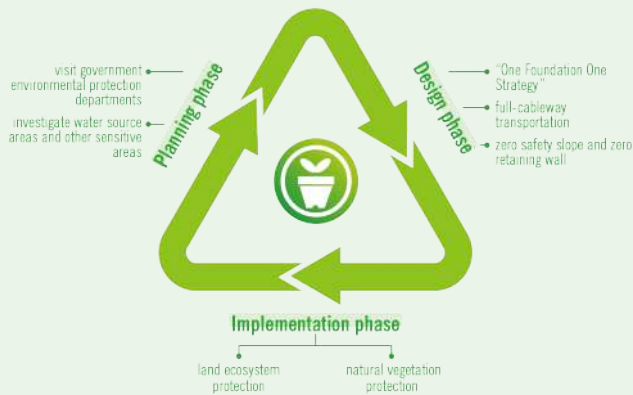


Figure: The ecological mode of “green infrastructure”

**In the planning stage**, the route and tower position were reasonably selected, the environmental protection departments along the line were visited, the water source protection areas and other sensitive areas were investigated, and water source protection areas such as Fenghuang Reservoir along the line were bypassed. During route selection and positioning, efforts were made to avoid low-lying areas, steep slopes and sections prone to landslides, landslip and other unfavorable geological conditions. When it is impossible to avoid such areas, the straight-line corner tower or the straight-line tower with a small angle shall be adopted for such geological sections as far as possible if allowed by tower head clearance and allowable load, and harsh terrains shall be avoided as far as possible to select the appropriate tower position and reduce the impact on the environment. Also, the original soil foundation should be adopted as much as possible at the tower sites in the mountainous areas to reduce excavation and earthwork. According to the tower topographic map of complex terrain survey, the tower foundation cross-section survey method is optimized, and the design is made on the basis of the tower micro-topography. Different lengths of stub reinforcements and foundations of unequal heights are combined to avoid the extraction of the base surface.

**In the design stage**, “one foundation one strategy” was initiated in the 500kV power transmission project of the Changlongshan Pumped Storage Power Station. “One foundation one strategy” was adopted for the 76 foundation iron towers along the line in accordance with factors such as topography, outward transportation conditions, stacking point conditions and cost. According to the individual characteristics of the microenvironment of the tower foundation of each foundation iron tower, a single foundation design and construction plan were respectively developed, thus fully controlling the basic engineering units and minimizing the impact of single foundations on the eco-environment. In order to protect “lucid waters and lush mountains”, the concept of “Zero Slope Protection and Zero Retaining Wall” has been put forward. During the construction process, no slope protection or retaining wall is used to pile up residual soil, thus fundamentally preventing the risk of retaining wall collapse and landslide. It is also proposed to implement the full cableway transportation scheme to reduce the clearance and felling of hundreds of mu of vegetation and trees, which play a key role in protecting the natural vegetation in the mountainous areas along the line.

**In the implementation stage**, a large amount of surplus soil is generated during the construction process. Measures are taken to treat the surplus soil, such as spreading the surplus soil on the spot, piling it near a suitable location and moving it outside. The risks of retaining wall collapse and landslide are fundamentally eliminated, and the terrestrial ecosystem is protected. The areas affected by construction and the surplus soil piling areas are intensively regulated, and measures such as sowing grass seeds and the like are taken to restore vegetation. Shrubs are planted or turfs are laid when necessary, and suitable grass seeds or tree species are selected to ensure the survival rate of vegetation. Meanwhile, the impact on natural vegetation is minimized.

## IMPACT AND SUSTAINABILITY

To promote sustainable development with “Green Infrastructure” is our commitment and more importantly our action! State Grid Zhejiang Construction Company will follow the path of “Green Infrastructure” and apply the ecological model of “Green Infrastructure” to other projects. It will adjust measures to local conditions and implement reasonable policies to improve the regional ecological environment, create favorable conditions for project construction, production and operation, and the sustainable development of the local economy, ensure the balance of the economic benefits, ecological and environmental benefits, and social benefits of the project operation, and strive to achieve zero pollution and zero encroachment on the local environment. We adhere to energy conservation and consumption reduction, adhere to the integration of innovation and ecological protection, and actively promote comprehensive environmental management, overall process control, all-round coverage and full participation to protect the natural environment, so that everyone can enjoy both the bright lights of cities and lucid waters and lush mountains. We work for a better life of all people!



## JD DIGITAL TECHNOLOGY GROUP

### "AI+ THERMAL POWER" COMBUSTION OPTIMIZATION

#### PROJECT OVERVIEW

At present, thermal power still accounts for about 70%<sup>1</sup> of total electricity generated in China. Nearly half of the more than 3.5 billion tons of coal consumed in China each year is used in coal-fired power generation. Coal-fired power generation poses a major challenge for the energy sector to reduce greenhouse emissions.

In 2018, JD Digits made its first attempt to revolutionize the operation of thermal power generation through big data technology. Relying on its leading artificial intelligence (AI) and big data capabilities, after optimizing the control strategy of thermal power units, "AI+ thermal power generation optimization" technology has proven that it can improve the boiler combustion system, power plant management and other plant modules, creating a precedent move toward the application of AI 'deep reinforcement learning' technology in the field of power station boilers. At the same time, the technology employs deep reinforcement learning and deep neural networks to help power plants reduce coal consumption by improving boiler's combustion efficiency, thereby it effectively reduces air pollution and greenhouse gas emissions. It further helps in building low-carbon cities to cope with the severe challenges of global climate change.

AI+ Thermal power generation optimization will be implemented through cooperation with national energy group to complete the transformation of the technology from theoretical research to real-life practices. Real-world experiments show that AI optimization technology can improve the combustion efficiency of thermal power generating unit by 0.5%. It means that one 600 MW coal-fired thermal power generating unit could reduce coal consumption by 3600 tons per year<sup>2</sup> and reduce nearly 9,000 tons CO<sub>2</sub> emission<sup>3</sup>. The technology is now being rolled out to dozens of coal-fired power plants across the country. If the technology would be applied to more than 2,000 power generating units nationwide, 6.3 million tons of coal could be saved annually, which means 15.7 million tons of CO<sub>2</sub> could be reduced at the same time.

#### PROJECT OUTCOME

- 0.5% energy reduction;
- 6 patents accepted by the Patent Office;
- 1 software copyright;
- The innovation award of China Artificial Intelligence Summit 2018 (CAIS 2018).



#### COMPANY PROFILE

Jd Digital Technology Group was founded within JD.com group and began to operate independently in October 2013. With big data, AI, Internet of Things, blockchain and other cutting-edge technologies as the core development, the company has completed a comprehensive layout in the three fields of digital finance, digital enterprise services and digital city, and realized the integration of the personal end, enterprise end and government end in the customer group. In 2018, the company has completed series B financing, valued at more than 130 billion yuan.

JD Digits began to build a smart city operating system in 2018, emphasizing the application of big data, AI and other new technologies in city construction and operation. Through the collection and management analysis and mining of city data, JD Digits provides intelligent city governance solutions for various vertical industries. Among them, the thermal power generation AI optimization control guidance system developed by JD Digits has gained extensive attention due to its great potential of emission reduction for low-carbon cities.

1. 2018 China Statistic Yearbook, National Bureau of Statistic of China

2. It is assumed that the medium thermal power unit could generate 4000 hours of power per year

3. Take the carbon dioxide emission coefficient as 2.493, that is, one unit of power generation burning standard coal will produce 2.493 unit of carbon dioxide emission equivalent

## ◎ PROJECT IMPLEMENTATION

**The highlight of the project is identifying the synergy between AI technology and the thermal power industry for achieving climate and environmental goals.**

Optimization of combustion efficiency has always been a challenge in the traditional thermal power industry. Traditional optimization methods, based on physical rules and modelling of the combustion mechanism, can optimize with a limited number of parameters. Also, the traditional approach lacks understanding of the complex relationships involved in high-dimensional data, which is unable to achieve real-time optimization. To solve these challenges, and to help achieve energy conservation and emission reduction, JD Digits has decided to capitalise on its big data capabilities to empower the power sector with AI technology, opening the door to integration between the high-tech and traditional industries.

### Transcending Professional Boundaries

In the process of empowering traditional industry with state-of-the-art AI technology, there will be many inevitable challenges. Effective communication between researchers of JD Digits and the operational personnel of a power plant is a prerequisite for the effective development of the project. It is a difficult task to translate the complex operational principles as well as professional terms and knowledge of the power industry into the language that AI researchers and software engineers can understand. It is also a challenge to develop models for the R&D team to grasp the specific nature of the thermal power industry. To cope with such difficulties, the JD Digits team were stationed at the power plant for several months and completed systems research, assessment of areas for improvement, as well as bonding with staff at the power plant, which provided a solid foundation for the research and development in to the optimization algorithm for the plant, and implementation of the AI solution. Throughout the process, the strong support of JD Digits' Chief Data Scientist, Dr Yu Zheng, and the participation of many experts from the China Energy Group and Guodian Nanning Power Plant were essential to the whole project.

Finally, based on a full understanding of the operational mechanisms of the thermal power generation unit and its control processes, JD Digits pioneered the application of big data technology to the boiler operation to help achieve a high level of precision in the management of the coal-fired power station. Through the research conducted on the core algorithm for optimization of boiler combustion, the plant operators can utilise in the appropriate amount of coal, air and water with appropriate timing according to the boiler state, and automatically adjust its temperature and state to improve operating efficiency and reduce emissions as much as possible.

### Breakthrough in Traditional Thinking and Technical Barriers

The breakthrough of AI thermal power generation optimization technology lies in the system optimization of a highly complex thermal power boiler, to obtain the optimal effect under the current working conditions. The optimization algorithm mainly includes three parts: (1) control optimization of the coal pulveriser to accurately control the coal pulverization system from coal feeding to valve control; (2) modelling the boiler combustion process and building a combustion system simulator; (3) optimization of boiler combustion control based on deep reinforcement learning.

