

Decarbonisation Action 2030

— Journey to Net Zero



Table of Contents



Decarbonisation Action Outline

01.

Background

 ENN Energy's Idea and Practice of Sustainable
 08

 Development
 10

 ENN Energy's Ideas of Decarbonisation Actions
 12

03.

Green Household

05.

02

02.

ENN Energy's Journey to Decarbonisation

Decarbonisation Actions of City Gas Business	16
Green Development of Integrated Energy Business	28
Green Office	32

04.

Promoting Practices and Applications of Green Technology

40	Biomass Liquefaction and Gasification	52
42	Geothermal Energy	54
44	Energy Storage	56
	Hydrogen	58
	Carbon Capture	59

60

Decarbonisation Action Outline



01 Carbon-neutral **Development** Background

Guided by China's commitments to reach carbon peak before 2030 and achieve carbon neutrality before 2060, accelerating the phase out of coal, transition backed by natural gas, and expansion of new energy will be inexorable trends in the energy industry. In the short and medium term, the replacement of high-emissions coal with low-carbon natural gas will provide huge business growth potential for ENN Energy ("the Company", "we", "us", "our"). Taking a long-term view, in the course of achieving the ultimate goal of carbon neutrality, ENN should consider how to grasp this new development opportunity while maintaining its existing business development, to achieve low-carbon operation and low-carbon transformation, and honour the social responsibility to lead the whole industry to realise green and lowcarbon development.

02 ENN Energy's Journey towards Decarbonisation

To meet the long-term needs of low-carbon development, enhance our competitive edge in the carbon-neutral era, fulfil the responsibility as a leading player in the energy industry, we have incorporated the compulsory tasks of lowcarbon and zero-carbon developments into strategic planning, and eventually formulated the decarbonisation strategies:

- The carbon emission reduction at the operational level is a key element of our decarbonisation action plans. We will take actions in six aspects, involving methane management of city gas business, low-carbon trade and transportation; energy efficiency improvement, energy structure transformation and green technology application for integrated energy business (IEB), and green offices, to improve energy conservation and reduce emission for our own operations.
- Besides strengthening our own carbon emission management at the operational level, we expect to facilitate downstream industrial, commercial and residential customers to reduce GHG emissions by providing them with low-carbon solutions and products.
- Meanwhile, we are conducting in-depth research, developing and applying low-carbon technologies including photovoltaic, geothermal, biomass, hydrogen, etc., for different energy use scenarios, to enrich our approaches of emission reduction, thus enhancing the overall emission reduction performance.

* Decarbonisation **Actions of City Gas Business**

- We aim to reduce the intensity of GHG emissions (combined Scope I and II GHG emissions / natural gas sales volume) by 20% from 2019 baseline by 2030;
- We have included methane emission control in our decarbonisation plan, and strive to achieve the goal of "reducing the average methane intensity during natural gas production to below 0.25% by 2025", together with members of the Alliance on Methane Emission Control of Chinese Oil and Gas Enterprises;
- Our energy transportation fleet will be completely powered by low-carbon fuels by the end of 2025, and we will introduce energy conservation and emissions reduction initiatives to our ecological partners in the energy transportation industry.

* Green Development of Integrated Energy **Business**

- The emission sources of Scope I and Il of integrated energy business mainly come from fossil fuels and purchased electricity used in the integrated energy (IE) generating facilities.We target to reduce the intensity of carbon emissions per unit of energy generated by 48% by 2030 against the 2019 baseline:
- We will improve the energy efficiency of IE generating facilities by 5% taking measures such as technical upgrading, optimisation of operation strategies, the building of digital and intelligent capabilities including the Serlink Smart Energy Management Platform;
- We will consistently increase the proportion of renewable and zero-carbon energy sources including photovoltaic, biomass, geothermal, hydrogen, etc. to 36% by 2030;
- We seek to launch carbon capture, utilisation and storage (CCUS) pilot projects by 2025, make sustained efforts to promote the popularity and application of CCUS technology in IE projects and aim to neutralise 5% carbon emissions generated from natural gas consumption each year after 2025

* Targets and Measures 03 Building A Low-carbon for Green Office Society

- and new energy substitution will facilitate energy conservation and carbon emissions in the offices. We aim to reduce energy consumption per unit area of office buildings by 10% within five years, and aim to increase photovoltaic power generation to 5% of total electricity consumption by 2025:
- 50% of employees shuttle bus, industrial parks commuter bus and pipeline patroling vehicles will be powered by new energy, replacing existing oil-powered vehicles, so as to reduce direct carbon emissions from transportation by 2025.

The overall energy efficiency improvement

Leveraging on the integrated energy business, we extend green and lowcarbon products and services to customers and society by helping customers build lowcarbon industrial parks, green factories, green buildings and green households to

achieve their energysaving and emission

reduction goals.

04 Promoting Practices and Applications of **Green Technologies**

- Focus on the development of low-carbon technologies and track the development of technologies related to ENN Energy's business, customers, and the lowcarbon transformation of society, including hydrogen, energy storage, CCUS, photovoltaic, geothermal energy, biomass, etc.
- Participate in technology research and development and investment, taking demonstration projects as a starting point to promote large-scale application. contributing to a carbon-neutral society.

PANORAMA

City Gas Business

Methane Emission (ME) Management

• 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 align with international standards in 2023 and continuously improve transparency afterwards

• 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 remuneration

Promote the application of onsite detection technology

Aim to equip all city-gate stations with the onsite detection devices such as Pan-Tilt-Zoom (PTZ) by end of 2022, so as to improve quality and accuracy of ME data

• Encourage eco-partners to take actions

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ACTION

ECARBONISATION

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ENERGY

ENN

As a founding member of the China Oil and Gas Methane Alliance, we pledged 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

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Energy Transportation Decarbonisation

Adopt clean fuels for self-owned vehicles

Aim to achieve carbon emission reduction of 28.3% for selfowned transportation vehicles by eliminating diesel-powered vehicles by end of 2025, and switching to zero-carbon fuels such as hydrogen or bio-fuels around 2030

• Enhance efficiency and reduce emission with intelligent approaches

Continuously implement 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

• Promote low-carbon operations of eco-partners

Aim to adopt low-carbon transportation as a core criterion for supplier assessment from 2026



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

- Energy-efficient lighting fixtures and air conditions
- Paperless office
- Green building standards for office buildings construction
- Intelligent management of energy utilisation

Low-carbon Travel

Aim to replace 50% of self-owned administrative vehicles with new energy vehicles by 2025



BUILDING A LOW-CARBON SOCIETY ------

04

ENN Energy's Journey to Decarbonisation Action Outline 🚯 Background

Integrated Energy Business (IEB)



renewable energy use, and introducing hydrogen after 2025, we aim to increase the proportion of renewable and zero-carbon energy utilisation to 36%

Aim to further improve the overall energy generating efficiency by 5% against existing level of 90% by 2030 with technical and strategic optimisation and support from the Serlink Smart Energy Management Platform

storage (CCUS) pilot projects for IEB around 2025 and neutralise 5% carbon emissions generated from

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 developed for customers will increase to 200 respectively



Leveraging on our enriched technological know-hows on integrated energy and experience of energy management for customers, we provide green buildings solut ions and bui lding energy-saving services for architectural customers such as hospitals, hotels, airports, office buildings, etc.



