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ENN Natural Gas Co., Ltd.



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Green Action 2030 - ENN Journey to Net Zero

ENN Natural Gas Co., Ltd.

# Green Action 2030

## ENN Journey to Net Zero



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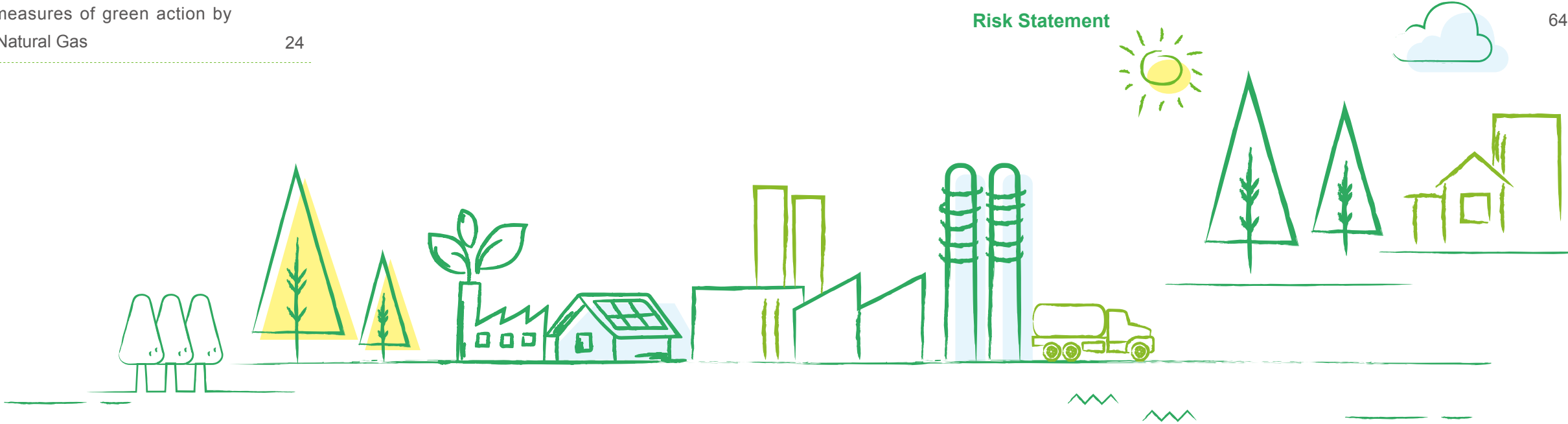
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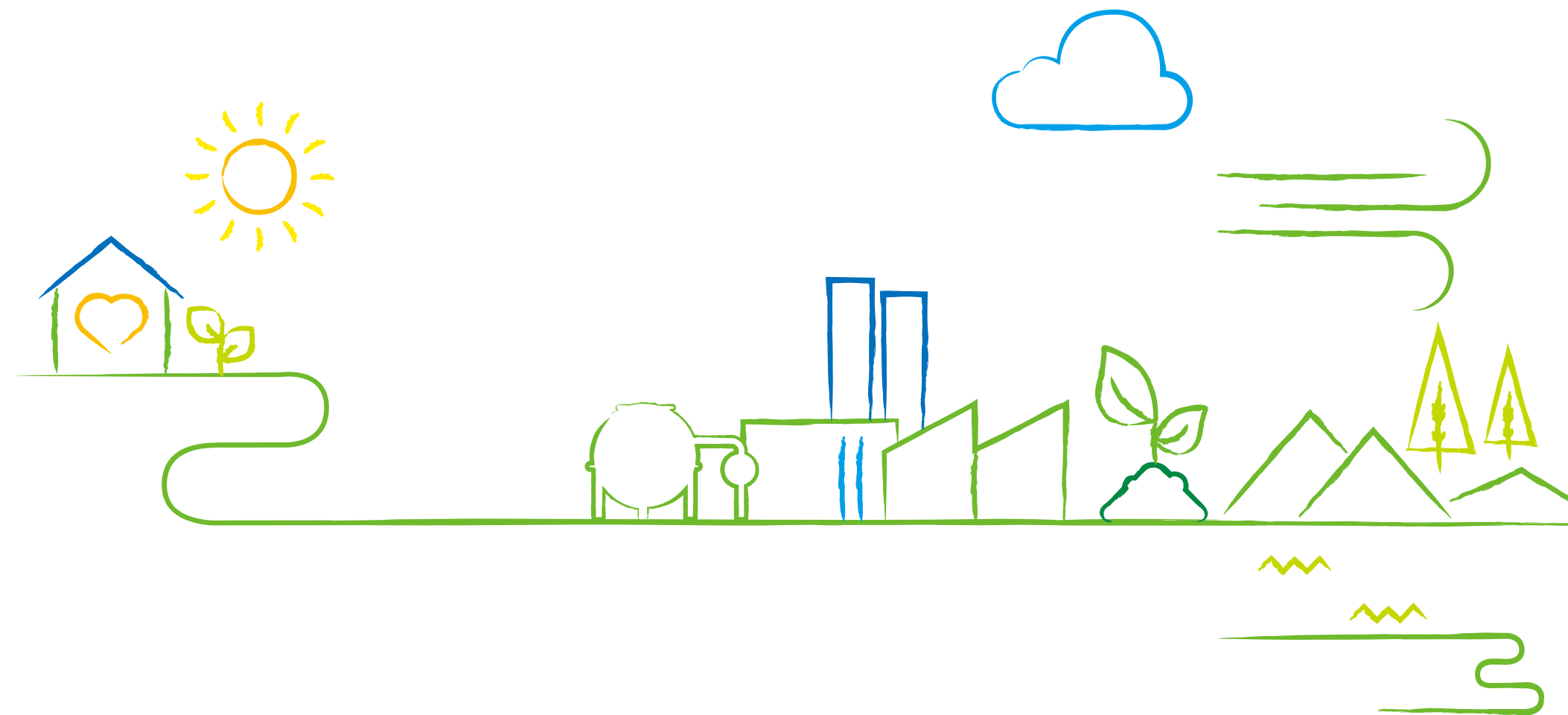
# Preface

Climate change is a global challenge that knows no boarder. On December 12, 2015, the *Paris Agreement* was adopted at the 21st meeting of the Conference of the Parties (COP21) which was convened by 197 countries in Paris to significantly reduce greenhouse gas (GHG) emissions across the world and achieve net-zero GHG emissions by mid-century. At the 75th Session of the United Nations General Assembly in September 2020, Chinese President Xi Jinping made ambitious pledges that China will peak its carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060.

The “dual carbon” goals showcase China’s determination to achieve carbon peak by 2030 and carbon neutrality by 2060. Every enterprise has the responsibility of responding to the national “dual carbon” call, and should seize the broad development opportunities. On the path towards “dual carbon” goals, the green reform in the energy sector and transition to renewable ener-

gy offer important approaches. ENN Natural Gas Co., Ltd (hereafter referred to as ENN Natural Gas, the “Company” or “we”) will resolutely seize the new opportunities of natural gas market reform and energy transition, formulate medium and long-term green action objectives, continuously improve the energy structure through innovation, promote the green reform, build a systematic green industrial system, and facilitate carbon emission reduction across the industry chain and the whole society.

ENN Natural Gas has mapped out a green action plan to meet our targets for carbon emission reduction and carbon neutrality. We continuously launch low-carbon and green solutions, and build a clean and beautiful new world with industrial chain partners. We also make every effort to facilitate the development of green innovative technologies, and contribute to the technological maturity and commercial application of clean and renewable energy.



## The Green Action Plan of ENN Natural Gas

We have set short, medium and long-term carbon emission reduction targets for the main business segments. We are committed to carbon peak by 2030 and net-zero carbon emissions by 2050

### Natural gas production, import and direct selling, and energy production (coal and methanol)

- We aim to reduce the greenhouse gas (GHG) emission intensity (total Scope 1 and Scope 2 GHG emissions/sales revenue) by 20% from the 2020 baseline by 2025. By 2030, the GHG emission intensity will be cut by 50% from the 2020 baseline. The Company will seize the development opportunity in the natural gas market, match energy production with the energy demand of our customers, and strengthen natural gas liquefaction, direct selling, and terminal business at Qinshui ENN and Zhoushan Terminal. For the coal, energy and chemical segments, we will adopt various measures, such as increasing the use of renewable energy and investing in green technologies and processes, to help our customers reduce carbon emissions while meeting our carbon reduction targets. In addition, the Company will accelerate the planning and design to improve our core capabilities for the full-cycle and low-carbon intelligent construction;

### Natural gas distribution (retail and wholesale)

- We will reduce the GHG intensity ((total Scope 1 and Scope 2 GHG emissions/natural gas sales) by 10% from the 2019 baseline by 2025. By 2030, we will further reduce the GHG emission intensity by 20% from the 2019 baseline. We will include the methane emission control into our carbon emission reduction development plan, and work together with our partners in the alliance on methane emission control established by China's oil and gas enterprises to achieve the goal of "reducing the average methane emission intensity in the natural gas production to below 0.25% by 2025";

### Integrated energy

- The emissions from Scope 1 and Scope 2 are mainly caused by fossil fuels and purchased electricity consumed in the energy production, namely the energy production facilities of the production-oriented integrated energy business. We focus on the green development of production-oriented integrated energy and aim to achieve a 48% reduction per unit of carbon intensity by 2030 with 2019 as the baseline year.

### Green office

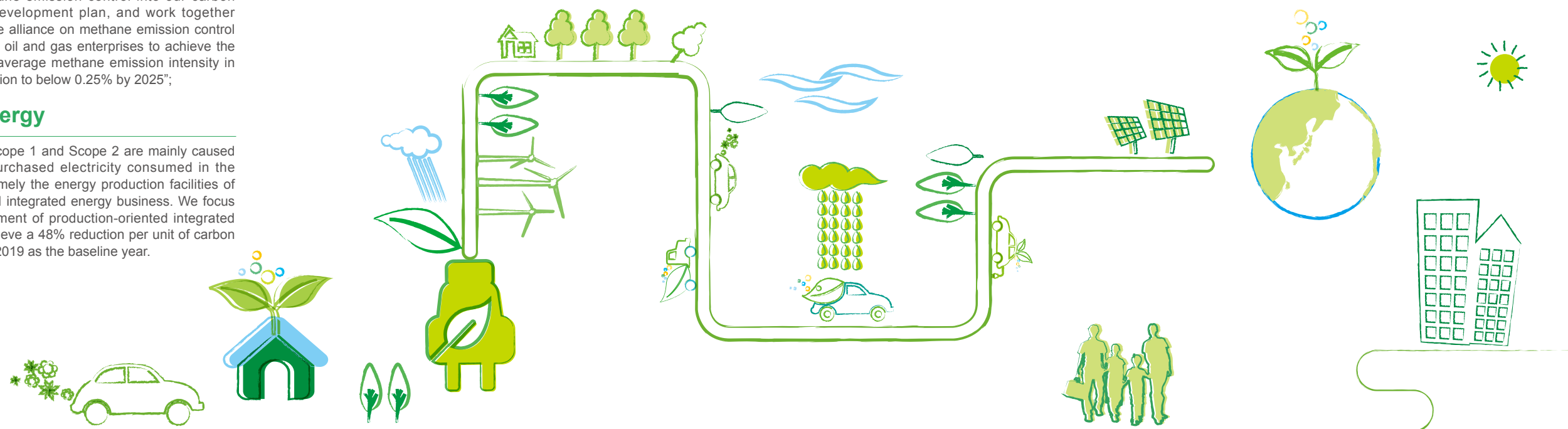
- We promote energy conservation in office buildings in such aspects as site selection, lighting, and air conditioning equipment, and apply intelligent sockets and other devices to control energy consumption;
- Besides advocating low-carbon travel and shared bicycles and replacing existing vehicles powered by diesel gradually with new energy vehicles (NEVs), we plan to purchase NEVs as a replacement for 50% of operating vehicles available from 2022 and deploy 50% of shuttle buses for the staff and shuttle buses in the parks powered by new energy by 2025;
- We encourage low-carbon office and low-carbon life, and plan to reduce paper consumption by 10% annually from 2022 to 2025.

## Pursuing green and low-carbon development and working together to build a clean and beautiful new world

- We pay particular attention to the carbon reduction contributions of our businesses to our customers and society, actively engage in external cooperation to achieve carbon neutrality in the full lifecycle of imported LNG, and strive to build the first "zero-carbon" LNG terminal in China by 2030;
- We care about energy consumption and offer green plants and low-carbon park energy-saving improvement services for manufacturing customers under innovative models such as low-carbon resources and smart energy consumption management platforms. Currently, we provide energy services for customers in more than 40 cities, such as Shanghai, Tianjin, Hangzhou, and Qingdao;
- We follow the electric renewal plan of operating vehicles, promote the transformation of charging and swapping business, explore new varieties of the transportation energy business, and realize multi-type operations and extended business benefits at our gas stations and other land resources such as self-owned or leased stations and service centers, as well as the station resources of our enterprise partners and customers;
- We build three green building business practices, namely green villages, low-carbon buildings and low-carbon building clusters, for different scenarios of our customers. We provide rooftop photovoltaic (PV) systems, energy facility hosting, optical storage and charging services, heating installation, and other services according to their different needs for low-carbon upgrades.

## Promoting the application and practice of green technology

- In achieving our carbon reduction targets through innovation, we focus on developing low-carbon technologies, make an early blueprint for renewable energy, green technology, energy storage, and the carbon dioxide capture, storage and utilization (CCUS) technology, tap into low-carbon products and services, and build a green and sustainable supply chain together with our upstream and downstream partners;
- We build a new energy system for comprehensive utilization of renewable energy, further expand the application of green technology in the industry, and promote hydrogen energy business development, and participate in R&D and investment. From demonstration projects to large-scale technology applications, we contribute to achieving carbon neutrality in the whole society.





01

# Background



In 2020, ENN Natural Gas completed the integration and restructuring with ENN Energy, penetrated the natural gas industry chain with forward-looking layout, and firmly seized the opportunity of natural gas market reform. The Company is committed to becoming an intelligent ecological operator in the natural gas industry. Upholding the mission and responsibility of “building a modern energy system and improving the quality of people’s life”, the Company has deeply studied the requirements of the national “dual carbon” goals and the development status of the energy market. We aspire to continuously promote the green and low-carbon development of the natural gas industry chain and engage in the profound reform of the global energy production and consumption modes.



China’s carbon neutrality policies and impacts



Historic opportunities amid carbon neutrality policies





## China’s carbon neutrality policies and impacts

Since the Reform and Opening-up, China witnesses economic boom accompanied by the rapid growth of energy and natural resources consumption, pollutants and carbon emissions. In the context of the “dual carbon” goals, China takes carbon-neutral actions in such aspects as energy system transformation, industrial system upgrading, clean development, and the development and utilization of negative carbon technologies while ensuring steady economic development. For the energy sector, relevant national policies focus on building a clean, safe and efficient energy system on both the energy consumption and supply side.

On the energy consumption side, the government releases a series of policies targeting key areas such as energy, industry, urban and rural construction, and transportation, as well as key industries such as steel, petrochemical, chemical, non-ferrous, building materials, and electric power. As differential measures are put in place to control the energy use and carbon emissions of different industries, the energy-saving and carbon-reducing solutions have rigid demands to the operations of the Company and our customers.