The thermal power unit system is very complicated. A 600MW thermal power generator unit contains more than 10,000 sensors, and the boiler combustion control section involves more than 100 major control parameters. In the process of operation, these control variables are prone to wear and tear. At the same time, there are many safety constraints in the operation of thermal power units, and the combustion process cannot be optimized through trial and error simulation. In this regard, JD Digits' technical team made continuous attempts to analyse and process big data for different load segments of the system through simulation and dynamic correction, to solve the problems caused by "high-dimensional continuous variables". At the same time, JD Digits has designed a dedicated deep neural network to model the safety constraints of the system into the deep reinforcement learning algorithms, which optimizes the control strategy of coal-fired boilers while satisfying system safety constraints.

Compared with traditional thermal power optimization systems, JD Digits' AI boiler combustion optimization technology possesses great advantages in adaptability, learnability and revisability.

At present, the project Guodian Nanning Power Plant has received third-party approval from an expert group in Nanning. The real-world experiment results show that the combustion efficiency of the boiler increased by 0.5% when using the optimization management strategy. To further promote the implementation of this energy optimization technology in thermal power plants nationwide, JD iCity (a team under JD Digits) has already completed product design based on this model. After further improvement, the product is expected to play an important role in supporting China's power industry to improve its efficiency and help China achieve to its emission reduction targets.

## ◎ IMPACT AND SUSTAINABILITY

Based on the completion of the first demonstration, JD Digits will further improve the existing boiler combustion optimization model for a variety of boiler types and is committed to building a comprehensive and intelligent energy saving and cost reduction solution for thermal power enterprises. In the next step, JD Digits is planning to complete the implementation and verification of the upgraded optimization model in three more pilot power plants in 2019, as well as the incubation of other 'smart' power plant product modules, and promote the solutions to more than 20 power plants in 2020.

In the future, JD Digits is committed to deploying its technology as extensively as possible across China. If the approach achieved full coverage of the more than 2,000 coal power plants nationwide, it could save as much as 6.3 million tons of coal-burning and 1.5 billion yuan of environmental pollution treatment costs for China every year.

The success of this project proves that AI technology can provide innovative solutions to dealing with climate change. The technology of the future could be applied to a wider range of climate actions, such as clean energy, clean cars, low-carbon cities and other areas of low-carbon development. With business knowledge and AI capabilities, JD Digits has extended AI and big data technology to gas maintenance, water quality prediction and other environmental protection fields, and is promoting smart city operating systems for traffic planning, environmental management, public safety, etc.



## LANZHOU HUANENG ECOLOGICAL ENERGY TECHNOLOGY CO., LTD.

### "FOUR RENOVATIONS" IN RURAL NORTHWEST CHINA

#### PROJECT OVERVIEW

In view of environmental pollution in northwest China and taking into account the rural way of life, typical structural traits of housing, lifestyle and spending power of residents, among other factors, this company has proposed the "four changes" scheme aiming at improving the residential environment of rural China. Since January 2016, efforts have been made to renovate and upgrade the traditional bed/stove structures and cooking fixtures, original kitchen and dry toilets, replacing said facilities that have a high level of energy consumption, emission and pollution with our more energy-efficient products, thereby conserving energy, reducing emissions. As of September 2019, renovate has been completed for over 270,000 households in Gansu and neighboring provinces. The scheme has facilitated the improvement of residential environment in rural northwest China, enhancing the quality of life for rural residents, making positive contributions to China's air pollution treatment efforts.

#### PROJECT OUTCOME

**Emission reduction:** the heated bed/stove reduces the emission of CO<sub>2</sub> by 209,100 tons p.a.; stoves reduces emission of CO<sub>2</sub> by 252,720 tons p.a.

**Energy savings:** 1,385,460 tons of CO<sub>2</sub> emission reduction in aggregate since the implementation of the "four-changes" scheme, which is the equivalent of 556,400 tons of standard coal.

**Other environment/social benefits:** the scheme fostered air pollution treatment in northwest China, restoration of natural environment in the countryside, significantly improved rural residential environment, and enhanced quality of life for rural residents.

#### Awards:

- Rural Clean Energy Product Technology Reform Innovation Award
- China Biomass Fuel Forming Equipment Development Contribution Award

#### COMPANY PROFILE

Lanzhou Huaneng Ecological Energy Technology Co., Ltd. is a high-tech company committed to the provision of integrated green building and clean energy solutions under its development philosophy of "green creates value, technology leads to the future". The company has four key brands—Earth Commune, Cozy Wifey, Mei Jia Nuan (beautiful home heating) and Blue Love—and its primary offerings include: green building design and construction; solar photovoltaic power generation system engineering; regenerative electromagnetic thermal heating system; air source heat pump, graphene heating product line; eco-friendly toilet; sewage treatment; new material development and related technical services. The company is proud recipient of a number of honors and awards, including high-tech company, Quality award by the Gansu provincial government. The company was involved in drafting the "NB/T34010-2012 Biomass Cooking Stove Test Method", "NB/T34009-2012 General Technical Regulations for Biomass Cooking Fixtures", both are industry standards for the energy sector.

Vision: create a beautiful life, establish a century-old brand.

Mission: develop green building and clean energy with a tailored approach, make people's lives happier with our products.

Development philosophy: green creates value, technology leads into the future.

Corporate social responsibility: facilitate social advancement with our products, pay taxes to the state, create jobs and spread love.

#### PROJECT HIGHLIGHTS

"The 'four-changes' scheme allowed our villagers to put an end to an era of smoke-filled kitchens and stinky dry toilets in summers. We no longer have to tend to our bed/stove facilities in winters, making our lives a lot easier. The clean heated bed/stoves are safe and comfortable. Plus, Huaneng's stoves are coal-efficient, user and budget-friendly. The scheme has made our households cleaner and the air in our village is a lot better."

--A party secretary of a village in Linxia

## PROJECT IMPLEMENTATION

Traditional bed/stove facilities typically use straw as fuel. Every ton of straw produces about 1.7 tons of CO<sub>2</sub> when burned, and conventional stoves produce 1.8 tons of CO<sub>2</sub> when burning 1 ton of standard coal. In villages in the northwestern part of the country, households typically have five members. In winters, 3 bed/stove facilities and 2 traditional stoves are used, burning 2.7 tons of coal and 3 tons of straw annually. This company's clean stove is over 40% more energy efficient than the traditional stoves through secondary combustion of flue gas. On application of our clean heated bed/stoves and clean stove products, each farming household will need only 1.8 tons of coal to meet daily heating needs. After the renovation work, each household will save 0.9 tons of coal, 3 tons of straw per year, and reduce CO<sub>2</sub> emission by 9.96 tons. Since 2016, this company has renovated 123,000 units of traditional bed/stove facilities, rolled out 156,000 units of clean stoves. The annual output of CO<sub>2</sub> from heated bed/stove facilities was reduced by 209,100 tons, and 252,720 tons for stoves.

In addition, the "four changes" scheme renovated/upgraded kitchens in 5,460 households and completed 3,580 rural toilet renovations. It costs CNY1,200 to renovate a single unit of traditional bed/stove facilities and the price of cleaning stove products ranges from CNY630 to CNY1,300. The cost of toilet renovation is CNY3,800, and CNY5,400 for kitchens. Products used in the scheme have a service life of over 50 years. On applying the new products, each household will be able to save CNY1,000 p.a. in heating and power bills, while enjoying a more comfortable and healthier way of life.

### Before vs. After



Traditional heated bed

Renovated clean heated bed



Traditional stove

Renovated energy-efficient, low-emission stove



Rural kitchen

Renovated eco-friendly kitchen



Rural toilet

Renovated toilet

### Challenges and Opportunities

**Challenges:** rural environmental governance involves a wide range of issues, requiring virtuous cooperation and interaction between the government, businesses and residents. However, due to the imbalance of economic development stages and traditional lifestyles, the "four changes" schemes carried out by our company in rural areas are facing some challenges, primarily from the business itself and the external environment. From the business's own perspective, the upgrade and iteration of products means the commitment of extensive research talents and budget. And the company's lack of top-notch research and development talents has hindered its capacity for innovation; from an external perspective, the company's product may have a bright market outlook, the limited economic development and the public's way of life in northwest China could mean certain resistance to the scheme. The "four changes" scheme has made slow progress due to dated public awareness and weak environmental protection awareness in rural China and the consequent lack of understanding of the policies. Take the renovation of traditional bed/stove facilities, Gansu province alone has over 3 million units of such facilities, and this company has managed to renovate a mere 120,000 units so far.

**Opportunities:** the Chinese government attaches a high level of importance to environmental protection and large-scale pollution governance has been ongoing in China for years. With the rollout of the state's "countryside reinvigoration" strategy, it has become imperative to build eco and resident-friendly beautiful countryside where pollution governance has been effective. And comprehensive governance of the countryside is the focal point of the development of beautiful countryside. This company, since our foundation, has been committed to the comprehensive development and utilization of clean energy in rural China. The state policies will provide once-in-a-generation development opportunities, which we shall seize upon to embark on a new journey of globalization.

## NEXT STEPS

In the next 3-5 years, we will engage in active collaborations with all levels of government agencies in China to renovate the traditional bed/stove facilities, winter heating, kitchen environment and toilets in northwest rural China on a village-by-village basis. Our goal is to contain the carbon emission from traditional heating approaches and water pollution from dry toilets, ultimately to lower pollution indicators, improve the environment in the countryside, enhance the sense of happiness of village residents, making the sky bluer, ground greener, water clearer and the environment more beautiful.



## METRO CHINA

### FEP PROJECT IN CHINA

#### PROJECT OVERVIEW

As a multinational company with a strong sense of social responsibility, Metro Cash & Carry China (MCC CN) has been committed to energy saving, emission reduction and sustainable development. In introducing the CO<sub>2</sub> system into the China market, Metro formulated a step-by-step strategy.