Green Households

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

Background

Adhering to the mission of "Create a Modern Energy System, Improve the Quality of People's Life, and Become a Respectable, Innovative and Intelligent Enterprise", ENN Energy actively seizes opportunities arised from the decarbonisation development of the nation, through optimising its own energy mix, deploying clean energy technology and upgrading its capability of energy smart management, so as to achieve low-carbon business transformation and provide low-carbon and clean energy products as well as services to customers, co-creating a low-carbon future.

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ENN Energy's Idea and Practice of Sustainable Development

ENN Energy has always been adhering to the core value of sustainable development. We have established an environmental, social and governance ("ESG") management system and mechanism from board level to operational level to enhance accountability by setting ESG-related performance indicators for senior management, business teams and member companies, so as to integrate sustainability topics into our daily operations.We actively respond to China's carbon peak and neutrality goals, and have formulated policies such as ENN Energy's Climate Change Policy and Sustainable Development Policy to implement sustainable development from top down, and actively adopt international standards and best practices to guide the implementation of relevant works:

ENN's Mission

Become a respectable, innovative and intelligent enterprise

ENN's Vision

Create a modern energy system and improve the quality of people's life

ENN's Philosophy

Customer-oriented, creating win-win, co-building the ecosystem

ENN's Values

Integrity, self-motivation data-driven, willingness to share



intelligent system to improve management







Opportunities of Carbon Neutrality

China's carbon peak and neutrality goals will accelerate the transition to clean and low-carbon energy structure, green technology innovation and carbon market improvement, and will stimulate the demand for lowcarbon products and services from local governments, industrial and commercial customers, transportation sector and household customers, which provide opportunities for the rapid business growth of energy companies that are well-prepared.



Accelerate the energy structure transformation and enhance the demand for low-carbon and zero-carbon energy

China's carbon neutrality target will accelerate the substitution of high carbon emission energy like coal with natural gas, which will facilitate our city gas business development in particular, "coal to gas" business for industrial and commercial customers and "oil to gas" business for transportation customers. At the same time, we actively build intelligent tools such as intelligent gas pipe network and online service platform to continuously improve intelligent management and service capabilities, make every effort to ensure operation safety and improve customer experience, so as to strengthen the high-quality development of city gas business.

Carbon neutrality also pushes forward the development of renewable energy, but the intermittency and volatility of wind and solar resources pose challenges to the stability of the energy system. Therefore, the complementary use of renewable energy and natural gas, the coordination of heat-electricitygas, the integration of multi-technology, become an irreversible development trend. ENN Energy is actively engaged in integrated energy business utilising low-carbon energy source such as solar, biomass, geothermal energy, etc. This line of business will be an important growth driver for the Company at the backdrop of carbon neutrality.



Pursue low-carbon and digitally intelligent technological development and promote service capability

The government has significantly strengthened its efforts to promote the research and application of green and low-carbon technologies:

- China will vigorously develop the utilisation of renewable energy, including photovoltaics and biomass, with clear development goals;
- China regards hydrogen energy development as a key strategy for carbon neutrality, and takes energy storage technology as an important pillar to ensure the security and stability of the energy network;
- CCUS technology is one of the few carbon-negative technologies that can effectively reduce carbon emissions from fossil energy;
- The 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China have clearly defined the plan of "Pole Position in the Digital Economy", hoping to build new application scenarios and industrial ecology through digitalisation. The combination of digitalisation and energy has become an important direction.

In the future, new technologies and products in the above fields will continue to emerge. ENN Energy has the advantages of actively applying innovation and advanced technology in its business. The Company has participated in the development and utilisation of lowcarbon technologies such as solar, biomass utilisation, and geothermal energy for many years with rich project experience. Meanwhile, the Company is paying close attention to the development of hydrogen utilisation, energy storage and carbon-negative technology and actively participating in the industry-university collaborations to continuously integrate low-carbon solutions into integrated energy business. Meanwhile, ENN Energy attaches great importance to the use of digital technology to empower business, and relentlessly launch smart products based on technologies such as big data, Internet of things ("IoT"), online simulation, automation control, etc., to create digitalised smart tools to improve service quality.



New business opportunities brought by the carbon trading market

The construction of China's carbon trading market is prospering with an expanding market scale. The carbon price is expected to rise progressively. Companies with high energy consumption and high emission will face the challenges of increasing carbon emission costs and compliance risks. This delivers new business opportunities for us to provide carbon-related services. Leveraging on our advanced smart energy management system, we can help customers manage the carbon in the energy consumption process, and then carry out the overall optimisation of "energy + carbon", to achieve a balance between energy use and carbon emissions, so as to help customers reduce financial costs of carbon emissions and avoid compliance risks.

The development of carbon market also allows various types of carbon reduction projects including renewable energy utilisation. methane utilisation and biomass heating to generate incremental returns via carbon trading.



Opportunities brought by lowcarbon development of the industrial value chain

The carbon neutrality policy will drive the trend of green and lowcarbon energy consumption in the industrial sector. ENN Energy is well-positioned to leverage its advantages and help local governments and customers jointly build a green and low-carbon industry value chain:

- helping local governments build low-carbon industrial parks and helping customers build green factories by providing facility hosting operations and low-carbon solutions;
- Relying on energy-saving technology and project experience, providing building energy-saving solutions and energysaving management services to help customers develop green
- Promoting value added services including green lowcarbon products and household digital and intelligent energy consumption services, to help household users save energy, reduce energy consumption, and improve the quality of life.

ENN Energy's Ideas of Decarbonisation Actions



Develop the roadmap ofDecarbonisation Action 2030

The Decarbonisation Action 2030 focuses on reducing our own carbon emissions, and promoting the reduction of emissions in the industry value chain and society by serving our customers to reduce carbon emissions: .

- Decarbonisation for ourselves: focus on the Company's main sources of carbon emissions in Scope I and Scope II, which are the carbon emissions from operational level of city gas business and energy generating facilities of integrated energy business, and the carbon emissions from office buildings and vehicles owned by us.
- Decarbonisation for society: focus on the carbon reduction contribution that the Company brings to various customers and the society through integrated energy business and value added business, corresponding to Scope III carbon emissions of the Company.

Ultimate goal of decarbonisation actions

Achieve carbon neutrality by 2050

We set targets for our decarbonisation action and measures aligning with industry policies and our business development plan after identifying the source of carbon emission and accessing our emission reduction potential. This report demonstrates our determination and relentless efforts in achieving carbon neutrality.



Five principles of decarbonisation actions

- Strategy alignment: Focusing on the development strategy of "Building a modern energy system and innovating clean energy", develop low-carbon transformation goals and actions to achieve this strategy.
- Coordinated Promotion Principle: The project coordinates and mobilises various internal and external resources to comprehensively promote the implementation of the project from the aspects of management, system, action and performance.
- Comprehensive approach: Identifying key emission sources of our own operation and focusing on emission reduction potential of major sources. On the other hand, providing clean and low-carbon solutions for governments, industrial parks, C/I and residential customers to achieve carbon emission reduction for the society.
- Viability: The objectives and implementation plans are formulated with full consideration of the feasibility and operability of
- Regular review: Given the dynamic changes in the external environment and the Company's business strategies, the targets will be reviewed and adjusted every three years.







ENN Energy's Journey to Decarbonisation

ENN Energy actively respond to climate change and the national goal of "carbon neutrality" by integrating them into its development strategy and business operation. We set carbon emission reduction targets and formulated decarbonisation action plans according to the characteristics of the industry and our business development goals, demonstrating the Company's ambition and efforts to achieve the goal of carbon neutrality.