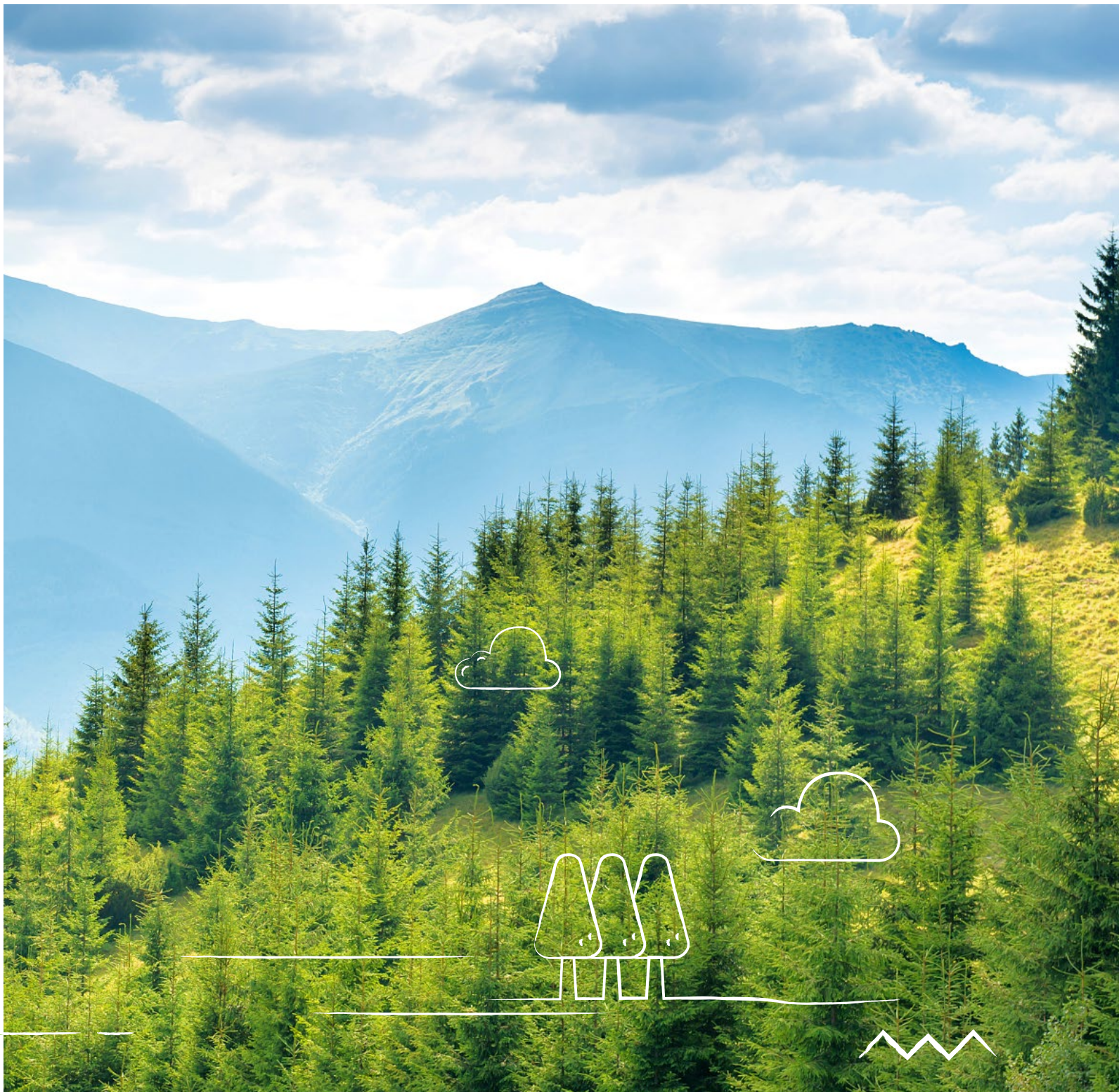
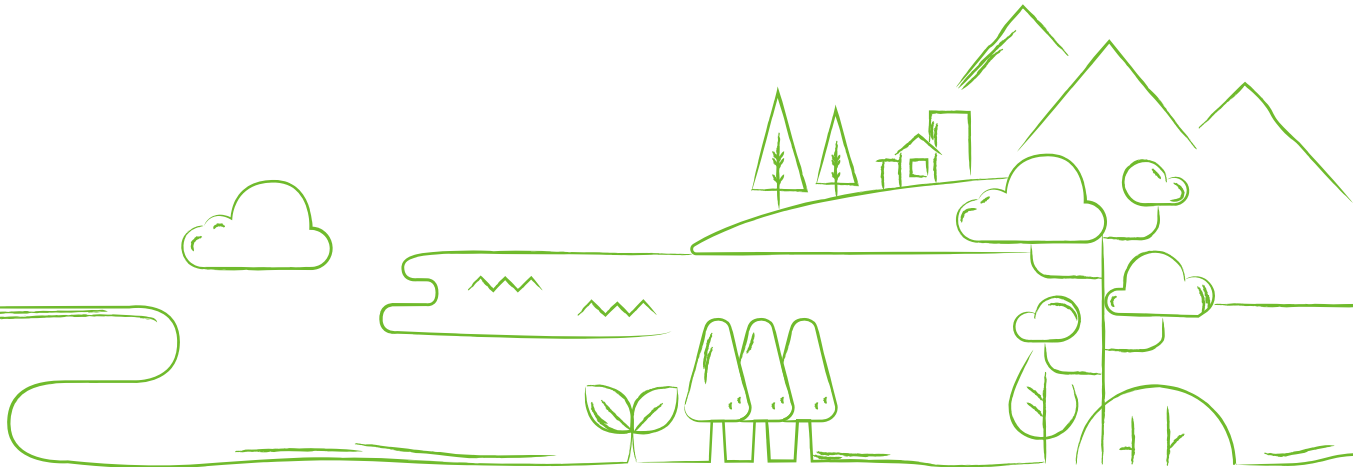
On the energy supply side, the government steps up efforts to accelerate the adjustment of the energy structure, increases the application scope of renewable energy, and **plans to increase the proportion of non-fossil energy in primary energy consumption to 25% in 2030 and to 80% in 2060**. Further efforts will be made to develop various energy forms such as wind power, solar energy, and hydropower, strengthen the regulation capacity of the system, and facilitate the transition to flexible energy storage and energy supply on the user side.

Plans to increase the proportion of  
non-fossil energy in primary energy  
consumption in 2030

to **25%**

In 2060

to **80%**







As an improved policy system around the “dual carbon” goals is established, the “dual carbon” actions adopted by various industries will accelerate the revolution of energy supply, consumption, technology and system, promote the transition to the clean and low-carbon energy structure, and facilitate the innovation of green technology and the improvement of carbon market.



## Historic opportunities amid carbon neutrality policies

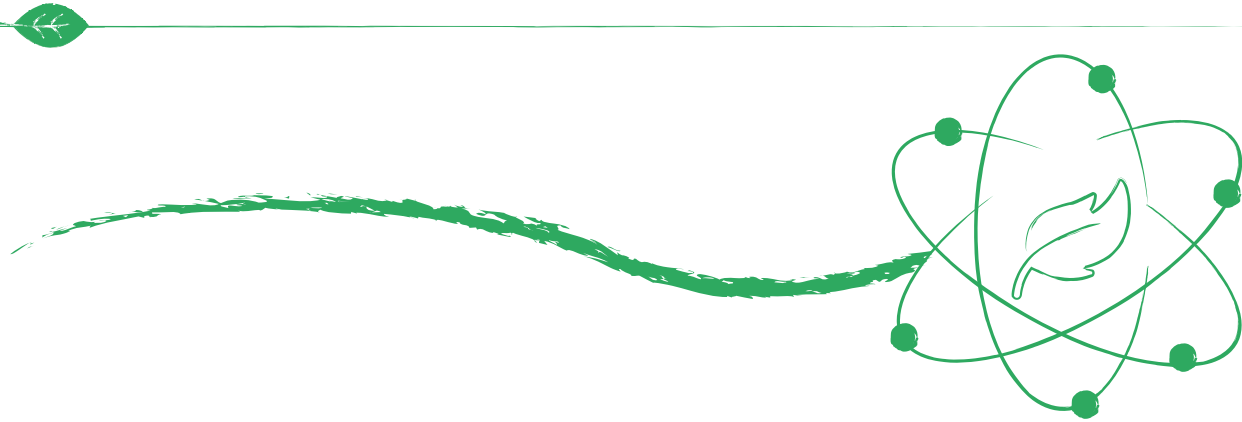
Carbon neutrality is vital to achieving the climate targets outlined in the *Paris Agreement*, so a growing number of nations are incorporating the targets into their national strategies. As China still has a huge economic growth potential with the overall energy consumption on the increase before peaking, it will present enormous challenges to meet the national “dual carbon” goals, which are decided by China’s economic structure and energy structure. For ENN Natural Gas, these challenges also bring along broad development opportunities.

### Rapid development of natural gas and other clean energy

In 2021, China continued to vigorously promote the market-oriented reform of the natural gas industry. To date, PipeChina has connected into the pipeline network for operation, realized the multi-user shipment of the West-to-East gas transmission pipeline, opened the LNG terminal window period, and made the access to the natural gas infrastructure more open and fairer. Under the guidance of the “dual carbon” goals, a series of policies have been rolled out to promote the clean energy transition. As a type (Type 1) of clean energy, natural gas can be utilized together with other types of renewable energy for complementary advantages, which is expected to stimulate the explosive growth of the industry.

### Building the full-cycle low-carbon intelligent construction capability

Driven by such factors as “dual carbon” policies and the development of new energy and digital intelligence technology, energy forms are transforming from the vertical-well mode dominated by the “energy network and giant companies” to the new mode featuring the efficient interaction between “individual companies, regions and key companies”. In particular, the energy system on the user side will evolve towards high energy efficiency, distribution, source-grid-load-storage integration, and intelligence, which will generate diversified business scenarios and create broad development opportunities for the Company. ENN Natural Gas makes the forward-looking layout of hydrogen energy, energy storage, biomass energy, photovoltaic energy, and other low-carbon energy, to provide a wide variety of products for downstream users, meet users’ demand for safe, efficient, clean and economical energy with optimal operation and control strategies, thus achieving high energy efficiency and low emission reduction.



## Integration of green finance into decision-making investment mechanism and governance system

Amid the profound reform around the “dual carbon” goals, the capital market undertakes the major task of optimizing resource allocation through financial means and promoting the green and low-carbon transformation of the whole society. The capital market also contributes to green finance by lending financial support to green and low-carbon industries, facilitating the development of green and low-carbon companies, and promoting sustainable finance efforts. Currently, more than half of the investing institutions in the world are implementing or evaluating environmental, social and governance (ESG) factors in their investment strategies, increasing financing support for green and low-carbon industries through such means as green bonds, increasing the investment in green and low-carbon industries and enterprises, so as to fully support the green and low-carbon economy.

## The establishment of the carbon trading market generates business opportunities

On July 16, 2021, China’s national carbon emission trading market was officially launched, making China the world’s largest carbon market covering greenhouse gas emissions. The carbon trading system will guide companies with price signals and encourages them to carry out energy conservation and emission reduction, thus effectively contributing to “dual carbon” goals. The national carbon emission rights trading market is developing faster with the expansion of market coverage, the diversification of trading varieties and trading methods, and the improvement of quota allocation management. Carbon sink trading is also expected to be included in the national carbon emission trading market as an ecological protection compensation mechanism, thereby providing various means for companies to participate in or benefit from the carbon market.

### Providing low-carbon solutions for the industry chain

As China puts forward “dual carbon” goals, the concepts of low-carbon development and circular economy have been widely extended. Green economic forms, such as green parks, green transportation, and green buildings, play a vital role in fostering the circular economy. ENN Natural Gas is committed to helping China establish and improve the green, low-carbon, and circular economy system, laying out the blueprint for promoting the overall green transition of economic and social development, tapping into low-carbon green products and services, and cooperating with upstream and downstream partners to create a green and sustainable development supply chain.





02

# Panorama of green actions of ENN Natural Gas



The green action plan of ENN Natural Gas aims to reduce carbon emissions in operations by adopting energy-saving and consumption reduction technologies, conducting energy structure reform, and vigorously developing renewable energy and green technology. In addition, we are also committed to providing customers with more low-carbon products and services and promoting carbon emission reduction across the whole industry chain and in the whole society. For the green action plan, we set emission reduction targets using a top-down approach while exploring the potential of emission reduction through bottom-up efforts.

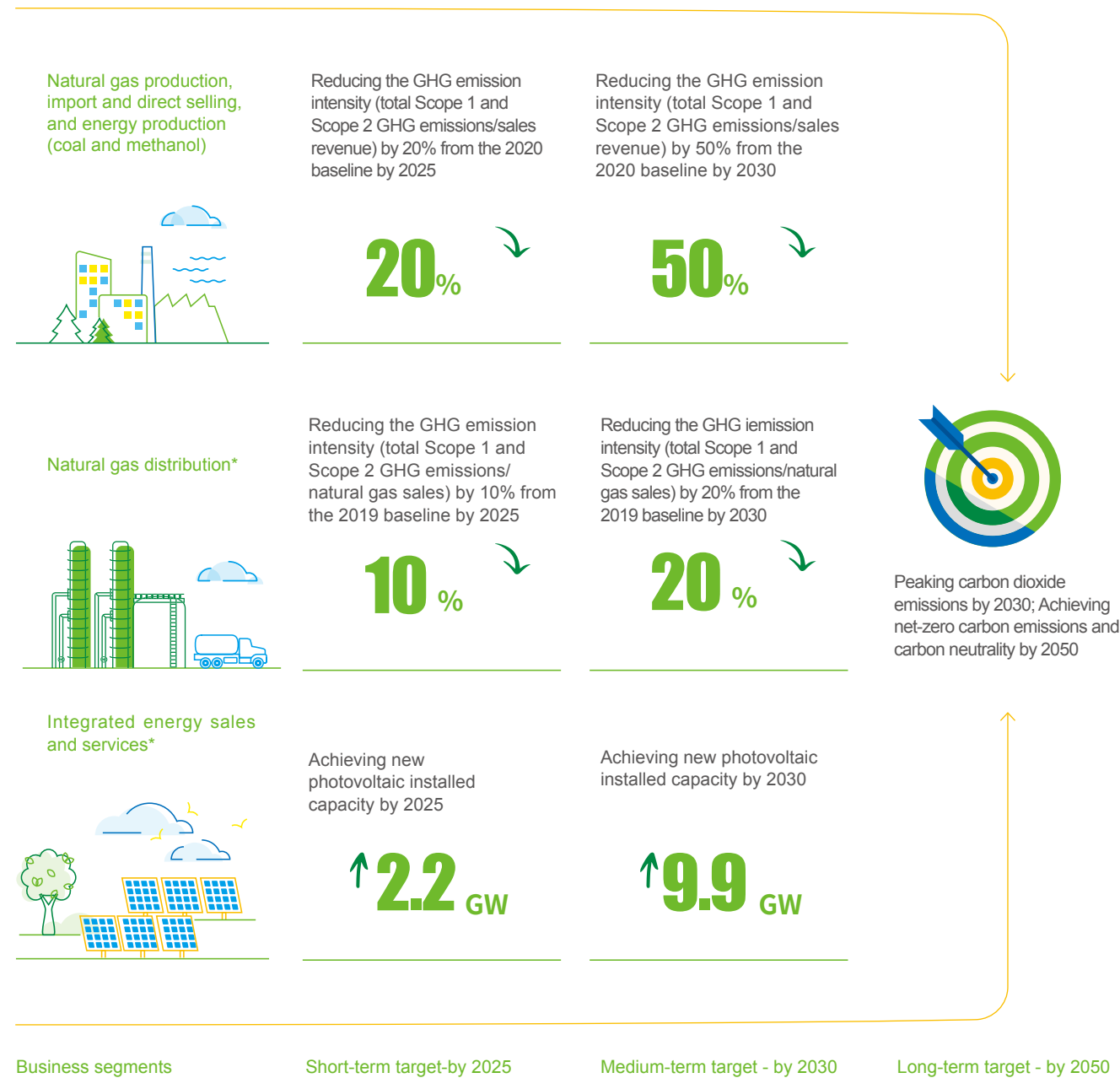


Overall targets



Basic principles

## Overall targets

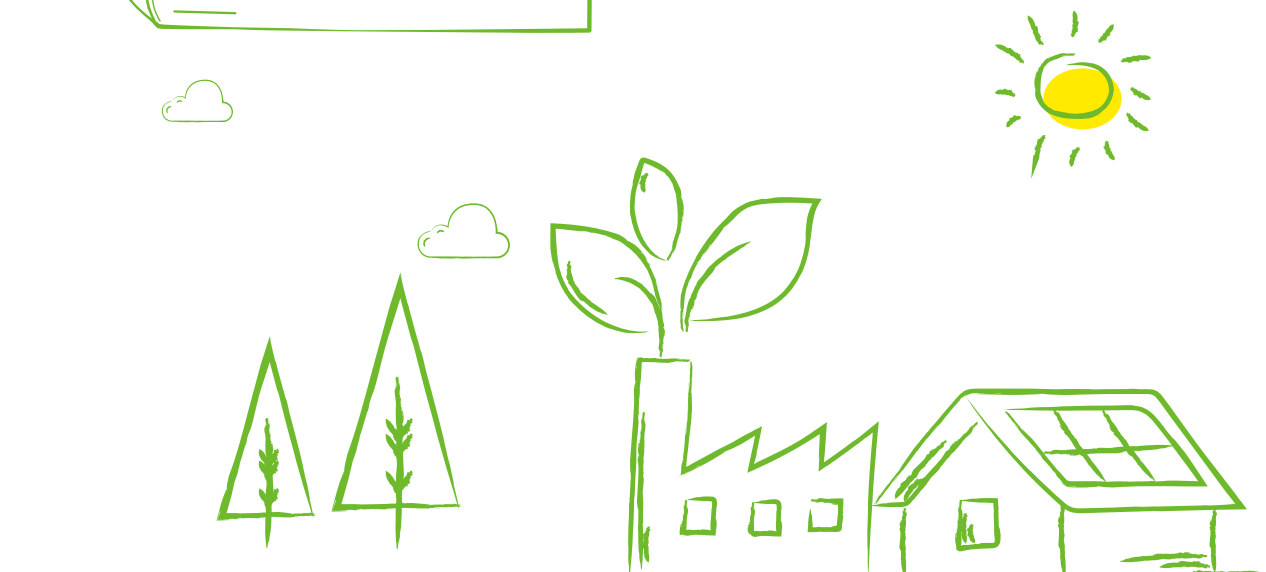


\*The baseline year for natural gas distribution, integrated energy sales and services is 2019, and the baseline year for energy production is 2020.

Scope 1 GHG emissions include emissions directly generated from energy consumption (coal, diesel, gasoline, natural gas) of ENN and its member companies, and CO<sub>2</sub> emissions from raw coal decarbonization during methanol production in 2021.

Scope 2 GHG emissions include emissions indirectly generated from purchased electricity consumed by ENN and its member companies in 2021.

## Basic principles





# ENN Natural Gas Green Action Plan 2030 Panorama

## 01 Energy Production

### 01A Coal

#### Green Mine

**Forest Carbon Sink:** the Company has carried out comprehensive renovation and restoration around the mine area, to increase the forest coverage and establish a forest carbon sink and green industrial demonstration base. We will extend our grassland carbon sink pilot alongside with the policy development.

**Increase the proportion of renewable energy consumption:** the Company has been promoting distributed photovoltaic projects with a goal of launching power generation before 2025. Such efforts would significantly optimize our existing energy consumption structure.

### 01B Methanol Production

**Lean operation to achieve energy saving and consumption reduction:** the Company has deployed the smart control of Methanol Production facilities. Through the overall system optimal design, we improve the average production stability and material utilization. While stabilizing the production indicators, we also achieve energy-saving and emission reduction in production. By recovering vapor and water resources from coal-to-methanol production, we can supply engineering energy in the surrounding parks and continuously improve resource utilization efficiency.