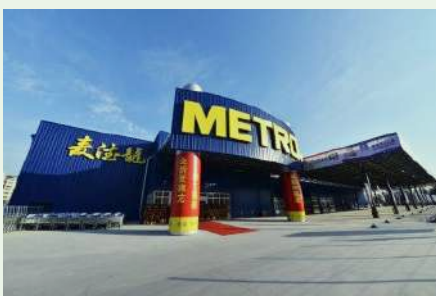
Starting from the low-complexity cascade system, MCC CN introduced the first CO<sub>2</sub> cascade refrigeration system in China in 2016. By 2019, it had been used in 44 stores, accounting for half of all MCC stores in China. Among them, 26 existing stores replaced the original R22 system with CO<sub>2</sub> cascade refrigeration system, reducing 1500kg Freon emissions. The energy saving rate is 5%, and each store saves 87,965 kwh of electricity and reduces 180 tons of carbon emission per year. After renovating the refrigeration system, the Dongguan store won the LEED Gold Award and the three-star green building operation identification certificate.

In 2017, MCC CN started introducing a more sophisticated trans-critical CO<sub>2</sub> system. Compared with the cascade system, the maintenance of the trans-critical CO<sub>2</sub> system is more difficult and requires higher technical level. It is also a capacity building opportunity for the domestic maintenance team. By 2019, MCC CN adopted 3 sets of R744 CO<sub>2</sub> trans-critical refrigeration system, 2 for existing stores and 1 for a new store(NSO). After renovation, each store saves 25% of energy. For the two 10+ years old stores where the R22 systems were replaced by the CO<sub>2</sub> trans-critical refrigeration systems, in their remaining 20 years' service life, 230kg Freon emission and 39100 tons of CO<sub>2</sub> equivalent will be reduced. The energy saving rate is 25%. Each of the 3 stores saves 325,647kwh of electricity and reduced 900 tons of carbon emissions per year.

#### PROJECT OUTCOME

- CO<sub>2</sub> cascade refrigeration system adopted in 44 stores
- CO<sub>2</sub> trans-critical refrigeration system adopted in 3 stores
- The Dongguan store won the LEED Gold Award and the three-star green building operation identification certificate

#### COMPANY PROFILE



METRO Cash & Carry stands for one of the most successful stories in modern commerce. In its successful history of over half a century, the company has been dedicated to providing its customers with high quality products and customized solutions. METRO Cash & Carry is focusing on professional customers such as hotels, restaurants, caterers as well as small and mid-sized retailers and institutions. Compared with other traders, METRO Cash & Carry has unparalleled expertise in fresh food. Taking sustainable development as its obligation, METRO has made great efforts, including building and turning existing stores into green stores, setting up solar power stations and upgrading the refrigerating systems, to reduce energy consumption and emissions.

## ◎ PROJECT IMPLEMENTATION

Since 2016, a total of 28 R22 refrigeration system renovations have been completed, and 19 NSOs have adopted CO<sub>2</sub> refrigerating systems. Among them, there are 3 CO<sub>2</sub> trans-critical refrigeration system projects, 2 of which are upgrading project and 1 NSO project.

The NSO CO<sub>2</sub> trans-critical system project was completed in 2017 in Beijing.

- **Beijing Lishuiqiao CO<sub>2</sub> trans-critical system project:**

Beijing Lishuiqiao store was opened at beginning of 2018 with a floor area of 7,719 m<sup>2</sup> and a sales area of 3,806 m<sup>2</sup>. Since Beijing belongs to the temperate zone, the direct expansion pressurized CO<sub>2</sub> trans-critical compressor that suits the temperate zone was selected. This was the first ever application of an CO<sub>2</sub> trans-critical refrigeration system in the Chinese market.



2 renovation projects using trans-critical systems were completed in 2019.

- **Chongqing Nan'an store FEP renovation project:**

Chongqing Nan'an store was opened in May 2001, with a floor area of 15,536 m<sup>2</sup> and a sales area of 8,597 m<sup>2</sup>. The CO<sub>2</sub> trans-critical system was used to replace the original R22 system which served more than 18 years with aging equipment, high energy consumption and high leakage risk. Due to the high temperature of Chongqing in summer, we chose Ejector system as a solution for this store. It was also the first Ejector system in the Chinese market.



The project was completed in June 2019, resulting in more than 30% energy saving, and 917.65 ton/year emission reduction.

- **Beijing Shilihe store FEP renovation project:**

Beijing Shilihe store is opened in Nov. 2nd, 2006, with a total area of 11,196 m<sup>2</sup> with 2 floors (basement floor and ground floor) and a sales area of 6,587 m<sup>2</sup>. The CO<sub>2</sub> trans-critical system was used to replace the original R22 system. As Beijing is in the temperate zone with cold winters, we chose the most advanced multiple parallel compressor system as a solution for this store. It's the second trans-critical system in Beijing, and the first multiple parallel compressor system in China. The system integrates low, medium and high temperature compressors in one system. Compared with the traditional device, this integration method can ensure operation efficiency of the system, greatly reduce the initial investment and save space. It has the advantages of high reliability, high efficiency and low failure rate.



The project was completed in June, 2019, resulting in 30% of energy saving and 830 ton/year emission reduction.

Compared with the traditional refrigerant Freon R22, the Ozone Depletion Potential and Global Warming Potential of R744 (CO<sub>2</sub>) are respectively 0 and 1, which means that R744 as a refrigerant has no damage to the ozone layer and will not cause global warming. It means it has positive environmental and social benefits. In the field of refrigeration, it is very suitable for food cold chain because of its stable chemical properties. Moreover, due to the characteristics of the trans-critical cycle system, the high pressure can exhaust, with its temperature exceeding 90 degrees, provides a natural recyclable heat source for hot water supply in supermarkets, achieving energy saving and emission reduction, and at the same time reducing the store operating expenses, promoting resource conservation and protecting the ecological environment.

## ◎ IMPACT AND SUSTAINABILITY

Since the introduction of the CO<sub>2</sub> refrigeration system in 2016, MCC CN has been continuously improving its efforts in reducing the use of R22 and fundamentally reducing the impact of R22 on the atmosphere.

China has vast territory and varied climate conditions. MCC CN uses a number of innovative technologies to introduce CO<sub>2</sub> trans-critical systems that are suitable for local conditions according to the climate characteristics of different regions. Since the introduction of the first CO<sub>2</sub> trans-critical system in China in 2017, a total of 3 stores have used trans-critical systems, and the 3 sets of systems have their own specifications. They adopted different structural forms to adapt to different climate conditions in the frigid zone, temperate zone and tropical zone. The advantages brought by the new trans-critical refrigeration system are very obvious, such as small size, convenient installation, high efficiency, low failure rate, minimum noise and zero pollution. The CO<sub>2</sub> system reduces resource consumption and environmental damage. It is not only extremely suitable for the food industry, but also the guarantee of energy-saving and environment-friendly commercial buildings.

The CO<sub>2</sub> refrigeration system has become the standard for all NSO in MCC CN. MCC CN is committed to introducing the most advanced technology for better energy saving and emission reduction. With the successful cases of our enterprises, we will promote the application of CO<sub>2</sub> trans-critical refrigeration system in the Chinese market, and be a model for sharing with others.





## MANTRU.E COMMERCIAL EQUIPMENT MANUFACTURING CO., LTD.

### ALL-ELECTRIC KITCHEN PILOT PROJECT

#### ◎ PROJECT OVERVIEW

In August 2015, Mantru.e carried out the pilot project of all-electric kitchen renovation for the third canteen in Zhejiang University, Yuquan Campus, replacing 12 old natural gas stoves with electric equipment, which was officially put into use on September 1, 2015.

After one year's operation, this all-electric kitchen renovation project has achieved positive environmental and economic benefits, with energy consumption reduced by 74%, saving 62.894 tons of standard coal; carbon emission reduced by 44%, i.e. 60.154 tons; energy expenditure reduced by 55%, saving a total of 16,900 US dollars.

With such project outcome, Zhejiang University promoted all-electric kitchens in newly planned and existing canteens in all campuses during 2016 to 2018. A total of 524 kitchen appliances were upgraded, which greatly contributed to campus energy conservation and environmental protection, and set a good example for schools nationwide.

Take the year 2018-2019 as an example, the annual energy consumption has been reduced by 50.3%, saving 1857.368 tons of standard coal; the carbon emission has been reduced by 37.2%, namely 2232.656 tons; the energy expenditure has been reduced by 32.4%, saving a total of 439,000 US dollars.

#### ◎ PROJECT OUTCOME

(take the third canteen of Yuquan campus as an example)

- Emission reduction: 44% reduction in carbon emission, i.e. 60.154 tons;
- Energy savings: 74% reduction in energy consumption, saving 62.894 tons of standard coal;
- Economic benefits: 55% reduction in energy expenditure, saving 169,00 US dollars;
- Other benefits: the pilot project promoted all-electric kitchen renovation in all campuses of Zhejiang University from 2016 to 2018.

#### ◎ COMPANY PROFILE

Mantru.E Commercial Equipment Manufacturing Co., Ltd. is a national high-tech enterprise that committed to the research and development of all-electric kitchen equipment adapted to Chinese cooking habits. The company owns more than 100 independent R&D patents, such as real fire simulation technology. The company focuses on the R&D and manufacturing of energy-saving and environmental-friendly commercial kitchen equipment, and uses electric energy to replace traditional fuel/gas



as the main heating resource of commercial kitchenware, so as to build an energy-saving and low-carbon all-electric kitchen with low noise, low energy consumption, no real fire and low emission.

#### ◎ PROJECT HIGHLIGHTS

“We are concerned more about car exhaust on the road than the high carbon emissions of the kitchen. The all-electric kitchen is to change the current situation of high carbon emission in Chinese kitchens. “

-- Mantru.E

## ◎ PROJECT IMPLEMENTATION

### Project Plan

The third canteen of Zhejiang University, Yuquan Campus mainly provides Chinese food to teachers and students. The main cooking equipment there includes 8 large Chinese cauldron stoves and 4 small Chinese woks. Natural gas had been used for more than five years before renovation. During the renovation, Mantru.E decided to maintain the original layout and function of the kitchen after comprehensively taking account the factors including the original layout, supply capacity, chef's feedback and project investment, and replaced the original 12 natural gas stoves with electric kitchen equipment with the same function all at once, completing the pilot renovation with minimum cost.

**Challenge:** There were some strong concerns with using all-electric kitchen equipment among the chefs, because they were used to gas kitchen equipment and were worried that they could not handle the new all-electric equipment which might affect the quality of their work.