Decarbonisation Actions of City Gas Business

The main sources of GHG emissions of city gas business include methane venting from transmission and distribution business, fuel and gas consumption of transport vehicles in energy trading business, fuel consumption by administration vehicles and purchased electricity and heat, etc. This chapter will focus on the GHG emissions reduction from methane venting, transportation management in the trading business. For emission reduction of office building and business vehichles, please visit Page 32-37 Green Office section for details.



Our goal

operations and administration level of city gas business by 20%* by 2030 against 2019 baseline



Methane Emission Control

Working together with alliance members to achieve the common goal to reduce the methane emission intensity during natural gas production to below 0.25% by

0.25%



According to the Methane Tracker 2021 issued by the International Energy Agency in January 2021, methane emissions are the second largest cause of global warming. In 2020, methane emissions from global oil and gas operations reached 70 million tons, which is equivalent to about 2.1 billion tons of CO₂ equivalent ("CO₂e"), and to the total energy-related carbon dioxide ("CO₂") emissions in the European Union. Methane control has been a key task for the global energy industry to address climate change and reduce GHG emissions. The focus of China to combat climate change has gradually transformed from merely CO₂ to methane and other greenhouse gases.

Methane emission control has gradually become an important emission reduction task for the city gas operators as awareness increased. ENN Energy, as one of the largest city gas operators nationwide, has been fully aware of the challenges of methane emission reduction and has responded to it proactively. We have included methane emission reduction as an important part to achieve carbon neutrality goal by 2050. On March 19th, 2021, ENN Energy officially joined the Methane Guiding Principles to work with the global alliance members to commit reduction of methane emission. On May 18th, 2021, the Company joined China Oil and Gas Methane Alliance as a founding member and pledged to work together with alliance members to achieve the common goal of "striving to reduce the average methane intensity during natural gas production to below 0.25% by 2025, which is close to the performance of leading players in the world, and making effort to reach world-class level by 2035".

There are two challenges in methane emission management and reduction, the first challenge is the identification and quantification of emissions data, as the technology to measure actual methane emissions is still in its infancy. The traditional emission factor calculation method which is widelyadopted now in the industry will be prevalent in the coming years. The second challenge is discovering effective approaches to reduce emissions, and a lot of work has been conducted across the industry. We are playing an active part in this area, and has made some important efforts in 2021.

administration level by 2030



Identify emission sources, improve quality and transparency of data

We will deploy methane emission monitoring system to collect real-time data, target to cover all of the city gas projects by the end of 2022, and strive to disclose methane emission data in accordance with international standards by 2023 and continue to improve the transparency.

We identified the main sources of methane emissions in major operational scenarios of the city gas business:

Scenari	os	Emission sources	Emission causes
		Connecting pipes for LNG loading and offloading	• Connecting pipes have to be depressurized via venting before dismantling
	City-gate stations,	Equipment maintenance	All pipelines have to be depressurized via venting before maintenance
	storage and distribution stations,	 Pressure gauges, safety valves, gas meters calibration 	Methane at the joint should be fully discharged before dismantling
	refueling stations	Pipeline filter drainage and cleaning	• When the filter is discharged and cleaned, the gas pressure will be released at the joint
		• Connection parts (valves, flanges, etc.) of the pipelines and ancillary facilities at the city-gate stations	Loose connection or damage due to corrosion
	Pipeline networks and ancillary facilities	 Leakage in the main pipelines Leakage in the courtyard pipelines Pressure regulating facilities 	• Loose connection of the connecting parts (valves, flanges, etc.) or damage due to corrosion







Emission sources	Emission causes
Household meterHousehold pipeline	 Loose connection of the connecting parts (valves, flanges, etc.) or damage due to corrosion
Pipeline cracks	Pipeline cracks caused by third parties' damage
Pipeline venting or purge	Gas purge for newly-built, repaired or abandoned pipelines
Equipment purge	Gas purge during equipment maintenance or overhaul
• Emergency discharge of gas in stations	Emergency discharge of methane in case of fire and other safety accidents in the station
Safety valves	Discharge of methane via safety valves when pipeline is overpressured
LNG tank residual pressure emission	Discharge of residual methane from LNG tank
Accidental damage of LNG tank	Methane discharge due to damage of tanks and operator box caused by traffic accidents

We actively promote actual monitoring of methane emission instead of estimation to improve data reliability. Currently, we have deployed the Pan-Tilt-Zoom (PTZ) laser methane monitoring system covering two city gate stations to monitor methane emissions. We plan to deploy the system covering 50% of our city gate stations by the end of 2021, and to cover all projects by the end of 2022. The related techniques, measurements, and standards will also be included in the standards for design, construction and operation of new projects.

Case

The laser methane emission monitoring technology with PTZ devices and its application in the city gate station of ENN Rui'an Project

By using laser methane emission monitoring technology with PTZ devices, the Company can achieve real-time monitoring of methane emission in city gate stations. A single probe of the system has the detection radius of 150 meters, which only responds to methane and exclude other gas interference. The integrated camera and laser head of the device can pre-set point cruise, which can conduct 24/7 monitoring for every point in the stations. The system uses network and IoT technology to connect all monitoring equipment, without limitations by terrain and station facilities layout. In addition, the equipment used for scanning and detection can operate independently even if the connection with the central control is interrupted, ensuring real-time and uninterrupted monitoring of methane emissions in the stations.

We have employed the second-generation PTZ laser methane monitoring system in city gate stations of ENN Rui'an. The laser methane monitoring system covers 87 key monitoring areas of the station, and can complete the whole station inspection within 10 minutes. The application of this technology changes passive detection into active monitoring reducing human judgment and improving the safety grade inspection efficiency of the station.

In January 2021, Rui'an Station organised a methane leakage monitoring and risk demonstration test, the PTZ system quickly identified and locked the leakage location and immediately triggered the alarm program. Sound and light alarm in the station, speaker alarm in the station control room, and then testers quickly rushed to the leak point under the PTZ guidance. The PTZ system started alarm video recording at the same time as the alarm beeping until the tester control the leakage.



Implement methane emission reduction measures

We have implemented methane emission reduction measures, including the improvement of internal protocols, standards, procedures related to methane management, using digital and intelligent tools to realise PDCA closed-loop management of operation process, and improving employee skills through training. We also aim to gradually establish a performance appraisal and salary incentive mechanism relating to methane emission reduction.

For each methane emission scenario, specific emission reduction measures deployed include:



- We strengthened operation management standards to avoid unplanned maintenance, ensure the stability of equipment and facilities and reduce methane emission during operation:
- Digital and intelligent products were applied for effective operational managements
- To guarantee effective and quality operation, employees had improved their skills through internal competition and training
- We applied advanced technologies to improve operation quality and efficiency, secure operational safety and mitigate methane emissions:
- Replaced unloading hose with crane arm and interlocking devices to ensure safety during gas loading
- Laser methane detectors were applied for monitoring emissions in stations



- Special campaigns were held to rectify old pipeline networks
- Wider application of industrial IoT and pipeline network simulation technology:
- Applied IoT in pressure regulating facilities, valve wells, valve chambers, cathodic protection, etc. to monitor pipeline network and ancillary facilities
- Accessed online simulation technology, which can dynamically simulate and compute pipeline running status, identify deviations from actual operation, and automatically remind operators of possible faults and leaks, to support the real-time pipeline monitoring and faults identification system
- Advanced methane monitoring equipment and gas emission laser inspection vehicles were introduced to effectively, quickly, and accurately inspect and determine pipeline safety hazards
- We promoted and applied a comprehensive coverage pipeline network visualisation system with a "plan-do-check-act" closed-loop management for the operation process
- A pipeline integrity management system and a dynamic preventive operation management model were established to guarantee pipeline safety



- Stronger indoor security checks to ensure the safety of gas user
- Promoted gas safety instruction
- Alarm and automatic cutoff valve linkage technology to avoid leakage



- We promoted the installation and utilisation of residual gas recovery devices to reduce residual methane emissions during gas loading and unloading
- In addition to maintenance and upgrade for old vehicles, tank pressure testing equipment had also been installed
- Digitalised and intelligent dispatching system was adopted to improve fleet efficiency and reduce transportation mileage
- We enhanced safety management capabilities with strict operation standards for gas transportation and provided relative training to employees. By the end of 2023, we will introduce mandatory defensive driving training requirements in transportation service supplier engagement

calculations

and leakage management.