**Deployment of hydrogen, photovoltaic and other clean energy:** the Company has been investing in distributed photovoltaic projects and photovoltaic electrolysis water to produce hydrogen technology, which will be added to the coal-to-methanol system, thus reducing the consumption of raw coal and purchased oxygen. It is expected to reduce CO<sub>2</sub> emissions from oxygen. It is from Methanol Production.

**Carbon Capture, Utilization and Storage:** the Company has been developing the industrialization of Carbon Capture, Utilization and Storage (CCUS) technology through independent research and external cooperation. Having the most advanced CO<sub>2</sub> fracturing lab, we conducted supercritical CO<sub>2</sub> staged fracturing and sequestration experiment to achieve a large-scale CO<sub>2</sub> sequestration. We set up a food-grade liquid carbon dioxide production unit to recycle the carbon dioxide emitted by the methanol unit, with an annual utilization of 150,000 tons of CO<sub>2</sub>.

**Green Methanol:** the Company has actively researched and developed green methanol process. With the carbon dioxide discharged from the existing coal-to-methanol unit as raw material, it is estimated that 52,700 tons of CO<sub>2</sub> emissions will be reduced every year.

## 02 Natural gas production, import and direct selling

### Full Life Cycle Carbon Neutral LNG

**Increase GHG Transparency in LNG Supply Chain:** the Company collaborates with Cheniere Energy to develop full life cycle carbon footprint standard to deliver LNG with carbon label. We also develop carbon neutral LNG products and make online transactions.

### LNG Production Carbon Reduction

**Overall optimization and upgrading of existing production equipment:** through the technical transformation of production equipment, we achieve the purpose of energy saving, improving efficiency and stability, reducing the consumption of electricity, natural gas and other energy.

### Zhoushan LNG Terminal To Build a Zero-Carbon Terminal

**Energy conservation and efficiency improvement with integrated energy use and supply:** targeting all scenarios of the natural gas industry, Zhoushan Terminal integrates energy supply and realizes system energy saving through energy facility optimization + digital intelligence. Zhoushan Terminal achieves the upgrade from the transformation and optimization of a single facility and a single system into the overall matching between multiple systems. Besides, Zhoushan Terminal also builds energy use scenarios featuring integrated energy use and supply, and reduces carbon emissions from purchased electricity, transportation, and production.

**Residual energy exploration and utilization:** the smart energy management system is used to explore the LNG cold energy and fully utilize the potential energy of LNG circulating cooling water for power generation. It is expected that the cold energy single-and-double cycle power generation and cold energy air separation projects will be completed by 2035, and the LNG cold energy will be fully utilized to develop the circular economy.

## 03 Engineering construction

### Low-carbon intelligent construction service provider

**Build the core full-cycle low-carbon capacity:** by integrating technologies such as digital intelligence technology, digital twins, and digital operation with low-carbon chain, the Company offers the low-carbon intelligent construction process solutions, digital delivery low-carbon intelligent solutions, and low-carbon intelligent calibration whole-process solutions. We also reshape the "planning - construction - operation" service model, and achieve low-carbon operation throughout the whole cycle.

## 04 Natural Gas Distribution

### Methane Emission Management

- (1) **Align with international standards and improve transparency,**  
Joined the Methane Guiding Principles (MGP) in 2021, we aim to adopt best practices for identification, monitoring and reporting of ME, and to disclose ME data in align with MGP in 2023 and continuously improve transparency afterwards.
- (2) **Improve ME management policies and measures,**  
Integrate methane management into daily operations, deploy continuous emission reduction measures, and gradually link performance related to ME management with compensation.
- (3) **Promote the application of onsite detection technology,**  
Aim to equip all city-gate stations with the onsite detection devices such as PTZ by end of 2022, so as to improve quality and accuracy of ME data.
- (4) **Encourage eco-partners to take actions,**  
As a founding member of the China Oil and Gas Methane Alliance, we pledge to achieve the common goal of the alliance and advocate for more eco-partners to take actions on ME management, including taking advanced technologies and improving disclosure transparency.

## 05 Integrated energy sale and service

### Energy Generating Facilities

- (1) **Promote the use of renewable energy**  
By accelerating solar, biomass, geothermal and other renewable energy use, and introducing hydrogen after 2025, we aim to increase the proportion of renewable and

zero-carbon energy utilisation to 36% by 2030.

- (2) **Improve overall energy generating efficiency**  
By 2025, 50% of self-owned office vehicles will be replaced with new energy vehicles. Aim to improve the overall energy generating efficiency by 5% on the current 90% by 2030 with technical and strategic optimisation and support from the Serlink Smart Energy Management Platform.
- (3) **Boost carbon-negative technology application**  
Aim to establish CCUS pilot projects for Integrated Energy Business around 2025 and neutralise 5% carbon emissions generated from natural gas consumption annually thereafter.

### Low-carbon Industrial Parks and Green Factories

To assist the green development of industrial parks and customers, we aim to help them build 50 green factories and 50 low-carbon industrial parks by 2025. By 2030, the number of green factories and low-carbon industrial parks we served for customers will increase to 200 respectively.

### Green Buildings

Leveraging on the abundant IE technologies and experience of energy management for customers, we provide green buildings solutions and building energy-saving services for architectural customers such as hospitals, hotels, airports, office buildings, etc.

## 06 Energy Transportation Decarbonisation

- (1) **Adopt clean fuels for self-owned vehicles**  
Aim to achieve carbon emission reduction of 28.3% for self-owned transportation vehicles by eliminating diesel transporting vehicles by end of 2025; switch to zero-carbon fuels such as hydrogen or bio-fuels around 2030.

- (2) **Enhance efficiency and reduce emission with intelligent approaches**  
Continuously implement the digital and smart technologies including Yuntu Cloud System and smart dispatching to optimise route and minimise the idling rate, so as to improve efficiency and reduce carbon emissions.
- (3) **Promote low-carbon operations of eco-partners.** Aim to take the low-carbon transportation as a core criterion for supplier access since 2026.

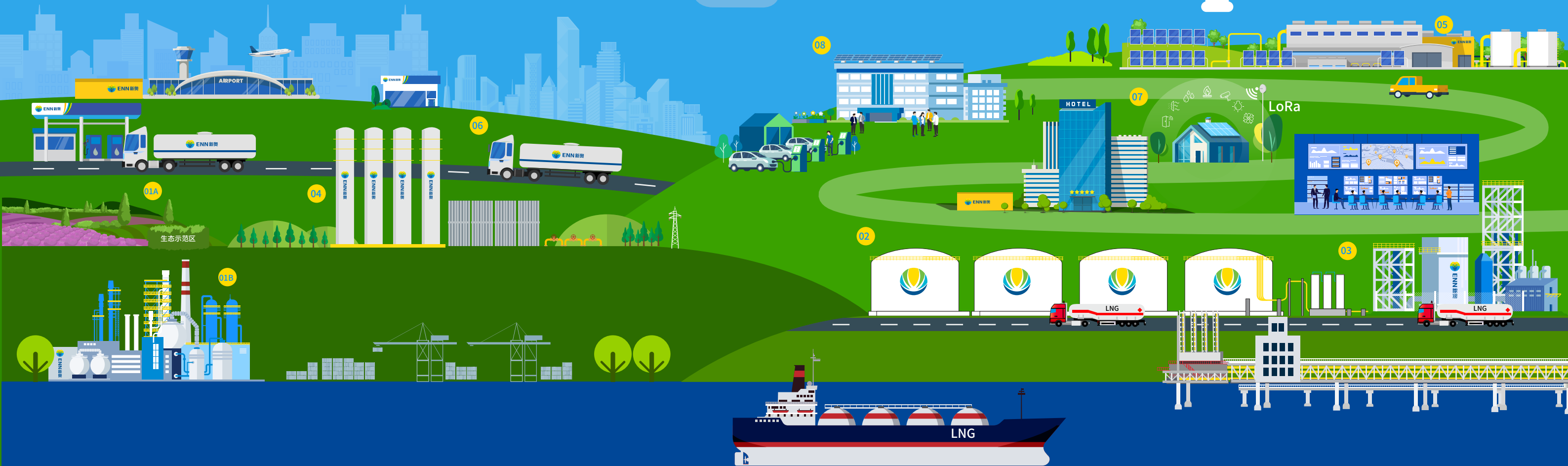
## 07 Value Added Business

### Green Households

Understanding the household customers' pursuit of smart energy usage, safety and low-carbon quality of life, we will serve them by leveraging the use of digital and intelligent technologies such as LoRa, LoT, big data, etc.

## 08 Green office

- (1) **Energy Conservation in Office Buildings**  
Use of renewable energy, Aim to fully deploy photovoltaic for self-owned office buildings, with solar power generation accounting for 5% of electricity consumption by 2025. Energy-saving management of office buildings. Aim to reduce energy consumption per unit area of office buildings by 10% by 2025.  
1 Energy-efficient lighting fixtures and air conditions  
2 Paperless office  
3 Green building standards for office buildings  
4 Intelligent management of energy utilisation
- (2) **Low-carbon Travel**  
Aim to replace 50% of self-owned administrative vehicles with new energy vehicles by 2025.



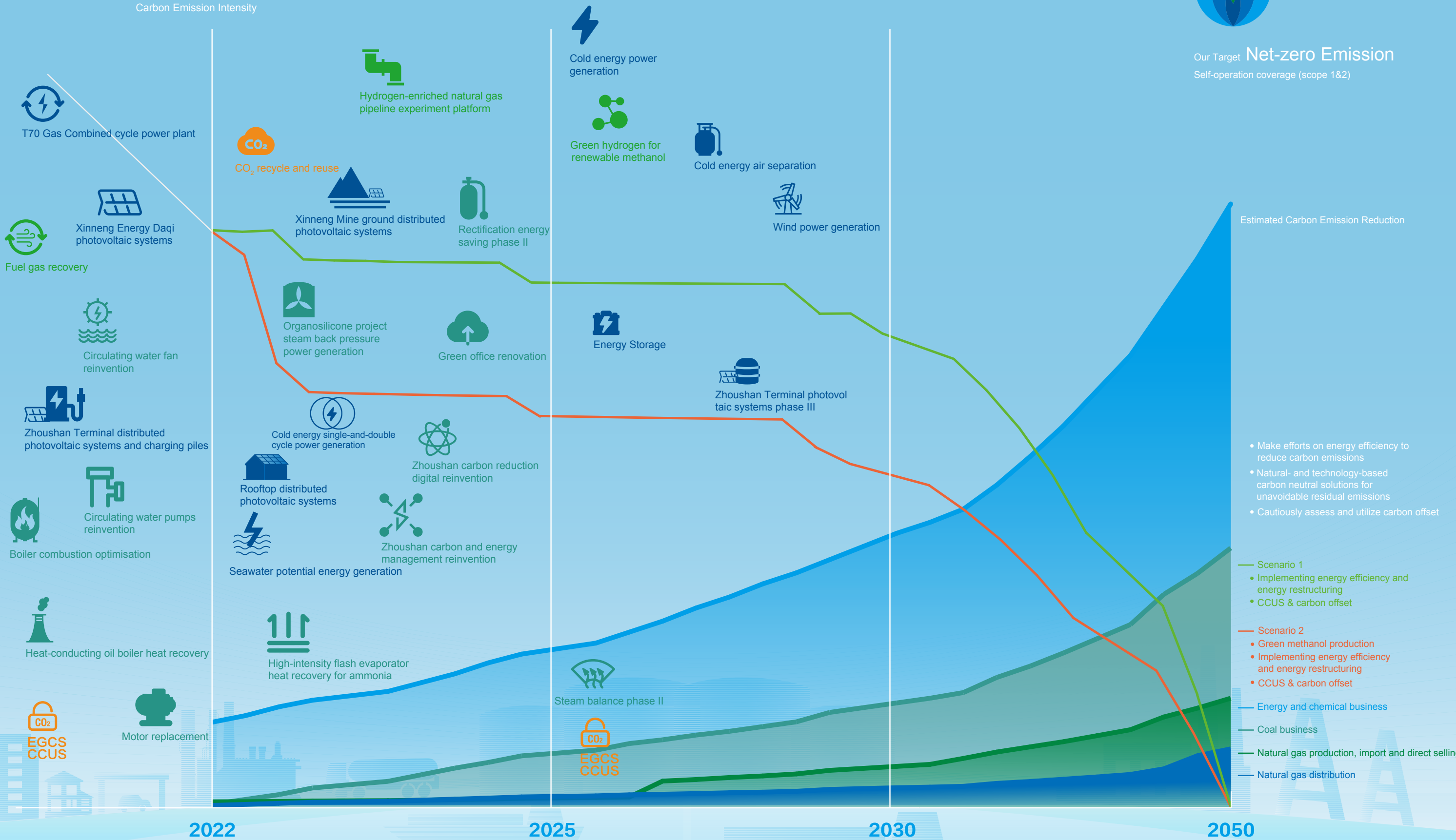


# ENN Net-zero Roadmap



Our Target **Net-zero Emission**  
Self-operation coverage (scope 1&2)

Carbon Emission Intensity



03

# Green action plan of ENN Natural Gas



→ GHG emission management system of ENN Natural Gas

→ Key measures of green action by ENN Natural Gas





## GHG emission management system of ENN Natural Gas

ENN Natural Gas always believes in the core value of sustainable development, actively responds to the national “dual carbon” strategy, and pursues high-quality green development mode to achieve carbon neutral. We have established a sound ESG governance mechanism, included ESG factors into strategic decision-making and daily operation management to created long-term and stable environmental, social and corporate value. The Board of Directors attaches great importance to sustainable development. To achieve carbon peak by 2030 and zero-carbon emissions by 2050, the Company sets up a special working group for the green action plan in 2021, which is responsible for implementing our green action plan properly and reporting to the Board of Directors about the project progress and strategic adjustments regularly.



## Key measures of green action by ENN Natural Gas

### Natural gas production, import and direct selling

Shanxi Qinshui ENN Clean Energy Co. Ltd. is the main producer of our LNG. Relying on the LNG facilities and mature technologies, Qinshui ENN turns coal-bed methane (CH<sub>4</sub>) into liquid through compression, purification, and refrigeration, realizing the development model covering the transfer of natural gas, LNG direct selling, and external purchase & sales. **Qinshui ENN has a daily coal-bed methane processing capacity of 450,000 m<sup>3</sup>, an annual LNG output of 100,000 t, and a maximum designed reserve of 3,000 m<sup>3</sup>.**



Qinshui ENN Clean Energy Co. Ltd.

Qinshui ENN has a daily coal-bed methane processing capacity of

**450,000 m<sup>3</sup>**

Annual LNG output of

**100,000 t**

Maximum designed reserve of

**3,000 m<sup>3</sup>**

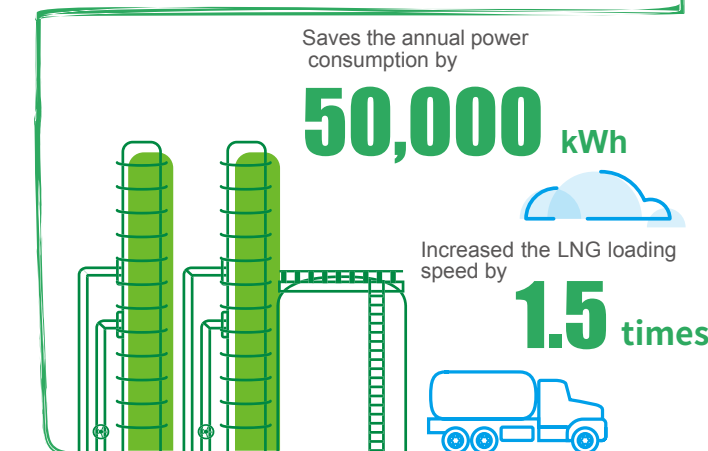
### GHG emissions

Currently, the main emissions of Qinshui ENN include carbon dioxide, methane, and other greenhouse gases. According to the category of emission sources, carbon emissions are mainly generated in forklifts, cutting machines, heat-conducting oil boilers, torches, deacidification systems, nitrogen generators, and refrigeration driers, as well as gas cooking appliances, vehicles, and air conditioners in the office area.

Focusing on the changes in the natural gas market demands and the requirements of the national “dual-carbon” strategy, we continuously explore the energy conservation and emission reduction measures for the whole business process and set emission reduction targets.

## Energy conservation and emission reduction technologies and projects

Qinshui ENN continuously conducts technical upgrading and equipment optimization, and reduces the comprehensive production energy consumption of the plants in line with the policy requirements of local governments for energy conservation and carbon reduction. In addition, we actively promote energy-saving technical improvement of circulating water pumps and LNG pumps, replace inefficient motors and pipelines, and optimize and upgrade equipment, so as to save power consumption, improve equipment efficiency and stability, and reduce dripping and leakage.



### Energy-saving technical improvement of LNG pump

As the main type of China's imported natural gas, the production and consumption of LNG mainly involve liquefaction, transfer, reception, transportation, and sales. LNG pumps play an important role in the whole industry chain.

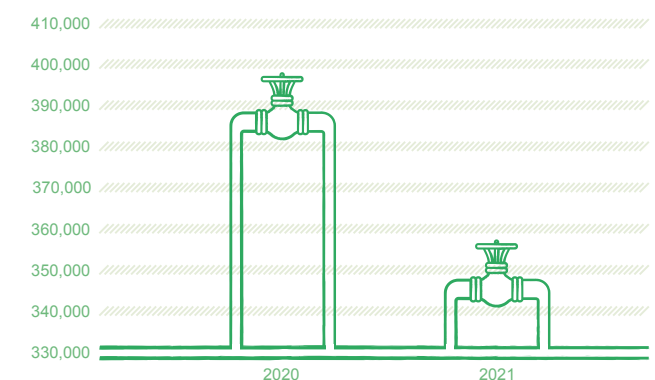
Before the energy-saving technical improvement of LNG pump, the loading and pre-cooling of LNG needed to be carried out continuously on a 24-hour basis, leading to high energy consumption. Through the technical improvement, **we increased the LNG loading speed by 1.5 times, and there is no need for the LNG pump to run continuously in standby for 24 hours. This energy-saving technical improvement measure saves the annual power consumption by 50,000 kWh.**



LNG pump of Shanxi Qinshui ENN Clean Energy Co., Ltd.