**Solution:** Mantru.E conducted a try-out session for the chefs. After try-out, chefs were impressed by the all-electric kitchen equipment, and spoke highly of its advantages in simple operation and ability to adapt to their original cooking habits. The chefs were also very supportive of all-electric kitchen equipment after knowing its outstanding features of energy saving and environmental protection.



### Before vs. After

	Energy Consumption	Carbon Emission	Energy Cost
Before Renovation	Natural gas 63,591m <sup>3</sup> (equivalent to 84.576 tons of standard coal)	137.356 tons	\$31,000
After Renovation	Electric power 176,422kWh (equivalent to 21.682 tons of standard coal)	77.202 tons	\$14,000
Benefits	74% reduced	44% reduced	55% reduced

## ◎ IMPACT AND SUSTAINABILITY

### Technological Innovation

using real fire simulation technology to solve the problems of food tastes and equipment performance.

In the past, all-electric kitchen marketing focused on its environmental benefits while ignoring what concerned people most - the taste. Besides, the Chinese way of cooking has its unique characteristics. Chinese cooking techniques such as stir frying, steaming, braising and stewing were hardly used in foreign countries, which left little reference for relevant research, resulting in bottlenecks of all-electric kitchen application.

Mantru.E is the first enterprise in China that has solved the technical bottleneck of "stir-frying" in the all-electric kitchen. Through R&D, we have developed a patent cluster of Chinese cooking represented by real fire simulation technology which meets all needs of Chinese cooking. We fully respect the habits of chefs and have developed over a hundred kinds of full electric kitchen equipment to meet their needs in traditional Chinese cooking.

### Next Steps

Replicate the successful case of all-electric kitchen renovation at Zhejiang University in catering, schools, hospitals, enterprises and other commercial or public sectors. If 50% of China's commercial kitchens could be transformed into all-electric kitchens at the annual rate of 10% in the next five years, the total carbon dioxide emissions will be cut down by about 400 million tons.



## SATERI

### ECOCOSY® CLIMATE LEADERSHIP ACTION PLAN

#### ◎ PROJECT OVERVIEW

In 2019, Sateri launched its new viscose brand EcoCosy®, which includes the premium BV fibre portfolios, Colour™ and antibacterial fibres for use in textiles and non-woven products. Made from 100% sustainable certified wood source and 100% bio-based material, EcoCosy® offers improved versions of traditional viscose products based on the “premium quality, preserving ecology, and preferred partners” attributes. The EcoCosy® BV Series fibres and Colour™ viscose enable downstream yarn and fabric firms to increase spinning and weaving efficiency, and thereby to reduce their labour intensity, energy consumption, and carbon footprints.

In response to the Climate Stewardship 2030 initiative of China National Textile and Apparel Council, Sateri’s EcoCosy® developed and launched the EcoCosy® Climate Leadership Action Plan in 2019, to drive low-carbon transformation of the industry.

#### ◎ PROJECT HIGHLIGHTS

• **Energy saving and emission reduction:**

- The EcoCosy® BV series improves fibre spinning efficiency by 20%; with large scale application, the BV series can help significantly reduce carbon emission along the value chain and drive low-carbon transformation of the industry.
- The EcoCosy® Colour™ viscose uses dope dyeing instead of traditional dyeing and finishing, which helps save 30% to 50% cost per ton of fabric produced. For medium depth colour fabric, using Colour™ viscose saves 11MWh, 100 tons of water, and 150 kg of dyeing materials per ton.

• **Other benefits:** The EcoCosy® Ecosystem Conservation Project of the raw material supply region helps conserve 759 species in the area and reduce emission by 688 million tons.

• **Award:** In 2019, EcoCosy® was ranked among the “Top 60 Responsible Brands of Chinese Corporate Citizens”

#### ◎ COMPANY PROFILE

Sateri is a global leader in viscose rayon. Our natural and high-quality fibre, made from trees grown on renewable plantations, can be found in comfortable textiles and skin-friendly hygiene products. As the largest maker of viscose fibre in the world – with four viscose mills and annual capacity of 1.1 million metric tonnes – we are committed to sustainability, environmental protection and responsible production from start to finish. With a history of expertise from Finland, our modern mills use European technology to make viscose from 100% dissolving wood pulp to ensure purity and quality.



All of Sateri’s mill operations have achieved the STeP by OEKO-TEX® and STANDARD 100 by OEKO-TEX® certifications, and is the first viscose company in the world to carry the MADE IN GREEN by OEKO-TEX® product label. With this highly coveted label, Sateri’s viscose products are independently verified as safe and responsibly-produced. All of Sateri’s mills have obtained the Chain of Custody (CoC) certification from the Programme for the Endorsement of Forestry Certification™ (PEFC™), and are certified under ISO 9001 and ISO 14001. It is also one of the world’s first viscose mills to have completed the Higg Facility Environmental Module (FEM) assessment.

## PROJECT IMPLEMENTATION

Sateri is one of the first fashion industry companies to join the “Climate Stewardship 2030” initiative. Together with China National Textile and Apparel Council, Sateri developed and launched the EcoCosy® Climate Leadership Action Plan on June 19, 2019, the National Low Carbon Day. EcoCosy® Climate Leadership is a voluntary emission reduction plan, which carries out climate empowerment, measurement, innovation sharing and implementation for large supply chain enterprises and brands in fibre, yarn and fabric industries, to practice emission reduction and drives low-carbon innovations among value chain partners.

To mitigate its impact on climate change, Sateri will leverage the sustainability attributes of its products to ensure the efficient use of resources and reduction of emissions, and further explore solutions to improve energy efficiency and productivity of the industry chain through innovations in raw material processing technologies. In addition, Sateri will work with its value chain partners to conduct GHG emissions accounting, product assessments, capacity building, community programmes, and other activities to promote low-carbon transformation of the textile industry and low-carbon development of the fashion industry.

### Sustainable Full-Process Management

- Through continuously optimizing the production closed-loop, Sateri has achieved the total sulphur recovery rate of carbon disulphide of 98%, which is superior to the national and EU standards;
- Sateri follows best practices in sustainable manufacturing, ensuring the most strict environmental and safety, and corporate social responsibility standards while reducing environmental risks;
- Sateri is one of the first company that completed Sustainability Apparel Coalition’s Higg FEM3.0 assessment and achieved a result far higher than the industry average.

### Product Sustainability

- All the EcoCosy fibres are sourced from PEFC™ or CFCC® certified forest;
- Certified as 100% bio-based products by USDA Priority Scheme®;
- Obtained EU “Seedling” certification of compostable degradation;
- passed the highest level of STeP certification by OEKO-TEX®;
- Obtained MADE IN GREEN by OEKO-TEX®;
- Obtained STANDARD 100 by OEKO-TEX®.



### Ecosystem Conservation

EcoCosy® started the Ecosystem Conservation Project

for its raw material supply region, an area more than twice the size of Singapore. The reserve is the habitat of 759 wild species, including 55 threatened species listed in IUCN Red List and 113 species included in the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora. the reserve, a rainforest area as the “lung of the earth”, helps reduce greenhouse gas emissions by 688 million tons (FFI report).

## IMPACT AND SUSTAINABILITY

- To further strengthen the management of GHG emissions, Sateri has voluntarily completed CDP’s climate change questionnaire in 2019, disclosing its GHG emissions in Scope 1, Scope 2 and Scope 3.
- Sateri has co-initiated the **Fashion Climate Innovation Fund, the first fashion industry climate fund in China**. The fund is also an innovation measure for low-carbon transformation of the fashion industry. It will support “Climate Stewardship 2030” through green finance among other means, and contribute to China’s nationally determined contributions and the low-carbon transformation of the textile industry in a cooperative way.
- Sateri has invested in the innovative technology of Infinited Fibre Company, which produces new fibres with used textiles, reducing resource consumption and significantly reducing the carbon footprint of fibre production.
- Follow-up plans:
  - By 2020, chemical oxygen demand (COD) emission concentration of each regenerated viscose fibre mill will be controlled under 50 mg/L; The emission concentration of sulphur dioxide (SO<sub>2</sub>) in the boiler of each mill will be controlled under 35 mg/m<sup>3</sup>; By 2020, the clean production audit and verification will be completed in each mill.
  - Sateri plans to invest 200 million dollars in the R&D of viscose fibres, an investment, will help develop solutions for alternative viscose or plant-based raw materials and closed-loop manufacturing. The investment will be allocated to the following three areas in the proportion of 70:20:10, including: (1) to scale-up mature clean technology in the fibre manufacturing industry; (2) to make the intermediate trial reach the industrial scale; (3) Conduct R&D of cutting-edge solutions.



## CHINA VANKE

### GREEN BUILDING: VANKE SEAFRONT PLAZA

#### PROJECT OVERVIEW

Vanke Seafront Plaza is located in Futian District of Shenzhen City in Guangdong Province, with a total land area of 5,775.05 square meters and a total construction area of 81,629.64 square meters. The project aims at a three-star green building certification and has adopted a number of advanced green technologies in energy conservation and consumption reduction, sponge city development, and the creation of a healthy and cozy environment. In May 2018, the project was awarded the three-star green building design identification certificate and passed US LEED-CS Gold Pre-certification.

The National Urban Ecological Protection and Construction Plan (2015-2020) jointly issued by the Ministry of Housing and Urban-Rural Development and the Ministry of Environmental Protection has expressly raised the overall industry requirement of “urban green buildings accounting for more than 50% of all newbuild projects”. Vanke has taken active actions in response to the state and continued to explore the rollout and application of the “Green Building Evaluation Standards” (GB/T50378-2014), rigorously controlling the environmental management of buildings throughout their life cycle, from design to operation. All new projects of Vanke’s meet local green building star rating requirements. In 2018, the floor area of green buildings totaled 35.016 million square meters, propelling the aggregate floor space to 147 million square meters. In 2018, the green one/two-starred projects totaled 34.669 million square meters, and 347,000 square meters for three-starred projects. Vanke Green Building focuses more on user experience and actual operational outcomes. In 2018, Vanke Green Building Operation Identification Projects totaled 467,000 square meters in floor space, an increase of 138% from the previous year.