PSIganesi simulation technology is a dedicated simulation technology for oil and gas pipelines that serve as an important aid for pipeline operation control and management. It can analyse the current status of network operations and predict that of the future, with pipe cleaner tracking and leak monitoring and location functions. PSIganesi has a built-in GIS system so that it can visualise the key parameters of the simulation calculations. This technology enables the identification of the utilisation rate of the pipeline network under different supply scenarios, calculates the potential methane leaks and their volume, and helps operators to continuously optimise network operations.





ENN Energy uses PSIganesi, a natural gas pipeline network simulation technology, to simplify the operation and management of complex pipeline networks. It performs real-time online monitoring and calculation of data such as gas flow pressure and flow rate in natural gas pipeline networks, providing monitoring data for the safe operation of pipeline networks, methane emission

Encourage eco-partners to reduce methane emission together

ENN Energy aligns with international best practice in deploying innovative technology to improve the quality of methane data for city gas projects. We are also advocating for the participation of eco-partners to jointly promote methane management. We will actively engage in constructive cooperation with academic institutions, governments, industry and/or voluntary organisations by providing application scenarios for technologies, equipment and/or methodologies testing, so as to promote the development of methane emission reduction measurement and technologies. We will encourage supply chain partners to use reliable methane emissions measurement and to promote transparency in methane data disclosure.



CFO Mr. Andrew Liu participated in the commencement of China Oil and Gas Methane Alliance, which ENN Energy is one of the founding members.

Low-carbon Transportation

The majority of GHG emitted during trade and transportation are generated by fossil fuels combustion in transport vehicles, and methane emissions from LNG tank pressure regulation or residual gas discharge (please visit Page 17-24 Methane Emission Control section for details). Currently, most vehicles used by energy trading and transportation industry are primarily powered by diesel. Diesel-fueled vehicles account for 17% of ENN's energy trading fleet, but their emissions account for 24% of the entire fleet, indicating more room for decarbonisation. At the same time, problems such as low efficiency of vehicle dispatching and usage also cause excessive energy consumption and additional carbon emissions. We are driving a green and low-carbon development of energy trading business by using clean energy vehicles, upgrading intelligent vehicle management, and engaging ecological partners to apply low-carbon approaches.





Clean energy for our fleet

ENN Energy will gradually replace existing oil-fueled energy transportation vehicles with clean fuel vehicles. We no longer add oil-fueled vehicles to our fleet starting from 2021 and will phase out all of these vehicles by the end of 2025. We will also include low-carbon transportation as a core criterion for supplier management after 2026. It is estimated that the clean fuel action plan for our fleet will contribute to 28.3% of carbon emissions reduction in 2026 compared to that in 2021.

Replacing oil with natural gas as vehicle fuel, which is cleaner and generates less carbon, is a transitional solution for our energy trading business to carbon neutrality. We will continue to closely monitor the development and application of clean fuel vehicles, such as heavy trucks powered by hydrogen and biofuel, as well as the promotion of related refuelling stations. We will introduce and adopt cleaner and low-carbon power in due course to constantly adjust the energy consumption structure of the fleet. We plan to adopt zero-carbon fuels such as hydrogen and biofuels for our energy trading fleet by 2030.

Note 1: Emissions of diesel and LNG vehicles are calculated by multiplying LNG and diesel consumption by certain emission factors, in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines).

The clean fuel action plan will reduce CO₂ emissions from energy trading business by



Effective emission reduction with intelligent tools

We are promoting and applying intelligent systems to modify the transportation route of our fleet, improve their dispatching and operational efficiency and reduce deadhead miles, thereby effectively improving energy efficiency and reducing carbon emissions caused by vehicle operations. In addition, digitalised and intelligent tools such as "Yuntu Cloud System" and smart dispatching platforms are adopted to cater for the imminent needs of customers at LNG receiving terminals and industrial parks.

Case

The application of the Yuntu Cloud Intelligent Platform

The Yuntu Cloud Intelligent Platform is designed based on the IoT, which considers safe and intelligent logistic of liquid hazardous chemical and intelligent delivery of LNG industry as its core. The platform carries more than 75% of dynamic transportation capacity data of the LNG industry and can perform accurate industry emission measurement. It is pivotal for launching the logistics ecosystem for the carbon peak and neutrality goals and aligning the strategic goal of the international carbon emission management scheme.

The Yuntu Cloud System is a support provider for transportation scenarios since it can save loading time, improve vehicle dispatching efficiency, reduce transporting time, and thus reduce carbon emissions. It can also enable an integrated application of service-linked platforms and enhance efficiency with digital and intelligent technologies, thus reducing energy consumption and carbon emissions. The system was fully applied to serve the delivery business of ENN Energy in 2019, and had developed solutions and product systems for government regulation, corporate delivery management and delivery management of resource providers in 2020. In 2021, the system is now making an unremitting effort to build an intelligent platform for the industry supply chain.



Case

Application of intelligent dispatching platform

The energy trading business involves multiple systems such as SAP system, greatgasnet, Yuntu Cloud System, customer big data system and internal workflow system, etc. In order to improve operational efficiency, ENN Energy adopted SAAS (Software as a Service) technology development tools to integrate and optimise multiple platforms and systems in 2018, and tailored intelligent dispatching platform for energy trading business. With the advancement of the modern Internet and IoT technology, the data collection systems of the platform are constantly iterated and innovated. At present, the intelligent dispatching platform has illustrated various model algorithms such as demand prediction, price calculation and capacity planning, and has standardised management for the three basic business modules for gas sales, procurement and transportation capacity. It is also supplemented by such module functions as intelligent matching, transportation execution and settlement management. With these functions mentioned, the online whole-process management system of the energy trade business can come to a reality, so does the business management mode which features point-line-surface coordination.



Encourage eco-partners adopt low-carbon operations

Transportation needs will grow in tandem with our expanding energy trading business, therefore, decoupling carbon emission from the trading volume expansion is an important task to decarbonise our energy trading operations. We will control the size of our own fleet and deploy ecosystem partners' fleet to meet our transportation needs. We will develop low-carbon transportation standards for suppliers and incorporate the standards as core criteria for supplier and partner engagement from 2026, with a view to reducing emissions joining hands with our ecosystem partners in the industry.



and travel to location C with gas source (generally the unloaded mileage is less than the distance between B and A) for the coming business. Through the intelligent management function of the intelligent dispatching platform, the overall loaded mileage vehicles traveled is longer than the travel distance with empty tank. As a result, it has effectively shortened and optimised vehicle travel distance, minimised the idling rate of vehicle. improved the utilisation rate of transportation capacity, reduced energy consumption intensity of vehicles, and contributed to energy saving and emission reduction of the energy trade business.