### Energy-saving improvement of amine liquid regeneration tower to reduce regeneration temperature

In the process of amine liquid regeneration, it is necessary to use heat-conducting oil to maintain a high temperature for the decomposition of amine salt. Before the improvement, the amine liquid (Phase 1) has the disadvantages of fast aging, a short life cycle, and a high cost. Moreover, the temperature of the heat-conducting oil used for amine liquid regeneration remains at 140 °C for a long time, which is 10°C higher than that of Phase 2, resulting in high gas consumption. In 2021, we carried out the energy-saving improvement of the amine liquid regeneration tower (Phase 1). After the improvement, the temperature of the heat-conducting oil used for amine liquid regeneration was reduced from 140°C to 127°C. **In 2021, the fuel gas consumption totaled 357,658 Nm<sup>3</sup>, which is 39,996 Nm<sup>3</sup> lower than that in 2020 and equivalent to a reduction of 86.48 tons of CO<sub>2</sub> emissions.**



The gas amount saved after energy-saving improvement of amine liquid regeneration tower (Nm<sup>3</sup>)

The fuel gas consumption totaled

**357,658 Nm<sup>3</sup>**

lower than that in 2020

**39,996 Nm<sup>3</sup>**

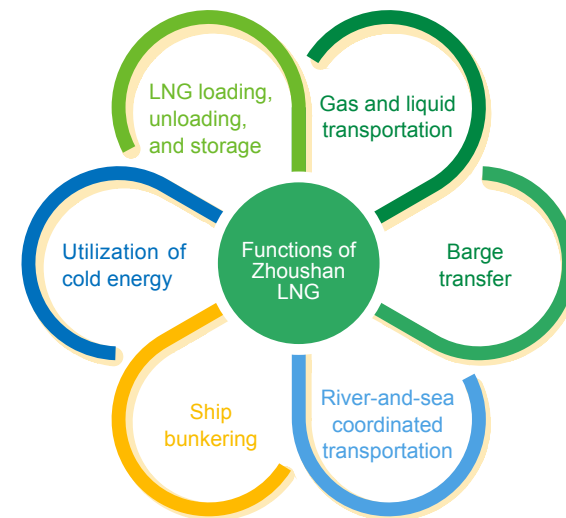
Equivalent to a reduction of

**86.48 tons of CO<sub>2</sub> emissions**



## Zhoushan LNG Terminal

The Company carries out LNG loading, unloading, storage and gas & liquid transportation via the entrusted operation of ENN (Zhoushan) Liquefied Natural Gas Co. Ltd. (Zhoushan Terminal). Located at the China (Zhejiang) Pilot Free Trade Zone, which is an economically developed coastal core area of China and has a huge demand for natural gas consumption from industrial enterprises and urban residents, Zhoushan Terminal is the first large-scale LNG terminal approved by the National Energy Administration, and invested, constructed and managed by private enterprises in China. In the future, we will further utilize the storage and transportation capacity of Zhoushan Terminal to regulate and empower the industry chain and develop Zhoushan Terminal into an important application scenario of digital product transformation. It will also facilitate the “digital intelligence transformation”, match the demand, supply, transportation and storage intelligently, as well as improve the hard power of ENN Natural Gas to boost industrial development.



Functions of Zhoushan Terminal

## GHG emissions

Zhoushan Terminal formulated the *Regulations on the Zhoushan Infrastructure Operation and Intelligent Group Carbon Emissions* and the *Procedures for GHG Quantification and Reporting Management of ENN (Zhoushan) Liquefied Natural Gas Co., Ltd.*, and developed the low-carbon accounting data model for LNG terminals and natural gas transmission pipelines. According to the carbon accounting results of Zhoushan Terminal in 2021, GHGs are mainly generated from purchased electricity, methane leakage, carbon dioxide from the combustion of torches, and a small amount of nitrous oxide from the incomplete combustion of methane.



## Energy conservation and emission reduction technologies and measures

Case

### Energy conservation and efficiency improvement with integrated energy use and supply

Targeting all scenarios of the natural gas industry, Zhoushan Terminal integrates energy supply and realizes system energy saving through energy facility optimization + digital intelligence. Zhoushan Terminal achieves the upgrade from the transformation and optimization of a single facility and a single system into the overall matching between multiple systems. Besides, Zhoushan Terminal also builds energy use scenarios featuring integrated energy use and supply, and reduces carbon emissions from purchased electricity, transportation, and production.



#### Electricity service

- Harmonic transformation, energy-saving improvement, optimized operation, and predictive maintenance of the distribution network in the plant.



#### “Source-grid-load -storage” new integrated energy system

- Establishing a new source-grid-load-storage energy system including wind power, solar power, power storage and LNG cold energy power generation;
- Building office rooftop photovoltaic system and charging piles in the shading zone, and exploring and developing opportunities for distributed photovoltaic systems in the factory area at the later stage;
- Planning to construct 2-3 large fans with the capacity of 5MW respectively; developing photovoltaic systems inside the sea dike with a capacity of 3-4MW; building the terminal (phase 3) with a storage capacity of 10MW after temporary demolition.



#### Energy storage + ancillary services

- Demonstrating electricity storage and discharge application;
- Participating in the auxiliary power services market when necessary.



#### Reducing energy consumption in transportation

- Using hydrogen and electric energy to replace fuel for tankers, ships and other transportation vehicles

Case

### Residual energy exploration and utilization

The smart energy management system is used to explore the LNG cold energy and fully utilize the potential energy of LNG circulating cooling water for power generation. It is expected that the cold energy single-and-double cycle power generation and cold energy air separation projects will be completed by 2035, and the LNG cold energy will be fully utilized to develop the circular economy.

#### Smart energy management system

The traditional terminal mode is upgraded into the full-scenario smart energy operation mode covering smart transaction, multi-user smart scheduling, smart security, and smart transportation, thus realizing multi-user window scheduling prediction, shipping schedule adjustment, loading and unloading management, inventory management and, smart coordination of gas & liquid delivery, improving operation efficiency and reducing energy loss;

#### Cold energy power generation

Phase 1 single/dual cycle 1,966/2,040 kw, dual-cycle cold energy utilization system has been installed;



#### Potential energy power generation

Optimizing the seawater cooling scheme based on potential energy generation characteristics;

#### Cold energy air separation

Continuously promoting the LNG cold energy air separation project.

Case

### LNG cold energy air separation unit

LNG cold energy air separation is a process in which the LNG gasification system works together with the air separation system and the huge amount of cold energy released during LNG gasification is used to produce liquid products such as liquid nitrogen and liquid oxygen. It mainly involves the air filtration and compression system, air purification system, oxygen and nitrogen distillation system, LNG heat exchange system, cryogenic liquid storage system, ethylene glycol circulating cooling system, and instrument electric control system. **The LNG cold energy air separation unit can produce 300 tons of liquid oxygen/day and 300 tons of liquid nitrogen/day. The unit is expected to save 60,000 tons of carbon,** which was derived from a 65 tons/hour of gasified LNG basis and will be offsetting the CO<sub>2</sub> emissions generated by electricity consumption. A large scale deployment of such units would accelerate our zero-carbon terminal goal.

The LNG cold energy air separation unit can produce

**300 tons**  
of liquid oxygen/day

The LNG cold energy air separation unit can produce

**300 tons**  
of liquid nitrogen/day

Expected to save

**60,000 tons of carbon**



## Energy production

### Coal

Xinneng Mining Industry Co., Ltd. (hereinafter referred to as Xinneng Mining) is mainly responsible for the coal business of ENN Natural Gas. Main products can be categorized into blended coal or cleaned coal. Blended coal (mainly low-calorie coal) customers are mainly concentrated in the electric power industry and chemical industry. Cleaned coal (mainly high-calorie coal) customers are mainly from the metallurgy, chemical industry, building materials industry, cement industry, corn drying industry, and civil industry.

### GHG emissions

Currently, the main GHG emissions of Xinneng Mining include carbon dioxide and methane, which mainly come from boiler combustion, underground mining, and electric power consumption.



## Energy conservation and emission reduction technologies and projects

Xinneng Mining increases the use of renewable energy, promotes technological improvement, improves technological processes, and enhances electricity use efficiency to meet the carbon emission reduction targets. In the future, Xinneng Mining will focus on developing intelligent mining technology and achieving unmanned mining at the operation level.

Xinneng Mining has planned and implemented emission reduction measures such as technological improvement, carbon capture and electricity replacement. We adopt the smart transportation system to regulate the speed of belt conveyors according to load, thus saving power consumption. We also introduce underground belt conveyors, permanent magnet machines, and permanent magnet electric drums for energy-saving. In addition, we realize efficient utilization of waste heat in air compressor rooms and reduce hot air power consumption in the main inclined shaft by increasing air-conditioning exhaust pipes. In 2021, we introduced explosion-proof diesel engine trackless rubber-tyred vehicles. By replacing the National II Emission Standard with the National III Emission Standard and lowering the exhaust emission indicator, we achieved zero emission, low noise, clean and efficient operation of vehicles.

Xinneng Mining conducts comprehensive governance of the coal mining subsidence area. According to the overall principles of "forestry and grassland suitable for local conditions", Xinneng Mining engages in restoring the ecological environment and increasing forest carbon sinks by planting trees and sowing grass seeds.

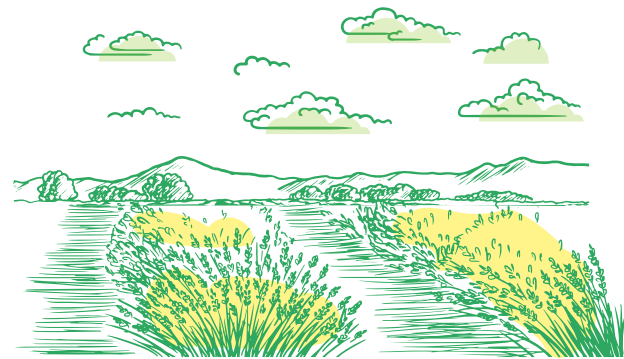


Case

### Xinneng Mining continuously carries out comprehensive governance of subsidence area

Wangjiata Coal Mine of Xinneng Mining is located at the central and northern part of Dongsheng Coalfield, Nalintaohai Town, Ejin Horo Banner, Ordos City of Inner Mongolia. The area features ravines, vegetation degradation and frequent floods. Xinneng Mining has carried out comprehensive renovation and restoration in the subsidence area. According to the principle of "one policy for one mine", Xinneng Mining has formulated the preliminary design for the comprehensive governance of Wangjiata Coal Mine Subsidence Area. The company also planned to implement water conservation forest projects, water and soil conservation projects, and related construction projects, to improve the ecological environment of the mining area, address the ecological vulnerability, develop ecological agriculture and animal husbandry according to local conditions, vigorously promote industrial ecology, and build Wangjiata Coal Mine into a forest mining area.

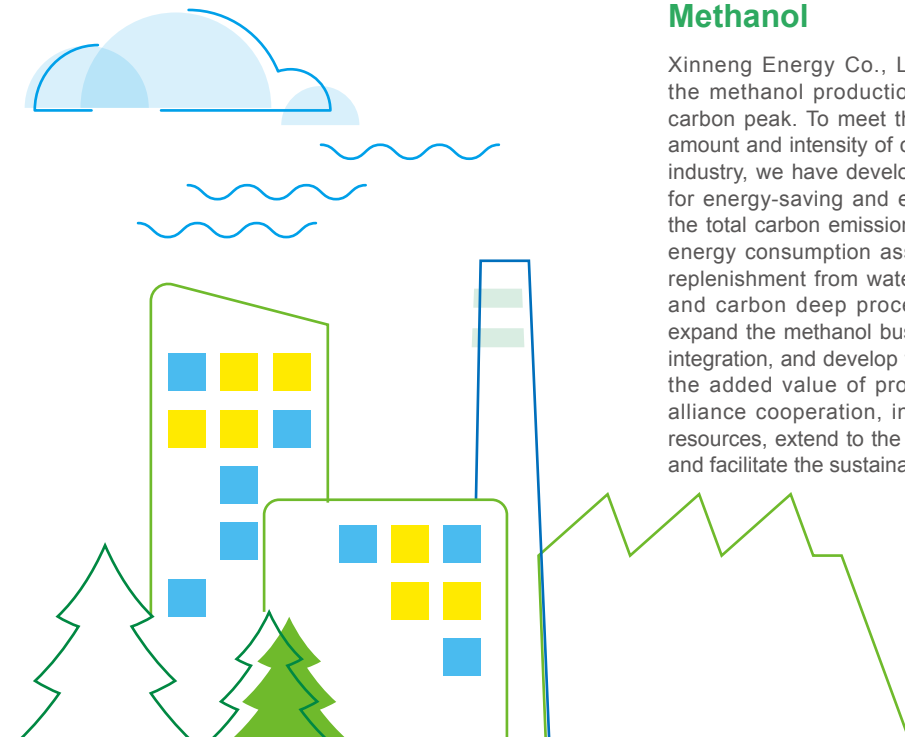
In 2021, the Wangjiata Coal Mine had a planting area of 60 acres, including 5,252 pinus tabulaeformis trees, 357 broad-leaved poplar trees, and 60 locust trees. According to international standards, it can offset about 130 tons of carbon dioxide equivalent emissions every year. In 2022, the Wangjiata Coal Mine plans to cultivate 200 acres of shrub forest and 60 acres of arbor forest, including 3,850 shrub sea-buckthorns and cerasus humilis trees (large trees), and about 850 arbor trees. It is expected to reduce 108 tons of carbon dioxide equivalent emissions. In the future, the company will actively build a state-level green mine, establish a forest carbon sink demonstration base, and extend its influence to surrounding areas.



## Energy production

### Methanol

Xinneng Energy Co., Ltd. (Xinneng Energy) expects that the methanol production will remain stable and approach carbon peak. To meet the national requirements of the total amount and intensity of carbon emissions in the coal chemical industry, we have developed a detailed pathway and strategy for energy-saving and emission reduction. First, we reduce the total carbon emission through technological improvement, energy consumption assessment, hydrogen production and replenishment from water electrolysis, carbon sequestration, and carbon deep processing and utilization. Second, we expand the methanol business through the industry and trade integration, and develop the methanol fuel strategy to increase the added value of products. Moreover, we also promote alliance cooperation, integrate upstream and downstream resources, extend to the methanol downstream industry chain, and facilitate the sustainable development of enterprises.



## Energy conservation and emission reduction technologies and projects

### Carbon reduction

Since 2017, Xinneng Energy has conducted advanced control of air separation unit, gasification unit, purification unit, as well as conversion and synthesis unit. At present, the smart control of production facilities has been realized in smart plants. Through the overall system optimal design, we improve the average stability of coal-to-methanol production by more than 50%, and the application rate of automatic control loop in the advanced control system reaches 95%. While stabilizing the production indicators, we also achieve energy-saving and emission reduction in production. By recovering vapor and water resources from coal-to-methanol production, we can supply engineering energy for nine units in the surrounding parks and continuously improve resource utilization efficiency. Xinneng Energy has actively invested in photovoltaic projects and planned to build 4.5 MW of distributed photovoltaic power generation.

Xinneng Energy plans to use photovoltaic electrolysis water to produce hydrogen, which will be added to the coal-to-methanol system with the capacity of 10kNm<sup>3</sup>/h, thus reducing the consumption of raw coal and purchased oxygen. It is expected to reduce 120,000 tons of carbon dioxide emissions every year.

### Carbon utilization

In 2019, Xinneng Energy set up a food-grade liquid carbon dioxide production unit to recycle the carbon dioxide emitted by the methanol unit in Dalad Banner, with an annual utilization of 150,000 tons of carbon dioxide. Xinneng Energy has actively researched and developed green methanol process and explored the green methanol production unit using carbon dioxide as raw material. With the carbon dioxide discharged from the existing coal-to-methanol unit as raw material, it is estimated that 52,700 tons of carbon dioxide emissions will be reduced every year.

### Carbon capture

Currently, the Company is accelerating the construction of a new Enhanced Geothermal & Carbon-Capture System (EGCS) technology demonstration project. Besides the research and development of deep geothermal "zero carbon plus negative carbon" technology, the Company aims to achieve a large-scale CO<sub>2</sub> sequestration by 2025 and contribute to China's "3060" goal.

### Energy-saving improvement project of Xinneng Energy

In April 2021, Xinneng Energy put into operation the first phase of ethanol reduction and energy-saving improvement project, which is expected to save 14,147 tce of energy and reduce 35,270 tons of carbon dioxide every year. The energy-saving improvement project replacing low-standard vapor with medium-pressure saturated vapor was carried out in July 2021. It is expected to save 13,264 tce of energy and reduce 33,068 tons of carbon dioxide every year.