#### PROJECT OUTCOME

- CNY1.222 million p.a. in electric power bill savings
- CNY39,211 p.a. in water bill savings
- Overall power consumption p.a. per unit of building area contained at <80 kWh/sqm.

#### COMPANY PROFILE

China Vanke Co., Ltd. was established in 1984. After 30 years of development, it has become a leading urban and rural development and living services provider in China. The Group centers on the three most vibrant economic circles nationwide and hub cities in Midwest China. In July 2016, the Group was first listed on Fortune Global 500, ranking 356th. In 2017, 2018 and 2019, the Group ranked 307<sup>th</sup>, 332<sup>nd</sup>, and 254<sup>th</sup> respectively.



In 2014, Vanke had extended its position as a company offering “good houses, good services, good community” to an “integrated urban services provider” in its fourth ten-year development plan. In 2018, Vanke further upgraded such position to “urban and rural development and living services provider” and refine it into four roles: a solution provider of better life, a contributor to real economy, an innovator for future development and a creator of harmonious ecosystem.

Vanke always upheld the vision of “building quality housing for ordinary people, developing premises for accommodation”. The Company adhered to two main development policies of synchronous development with the municipalities and our customers. Vanke will insist on providing quality products and services to ordinary people and contribute to satisfying people’s demand for a better life with its best efforts. The core business of the Group includes property development, property service and rental housing. In 2018, the Group further enhanced its positioning to “urban and rural development and living services provider”. The ecological system formed had already taken its shape. On the basis of consolidating the inherent advantages of residential properties development and property services, our businesses were extended to areas such as commercial development and operations, logistics and warehousing services, rental housing, industrial towns, skiing resort business, elderly care and education. This had laid a sound foundation for better serving the people’s needs for a better life and achieving sustainable development.

#### PROJECT HIGHLIGHTS

- Design featuring high energy conservation rate
- Pre-fabricated building assembly
- Utilization of unconventional water sources

## PROJECT IMPLEMENTATION

### Energy Savings

- Curtain walls to use double-silver LOW-E laminated insulating glass, and the solar heating coefficient of the outer window is 10% higher than stipulated in the “Public Building Energy Efficiency Design Standard” (GB 50189-2015).
- Adoption of a Grade I energy-efficient air-conditioning system and a water-cooling system, reducing the annual electricity cost by about CNY312,700, and the payback period for additional investment will be 4.3 years.
- Use of high-efficiency inverter air-conditioning system, saving air conditioning power consumption by 712,000 kWh annually, and annual electricity bill about CNY712,000.
- LED lighting design, saving annual energy consumption for lighting by 197,300 kWh, and the annual electricity savings is about CNY197,300.
- The eQUEST full energy consumption simulation analysis shows that the annual comprehensive power consumption per unit of building area is controlled at around 80 kWh/m<sup>2</sup>.
- A carbon dioxide concentration sensor is installed in the underground garage to control the switch-on/off of each ventilation system based on the concentration of carbon dioxide in the garage, reducing operating energy consumption.

### Sponge City

- Sponge estate: the design features a rainwater garden, permeable overhead platform, roof greening and rainwater collection and reuse to achieve a total rainwater runoff control rate of over 80%, enabling small plot-based public building projects in downtown areas to function as top-notch sponge estates.
- Rainwater utilization: a 200-cubic-meter rainwater treatment station is set up to collect rainwater from wells and air-conditioning condensate. Once treated and disinfected, the collected water is used for irrigating the green plants on the ground and the roofing of podium, supplementing landscape water and part of cooling tower water. The designed total of rainwater use is 13070.33 cubic meters p.a., saving CNY39211 p.a. in water bills.
- Water conservation: Grade I water-saving appliances are used, the project’s water-saving rate is >10%; 100% of green plants use micro-irrigation and rainfall sensors to improve water use efficiency.

### Health and Comfort

- The amount of fresh air in the lobby is controlled based on the carbon dioxide content to create a healthy indoor environment.
- An electrostatic precipitator air purifier is installed in the new air unit to keep the air in the office fresh.
- The office area uses overhead grid-like flooring to effectively improve the indoor acoustic environment.

**Energy Saving and Emission Reduction in Property Management:** Vanke Property Management will take targeted measures to improve energy management in property operations in accordance with the requirements of the “Regulations on Energy Conservation and Consumption Reduction” to better achieve energy conservation and emission reduction targets.

- Energy-saving renovation: active efforts are made to promote the application of energy-saving lamps in newbuild projects. For delivered projects, the lighting fixtures in underground garages, estate’s road network, all building floors, office areas, equipment rooms and other places are replaced on a regular basis to reduce power consumption.
- Electricity use management: time control or light control devices are installed for public area lighting power supply, and the lighting levels within the estate are adjusted to season in accordance with the control requirements of Vanke’s “Public Site Lighting Standards and Measurement Methods”; appropriate air conditioning temperatures are set for the office area. Apart from necessary lighting for surveillance purposes in off hours, the equipment used in the office area must be turned off.
- Energy consumption analysis: energy consumption data are analyzed and report energy consumption reports are prepared by designated personnel on a monthly basis. Energy consumption abnormalities are identified via data comparison, and energy conservation and consumption reduction meetings are held at least once every six months, where comprehensive considerations of the energy consumption of each project are made and effective measures developed to promote energy conservation and emission reduction.

## NEXT STEPS

To achieve green operations in the truest sense, Vanke has set detailed and step-by-step carbon emission reduction targets for its retail project holdings and overall energy conservation targets for 2020.

- Build an energy management system to improve energy efficiency of the electromechanical system through efficient and optimized operation control system;
- Replace the lighting in underground parking and logistics passageways with LEDs for energy conservation and environment protection purposes;
- Bring rooftop greening, green space and other measures into greenfield, brownfield and renovation projects, to reduce urban heat island effect;
- Take actions to raise lessee awareness of green lifestyle and energy conservation, provide lessees with free energy audits, guide them to energy conservation and emission reduction practices.



## BROAD GROUP

# GAS BOILER RETROFITTING WITH NON-ELECTRIC HEAT PUMPS

### ◎ PROJECT OVERVIEW

Daxing Kangzhuang Heating Center is one of the largest heating stations in Beijing and provides heat for its surrounding neighborhoods totaling more than 5 million square meters. The heating center is a key “Coal to Gas” project in Beijing. Currently, four gas-fired boilers 70MW/each (100 steam tons) are equipped, with a total heating capacity of 280MW. After shifting the fuel from coal to natural gas, the heating cost increased rapidly, and the white smoke brings negative impact to the surrounding residential areas.

In the project, the 60 °C low-temperature smoke exhausted from gas boiler is cooled to 30 °C by the non-electric heat pumps. The heat from low-temperature smoke is removed into high-temperature energy, which is then supplied to heat network. Using non-electric heat pump to realize heat recovery can not only reduce about 10% energy consumption of heating station, but also condense more than 80% water vapor in exhaust, to eliminate “white smoke”.

Daxing Kangzhuang heating station can save 8.7 million yuan of operation cost during a complete heating season. The whole project ROI is about 3 years.

Retrofitting Period: May 2018 – Oct 2018

Operation Period: Nov 2018 – Mar 2019 (a complete heating season)

Location: Daxing, Beijing

### ◎ PROJECT OUTCOME

#### Emission Reduction

- CO<sub>2</sub> emission: 7,535 ton/year

#### Energy Conservation

- natural gas saving: 3.77million m<sup>3</sup>/year

#### Other Environmental/Social Benefits

- vapor removal: 4,521 ton/year

#### Awards

- “Typical application cases of key energy-saving technologies” of National Energy Conservation Center
- second prize of Hunan Science and Technology Progress Award

### ◎ COMPANY PROFILE

BROAD Group is a private manufacturing enterprise dedicated to original innovation. Headquartered in Changsha City, Hunan, China, it has over 3,000 employees and products sold to more than 80 countries. BROAD wholly-owns the following subsidiaries:

- BROAD Air Conditioning Co. Ltd., founded in 1988, supplies non-electric central air conditioning under built-in vacuum condition powered by natural gas and waste heat and packaged water distribution system. It is world-renowned for super energy efficiency
- BROAD Clean Air Technology Co. Ltd., founded in 2005, supplies clean fresh air machine that recovers 80% heat and filters PM2.5 by 99.9%, as well as a complete series of clean air products and air quality monitoring device for commercial to domestic use and wearable for personal use
- BROAD Energy Service Co. Ltd., founded in 2007, provides equipment, investment, design, construction and operation of district cooling-heating-power (CHP) projects, and pursues the greatest extent of energy conservation through market mechanism
- BROAD Sustainable Built Technology Co. Ltd., founded in 2009, supplies ultimate structural material for construction and transportation sectors, i.e. BCore slab, truly bringing about a sustainable development path for human being

### ◎ PROJECT HIGHLIGHTS

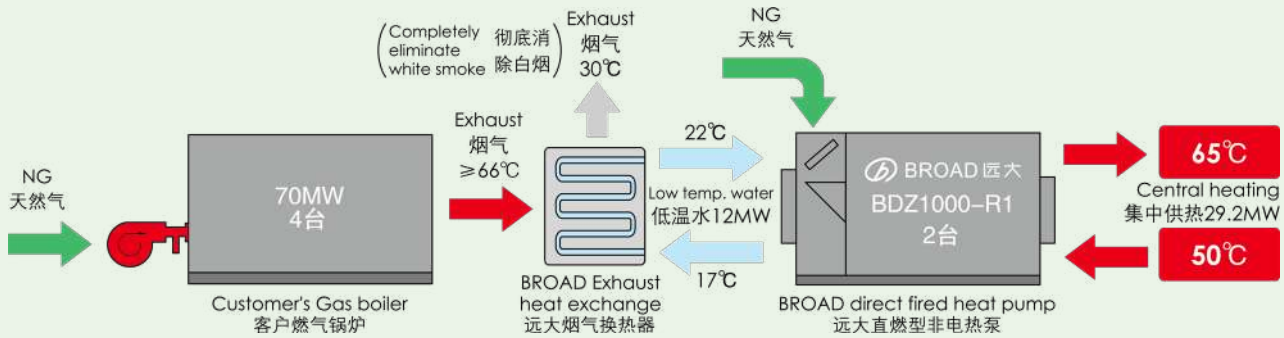
Client: “After the retrofitting of whole gas boiler system, the final exhaust smoke temperature is reduced to about 20 °C .