Our goal

the 2019 baseline.

Green Development of Integrated Energy **Business**



As an active practitioner in the implementation of the Paris Agreement on Climate Change, the Chinese government clearly stated that by 2030, the proportion of non-fossil energy in the country's primary energy consumption will reach about 25%, and the total installed capacity of wind and solar power will reach 1.2 billion kilowatts or more. Driven by China's carbon peak and neutrality goals and supporting policies, the proportion of renewable energy in energy consumption will continue to increase, and renewable energy technology will be further innovated. It is expected that the low-carbon transformation of the energy industry will be accelerated with priority given to high-quality development.

Taking advantage of the opportunity arisen from the clean and low-carbon transformation of energy structure, the Company proactively developed integrated energy business. We adopted various clean energy sources including natural gas, industrial waste heat, biomass, solar energy, geothermal energy and other renewables in our IE business, incorporating customers' specific energy needs, to provide tailor-made integrated energy solutions comprising various forms of energy such as electricity, steam, cooling and heating. The Scope I and II emissions of integrated energy business mainly come from fossil fuels and purchased electricity used in the integrated energy generating facilities².

Taking 2019 as the baseline year, in combination with the development trend of national energy consumption structure and our own business planning, we deeply tap the potential of emission reduction by increasing the proportion of renewable energy, improving energy efficiency and considering the application of CCUS technology etc. By conducting scenario analysis and guantification of energy consumption structure and emission reduction outcomes, we have formulated a 2030 development plan for the energy generating facilities of IEB.

Note 2: Only includes the energy generating facilities that are invested, constructed and operated by the Company based on the principle of financial control.

* The Scope I direct emissions of the energy generating facilities of IEB are calculated in reference to the 2006 IPCC Guidelines by multiplying the consumption of coal and natural gas by the emission factor. The scope II indirect emission refer to the emission factor of Corporate Greenhouse Gas Emission Accounting and Reporting Guidelines - Power Generation Facilities multiplied by the amount of purchased electricity. Emission intensity = Scope I and II emissions of the energy generating facilities of IEB / Energy sales of the the energy generating facilities of IEB

Our action plans



Gradually increase solar energy installed capacity, and improve the proportion of biomass and geothermal energy consumption in the energy mix. We will also introduce hydrogen in the IE ecosystem after 2025 to increase the proportion of renewable energy in the energy mix to 36% by 2030.

Energy efficiency improvement

Improve the energy efficiency of energy generating facilities for IEB by 5% (on top of existing level of 90%) by 2030 through technical upgrade and optimisation of operation strategies, and improvements of the core technology of the Serlink Smart Energy Management Platform, etc.

Natural gas decarbonisation

In the short term, operating areas with high gas utilisation rate will be seletced to establish CCUS pilot project by 2025, followed by gradually deploying CCUS technology in the energy generating facilities of IEB to offset 5% of carbon emissions from natural gas annually.









Energy structure adjustments



Green Office

ENN Energy builds green office through organising energy conservation practices in self-owned office buildings, green travel and green meetings. We also sets target to upgrade and replace existing administrative vehicles in respond to the national strategy of vehicles electrification, so as to implement green travel. ENN Energy take actions to incorporate carbon neutrality into our corporate activities, including organising carbon neutral shareholder meetings.



Year 2025



Energy consumption per unit area of office buildings will drop by 10%

50% of self-owned office vehicles will be replaced with new energy vehicles



Energy conservation in office buildings

ENN Energy currently owns 101 office buildings with a usable rooftop area of 34,216 m², providing huge space for installing distributed photovoltaics. Meanwhile, existing lighting facilities in the office can be replaced by energy-saving LED lighting, and the heating and cooling systems also have room to be optimised and upgraded.

We have formulated decarbonisation plan for office buildings and taken actions related to air conditioning, lighting, renewable energy use, energysaving management, paperless office, and building standards management to achieve green and low-carbon office transformation. Taking energy-saving upgrading in Langfang headquarters as a demonstration, we will further promote building energy-saving concepts and services.

Our action plans

Office lighting

All new office buildings will use LED lighting while existing buildings will be fully equipped with LED lighting within 3 years. It is estimated that 5.081 LED light bulbs are needed to be installed, after which about 2,110,170 kWh of electricity can be saved annually, and 1,287.41 ton of CO₂ emissions will be reduced³.

Air-conditioning equipment

Newly purchased air-conditioners should meet the first-class energy efficiency standards, and all existing air-conditioners will be changed to first-class energy efficient air-conditioners within five years.



Energy efficiency management of office buildings

By 2025, our own office buildings with an area larger than 10,000 m² will deploy energy management system, which will optimise energy supply and is expected to reduce energy consumption by 10%. For office buildings that we own or leased with an area less than 10,000 m², we aim at strengthening their energy management with a target to reduce energy consumption by 5%.

emissions accounting and reporting - Power generation facilities.

Paperless office

Promote paperless office via digitalisation, reduce unnecessary use of papers and printing.

Proportion of renewable energy use increasing

By the end of 2022, roofs, carports and open spaces of all office areas and station buildings will fully deploy distributed solar photovoltaic facilities. By 2025, solar energy generation in the offices will account for 5% of the total electricity consumption; Solar photovoltaic systems installation will be well-considered for new office buildings and factory rooftops.

Building standards

All new buildings should be constructed in accordance with the China 3 Stars Green Building Evaluation Standard, while existing buildings will be upgraded to the current energy-saving standards of public buildings within five years.

The pilot energy-saving project-ENN Energy's headquarter building in Langfang

We have launced the energy-saving renovation for our headquarter building in Langfang. After a comprehensive evaluation on the building structure, existing energy-related facilities and energy consumption needs, we have tailored a green building renovation plan to reduce energy consumption, enhance energy efficiency and incorporate the use of renewable energy. Carbon emission of the building is expected to be reduced by 50% after the renovation. The project will serve as a demonstrative project for our green building solutions.





Fluorescent lights account for 45% of the lighting facilities

Electric water heaters are on 24/7

The heat pump units are not energy-efficient



of which 55% have been

and the remaining 45%

Meanwhile, there are **11** electri

and **23** electric hand warmers in

ump and the ground-source-le water pump of the building's ground source heat pump system are not equipped with frequency conversion, which causes the phenomenon of water pump idling and "larg ow rate but small temperatu ference" and thus lead to h

ENN Energy's Langfang headquarters is located in Building A, ENN Industrial Park, Economic and Technological Development Zone, Langfang City, Hebei Province. The power consumed by the building is mainly used for lighting, office equipment, electric water heaters, cooling and heating.



Low-carbon Travel

The Ministry of Industry and Information Technology (MIIT) proposed in the Energy-saving and New Energy Vehicle Technology Roadmap 2.0 that the carbon emission of China's automobile industry would have the carbon peak ahead of the national carbon peak commitment by 2028; by 2035, the total carbon emissions will be reduced by more than 20% from the peak; new energy vehicles will gradually become the mainstream vehicle type; by 2030, the annual sales of electric and hybrid vehicles will account for 30% to 40% of total vehicle sales.

ENN Energy fully grasps the trend of vehicle electrification and promotes the application of green travel within the group, reducing the use of fossil fuels and carbon emissions by purchasing new energy vehicles and gradually phasing out existing gasoline vehicles. By 2025, we plan to replace 50% of shuttle buses for staff, shuttle buses in the parks, and patrol vehicles with new energy vehicles. We encourage the use of new energy vehicles on a priority basis within the group and actively engage in the construction of green transportation infrastructure.