Annual utilization of

**150,000** tons  
of carbon dioxide

Estimated to reduce

**52,700** tons  
of carbon dioxide  
emissions each year

Case

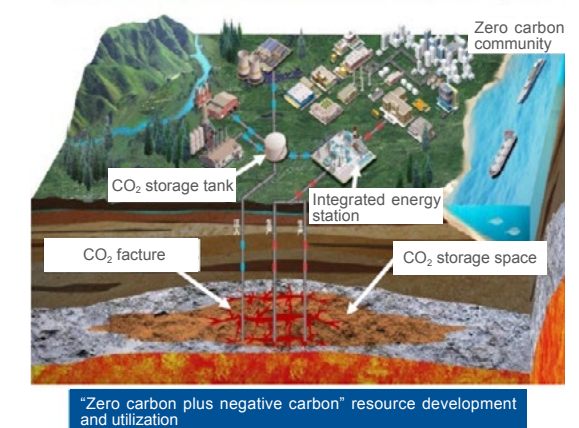
### The demonstration project of supercritical CO<sub>2</sub> enhanced geothermal & carbon-capture system (EGCS)

Transform sedimentary rocks into artificial reservoirs with high permeability. Using CO<sub>2</sub> as a circulating agent to extract thermal energy, and achieving a large-scale CO<sub>2</sub> sequestration.

The suitable reservoir for EGCS technology is carbonate rock, which has moderate porosity and permeability, good compressibility and CO<sub>2</sub> sequestration characteristics.

After research and demonstration, there is no supercritical CO<sub>2</sub> geothermal demonstration project in the world so far.

### 超临界CO<sub>2</sub>增强型地热系统-EGCS (Enhanced geothermal & carbon-capture system)



Supercritical CO<sub>2</sub> enhanced geothermal & carbon-capture (EGCS) system

## Natural gas distribution

The Company carries out the natural gas distribution (retail and wholesale) through the subsidiary ENN Energy.

## GHG emissions

The main emission sources of this business include methane emission from transmission and distribution, the fuel consumption of transport vehicles in energy trade, fuel combustion of vehicles in office operation, and greenhouse gases generated by purchased electricity and heat.

## Energy conservation and emission reduction technologies and measures and methane emission monitoring

### Methane emission monitoring

ENN Energy actively adopts digital intelligence measures to monitor methane emissions in real time and improve the reliability of monitoring data. The PTZ laser methane monitoring system is also put in place to monitor methane emissions. To date, **ENN Energy has deployed the system at 50% of its self-owned stations** and planned to achieve full coverage by 2022.

ENN Energy has deployed  
the monitoring system at

**50%**  
of its self-owned stations

## Methane emission reduction

In response to the call of the world and the country, ENN Energy pledges to work with the alliance partners to control the intensity of methane emissions from natural gas production, and **control the average emission intensity below 0.25% by 2025**. To this end, ENN Energy will take three measures as follows.

Identifying methane emission sources and quantifying methane emission data;

Adopting technologies and conducting equipment maintenance to reduce methane emissions and the risk of methane leakage;

Strengthening the training of employees and users, raising their awareness of safety production and use, and reducing the occurrence of methane leakage.

Control the average  
emission intensity below

**0.25%** by 2025

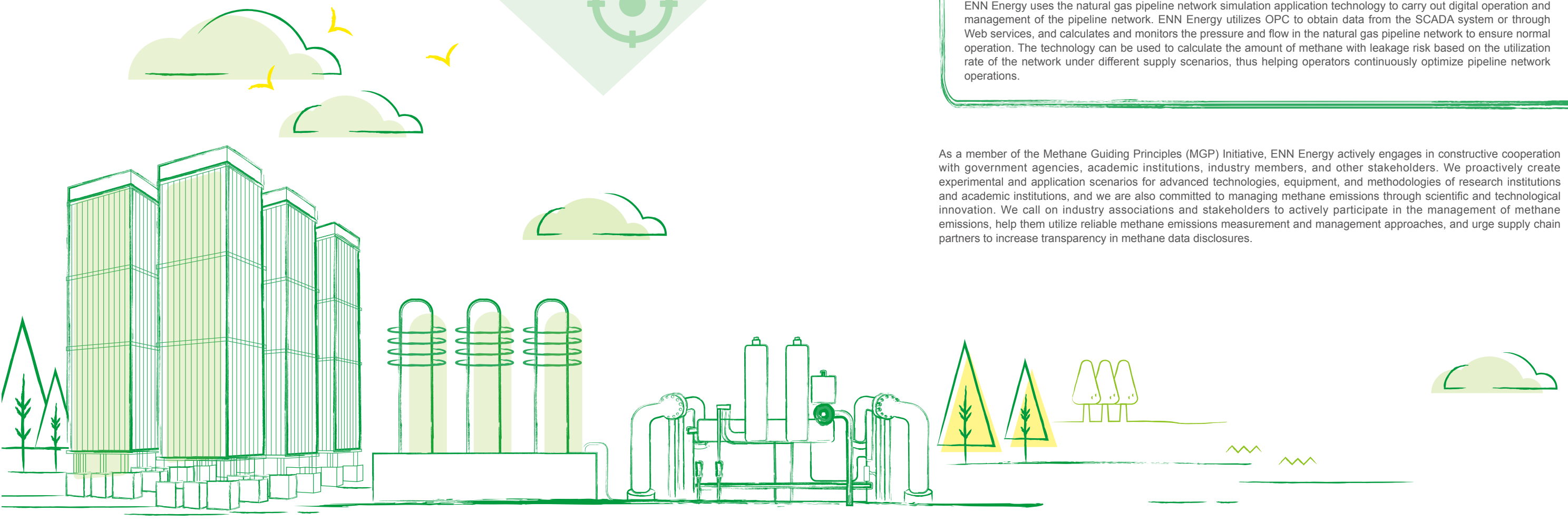


Case

### ENN Energy uses smart pipeline network dynamic simulation technology to monitor and manage methane leakage

ENN Energy uses the natural gas pipeline network simulation application technology to carry out digital operation and management of the pipeline network. ENN Energy utilizes OPC to obtain data from the SCADA system or through Web services, and calculates and monitors the pressure and flow in the natural gas pipeline network to ensure normal operation. The technology can be used to calculate the amount of methane with leakage risk based on the utilization rate of the network under different supply scenarios, thus helping operators continuously optimize pipeline network operations.

As a member of the Methane Guiding Principles (MGP) Initiative, ENN Energy actively engages in constructive cooperation with government agencies, academic institutions, industry members, and other stakeholders. We proactively create experimental and application scenarios for advanced technologies, equipment, and methodologies of research institutions and academic institutions, and we are also committed to managing methane emissions through scientific and technological innovation. We call on industry associations and stakeholders to actively participate in the management of methane emissions, help them utilize reliable methane emissions measurement and management approaches, and urge supply chain partners to increase transparency in methane data disclosures.





## Low-carbon trade and transportation

According to the *Opinions on the Complete, Accurate and Comprehensive Implementation of the New Development Concept to Achieve Carbon Peak and Carbon Neutrality* issued by the Central Committee of CPC and the State Council, establishing a low-carbon transport system is one of the important pathways to achieving the "dual carbon" goals. ENN Energy plans to power all vehicles with clean energy by the end of 2025, turn low-carbon transport into a core criterion for suppliers' access from 2026, and help to reduce carbon dioxide emissions from the energy trade by 28.3%<sup>1</sup> in 2026 compared with 2021. In addition, ENN Energy plans to apply zero-carbon energy such as hydrogen and biofuel in transport vehicles by 2030. GHG emissions from trade and transportation are mainly caused by GHG emissions from fossil fuels used in transport vehicles, and methane emissions from LNG tank pressure regulation or residual gas discharge. Because most vehicles in the energy trading and transportation of ENN Energy are primarily powered by diesel with low efficiency, promoting the use of clean energy, improving fuel efficiency, and adopting smart vehicle management are effective pathways to facilitating the green trade and transport.

Reduce carbon dioxide emissions from the  
energy trade by

**28.3** %  
in 2026 vs 2021



To reduce carbon emissions, ENN Energy plans to gradually replace vehicles powered by diesel with vehicles powered by clean energy. During this period, ENN Energy will take the following measures.



Replacing vehicles powered by oil with vehicles powered by gas that is cleaner and low-carbon;



Closely monitoring the development and application of transport vehicles powered by cleaner fuels, such as heavy trucks powered by hydrogen and biofuel, as well as the popularity of related refueling stations;



Introducing and adopting cleaner and low-carbon power fuels in due course to continuously improve the energy consumption structure of transport vehicles.

In addition, ENN Energy actively promotes the use of digital intelligence tools, such as the "Yuntu Cloud System", and intelligent dispatching platforms to optimize the transport vehicle route, improve the vehicle scheduling and operation efficiency, and reduce the idle rate, thereby effectively improving energy efficiency and reducing carbon emissions caused by vehicle operations.



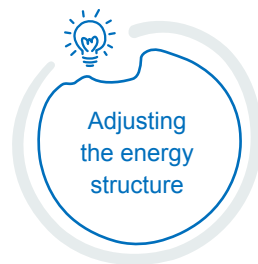
<sup>1</sup>The emissions of LNG vehicles powered by diesel are calculated by multiplying the amount of LNG and diesel used by the emission factor, in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines).



## Integrated energy sale and service

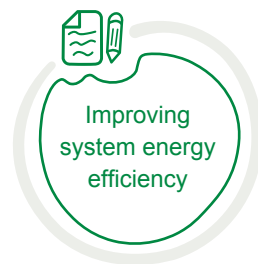
ENN Energy adopts a targeted strategy to develop the integrated business. According to local energy conditions and customer needs, we actively apply and integrate a variety of clean renewable energy including natural gas, industrial waste heat, biomass energy, solar energy, and geothermal energy, to match customer needs, and develop complementary integrated solutions for various users.

To this end, we take measures to increase the proportion of renewable energy, improve the system energy efficiency, and introduce technologies such as CCUS. Based on the analysis and quantification of emission reduction scenarios, ENN Energy formulates a green development plan for the production-oriented integrated energy business by 2030.



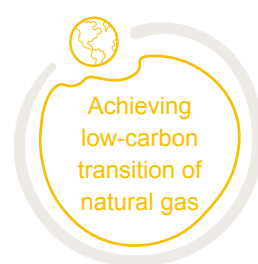
Adjusting  
the energy  
structure

- Increasing the photovoltaic installed capacity to enhance the photovoltaic power generation by stages;
- Increasing the proportion of biomass energy and geothermal energy in the energy structure;
- Introducing hydrogen energy in integrated energy scenarios from 2025 after contemplation;
- Raising the proportion of renewable energy in the energy structure to 36% by 2030.



Improving  
system energy  
efficiency

- Improving the system energy efficiency of the production-oriented integrated energy business through such means as conducting technological improvement, optimizing operation strategy, upgrading the core technology of Serlink smart energy management platform;
- Raising energy efficiency by 5% from approximately 90% in 2020 by 2030.

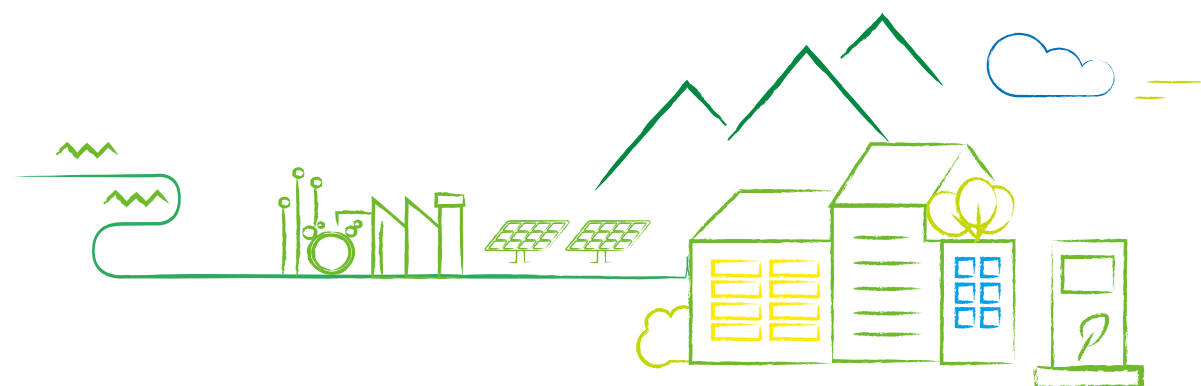


Achieving  
low-carbon  
transition of  
natural gas

- Actively researching and developing the carbon capture, utilization and storage (CCUS) technology and selecting gas companies with high gas utilization rate and great benefits to conduct the regional test;
- Realizing the demonstration application of the CCUS project in 2025, and gradually applying the CCUS technology in the integrated energy business to offset 5% of carbon emissions from natural gas annually.

## Value-added Business

ENN Energy is aware of the needs of home users and provides "smart, low-carbon and safe" products and services to help users achieve green and low-carbon homes while improving living condition of comfort and safety. For more details, please refer to "Decarbonisation Action 2030 — Journey to Net Zero" by ENN Energy.



## Engineering construction

The aim of the energy system reform is to inject new momentum into the digital and intelligent new infrastructure, such as the Internet of everything, intelligent control, and smart operation. With the goal of becoming an "industry-leading low-carbon intelligent construction service provider", the Company accelerates the construction of the core full-cycle low-carbon capacity, and contributes to the implementation of the national "dual carbon" strategy.

By integrating technologies such as digital intelligence technology, digital twins, and digital operation with low-carbon chain, ENN Natural Gas offers the low-carbon intelligent construction process solutions, digital delivery low-carbon intelligent solutions, and low-carbon intelligent calibration whole-process solutions. We also reshape the "planning - construction - operation" service model, and achieve low-carbon operation throughout the whole cycle.

Case

### Changsha Huanghua International Airport

Changsha Huanghua International Airport is a **4F-class international civil airport covering a total construction area of 212,000 m<sup>2</sup>**. With passengers. To meet With two terminals and supporting energy consumption facilities, **the airport boasts an annual throughput of 33 million passengers**. To meet the overall energy consumption demand of the airport, the Company develops an energy supply system by scientifically designing the load distribution and energy supply between energy stations, which can realize the coordinated optimization between energy stations and reduce the overall functional cost. Relying on the mode of entrusted operation and smart management of terminal energy consumption, the Company has also built a smart energy management platform for the airport. Besides, the Company helps the airport conduct energy-saving improvements on traditional air conditioning and lighting facilities, provides various services such as collaborative optimization and energy-saving management covering the energy use needs such as electricity, gas, cold energy, heat and hot water, and thus realize the integrated and smart energy management.

Electricity  
**5.542** million kWh



Natural gas saved  
**1.963** million m<sup>3</sup>



Carbon dioxide emissions reduced  
**7,625.6** tons



Changsha Huanghua International Airport

Green office

The Company attaches importance to reducing low-carbon emissions during production, adheres to green office, and encourages employees to practice the concept of environmental protection. In 2021, we promoted green office by practicing energy conservation in our self-owned office buildings, as well as low-carbon travel, low-carbon office and low-carbon way of life.



Green and Low-carbon Initiative of ENN Natural Gas

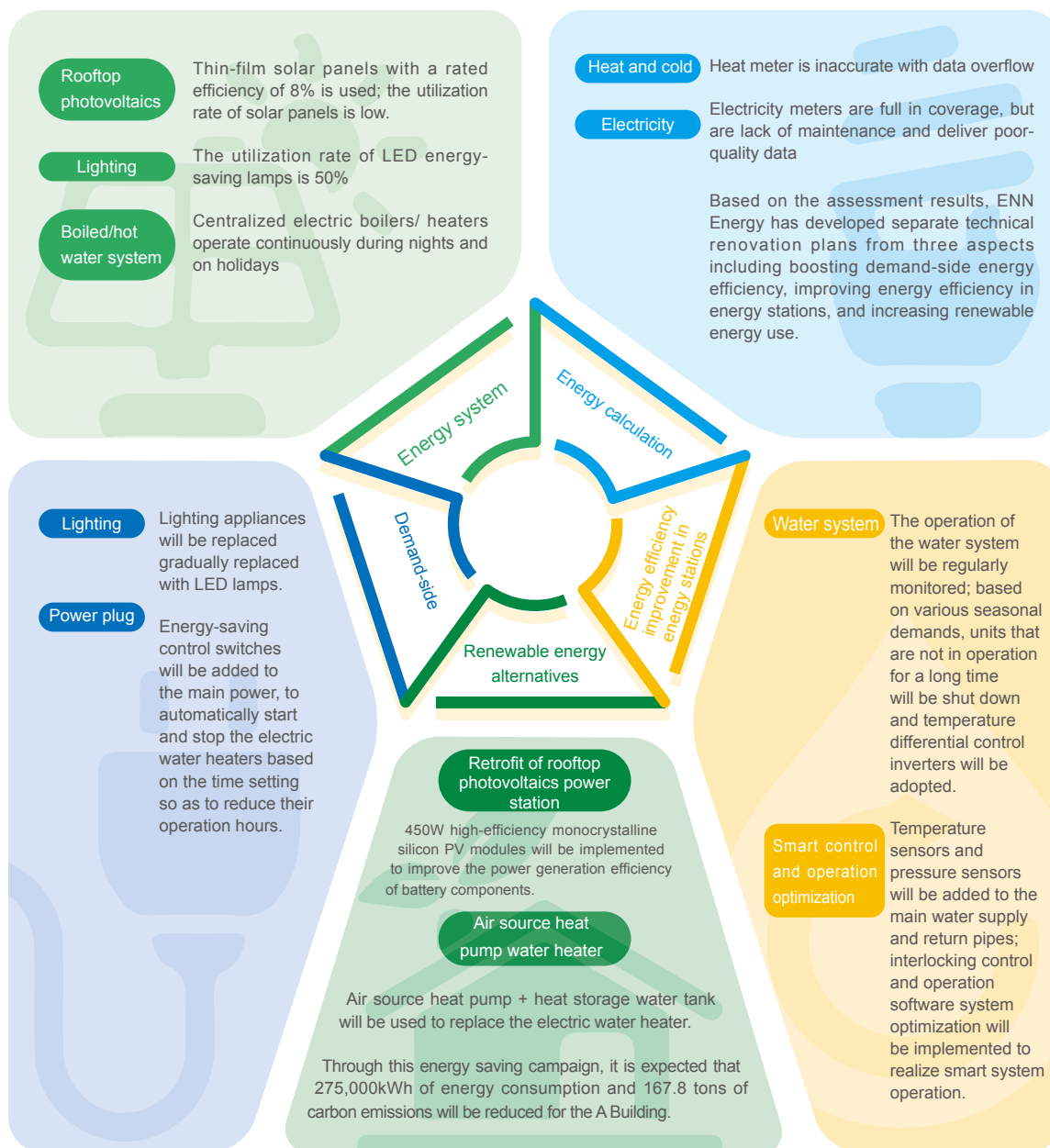
Table: Green Office Action Plans

Site selection of office buildings	Energy conservation in office buildings	Air-conditioning
priority is given to sites with charging posts to facilitate the use of new energy vehicles (NEVs)		it is estimated that all existing air-conditioning equipment will be upgraded to Class 1 energy-efficiency equipment within five years; digital intelligence system will be used to realize automatic temperature control of centralized air-conditioning
Lighting	Low-carbon travel	Smart socket
all new office buildings will use LED lamps and existing buildings will be fully equipped with LED lamps within three years; Existing buildings will be renovated to increase external lighting, thus reduce the number of lamps required		smart sockets and other devices will be installed to control energy consumption
Vehicles	Low-carbon office	Bicycle
NEVs will be purchased to gradually replace gasoline vehicles. It is expected that from 2022 onwards, NEVs will account for 50% of all newly purchased business vehicles, and by 2025, 50% of the staff shuttle buses and park ferry cars will be replaced with NEVs		sharing bicycles will be widely promoted to reduce the use of electric ferry cars in large parks
Administrative procurement	Low-carbon living initiative	Paperless office
priority will be given to labeling materials that are low-carbon, environment-friendly and energy-saving		the use of paper and consumables will be reduced; it is expected that from 2022 to 2025, the use of paper and consumables will be reduced by 10% annually
"Clear your plate" campaign will be rolled out for food conservation		Teleconferencing
Garbage classification will be promoted		the use of video conferencing platform will be promoted across the board to reduce travel costs
		One-off items will be less used, and the reuse of items will be promoted
		The use of renewable energy will be promoted