It not only reduces the consumption of natural gas, but also eliminates the white smoke, which has a very good effect of energy conservation and emission reduction. It is worth promoting and scaling up”.

**PROJECT IMPLEMENTATION**

Exhaust-water heat exchanger is installed on the exhaust duct of gas boiler. 12°C low-temperature water is produced via natural gas driving non-electric heat pump. The water is then sent to each heat exchanger to recover exhaust heat of gas boiler. Finally, the exhaust is discharged below 30°C . Meanwhile, both exhaust heat and natural gas heat are sent into heat networks.

Non-electric heat pump is a kind of low-temperature waste heat recovery device driven by thermal energy (such as gas, steam, high-temperature hot water), and the power consumption is very small, less than 5 % against its heating capacity. These driving heat sources are exactly consistent with the drive energy (such as gas) or transmitted energy (such as steam, high-temperature hot water) of the boiler, reducing the system power demand. In addition, compared with the compression electric heat pump, the non-electric heat pump is widely used in the recovery of industrial circulating cooling water and low temperature waste heat due to its large heating capacity (up to 30MW), high heating temperature (up to 90 °C ), large heating temperature difference (up to 50 °C ), and long life span(over 30 years).



Two non-electric heat pumps with a heat recovery capacity of 6MW/each are applied to recycle the low-temperature exhaust heat of 4 x 70MW boilers. The waste heat can be calculated by installing a heat meter on the low-temperature water to measure the heat recovered from the low-temperature exhaust. After a complete heating season operation, it can save 3.77 million m<sup>3</sup> of natural gas.



Before vs. After

**Before:** high water content in exhaust, and the white smoke is very obvious.

**After:** most of the water vapor is condensed into water after being cooled by the heat pump, almost eliminate white smoke.

**IMPACT AND SUSTAINABILITY**

In 2015, non-electric heat pump was used to recover the exhaust heat of low-temperature exhaust gas, setting a benchmark for energy conservation and emission reduction. By the promotion in recent years, more than 100 boiler rooms have been used in China to recover low-temperature exhaust gas and waste heat from boilers by non-electric pumps, with an annual reduction of natural gas consumption of nearly 100 million cubic meters and carbon dioxide emission reduction of more than 200,000 tons. The innovative application has attracted great attention from the National Energy Conservation Center, and “BROAD’s Low-Temperature Flue Gas Deep Recovery Technology” has been promoted as a key energy-saving and low-carbon technology in the boiler rooms.

BROAD Group continually promotes this innovative application, which is not limited to the waste heat recovery of gas boiler. For example, in Incheon, South Korea, a large-scale energy-saving technology is used to recover 23MW exhaust waste heat of gas turbine, saving 12.78 million m<sup>3</sup> of natural gas annually. In Denmark, a large-scale energy-saving technology is used to recover 13MW exhaust waste heat of biomass boiler, saving 7.18 million m<sup>3</sup> of natural gas annually. In the future, BROAD will carry out waste heat recovery of exhaust heat of coal-fired boiler, and finally realize the clean-up of the whole heating industry.





## BROAD CORE BUILDING BROAD TREEHOUSE

### PROJECT OVERVIEW

In October 2019, BROAD Treehouse was completed in BROAD Town, Hunan province. The building adopts a disruptive innovative technology -- stainless steel BCore slab, which breaks through the conventional structure form. The Treehouse was assembled by “building blocks”, a simple and fast method to form a cascade of hanging garden, demonstrating a new construction method.

Name of the Building:	BROAD Treehouse
Number of Layers / total height:	16F/48m
Building Area:	7500 m <sup>2</sup> (upper single-layer 1100 m <sup>2</sup> , lower single-layer 150 m <sup>2</sup> )
Structural Material:	stainless steel BCore slab
Structure Weight:	109kg/ m <sup>2</sup>
Building Energy Consumption:	100kwh / year m <sup>2</sup> (about 1/5 of traditional similar buildings) Exterior wall K value = 0.45, heat transfer: 1/20 of concrete (There's 99.9% argon in hollow glass, the heat transfer of which is 1/3 of the traditional ones.)
Air Quality:	100 times cleaner than outdoor in PM2.5, with a fresh air volume 2.5m <sup>3</sup> / m <sup>2</sup> , CO <sub>2</sub> ≤ 900PPM

### PROJECT OUTCOME

- Emission Reduction:  
Annual carbon reduction is 90kg/ m<sup>2</sup>, equivalent to planting 5 trees.
- Energy Conservation:  
Energy consumption of the building is only 100kwh/ m<sup>2</sup>, about 1/5 of traditional similar buildings.
- Environmental Benefits:  
Air quality is 100 times cleaner than outdoor in PM2.5.
- Economic Benefits:  
Low cost in production and site construction; 10 times faster in construction time.

### COMPANY PROFILE

BROAD Core Building, a wholly-owned subsidiary of BROAD Group, was established on 10<sup>th</sup> September, 2018. It is located in BROAD Town, Changsha, Hunan, China.

BROAD Group is a global leader in environmental protection, energy conservation and future construction technology, as well as an important innovator in low-carbon industry. From 2009 to 2015, under the leadership of chairman Zhang Yue, five generations of industrial steel structures were successfully developed and more than 30 low-carbon buildings were built.

From 2016 to 2018, BROAD Group developed the 6th generation technology for sustainable building -- stainless steel BCore slab. In total, more than 1,000 researchers and ¥2 billion have been invested in research and development of this material. The BCore slab, which is completely independently developed by a globally unique 1100° hot-air copper brazing technology, has applied for the patent certification in 63 countries.

BCore slab is thought to be the first of its kind in the industry, and the copper brazing technology has ingeniously solved the core technical difficulty for BCore structure to be applied in the construction industry.



BROAD Group - landscape of BROAD Town in Changsha

### PROJECT HIGHLIGHTS

The Treehouse is a product of the Civilization series, which is also the first BCore slab office building in the world.

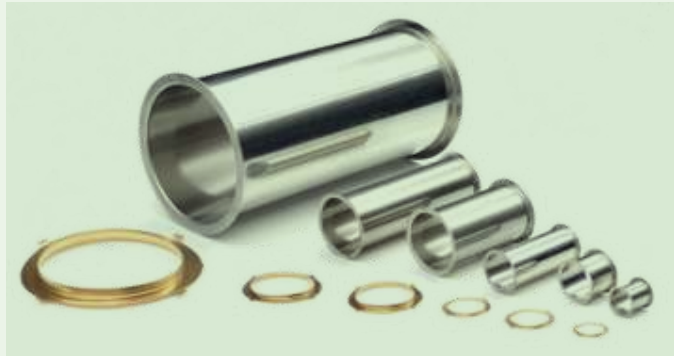
The building is up to standards of 9 magnitude earthquake resistance, 5 times more energy efficient, 10 times longer lifespan and 100 times purer air. Besides, it is 100% steel structure and no construction waste.

## ◎ PROJECT IMPLEMENTATION

Innovation is the soul of BROAD Group. The research and development of BCore slab lasted four years. It involved more than 1000 participants and experienced more than 100 serious failures.

The final product “BROAD stainless steel BCore slab” is the ultimate lightweight material with sandwich structure, which is:

- Ultrastrong and ultralight, elongation  $\geq 40\%$ . It can withstand any earthquake and has a service life of 10,000 years;
- The BCore slab is composed of two stainless steel plates held together with an array of extremely thin core tubes through a 1100°C copper brazing process. The sandwich structure is the ultimate structure with the best mechanical properties, and the steel consumption is 30~60% lower than the traditional structure;
- The Treehouse realize a 12-meter cantilever owing to Bcore structure. Besides, it greatly saves land resources since occupation of land is 150  $m^2$  while monolayer area reaches 1150  $m^2$ .



BROAD stainless steel BCore slab, the ultimate lightweight material

In the meantime, the Treehouse adopts the following energy-saving measure in construction process:

- “Building blocks” method - BCore slab is 100% prefabricated in factories, simple and fast to assemble. The Treehouse was assembled three floors a day to achieve total construction period of 6 days. It greatly shortened the construction period, saved labor costs and achieved zero construction waste.
- The external envelope of the building adopts BCore slab with super insulation. There are four layers of hollow glass windows and external shading. It's also combined with energy-saving non-electric central air conditioner and heat recovery fresh air machine to achieve more rational use of energy. The energy consumption of the building is 100kwh per year per  $m^2$  only, about 1/5 of similar traditional buildings.
- the Treehouse adopts BIM (Building Information Modeling) system throughout the life cycle management process, and carbon data system is implanted in the building for real-time calculation. Compared with traditional concrete and steel buildings, the average annual carbon emissions of the Treehouse are reduced by 90%.

## ◎ IMPACT AND SUSTAINABILITY

Buildings account for 40% of global energy consumption and carbon emissions. At the same time, the industrialization of prefabricated buildings has become a common trend. As a new material of environmental protection and energy saving, BCore is expected to completely replace traditional building materials due to its performance advantages.

In the era of big data, information high-tech technologies such as BIM, MMO and carbon data are implanted into the building to realize intelligent management in the whole life cycle. The Treehouse is a typical case.

BROAD's original hot air copper brazing technology enables aerospace materials to be applied in the field of construction at a low cost. The corrosion resistance of BCore slab is 200 times than carbon steel. Today, reinforced concrete buildings show gorgeous appearance, while in fact, they only have a few decades of life. After a short time, construction waste will be piled up on the earth. Buildings built with BCore slabs can last thousands or even millions of years. Besides, they are highly earthquake-resistant, resource-saving and resisting the risk of post-earthquake reconstruction.

Completion of the Treehouse is a further proof of BROAD Core Building's product line theory. With the Treehouse as the carrier, the product line will derive a whole set of “solutions to inherit the cultural heritage of architecture”. Through the construction of new materials, simulation and reproduction of different civilizations, classics will be last forever. As its product line changes, BROAD will launch more and more products in the future to help protect the planet.