Carbon-neutral practices at the annual g meeting of shareholders

The organising and running of offline meetings involve the mobili suppliers, personnel, and the use of vehicles, resulting in resource co and carbon emissions. The Ministry of Ecology and Environment of Ch the Implementation Guidelines for Carbon Neutrality in Large-scale (for Trial Implementation), which guides meeting organisers and part zero-carbon meetings. ENN Energy actively responds to the "Carb Meetings" initiative, integrates the carbon neutrality concepts into com and exchanges with stakeholders.

On May 10, 2021, ENN Energy Holdings Limited held the 2021 annu meeting of shareholders in both Langfang and Hong Kong. It was the fir neutral meeting of ENN Energy after announcing carbon neutralit 2050. China Classification Society Certification Company (CCSC) for supervision and certification.

We organised the meeting and arranged the process aiming to be green and low-carbon, and adopted paperless approach for participant communications and exchanges throughout the whole meeting. We produced publicity boards with green and environmentally friendly materials, provided knowledge and relevant training concerning carbon neutrality for the participants, and advocated green travel and preferential use of online meetings to reduce GHG emissions from the source.

An on-site GHG emis verification. We calcul the GHG emissions fr consumption of fossil caused by the transpo catering and accomm of the participants, the electricity and heat co due to the meeting, m supplies, and waste o According to the calcu the total GHG emissio the annual general m shareholders was 5.6 CO2e.



NEVs

Petrol vehicles

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Building A Low-carbon Society

realise green energy utilisation. With a low-carbon product portfolio, rich service capability of tailor-made clean energy solutions and smart energy management tools, we design low-carbon industrial parks, green factories, energy-efficient buildings and smart homes for our customers, helping all

Low-carbon Industrial **Park and Green Factory**



Low-carbon solutions for the Shanwei Industrial Park

The Shanwei Industrial Park is located in Chongzuo City, Guangxi Zhuang Autonomous Region. It has formed industrial clustering advantages in the wood processing and sisal industry, which are its pillar industries. It also contributes one-sixth of the national veneer production. The waste wood generated during the park production practices, whether dispersed by burning or directly discharged, will cause no serious pollution to the environment. The main energy demands of the park involve steam and municipal electricity, with an annual consumption of 560,000 tons and 93 million kWh, respectively. The traditional energy supply approaches of coal-fired boiler and municipal electricity fail to meet the demands of local government for low-carbon parks. Meanwhile, with above 580,000 tons of biomass available in the region every year and an average annual solar radiation up to 4531 MJ/m², the region boasts rich biomass resources and sufficient light and has the potential to build low-carbon parks.

By making full use of the local biomass, light conditions and other renewable energy endowments, ENN Energy has established a biomass cogeneration energy supply system for the industrial park and leveraged steel-structured roofs of the factory in the park with an area of 200,000 m³ in total to support the construction of distributed solar photovoltaic facilities. Moreover, the intelligent energy management system is applied to dynamically advance the operational efficiency of energy equipment and the energy supply strategy, thus improving the park energy efficiency. In addition, the remaining renewable energy power in the industrial park can be connected to the power grid in exchange for carbon credits, or participate in the verification of carbon emission rights to form carbon assets, and obtain carbon emission reduction benefits through carbon trading.

In addition to ensuring sufficient energy supply for the park, it is expected that 169,000 tons of CO₂ emissions can be reduced annually, with carbon emissions decreased by 90% compared with traditional energy provision.



Dalian CBAK Power Battery Co., Ltd: One-stop Energy Service Model

Dalian CBAK Power Battery Co., Ltd is a key high-tech project introduced by Dalian City. The preceding factory has seen 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 of the enterprise.

To cater the diversified needs of customers. ENN Energy provided a one-stop energy solution to the customer.







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 lowcarbon industrial parks developed for customers will increase to 200 respectively.





Energy has, through a series of onestop energy services such as electricity distribution and sales on-demand, smart energy use management, bill energy, and power outsourcing, intending to save cost, conserve energy and educe consumption for building green factories for customers.

Green Household

ENN Energy introduces smart and low-carbon value added products & services of eco-partners to provide emissions reduction solutions for its residential customers. Long Range Radio (LoRa) and Big Data Centre Platform are the smart systems that can accurately predict residential customers' energy needs and enhance interactions with customers, so as to provide them with all-rounded smart, low-carbon and safe products and services in a targeted manner, and help them create a low-carbon living environment.



Smart services

With the advancement of digitalisation and intelligence and the raising of low-carbon awareness of individuals, smart and convenient energy use has been the demand to enhance life quality. By virtue of LoRa technology, we ensure IoT connectivity and remote control of devices that safeguard the safety of natural gas use, including household natural gas use devices, safety products, gas meters, self-closing valves, and alarms, so as to provide smart home experiences for household users.

We also provide household users with bill analysis and a set of energysaving suggestions suitable for their lifestyle through in-depth data analysis and data mining based on household energy consumption status. We are committed to develop a smart adjustment for indoor environment, through which users can intelligently achieve various household management scenarios, such as real-time indoor temperature and humidity and other data monitor, and online indoor environment adjustment by using smartphone terminal. Consequently, residential users can create a green and low-carbon household while making their lives more comfortable and convenient.



Low-carbon Service

In addition to clean heating and smart home services, we also provide household users with low-carbon products such as green household appliances and green building materials to create a low-carbon lifestyle.

ENN Energy researches the product end and carries out carbon footprint analysis. In 2020, ENN Nanjing Intelligent Technology Co., an affiliate of ENN Energy, completed a carbon footprint certification process, which calculated the carbon emissions per unit of natural gas stove (JZT-M835G), and determined that each unit processed equated to 63.14 kg CO₂e. Through carbon footprint analysis, we made a detailed calculation of greenhouse gas emissions throughout the process of product life cycle, including sourcing, composition and quantity of greenhouse gases.

Identifying product carbon footprint is a key step in ENN Energy's value added business in greenhouse gas emission control. It helps us fully understand the impact of products on the environment and thus take feasible measures to reduce carbon emissions in supply chain. We provide consumers with information on product carbon footprint through carbon footprint analysis, so that consumers can have a guantitative understanding of the environmental impact of processed products, and opt for low-carbon consumption in decision making. In the future, we plan to continuously expand types of products covered by the product carbon footprint assessment system, including green building materials, so as to meet the market demand for low-carbon products.

Safety Services

ENN Energy attaches great importance to the issue of methane leakage and emissions at the user end. By providing gas safety and household safety products and services, we continue to carry out technical upgrade on gas transmission, distribution and storage processes, to strengthen pipeline safety inspection and maintenance, implement and upgrade the Boil-off gas (BOG) recovery, all in an effort to reduce the methane release at the user end.

Dynamic and static seals at valve, pump and flange connections are the main source of unorganised emissions. Whenever there are valves, there will be static seals (gland flange) and dynamic seals (valve stem packing seal), hence a risk of medium leakage to the environment. In operational practice, we install low emission valves for users and strictly implement safety inspection to effectively reduce methane emissions while ensuring the safety of gas consumption at the user end.

In addition to the inspection of potential hazards, our products can monitor and alert customers once leakage is detected. Moreover, we provide comprehensive security products, facility maintenance services, etc., in an effort to ensure the safety of household users and indirectly reduce fugitive emissions of methane.

Green Building

Carbon emission reduction in the construction field has become a crucial task for China's endeavour to achieve the goal of carbon emission peak and carbon neutrality. National and local standards and specifications have put forward mandatory requirements for water, material and energy conservation in the construction field, which create development opportunities for buildings energy conservation upgrades and energy management.