Case

## Low-carbon Action Plans in Office Buildings

ENN Natural Gas proactively responds to China's "Dual Carbon" goal and has carried out a pilot project of energy-saving renovation for our headquarters building in Langfang. In order to realize the emission reduction of the building, our subsidiaries have assessed a number of aspects from the building structure, energy use equipment, energy supply equipment to energy consumption:



Case

## Zero Carbon Meetings Practices

In response to the "Carbon-neutral Meetings" initiative, ENN Natural Gas plans to hold the Annual Results Announcement Meeting from 2022. We will hire certification authorities to supervise and certify the whole process from the preparation to the conclusion, so as to practice a zero-carbon meeting.



### Before the meeting

We organize the meeting and arrange the whole process with the aim to be green and low-carbon. We adopt a paperless approach and promote carbon-neutral knowledge to the participants through publicity boards made of green materials. Meanwhile, we encourage participants to travel green and attend the meeting online to reduce the greenhouse gas (GHG) emissions.



### During the meeting

We conduct on-site accounting of GHG emissions caused by the use and combustion of fossil fuels from the transportation, catering and accommodation of participants, as well as GHG emissions from the electricity and heat used at the meeting site, from meeting supplies and waste disposal, so as to calculate the CO<sub>2</sub> emissions equivalent of this meeting.



### After the meeting

We purchase a number of Chinese Certified Emission Reduction projects (CCERs) to achieve net-zero GHG emissions for this meeting.



04

# Working together for a clean and beautiful world



- LNG carbon-neutral exploration
- Green factories and low-carbon parks
- Green travel
- Green building

ENN Natural Gas integrates national "carbon neutrality" goal in our development strategy and business operation, proactively responds to the new trend of climate change, and helps our customers and the society at large to achieve emissions reduction, and jointly create a clean and low-carbon environment.



## LNG carbon-neutral exploration



ENN Natural Gas has actively carried out external cooperation to practice carbon neutrality in the entire life cycle of LNG import. In 2021, we signed the *Cooperative Framework Agreement on Climate Change* with Cheniere Energy, embarking on the first cooperation between the two parties in the field of natural gas. The two sides carry out an in-depth collaboration in the areas of LNG shipload carbon footprint, methane emission control, LNG shipload carbon neutrality, and carbon sink project investment. The Company will cooperate with natural gas suppliers and shipping partners to enable LNG to be marked with clear GHG emissions footprint and enhance the transparency of GHG emissions footprint across the LNG supply chain.



### Zero-carbon terminal

Through the analysis of the overall GHG generated from the LNG industrial chain, we optimized the shipping schedule to reduce the methane emissions. At the same time, we prioritize the use of low-carbon fuels and high-efficiency ships to reduce carbon emissions during shipping. For the midstream receiving and production section, we continue to reduce carbon emissions by controlling the fugitive methane emissions, utilizing clean energy, and adopting smart management. In addition, we reduce GHG emissions in LNG transportation by using clean fuels for transportation and implementing smart dispatching. Through above efforts, we strive to make Zhoushan Terminal become the first “zero-carbon” LNG terminal in China by 2030.



Mr. Zheng Hongtao, President of ENN Natural Gas and Mrs. Jia Ying, CEO of China, Cheniere Energy China sign the *Cooperative Framework Agreement on Climate Change*

To build up the first  
**“zero-carbon”**  
 LNG terminal in China by 2030



## Green factories and low-carbon parks



To respond to the policy guidance of manufacturing transformation and upgrading that aims to “build green manufacturing systems, green factories and green parks to achieve near zero emissions”, ENN Natural Gas provides green energy transformation services to manufacturing customers in their endeavors to build green factories and low-carbon parks. This will be achieved by leveraging low-carbon resources and smart energy consumption management platform.



Based on our customers' existing park status including industrial structure and resource characteristics, the Company formulates the park's development strategy, overall planning and phased implementation, which will be subject to the changing technical regulations and accommodate the customer's energy costs in short-term and China's “dual carbon” goals in the long run. At present, our energy consumers cover more than 40 cities including Shanghai, Tianjin, Hangzhou and Qingdao.

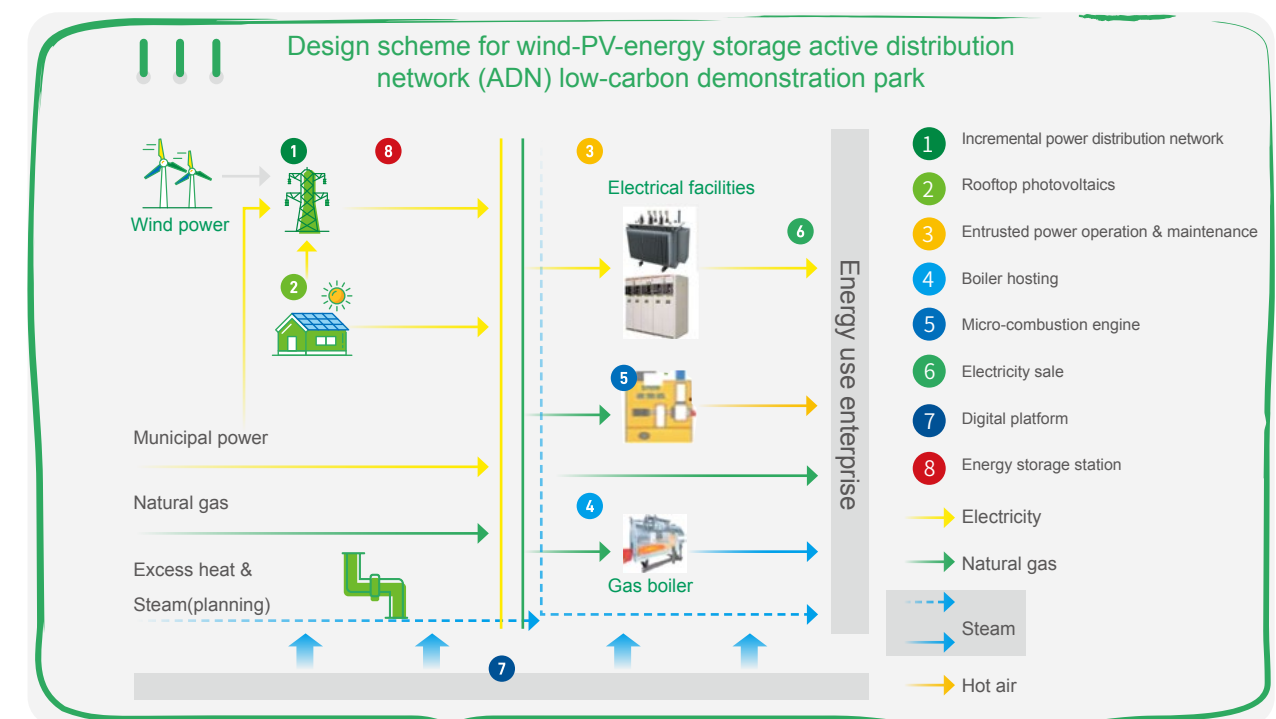
Reduce carbon emissions by

**300,000**  
per year after completion tons

Case

### “Four Networks Integration” Project in Xuancheng Economic Development Zone

The “Four Networks Integration” project in Anhui Xuancheng National Economic and Technological Development Zone (ETDZ) is one of ENN's pilot projects that enable the information flow to guide the energy flow by leveraging digital intelligence network integrated with the three networks of heat, electricity and gas, and allocating the energy based on green energy demand and low-carbon requirements. For this project, we work on the incremental electricity distribution network first, introduce zero-carbon resources including photovoltaics and wind power, and establish a multi-energy network by utilizing power plant excess heat, biomass thermal power and energy storage. In doing this, we can build green parks while ensuring safe and stable energy supply.





Case

### Green factory - Dalian CBAK Power Battery Co., Ltd

Dalian CABK Power Battery Co., Ltd. is a wholly-owned subsidiary of China BAK Battery, Inc and is also a high-tech project introduced by Dalian city. The factories of the company were faced with a number of issues, such as large fluctuation of gas price, high steam cost, unspecified energy cost, complete reliance on manual meter reading, poor accuracy and timeliness, all of which have seriously impacted the production cost.

#### A smart energy management system

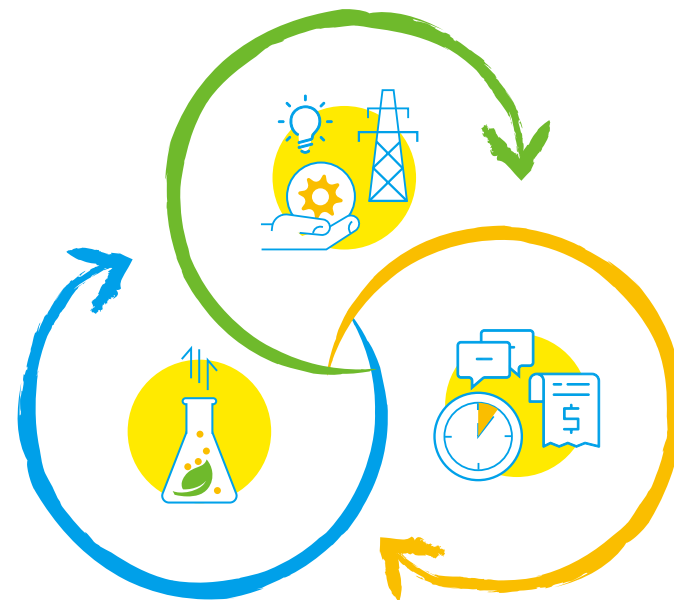
A smart energy management system has been built, with smart power terminals installed for each process of battery production, so as to identify the cost of unit output and energy consumption of each process in real time;

#### The Serlink Smart Energy Management Platform

The Serlink Smart Energy Management Platform has been used to capture the bill optimization possibilities, so as to timely communicate with enterprises and adjust the bill optimization plan;

#### Biomass steam generators

Three biomass steam generators have been built, to replace the existing steam supply by gas-fired boilers with power outsourcing, in order to meet customers' needs for clean energy and address the issue of gas price fluctuation;



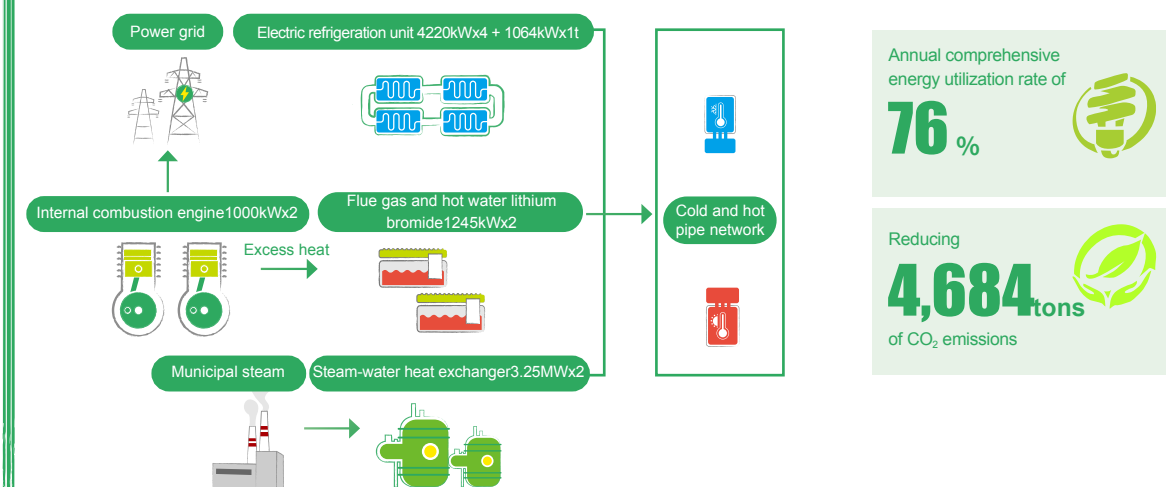
Through the above measures, ENN Natural Gas provides one-stop energy management services to meet customer needs, thus achieving the goals of cost saving, energy saving, consumption reduction, and building green factories.

### Low-carbon park - Huzhou Central Hospital integrated energy station project

Huzhou Central Hospital is currently the largest Grade A tertiary general public hospital in Huzhou that integrates medical treatment, scientific research, teaching, prevention, health care and rehabilitation. The hospital has 1,500 patient beds, 33 wards and intensive care units (ICU and RICU), with as many as 1.15 million outpatients and 50 thousand discharged patients every year. The hospital provides medical treatment and healthcare services for about 3 million people in Huzhou City and some surrounding cities inside and outside the province. In order to meet the green energy demand of the hospital, we choose to

adopt distributed energy with internal combustion gas engine + flue gas and hot water lithium bromide unit as the core, in order to drive a clean, efficient, cost-effective and smart energy system in Huzhou.

The project has achieved marked results in terms of energy conservation and emission reduction, with an annual comprehensive energy utilization rate of 76%, saving 594 tons of standard coal, reducing 4,684 tons of CO<sub>2</sub> emissions, 130 tons of SO<sub>2</sub> emissions, 41 tons of NO<sub>x</sub> emissions, and 54 tons of dust emissions.



## Green factory and Low-carbon park



Our goal: Guide the green development of industrial customers and industrial parks, and help our customers build 50 green factories and 50 low-carbon parks by 2025; help our customers build 200 green factories and 200 low-carbon parks by 2030.