# OFFICE FOR SOCIAL RESPONSIBILITY, CHINA NATIONAL TEXTILE AND APPAREL COUNCIL CLIMATE STEWARDSHIP 2030

## PROJECT OVERVIEW

In December 2018, China National Textile and Apparel Council (CNTAC), 31 global textile brands/enterprises, and 11 industry organizations jointly initiated and signed the Fashion Industry Charter for Climate Action under the United Nations Framework Convention on Climate Change (UNFCCC). To this end, the CNTAC has updated the “2020 Carbon Management Innovation Action” to “Climate Stewardship 2030” and formulated a climate action roadmap for the industry.

## PROJECT OUTCOME

### Project Outcome (2019)

- **Li Ning Co. Ltd., Sateri Group and its eight downstream value-chain partners, Sunrise Group, Chenfeng Group, K-BOXING, and Ruyi Group** have joined the Climate Stewardship 2030
- **The Office for Social Responsibility of the CNTAC, the National Textile Products Development Center, Chenfeng Group, Lenzing Group, SINOTYTEX, Mizuda Group, and K-BOXING** jointly initiated the **Fashion Climate Innovation Fund**
- Recommended by the Office for Social Responsibility of CNTAC, the following companies have signed the Fashion Industry Charter for Climate Action under the UNFCCC:
  - **Chenfeng Group**, first Chinese enterprise that signed the Charter
  - **K-BOXING**, first Chinese brand that signed the Charter
- **4 training bootcamps on low carbon climate action**
- August 27, Beijing, **Climate Innovation · Fashion Summit**, awarded “2019 Pilot Event of Human-Nature Harmony” by China Biodiversity Conservation and Green Development Foundation
- September 25-27, Shanghai, **China Sustainable Fashion Week 2019, Annual Conference on Social Responsibility in Chinese Textile and Apparel Industry**

## PROJECT HIGHLIGHTS

- Focus on the scale of the whole sector to increase the usage of clean energy and emission reduction technology effectively and to accelerate the enterprises’ transformation towards low-carbon implementation;
- Form Chinese low-carbon fashion flagship brands through **industrial collaboration** and thus increase Chinese enterprises’ competitiveness in the global **low-carbon supply chain**, actively participate in the international management of fashion industry climate action, and enhance global communication
- **Provide industrial solutions for China’s voluntary contributions to emission reduction.**

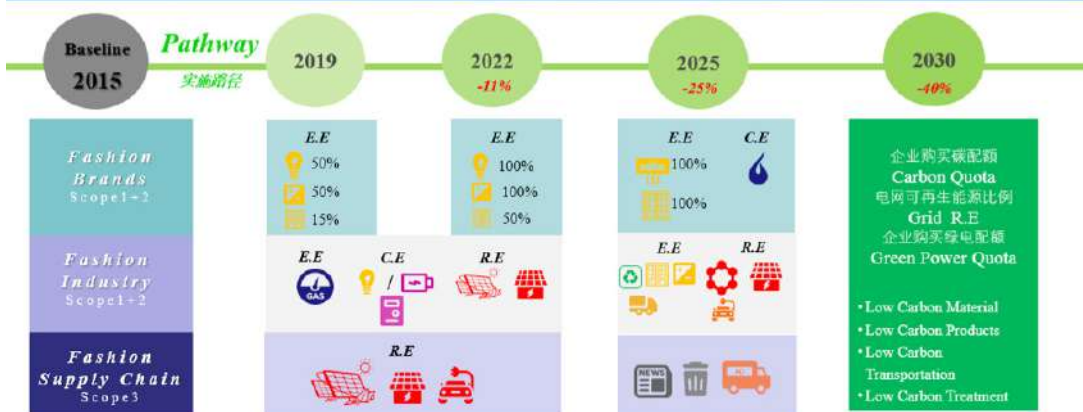
## ORGANIZATION PROFILE

China National Textile and Apparel Council (CNTAC) is the strategic development councilor and sector interest



representative of China’s textile industry. It has built a bridge between the government and enterprises on development strategy, policy research, standards establishment and information exchange. It has established a platform that supports government decision making professionally, empowers innovative transformation smoothly, and represents the interests of China’s textile and apparel industry strongly. As the first nation-level social responsibility department in China established in 2005, the Office for Social Responsibility is committed to enhancing information disclosure, perfecting management system and promoting cross-border collaboration, and emphasizing people, planet and profit baseline for the industry.

## Climate Stewardship 2030 Roadmap



**E.E** — New Energy Efficiency  
**C.E** — New Clean Energy  
**R.E** — Renewable Energy

LED, Photovoltaic Sensor, Energy-saving wall, doors and windows, Electric Vehicle (EV) Charging Pile, Use gas heating, Carbon disclosure  
 Gas substitute coal, Solar Energy, Energy Storage, E-Vehicle of supply chain, Heat-Recovering Technique, Waste classification  
 High efficiency battery, High efficiency Air compressor, B-Vehicle, HVAC, Biomass Energy

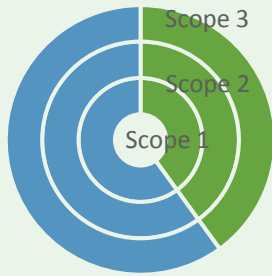
Sustainability  
 中国纺织工业联合会 社会责任办公室  
 CNTAC Office for Social Responsibility of CNTAC

◎ **PROJECT IMPLEMENTATION**

**Goal:**

- **Emission Reduction:** By 2030, carbon emission reduces by 40% (equivalent to 100 million tons carbon equivalent) using 2015 baseline. Annual carbon uptake equivalent to 17 million acres of forests (equivalent to 57 times the area of New York City or 11 times of Shanghai City).

纺织行业气候行动目标



**-40%**



- **Energy Saving:** In 2025, 25 GWh of electricity generated by renewable energy, equivalent to annual carbon uptake by 100 million hectares / 2.5 million acres of forests.

**Mechanism:**

- Provide analytical tools for emission reduction impact, and support enterprises to carry out baseline surveys and set emission reduction benchmarks;
- Promote carbon asset portfolio verification, carbon management capacity building and carbon information disclosure, support projects that increase resource efficiency or shift energy sources to renewable energy, disclose full industrial chain carbon footprint information, and apply low-carbon technologies to amplify carbon emission reduction impact throughout upstream and downstream;
- Invite key fashion brands and large manufacture companies to join the **Climate Leadership Project**
- Publish reports on total emission reduction's progress, influence, and challenges regularly in a transparent and systematic way.
- Establish broadcast pathways to showcase China fashion industry's contribution to global carbon emission reduction

**Framework:**

- Set up the strategic working group of the *of Fashion Industrial Action for Climate*
  - Empower China Fashion Industry using local strengths. For instance, consulting companies, technology innovation entities, education institutions, financial institutions, NGOs, etc., have jointly supported and strengthened climate friendly actions;
  - Learn international trends, strategies, best practices through participating in UNFCCC's working groups;
  - Leading localized climate efforts and add successful experiences to the knowledge pool.
- Establish non-profit special fund for fashion industry climate innovation action to ensure the achievement of industry's low-carbon goals through green technology and green finance
  - Establish the special fund for climate innovation purposed by Office for Social Responsibility of CNTAC;
  - Invite green finance to invest on innovative technologies or enterprises to empower low-carbon development and increase commercial value of the industry;
  - Create a supportive environment for low-carbon and circular development, and thus exploring and applying clean energy technologies, strategic solutions, new ideas learned along the way to the end of brand management and supply chain manufacturing;
  - Invest green capital to benefit projects/companies with advantages in life cycle assessment and life cycle cost.
- Encourage joint efforts of multi-stakeholders
  - Motive enterprises to commit to 40% emission reduction by 2030 using 2015 baseline, verify carbon asset portfolio, build carbon asset management capacity, and publish reports on emission reduction results or sustainability development;
  - Launch roadshows lecturing fundamental knowledge of climate change, climate innovation, and carbon emission reduction solutions, at 5 textile and apparel education institutions and 5 enterprises to enhance awareness and abilities of carbon asset portfolio management in the industry;
  - Achieve enterprise carbon asset portfolio management and amplify co-benefits of upstream and downstream emission reduction through carbon information disclosure, low-carbon technology application along the industry value chain.



## CHINA CONSTRUCTION BANK GREEN CREDIT

### PROJECT OVERVIEW

In 2016, *China Construction Bank Green Credit Development Strategy (2016~2021)* was approved by its Board of Directors, which aims at accelerating business green development, preventing environmental and social risks, and enhancing the social responsibility of China Construction Bank (CCB).

As of the end of 2018, the balance of the CCB's green loans was 1,042.26

billion yuan, an increase of 72.934 billion yuan compared with the beginning of 2017. The balance of green loans accounted for 15.35% of corporate lending, an increase of 0.52 percentage points from the beginning of the year.

In 2018, the total amount of newly granted green loans was 170.88 billion yuan, including 70.872 billion yuan in clean transportation, 45.017 billion yuan in clean energy, and 26.581 billion yuan in energy conservation and emission reduction.

### PROJECT OUTCOME

- *China Construction Bank Green Credit Development Strategy (2016-2021)*
- *CCB Notice on Strengthening Environmental and Social Risk Management*
- *CCB Green, Social and Sustainability Bond Framework*

Environmental Impact:

Green Credit projects had positive effects on renewable energy development, energy conservation, GHG and pollutant emission reduction, and air and water quality improvement.

### COMPANY PROFILE

China Construction Bank Corporation, headquartered in Beijing, is a leading joint stock large-scale commercial bank in China. With a market value of about \$207.179 billion at the end of 2018, the bank ranks fifth in the world on the chart of listed banks. The group ranked second in The Banker's Top 1000 World Banks 2018 based on Tier 1 capital.

With 14,977 branches including 200 overseas branches in 29 countries and regions and 345,971 employees, CCB serves hundreds of millions of individuals and corporate customers. The Bank's subsidiaries cover multiple business areas, such as mutual funds, financial leasing, trust, life insurance, property insurance, investment banking, futures and pension.

Adhering to the business philosophy of "customer-centric and market-oriented", the Bank is committed to becoming the most valuable, creative bank, maintaining consistency and good balance between short-term and long-term benefits, and business objectives and social responsibility objectives, in order to optimize the value of customers, shareholders, society and employees.