With the technology and customer side service management experience accumulated in IEB, ENN Energy can provide low-carbon design solutions for new buildings. Our three major types of customers are green villages, lowcarbon buildings and low-carbon building clusters. We provide rooftop solars, energy facility management, energy storage and charging services, heating installation and other services according to their different needs.

Our Service Model for Building Energy Saving:

Existing Buildings

With more comprehensive building energy-saving standards, buildings completed in the past 30 years are becoming more incompatible with current standards. Against the backdrop of carbon peak and carbon neutrality, we have seen great demands in the demand-side carbon emission reduction and low-carbon energy usage. ENN Energy improves its service capacity by means of digital intelligence, and applies the simulation platform for energy and carbon assessment, with a focus on existing energy-intensive buildings such as hotels, shopping malls and offices in urban areas. Based on the assessment results, the simulation platform will also be applied to produce the low carbon upgrading solution for buildings, according to which we will work with our eco-partners to jointly complete the green transformation of buildings.

After the transformation project delivery, we will continue to serve customers on low-carbon upgrading via entrusted operation, during which the smart energy management system is adopted for energy efficiency analysis, load projections, operation strategy optimisation, carbon emission monitoring, intelligent allocation and other functions for smart operation, so as to minimise the low-efficiency extra emissions during the system operation process.

New Buildings

ENN Energy conducts low-carbon designs and plannings for new buildings based on the concept of its IE solutions. Benchmarking with the national and local standards, we will decide the benchmark of energy consumption volume, the use of renewable energy and smart system adoption etc. for the buildings. Then, we will strictly govern the whole process from raw materials purchasing, construction and operation of the buildings.









Background

Energy-saving and carbon emission reduction solutions for the Mangrove Tree Resort World in Qingdao

Mangrove Tree Resort World, located in Huangdao District, Qingdao City, Shandong Province, is the largest seaside resort complex in northern China. It was completed and put into operation in 2017, with a planned construction area of 770,000 m² and more than 4,000 guest rooms. At present, about 178,000 m² and 1,803 guest rooms are open for business. With three boiler rooms, seven heat exchange /cooling pump rooms, two refrigeration stations and two domestic hot water pump rooms, the supply of electricity, hot/cold water, and steam are required throughout the year. In 2021, ENN Energy signed an agreement with the owner to engage in entrusted operation and maintenance (contracted energy management) by providing cooling, heating (including steam) and electricity supply for the hotel as well as IE service.

Based on the actual energy demand of Mangrove Tree Resort World, we have carried out an overall diagnosis and evaluation on its energy consumption, energy supply-side performance, use of control system, monthly energy consumption throughout the year, and put forward the utilisation of renewable energy and residual energy, optimisation and transformation of energy station process system, and intelligent upgrading of the control system, all as part of the Energy Saving and Carbon Emission Reduction transformation schemes.

23

Status analysis

Emission reduction actions



In view of the current energy status of Mangrove Tree Resort World, ENN Energy has helped improve its energy use efficiency, reduced energy consumption and carbon emissions with a three-pronged approach, which targeted respectively at renewable energy and residual energy utilisation, energy station system optimisation and transformation, as well as intelligent upgrading of the control system.

Renewable energy and residual energy utilisation

Energy savers for gas-heated hot water and steam boilers are installed to recover steam and residual heat, which can be used for heating up household-use water and reducing flue gas emission temperature (to 50°C); air source heat pumps are added to recover residual heat in laundry space, in order to partially heat up household-use water and thus reduce gas consumption.

Process system optimisation

Frequency converters for the chilled water pump and cooling water pump are installed, and the constant flow operation is changed to variable flow operation so that the water pump can automatically adjust the operating speed based on the user load, and thus reducing the transmission power consumption.

Intelligent upgrading of control system

The intelligent group control system for equipment, which will automatically adjust and optimise the operation strategy based on the user load is implemented to ensure that the system operates in a high-efficiency interval; the climate compensation is added, which will adjust the water supply temperature based on the climate forecasting, and hence improve the energy efficiency of the system.



Topology Structure of Energy System Network of Mangrove Tree Resort World



 Promoting Practices and Applications of Green Technology





Emission reduction achievements



Smart Energy Management of Changsha Huanghua International Airport

Changsha Huanghua International Airport (CHIA) is a level 4F civil international airport, with a total construction area of 212,000 m². It has two terminals and corresponding supporting energy consumption facilities, with an annual throughput of 33 million passengers. ENN Energy adopted a model of entrusted operation of energy facilities + smart management of energy terminals, and built a smart energy management platform to help the airport carry out energy-saving upgrading of traditional air conditioning and lighting facilities. We also provided services such as multi-energy complementarity, coordinated optimisation of energy equipment and energy-saving management, based on the demand for electricity, gas, cooling, heating and hot water in the airport, so as to realise smart energy management in a comprehensive manner.

Driven by Artificial Intelligence and Big Data and backed by Renewable Energy and Digital Technology, the Smart Energy Management Platform of CHIA carries out real-time and visualised monitoring and management of energy consumption data, energy facility network and energy services involved in the whole process. Through the smart management platform, the intelligent distribution of electricity, gas, cooling, heating and other energy loads, as well as intelligent control of energy supply equipment can be realised according to the seasonal energy consumption characteristics of the airport, and thus control the energy supply equipment in an intelligent manner. On the smart management platform, flights, passengers, weather and other information and data can be integrated and analysed to achieve coordination with the energy flow, and ultimately realise the accurate matching, refined management and intelligent scheduling of energy supply and demand, and thus improve the comprehensive energy utilisation and upgrade the passenger experience.

G Status analysis



Upgrading of the airconditioning system

By integrating temperature and humidity monitoring, the automatic control of the air conditioning system is improved. The control accuracy is also upgraded with a high level of automatic operation and coordination with the information on passenger flow, thus avoiding supply shortage and supply surplus. It can also realise energy conservation while ensuring a sufficient energy supply.

Refined energy management

With the smart energy management platform, the energy supply and consumption of electricity, water, gas and cooling and heating are monitored and managed in a centralised manner, in order to conduct statistical energy management, efficient and intelligent operation, formulate KPI indicators, provide energy–saving strategies and energy–saving basis, implement energy–saving assessment, and ultimately realise systematic energy conservation.

Coordinated optimisation of energy stations

Emission reduction actions

Based on the energy consumption analysis of the smart energy management platform, the load distribution and energy supply combination between energy stations are scientifically implemented in the consideration of the overall energy supply cost.

Upgrading of lighting system

High energy-consuming lamps are replaced by LED energy-saving lamps and a smart lighting system is built to adjust the illuminance based on the flight information, thus realising refined lighting management and reducing the lighting power consumption.









 Promoting Practices and Applications of Green Technology





Emission reduction achievements

aving

5,542,000 kWh

aving

1,963,000 m³

of natural gas

reduce the total CO₂ emissions by

7,625.6 tons

Promoting Practices and Applications of Green Technology

therm nergy Hydrogen Biomass uefaction an ENN # □ (H2)

ENN Energy carries scientific and technological innovation for technological empowerment, inputs continuous efforts in value-added service approaches in diverse forms, and unleashes the potential of IEB to create value for clients. In the future, we will continue to follow the latest progress of all green technologies and join hands with partners both inside and outside the industry to conduct joint specialised technology R&D and layout, in combination with our business model, contributing to scientific and technological development for China to achieve the carbon peak and neutrality goals.