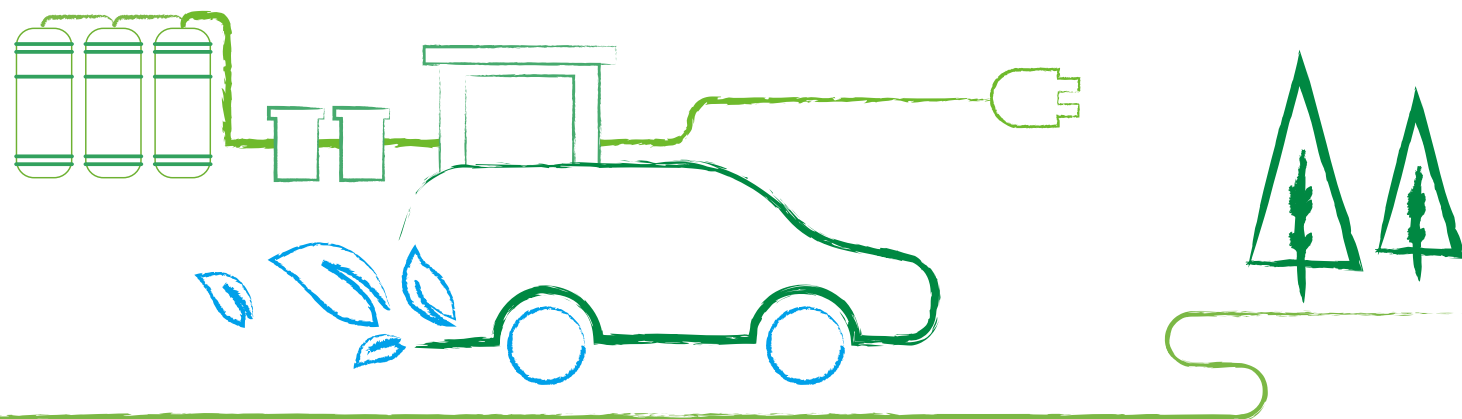
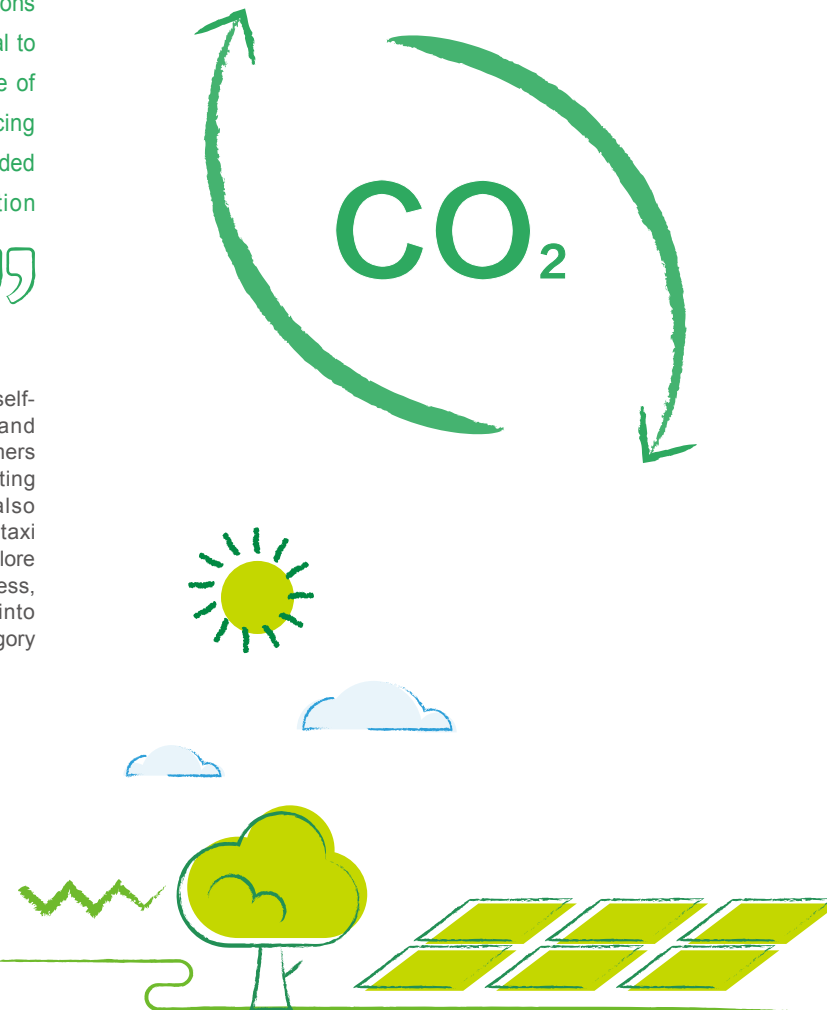
## Green travel



The transportation industry is one of major carbon emissions sources, therefore its low carbon transformation is crucial to achieving China's "dual carbon" goals. The main source of emissions is the combustion from fuel vehicles. Replacing traditional fuel vehicles with clean energy vehicles is regarded by the industry as the most feasible carbon reduction transformation solution.



The Company makes full use of the gas filling stations, self-owned or leased stations, service outlets and other land resources, as well as the resources owned by the customers and enterprise partners. With the governmental supporting policies and subsidies for new energy vehicles, we also keep track of the plan updates of the taxi associations, taxi companies, and online car-hailing platforms, proactively explore the transformation towards charging and swapping business, diversify the transportation and energy business, tap into existing resources and customer value, achieve multi-category operation, and extend business benefits.



Case

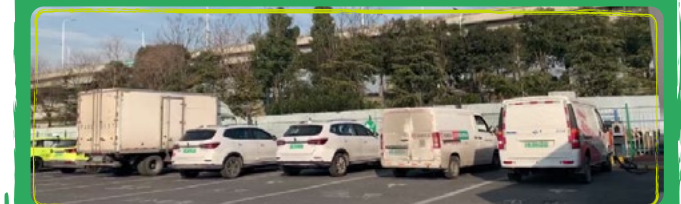
### ENN Energy promoted battery charging and swapping business in Shanghai and Quanzhou

Backed by digital intelligence system and business scenarios and through utilizing the site, station and customer resources, ENN Energy has built a low-carbon and smart transportation platform to drive the low-carbon transformation of transportation business, expanded the business model of PV-storage-charging-swapping integration, and realized the digitally intelligent interaction and collaboration with end customers.

By fully leveraging the gas station site resources, long-term cultivated customer resources and the advantages of our operation and management team, **ENN Energy has cooperated with our partners and put 20 charging and swapping stations into operation. We have 25 stations under construction in Shanghai and Quanzhou.** The construction and operation modes of charging and swapping stations mainly include independent construction and operation, construction and operation sharing, and site leasing. After several years of exploration, we have accumulated some operational experience and modes. With the increasing number of electric vehicles, the charging and swapping business will bring more revenue and profit to ENN Energy.



Our first swapping station in Quanzhou put into trial operation



Our Shanghai Kunlun Charging Station

Battery swapping business

Smart low-carbon transportation platform

Battery charging business



Backed by business scenarios and digital intelligence technologies

Build smart transportation and energy platform

Ensure safe operation and management

Interact with the client end in a digitally intelligent manner



Positioning

Business vehicle transformation, low-carbon travel Venue, client, team, experience

Resource

Venue, client, team, experience

Market

Taxi, online hailing car, urban distribution vehicle, heavy truck for short distance take-over

Model

Vehicle-power separation, battery operation, electric vehicle centralized purchase

Extension

Photovoltaics, micro gas turbine, energy storage

Vehicle operation and management platform

Battery charging and swapping operation platform

Crew, management, SRM/CRM.....

Battery security management

Vehicle operation board

Smart low-carbon transportation platform

Positioning

Supplement to battery swapping business, supporting facilities of smart city

Resource

Client, team, eco-partners

Market

Household car, urban distribution vehicle, environmental sanitation vehicle, bus

Model

Charging post operation, food and leisure service

Extension

PV-storage-charging integration, supporting facilities of new communities





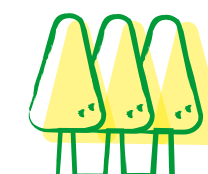
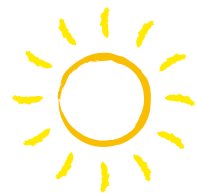
## Green building



According to the data released by the China Association of Building Energy Efficiency (CABEE), the total carbon emissions in the entire construction process accounts for more than half of the total carbon emissions in the country. Emissions reduction in the construction sector has become an indispensable part of China's efforts to achieve carbon peaking and carbon neutrality. As national and local requirements become stricter in the field of construction, there is a huge demand for energy side emission reduction and low-carbon energy use for existing buildings in order to meet the "dual carbon" goal.



Relying on cutting-edge technologies related to the integrated energy business and the management experience on the energy side, ENN Natural Gas integrates green development into the construction stage and provides customers with low-carbon overall design solutions for new buildings. According to different scenarios of customers, the Company sets out to create three green building business practices: green villages, low-carbon buildings and low-carbon building complexes. Moreover, based on various demands, we provide services including rooftop photovoltaics, energy facility trusteeship, PV-storage-charging integration and heating installation extended service, so as to fully meet customers' low-carbon upgrading needs.



Case

### Huaxia Yungu Data Center Industrial Park in Bengbu, Anhui Province

Based on the energy demand of Huaxia Yungu Data Center, and taking into account the energy consumption of office buildings surrounding the data center, ENN Natural Gas has designed a data industrial park with an integrated energy microgrid, securing an overall power supply capacity of 40MW, with a cooling capacity of 102MW and a heating

capacity of 50MW. After the completion of the project, the overall facility utilization rate has been increased by 150%, and the investment cost has been reduced by 50%. At the same time, we managed to cut the designed cooling load by 25.5% and the heat load by 34%, lowered the installed capacity of cooling facilities by 28%, and reduced the heating facilities by 50%.

Securing an overall power  
supply capacity of

**40** MW



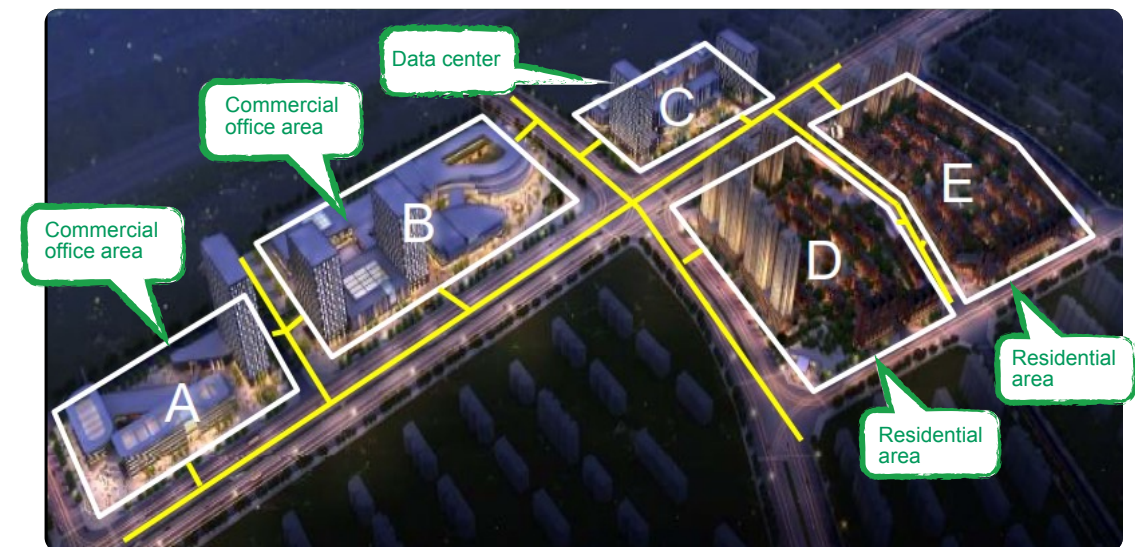
Cooling capacity of

**120** MW



Heating capacity of

**50** MW



Rendering of Huaxia Yungu Data Center Industrial Park



05

# Green innovative technology development of ENN Natural Gas



→ PV project

→ Biomass

→ Hydrogen energy

→ Energy storage

→ CCUS





## PV project



Photovoltaic power generation is the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect.



Photovoltaic power generation has become a clean, affordable, low-carbon energy generating form in many countries. It is not only adopted in developed regions such as Europe, America, and Japan, but is also rapidly emerging in some countries and regions in the Middle East and South America. Driven by the goal of "carbon neutrality", the transformation of clean energy and green recovery in many countries, it is expected that during the 14th Five-Year Plan of China, **the global PV installed capacity will increase by about 210-260GW every year.**

Case

### Shandong Shouguang Yangkou Distributed photovoltaic power generation project

ENN Energy assisted the client to carry out the Shouguang Yangkou PV power generation project, landing 2 sub-distributed PV power plants on the roof area of 11 plants in the industrial park, totaling 146,000 square meters. Each PV power station is equipped with an integrated automation monitoring system, which is responsible for telemetry, telematics, remote control, remote regulation, remote execution of scheduling, alarm and other functions. The operation and maintenance personnel adopt a "regular inspection + intelligent energy platform monitoring" operation and management method, realizing real-time monitoring and centralized management of each PV module and equipment working status.

Annual saving of standard coal

**5,455** tons

Annual CO<sub>2</sub> emission reduction

**14,184** tons



## Biomass



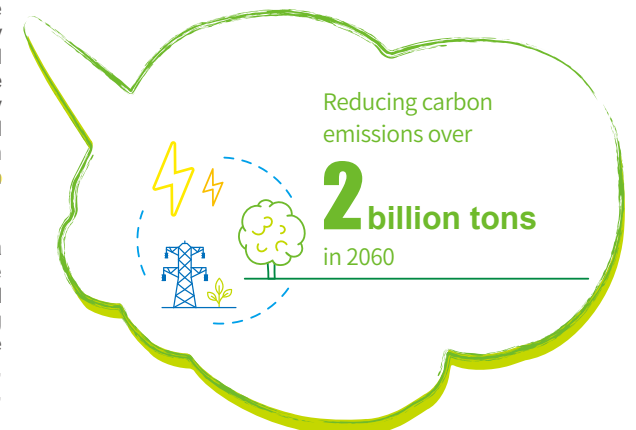
Biomass energy is an internationally recognized zero-carbon renewable energy. Biomass clean heating is mainly used in industrial parks, industrial enterprises, commercial facilities, public service facilities, rural residents' heating, and other heating fields. The main heating methods include biomass cogeneration, central heating with biomass boiler, and household boiler appliances.



Biomass energy can be mainly used to substitute fossil energy in the fields of power supply, heating and so on. Biomass clean heating and biological natural gas can effectively replace coal in most counties in China. Distributed power stations will be built in counties and towns to completely change the energy consumption structure in rural areas. When dealing with all kinds of waste, clean energy can be produced to provide heating and gas supply for residents. It is estimated that by 2030, the utilization of biomass energy in various ways will reduce the carbon emission by more than 900 million tons in the whole society, **reducing carbon emissions by about 2 billion tons in 2060.**

Inner Mongolia Deyu Biomass Thermal Power Co., Ltd., a controlled subsidiary of ENN Energy, is mainly responsible for the heat supply of the Economic Transformation and Development Pilot Zone of Resource-based Cities in Chifeng City. The place where Deyu Company is located and the surrounding areas are rich in resources such as straw of crops, understory, and industrial waste of wood processing enterprises,

which provide abundant biomass resources. The raw materials for biomass mainly include straw of crops, shrubbery understory and wood residues. Deyu Company acts according to local conditions and uses renewable energy to provide clean heat supply and green power for the pilot zone. At present, it has completed the transformation of biomass energy boilers, **with two 75t/h sub-high temperature and sub-high pressure high-low bed boilers that has a load of 20t/h each, connected to the steam 75t/h of Jiulian Coal Chemicals, supplying heat for 15 enterprises.** It's also planning to transform the generator units, using biomass to generate electricity, which will be fully connected to the grid, to provide green power for enterprises in the pilot zone, and contribute to its transformation of industrial production and achieving carbon neutrality.



Inner Mongolia Deyu Biomass Thermal Power Co., Ltd.

## ENN signed a cooperation agreement with Yangpu Economic Development Zone

In accordance with the *Strategic Cooperation Agreement on Comprehensive Energy Utilization and Power Distribution* signed between ENN and Yangpu Economic Development Zone, Hainan, ENN is expected to formulate a comprehensive energy promotion plan to meet the core demands of all parties and contribute to the development of the zone through the integrated energy microgrid project, based on the actual situation of Yangpu Development Zone and following the guidance of national energy development policies. For the heating business, it is planned to build an energy station with "two 45t / h biomass circulating fluidized bed (CFB) boilers + one 45t/h gas steam condensing boiler (for emergency use) +

2MW back pressure steam turbine + 500kW self-use rooftop solar" and a "5.4km medium pressure + 3.6km low pressure" steam pipe network, carrying out heating business exclusively in the southern area of Yangpu Economic Development Zone. During Phase I of the project, ENN enters the zone through the competitive price of biomass steam to establish the brand of ENN and build the trust of users, seeking to revitalize and reasonably match the huge stock of heat sources and load in the zone. In the meantime, we actively get prepared by developing power distribution and sales users, and strive for the opportunity of incremental distribution network when the power distribution policy of the zone is released.



Yangpu Economic Development Zone, Hainan

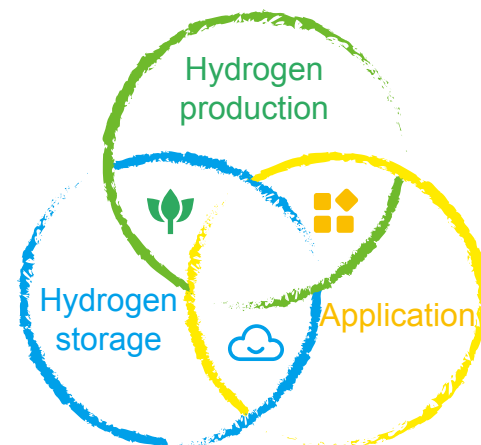
Case



## Hydrogen energy



As a clean energy, hydrogen energy is a priority research direction to promote the green and low-carbon transformation of the energy system. ENN Natural Gas has intensified input into the layout and development of hydrogen energy across the whole industry chain and put forward the whole industry chain strategy of "hydrogen production-hydrogen storage - application". In 2021, we made some achievements in the research of hydrogen production process, hydrogen production, hydrogen storage and transportation, and the construction of hydrogen energy projects. ENN will continue to conduct the technology R&D for hydrogen production from natural gas, further expand the sourcing of hydrogen energy technology and reserve more comprehensive hydrogen energy industry technologies, in a bid to guide the expansion of hydrogen energy business.



The whole industry chain strategy

## Efficient and low-cost technology for hydrogen production from natural gas

To improve the efficiency of hydrogen production and reduce environmental pollution, people have been paying increasing attention to the development of efficient and low-cost technologies for hydrogen production. ENN Natural Gas has been also actively engaged in technology research and development. We have independently developed a series of technologies such as hydrogen production by natural gas reforming, catalytic conversion of methane-rich gas and non-catalytic conversion of methane-rich gas respectively, and we can provide different solutions for hydrogen production from natural gas according to different application scenarios and scales of customers. Three new technologies of the Company have been applied to the industry. By 2021, there had been 27 completed efficient and low-cost projects for hydrogen production from natural gas.