### PROJECT HIGHLIGHTS

- Establishment of a green credit development strategy
- Strict enforcement of environmental indicators in credit access policies
- Green bonds issued to support sustainable development

## ◎ PROJECT IMPLEMENTATION

In 2016, the CCB Board of Directors approved *the China Construction Bank Green Credit Development Strategy (2016-2021)*.

In 2017, according to the Strategy, CCB issued *the Notice on Strengthening Environmental and Social Risk Management* which specifies environmental and social risk management throughout the credit process, and clarifies the requirements and differentiated management measures for pre-lending investigations, credit approvals, loan review, and post-lending management. For highly risky customers, in addition to strict control of credit granting, CCB enforces higher risk assessment requirements.

In 2018, **the total amount of newly granted green loans was 170.88 billion yuan, including 70.872 billion yuan in clean transportation, 45.017 billion yuan in clean energy, and 26.581 billion yuan in energy conservation and emission reduction.**

**The loan balance for high-pollution-and-high-energy-consumption industries fell by 4.16% year-on-year.** For CCB's branches in China, thermal power industry loans decreased by 0.50% compared with the beginning of the year, and coal industry loans decreased by 0.13%.

As of the end of 2018, **the balance of the Bank's green loans was 1,042.26 billion yuan**, an increase of 72.934 billion yuan compared with the beginning of 2017. The balance of green loans accounted for 15.35% of corporate lending, an increase of 0.52 percentage points from the beginning of the year.

Besides, in September 2018, CCB established the *Green, Social and Sustainability Bond Framework* and completed the issuance of a sustainability bond of 1 billion US dollars and a green bond of 500 million euros to support the development of green credit and inclusive finance.

### Green Credit Cases of CCB Branches in 2018

**CCB Zhejiang Branch** provided RMB104 million loans to support the development of a Fishery and Sloar PV Power Plant Integration Project. The project is to build a grid-connected solar PV power plant over a fish pond. The plant will help save 6664.1 tce per year, compared to coal-fired generation, assuming 325g (standard coal) consumption per kWh, and reduce carbon dioxide (CO<sub>2</sub>) emissions by 19,900 tons, smoke and dust by 2.06 tons, Sulphur dioxide by 13.71 tons, and NO<sub>x</sub> emissions by 13.71 tons.

**CCB Hubei Branch** provided RMB1.3 billion to support the construction of Beihu Sewage Plant and its affiliated projects. After the completion of the projects, the pollutants BOD<sub>5</sub>, COD<sub>cr</sub>, SS, NH<sub>3</sub>-N, TN and TP will be reduced annually by 12,045 tons, 23,178 tons, 17,520 tons, 4,709 tons, 2,829 tons and 374 tons, respectively. This will play a positive role in improving municipal water quality and protecting the Yangtze River.

**CCB Guangdong Branch** provided RMB300 million loans for a denitration project of a 3×660 MW generation unit. When put in operation, the project will help reduce the nitrogen oxides emissions by 13,341 tons annually, significantly lowering the ground concentration of nitrogen oxides. This will be of great significance for improving the air quality in the Pearl River Delta region.

## ◎ IMPACT AND SUSTAINABILITY

*The China Construction Bank Green Credit Development Strategy* upholds green banking as the goal of CCB's medium and long-term business planning, by integrating economic, social and ecological benefits as a whole. The Bank integrated low-carbon and green development, environmental protection and biodiversity conservation into credit policies and business principles, improved and updated the green credit policy system, accelerated credit restructuring, strengthened environmental and social risk management, provided more green credit products and services, and thus to effectively promote the development of green credit business and contribute to climate change mitigation.

CCB is committed to capacity building on client environmental and social risk management, guiding clients to effectively manage their own environmental and social risk through financial means, preventing credit and reputational risks arising from clients' own risks. Over the years when granting clients access to loans, CCB has always stuck to the clients' capability of meeting environmental standards as a requirement. Clients and projects that fail to meet environmental standards or make improvements in a timely manner will be under strict scrutiny.



## RE-CLOTHING BANK

### LOW-CARBON DESIGNS IN SHANGHAI FASHION WEEK

#### ◎ PROJECT OVERVIEW

On October 9, 2019, Re-clothing Bank held the “WANDERLUST Roaming” theme show in Shanghai Fashion Week, displaying a total of 68 garments in 38 looks that are made of environmental-friendly and recycled fabrics. At the same time, Re-clothing Bank cooperated with Carbonstop to calculate the carbon emission reduction of the recycled fabrics used for this show. The result showed that the fashion exhibited this time achieved 105.5kg carbon emission reduction compared with regular fashion.

#### ◎ PROJECT OUTCOME

- Compared with regular fabric, the recycled fabric per m<sup>2</sup> reduces 413.8g carbon emission, equivalent to saving 0.36kg standard coal, 0.32kg gasoline, or 1.53kwh electricity.
- The garments used an average of 3.75 m<sup>2</sup> recycled fabric, making a total of 105.5kg carbon emissions reduction for this show.

#### ◎ COMPANY PROFILE

Re-clothing Bank is a sustainable fashion brand founded in 2010 by Ms. ZHANG Na, independent designer and founder of a women clothing brand FAKE NATOO. Re-clothing means old-clothes redesign and remake; Bank refers to the mode of storage, circulation, and exchange of accepted old materials.

The company is committed to taking a second look at the outdated materials from the angle of “redesign”, remaking, recycling, and reviving used materials and fabrics, and creating timely fashion.



#### ◎ PROJECT HIGHLIGHTS

ZHANG Na believes that the “Berlin Wall” set an example of the antagonism between people and the environment. Through her brand, she hopes to break the “Berlin wall” by spreading the idea of refuse, recycle, and rebirth.

拒绝浪费

**RE**fuse

循环使用

**RE**cycle

时尚重生

**RE**birth



THE COLLECTION OF RE-CLOTHING BANK

## PROJECT IMPLEMENTATION

### Background

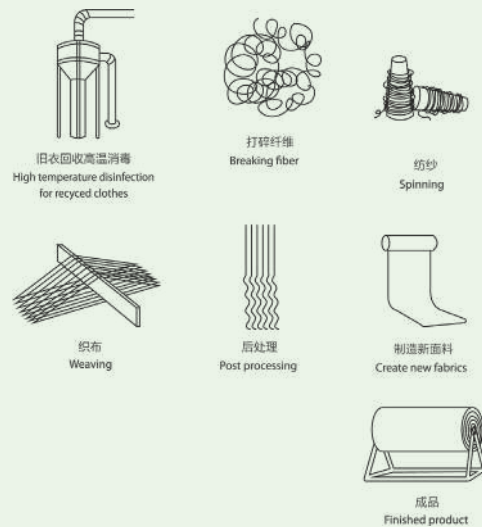
Since the founding of the brand, Reclothing Bank has been exploring the use of old clothes and recycled cotton materials and released environmental collections including “Zhong”, “Le” and “Zai”.

- The “Zhong” collection used recycled cotton as the main fabric. In order to achieve mass production, the materials came from obsolete civil service uniforms. In order to save water and avoid pollution during the printing and dyeing process, the designer deliberately kept the blue color of the original fabric as the theme color of the remade garments;
- The “Le” collection: Reclothing Bank worked with a women worker community to create this hand-stitched collection. Each piece of this collection was slight different and unique.
- The “Zai” collection carries touching stories of each client. A coat representing maternal love and companion was designed for a client from the old clothes of the deceased mother. A set of cloaks was designed for a family of three who often traveled separately around the world. The three cloaks can be connected to one another, symbolizing the bond of the family during their time on the road.

### Recycled fabric

Reclothing Bank recycles used clothes, sorts and disinfects them, then breaks them into fibers and reproduce fabrics from the fibers. Although the recycled garments are made from old clothes, they have been strictly processed in accordance with national hygiene standards and the cost of the fabrics is much lower than that of new fabrics.

The recycled fabric workshop covers an area of 10,000m<sup>2</sup>. In order to minimize the pollution and energy consumption in the process of producing recycled fabrics, all the equipment was imported from northern Europe and requires no more than 30 workers. The processing line uses the world’s most advanced infrared detection technology to automatically analyze the composition of old fabrics, and manufacture the recycled fabrics after classification and disinfection.



### Environmental-friendliness

The Reclothing Bank show has added a new dimension to the Shanghai Fashion Week. In addition to presenting a fashion feast, Reclothing Bank also collaborated with Carbonstop (Beijing) Technology Co., Ltd. to quantify the carbon emission reduction of the recycled garments, as shown in the table.

Emission Reduction by Garment Type

	Emission reduction (kg)	Standard coal equivalent (kg)	Oil gas equivalent (kg)	Electric power equivalent (kWh)	Trees planted
Shirt	0.93	0.36	0.32	1.53	0.19
jacket	0.93	0.36	0.32	1.53	0.19
pants	0.93	0.36	0.32	1.53	0.19
Dress	1.86	0.72	0.63	3.05	0.37
Trench coat	2.17	0.84	0.74	3.56	0.43

## IMPACT AND SUSTAINABILITY

The “WANDERLUST” show of recycled garments in the Shanghai fashion week was a milestone in the intersection of the fashion industry and the environmental field. It fully presented the mission of Reclothing Bank, that is, “Refuse, Recycle and Rebirth”. It underlined the brand culture and introduced recycled clothes to a broader audience. It provided an excellent example for future cooperation between the low-carbon and fashion fields and generated new ideas for low-carbon and fashion innovations. Reclothing Bank will remain true to its original aspiration and move forward on the road of environmental protection, low carbon development and public welfare.

Since its inception, Reclothing Bank has been committed to adding environmental and low-carbon elements to its own business. The founder, Ms. ZHANG Na, is also very enthusiastic about the environment and public welfare. In 2017, ZHANG Na won the title of “Annual Youth Model for Environmental Protection and Public Welfare” for her passion and commitment. In an interview with Beijing Youth Weekly, ZHANG Na spoke her own voice and called for joint effort to create equal and sustainable opportunity for every life to enjoy nature endowments.



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