27



completed efficient and low-cost projects for hydrogen production from natural gas

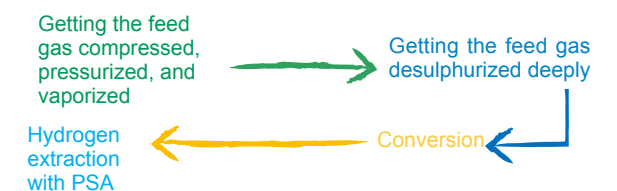
Case

## The project of 1,500Nm<sup>3</sup>/h hydrogen production from natural gas in Huludao, Liaoning province

The project is in a pharmaceutical factory, which is subsidiary to a pharmaceutical and chemical company in Liaoning. The project mainly includes the construction of facilities for producing hydrogen from natural gas, and supporting utilities and auxiliary facilities, with a hydrogen production output of 1,500Nm<sup>3</sup>/h, equivalent to 12 million NM<sup>3</sup>/a. In the project, natural gas is used as raw material and self-developed process and catalyst combination technology are adopted to produce high-purity hydrogen. The hydrogen production rate is greater than 2.3Nm<sup>3</sup>H<sub>2</sub>/Nm<sup>3</sup>CH<sub>4</sub>, earning a leading position in the industry.

Intelligent management mode is adopted for the whole process in the project. Starting from "hydrogen production from natural gas", intelligent management is extended to the custody operation of boilers, and synergetic billing optimization, power sales, platform, and other services. The steam is saved by optimizing the reactor temperature and reaction operation conditions, and improving the utilization rate of low-level heat energy, so that the comprehensive energy consumption index

The technical route of hydrogen production from natural gas of the project is as follows:



of the overall process has reached the advanced level in China, and the hydrogen production rate per unit has been improved in addition to saving fuel. The project saves about RMB 8.4 million of ammonia cost and RMB 200,000 of electricity cost for customers. It not only solves the problem of reinvestment in boiler construction, but also meets customers' expectations for low-cost and high-capacity technical products.

The project saves about

RMB **8.4** million  
of ammonia cost



The project saves about

RMB **200,000**  
of electricity cost for customers



Completed the research and development of

**200** kg/d

skid-mounted devices for on-site hydrogen production from natural gas

## Natural gas skid-mounted package technologies

At present, the high cost of hydrogen for hydrogen energy terminals is not conducive to the promotion of hydrogen energy. On-site hydrogen production can reduce the cost for transportation so that the cost for terminals can be reduced too. To this end, ENN has conducted research on natural gas skid-mounted technology, and has completed the research and development of 200kg/d skid-mounted devices for on-site hydrogen production from natural gas. With LNG gasified methane as raw material and fuel gas, the system operated stably and the purity of the produced hydrogen was qualified. At present, it is in the trial operation stage. It can be applied to hydrogen production in gas stations.



## Hydrogen production from electrolysis of water

Hydrogen production from electrolysis of water is a more convenient method to produce hydrogen. It produces hydrogen and oxygen through electrochemical reaction by supplying direct current to the electrolyte. In 2021, ENN reached a long-term cooperation intention with the 718th Research Institute of China Shipbuilding Industry Corporation (CSIC) in terms of technology, equipment, and market of hydrogen production from electrolysis of water, methanol, and ammonia decomposition. In cooperation with the 718th Research Institute, the Company has completed the design of Haibo'er project of producing hydrogen from electrolysis of water and the EPC of on-site hydrogen refueling stations in Zhangjiakou. At present, we have carried out a total of 10 projects for the design of hydrogen refueling stations.

Carried out a total of

**10 projects**

for the design of hydrogen  
refueling stations



Case

### The project of producing hydrogen from electrolysis of water in Zhangjiakou

ENN has been the EPC contractor of the construction project of Demonstration Park of Hydrogen Energy Industrial Application in Zhangjiakou, which provides hydrogen energy supply for the Olympic and Paralympic Winter Games Beijing 2022. The project adopts the technology of producing hydrogen from electrolysis of alkaline water. **The desalted water is electrolyzed to produce hydrogen with purity up to 99.999%, which is used for hydrogen refueling of fuel cell passenger cars after compression,** filling, and transportation, and to produce oxygen with purity higher than 99.2%, which is liquefied into liquid oxygen through cryogenic process and sold with tank wagons. The project was officially put into operation in September 2020. It can produce 2,000 normal cubic meters of hydrogen per hour, with a daily hydrogen production of 4 tons. The hydrogen can be filled and transported with 10 to 16 tube trailers every day, which can be used by as many as 300 hydrogen fuel cell vehicles.

During the Olympic Winter Games, the project supplied over 1 million normal cubic meters of hydrogen in total to ensure

the successful convening of the event. The project is also an important support for the development strategy of hydrogen fuel cell vehicles in Zhangjiakou and a link between Beijing and Zhangjiakou for the commercial operation of hydrogen fuel cell vehicles, which makes it highly important to the construction of Zhangjiakou Renewable Energy Demonstration Zone.

In terms of hydrogen energy infrastructure construction in Zhangjiakou, the Company has also successively participated in the construction of many key engineering projects, such as Weisan Road and Chuangba hydrogen refueling station projects of Zhangjiakou Jiaotou Hydrogen Energy New Energy Technology Co., Ltd., and Chicheng Wind-hydrogen-storage Multi Energy Complementary Demonstration Project of Hebei company of Guohua Energy Investment. While accumulating engineering construction experience, the Company has also made positive contributions to promoting the development of the whole industrial chain of hydrogen energy in Zhangjiakou, and has supported the development of "Green Olympics", turning the vision into a reality.

It can produce

**2,000**

normal cubic meters of hydrogen  
per hour

Daily hydrogen production of

**4 tons**

The hydrogen can be filled and  
transported with

**10-16**

tube trailers every day



Demonstration Park of Hydrogen Energy Industrial Application in Zhangjiakou

Can be used by as  
many as

**300**

hydrogen fuel cell vehicles



Supported the development of  
"Green Olympics", turning the  
vision into a reality

Case

### The Jingbao ENN project of hydrogen production from coke oven gas pressure swing adsorption (PSA) technology in Henan

The project is built inside the plant of Henan Jingbao ENN New Energy Co., Ltd. and it is aimed to purify hydrogen and develop hydrogen energy products by using the hydrogen-rich gas from the by-product of the intercooler in Jingbao ENN's project of LNG production from coke oven gas.

The project has a total investment of RMB 12 million and a construction area of 650m<sup>2</sup>.



The project has a total investment of

**RMB 12 million**



Construction area of

**650 m<sup>2</sup>**



Through the innovative process technology of producing high-purity hydrogen by technical transformation of the tail gas recovery with low calorific value, the project supplies high-quality hydrogen to Zhengzhou Yutong Company (a hydrogen energy automobile manufacturer) regularly. It also provides hydrogen for surrounding chemical, glass, and new materials factories. The project plays a leading and exemplary role in the LNG industry.

# Energy storage



Solid Oxide Fuel Cell (SOFC) is a high-temperature fuel cell with solid oxide as electrolyte. SOFCs are made with natural gas as a raw material. Chemical energy is directly converted into electric energy through electrochemical reaction, which makes SOFC have higher power generation efficiency than the traditional power generation technology from chemical energy to thermal energy, mechanical energy, and electric energy successively.

The power generation efficiency of SOFC can exceed

60 %

We have claimed

9

relevant technical patents



According to the relevant research, the power generation efficiency of SOFC can exceed 60%, much higher than that of the proton exchange membrane fuel cell (PEMFC) and traditional gas turbine, the power generation efficiency of which are both below 40%. With the advantages of high efficiency in power generation, quiet operation, and flexible modular design, SOFC has been widely used in Europe and the United States. Its customers are mainly data centers, large warehouses, and medical centers. Application projects include Apple headquarters, New York Municipal Building, AT&T data center, and Nokia office building. In China, SOFC has not yet been put into commercial applications on a large scale due to the technical barriers. The Company's research on SOFC aims to develop system output standards that meet commercial power consumption needs and form SOFC system integration technology with independent intellectual property rights.

At present, the power generation efficiency of 6kW SOFC developed by the Company has reached 60% and achieved stable operation for the first time in China, and we have claimed nine relevant technical patents. The Company plans to complete the integration of 30kW system next year and strive to realize external commercial operation in 2024.

Case

## Research on key technologies for cogeneration of SOFC

In 2020, the Company, together with Tri-Ring Group and Huazhong University of Science and Technology, lead the participation in the research of Special Project IV Research on Key Technologies for Heat and Electricity Cogeneration of SOFC in the national key R & D plan of Renewable Energy and Hydrogen Energy Technologies. The Project IV studies the coupling mechanism of multi factors on the performance of multi-stack modules to ensure the reliable sealing, uniform flow field and consistent performance of the stacks and complete the modular manufacturing of high-power stacks. It tries to make breakthroughs in dynamic distribution of multi-stack integrated fuel and heat and power control technology for the SOFC in wide range of temperatures, improve the

efficient cascade utilization of system heat, optimize the heat recovery compact BOP system and heat and electricity co-control technology, and realize efficient power generation of 30kW SOFC heat and power cogeneration system. We are trying to meet the application requirements of high efficiency, environmental protection and long life of fuel cell distributed energy system, and solve the key technical problems of multi-stack system integration to fill the vacancy in the field of medium-sized SOFC power generation system in China, and narrow the gap between our technology and the international advanced level.



## Application scenarios

- There is a stable demand for low-cost gas source and power, but there is no demand for heat;
- There is a stable demand for electricity, but it's impossible to be connected to the power grid, or the electricity cost is high;
- Scenarios where there are strict requirements for power supply safety and reliability

### Industrial Parks with low-cost gas source of chemical by-product tail gas

#### Utilization of chemical by-product tail gas

There are rich resources, especially, oil field associated gas, coal-bed methane, blue carbon tail gas and coke oven. The market scale is expected to reach RMB30 to 50 billion per year.



#### Integrated energy station

An integrated energy station of "storage and charging of gas and electricity" forms a microgrid of gas, SOFC power generation, municipal power, energy storage and charging, which can switch between two different operation modes of being grid-connected or off-grid, a new operation mode in the future.



### Urban industry and commerce with stable demand for electricity and high electricity price

#### Logistics parks and large businesses

With the acceleration of urbanization, the power consumption of the tertiary industry has been increasing rapidly, reaching 1.0801 trillion kWh in 2018, with a year-on-year growth rate of 12.7%, much higher than that of the primary and secondary industries. The popularity of electric vehicles has brought great pressure to the capacity expansion of urban power grid.



#### Offshore islands and remote areas

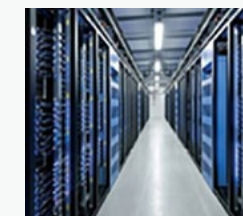
It's difficult to get offshore islands and remote areas connected to the power grid, and it is expensive to use the power. In this case, SOFC power generation is more economical.



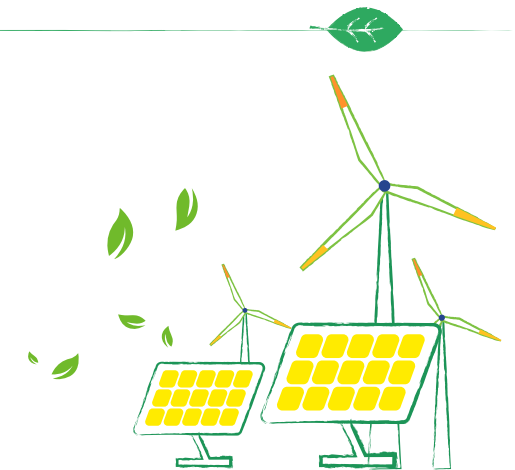
### Data centers in economically developed regions

#### Data centers

The average annual growth rate of China's investment in data centers is about 30%, and the market scale has reached RMB140 billion. SOFC technology can reduce the initial investment of data center energy system by 30-50%.



ENN Natural Gas will give full play to our advantages in the natural gas market. Complying with the "double carbon era" of clean and low-carbon energy, we will actively plan new businesses in combination with the technological development trends, make efforts to complete the demonstration projects of distributed energy utilization in residential areas or industrial parks as soon as possible, and develop the product mix of cold energy, heat and electricity with scale of 100 KW for SOFC distributed energy utilization. We will ensure that the power output of the system meets the commercial power consumption standard, and achieve design and integration technology for SOFC modular system with independent intellectual property rights, laying the foundation for integration and development of megawatt-scale system, and arriving the goal of promoting and applying the products.







Carbon Capture, Utilization, and Storage (CCUS) refers to the process of separating CO<sub>2</sub> from the industrial process, energy utilization or from the atmosphere, directly utilizing it or injecting it into the strata to realize permanent emission reduction of CO<sub>2</sub>. CCUS is the only technology option to realize the low-carbon utilization of fossil energy at present. It is the main technical means to maintain the flexibility of power system in the context of trying to achieve the goal of carbon neutrality. The negative emissions technologies (NETs) featuring the coupling of CCUS with new energy, is an important technical guarantee to achieve the goal of carbon neutrality.



It is expected to complete the feasibility demonstration and technical scheme of EGCS project, and start 3D seismic exploration and drilling of exploratory well(s) in

## 2022

We strive to realize millions of tons of CO<sub>2</sub> storage in

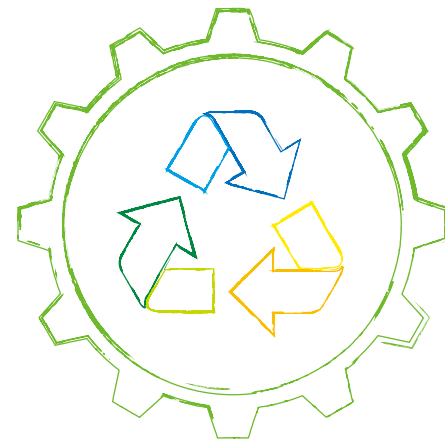
## 2025

and form the deep geothermal energy “zero carbon + negative carbon” development technology

Promote and apply on a large scale in

## 2028

to contribute to the achievement of China’s “3060” goals



About 40 CCUS demonstration projects have been put into operation or under construction in China, with a capture capacity of 3 million tons per year. Most of them focus on demonstration of small-scale capture and carbon dioxide flooding in petroleum, coal chemical and power industries, lacking demonstration of large-scale full process industrialization with various technologies combined.

Based on conventional enhanced geothermal system (EGS), the Company innovatively proposed to realize the practical application of the technical route of supercritical CO<sub>2</sub> EGS in the plant of Dalad Banner, upgrading the “zero carbon” development of deep geothermal energy to the “zero carbon + negative carbon” resource development and utilization, and realizing the deep integration of negative emission technology featuring the coupling of CCUS with new energy.

At present, ENN Natural Gas is carrying out preliminary 2D geophysical exploration for EGCS project in Dalad Banner, Ordos, to promote the demonstration project. It is expected to complete the feasibility demonstration and technical scheme of EGCS project, and start 3D seismic exploration and drilling of exploratory well(s) in 2022. We strive to realize millions of tons of CO<sub>2</sub> storage in 2025, and form the deep geothermal energy “zero carbon + negative carbon” development technology, which shall be promoted and applied on a large scale in 2028, to contribute to the achievement of China’s “3060” goals.

## Outlook

On the global decarbonization journey towards a sustainable future, “carbon peak and carbon neutrality” is a major opportunity for the Chinese government and enterprises to tackle the high carbon emissions from traditional fossil fuels and march towards high-quality economic and social development. Taking the opportunity provided by the “dual carbon” policy, ENN Natural Gas has put forward the goals of carbon emission reduction, carbon emissions peaking and carbon neutrality, made a comprehensive forward-looking layout, and placed addressing climate change in an important position in the future vision of the Company. The proposal is in line with the mission of “creating a modern energy system” and its corporate social responsibility, and will boost the high-quality business development.

As one of China’s largest private energy businesses and a responsible industry leader, ENN Natural Gas earnestly practices what it advocates, and pioneers in exploring energy facility optimization and digital and intelligent energy-saving tools covering natural gas, coal, energy and chemical industry, engineering construction and park operation, and making efforts to reduce carbon emissions during its own operation through energy conservation and consumption reduction, energy structure reform and vigorous development of renewable energy and green technology. In the meantime, we actively customize integrated energy solutions with multiple energy complementary for various users to promote the green and low-carbon transformation of the whole industrial chain and the green recovery and development of the whole society.

In the development blueprint of “14th Five Year Plan”, the Chinese government has clearly defined the overall requirements for energy conservation and emission reduction to support the timely realization of the carbon emissions peaking and carbon neutrality goals. Facing the future, ENN Natural Gas will actively respond to the national green and low-carbon development strategy and goals as always by incorporating “low-carbon, zero-carbon and sustainable development” into the Company’s development strategic blueprint as a necessary responsibility, and maintaining strategic determination, always adhering to the green development concept of being long-term, stable, and sustainable on the way to the emission target of carbon neutrality. Based on completing the carbon reduction of our own business, we provide customers with technology-driven green solutions, enable the green value promotion and industrial intelligence upgrading in the whole industrial chain, and strive to realize the business vision of an intelligent ecological operator in the natural gas industry.

# Risk Statement

Based on the current business status of business segments, the foreseeable future growth strategy of the Company and the industry development trends, ENN Natural Gas sets the carbon peak and carbon neutrality targets. We are fully aware that the carbon peak and carbon neutrality targets and roadmap of ENN Natural Gas disclosed in this Report may be affected by the following factors, which requires us to review and reconsider their rationality and applicability.

- 1 When major changes in our strategy cause dramatic difference in the type and structure of our businesses from those described in this Report;
- 2. when unforeseeable policies in locations where we operate expose us to a significantly different policy and regulatory environment;
- 3. when significant technical breakthroughs in the natural gas and energy industry enable us to adopt more environment-friendly technical routes;
- 4. when major changes (geopolitical influence, adjustment of national energy policy, etc.) in the energy industry in locations where we operate require us to adjust the industry chain accordingly.

ENN Natural Gas will assess the above risk factors as appropriate, and review and evaluate the carbon peak and carbon neutrality targets and roadmap to honor our commitment to contributing to environmental protection through appropriate action plans.