Biomass Liquefaction and Gasification

ENN Energy attaches great importance to the development of zerocarbon biomass energy and continues to develop rapid pyrolysis technology and equipment to produce biogas, bio-liquid fuel and biochar from agricultural and forestry waste through a rapid thermal cracking process at high temperature. With low tar content and high calorific value of gas, and a comprehensive efficiency of up to 80%, ENN Energy's biomass pyrolysis technology effectively realises the co-production of biomass gas, biochar and biofuel and can be widely applied in a variety of scenarios such as trigeneration in parks, furnace gas supply, and zero-carbon plants. The technology has obtained a total of 12 authorised patents and has been successfully selected in the Green Technology Promotion Catalogue (2020) issued by the National Development and Reform Commission.



lb. Case

Demonstration project of biomass fast pyrolysis in Mudanjiang

ENN Energy has built 50,000 tons/year biomass rapid thermal cracking units, two 20 tones/hour biogas and liquid dual-purpose steam boilers and 500m³ bio-liquid fuel storage supply systems with peak regulation in the Economic and Technological Development Zone, Mudanjiang City, Heilongjiang Province. The biogas and part of the bio-liquid fuel produced by the project can be transformed into steam, so as to meet the gas demand of customers in the zone, and the remaining bio-liquid fuel is sold to the neighbouring energy-consuming customers. The annual energy supply of the project is equivalent to 25,800 tons of standard coal, which is expected to reduce 67,300 tons of CO₂. The procurement of biomass raw materials from farmers brings them an annual income increase of RMB 20 million, realising the coordinated development of environmental and economic benefits.



The biomass fast pyrolysis device in Mudanjiang



Case



Biomass pyrolysis hydrogen production process

Coke is used as a reductant in the traditional metallurgical industry, which causes a lot of pollution and carbon emissions, so energy structure transformation is an urgency for the industry. Using hydrogen to substitute coke as a reducing agent is an effective way to achieve green, low-carbon and high-quality development for the metallurgical industry at present, but it is constrained by the source and price of green hydrogen. Through years of exploration and continuous optimisation of biomass pyrolysis hydrogen production process, ENN Energy aims to control the production cost of hydrogen-rich syngas to the range between 0.95 and 1.5 RMB/m³, with effective gas content of more than 90% and hydrogen up to 66%. The technique enables ratio adjustment of each product according to different needs to effectively meet the demand of hydrogen-rich ironmaking.

The hydrogen-rich gas produced by the hightemperature thermal cracking of biomass can replace coke for "reduction ironmaking using the hydrogen in a shaft furnace". As a result, each ton of steel smelted is expected to replace 321kg of coke, which is equivalent to a reduction of 1.2 tons of CO₂ emissions. Moreover, the overall cost can be saved by more than 15% compared with reduction ironmaking using coke and hydrogen produced from water electrolysis, which can upgrade the coke-based blast furnace ironmaking process to zero-carbon hydrogen-rich gas produced from biomass as raw material, helping the industry of such and customers to improve the quality of steel, to reduce the amount of slag and to achieve the goal of green smelting.



metallurgical industry to effectively reduce emissions

Geothermal Energy

China has abundant geothermal resources spreading widely across the nation. This is an important technological route to achieve the carbon peak and neutrality goals, which can be widely used in heating and power generation, thus, playing an important role in China's future energy consumption landscape.

As a clean energy operator, ENN Energy has incorporated the research and utilisation of geothermal technology into technological planning. We are actively applying ground source heat pump technology in public buildings such as ENN Science and Technology Park, Langfang Grand Theatre, and Tinghu Hospital. In order to adapt to building densification, we have expanded the geothermal utilisation to the mid-deep layers and conducted the R&D and application of underground heat exchange technology in the middle-deep layer. At the same time, we are conducting the R&D and demonstration of the enhanced hot dry rock technology based on the ENN Energy Research Institute, both of which have yielded milestone achievements. These achievements can contribute to energy saving and emission reduction while laying the foundation for ENN Energy to fully enter the new business field under the carbon peak and neutrality goals.

Mid-deep Underground heat exchange technology

Enhanced HDR technology



Mid-deep underground heat exchange demonstration project



54





Energy Storage

The problem faced by existing power system is that even with the large-scale installation of wind power, solar and other renewable energy generation equipment, the dramatically climbing electric load demand from demand-side can hardly be met immediately due to the intermittence nature of renewable sources. The penetration rate keeps increasing with its volatility posing a huge challenge to the security of the grid power supply. In addition, the utilisation rate of the existing power system, with ultra-high voltage (UHV) as the backbone, is less than 30%, witnessing a limited transmission capacity and an inadequate power supply. As a result, the existing power system pays high systematic cost for undertaking a higher proportion of new energy, further increasing the financial burden on low-carbon transformation of our community.

The promotion of a new power system with new energy and energy storage as the mainstay is the inevitable course to achieving a lowcarbon energy transition. Adopting both centralised and distributed methods can effectively solve the time difference between power supply and demand (peak modulation) and achieve a smooth supply of wind and solar power generation and other new energy output power (frequency regulation) through energy storage. The success of these efforts will be of great significance for users in the areas where electricity supply system is instable, electricity cost is high and the peak-valley tariff difference is huge.

In the future, energy storage power plants is expected to be widely deployed as the infrastructure of a new power system and will become scarce assets with financial attributes widely distributed in ENN Energy adopts a user-centred approach for the strategic layout of energy storage in the IEB and takes energy storage technology routes with advantages of industrial synergies as the main development direction, while pursuing alignment with new power systems. In the short and medium term, we keep the attention focused on the load storage link in the whole system of source, network, load, storage, and tap sufficient load storage resources. In the long term, we will build an energy Internet platform based on load and storage by relying on the digital intelligence platform of ENN Energy.



Super-fast charging anytime and anywhere E-travelling energy cloud Zero-carbon stations **Charging network** Zero-carbon data centres

Overview of energy storage application scenarios



Solar energy storage stations

Green buildings

Industry green power

"Energy cloud + Solar energy storage virtual power station"

Hydrogen

Hydrogen is carbon-free with high energy density, and is easy to be stored. Substituting hydrogen for fossil fuels can reduce the dependence on oil and gas imports. Compared with renewable electricity, hydrogen can be used flexibly across time and regions, making it an ideal energy storage medium. The development of hydrogen is beneficial to energy transition and achieve the carbon peak and neutrality goals. At the same time, it can enhance the ability to ensure an independent and efficient energy supply. According to the China Hydrogen Alliance, hydrogen will account for 5% of the energy consumption structure by 2030 and will increase to about 10% by 2050. At present, hydrogen only represents less than 1% in China's energy consumption structure, showing great potential. ENN Energy has expertise in natural gas storage, transportation, distribution, utilisation, and multi-energy integration. Our business nature and existing project pipeline can provide various business scenarios to explore, develop and utilise hydrogen.

We are exploring opportunities to develop hydrogen projects which is compatible with our existing business, evaluating the feasibility and economics of using hydrogen in IE projects, and exploring appropriate business model. Hydrogen projects which can be launched or under R&D in short term include:

Hydrogen production from on– site natural gas reforming and refuelling stations

The utilisation of hydrogen in the energy sector is still in its infancy. Compared with other zero-carbon energy sources such as solars and biomass, it requires a longer incubation period. We will continue to pay attention to any breakthrough in hydrogen technology and the progress of demonstrative projects. We will be more well-quipped for the future incorporation of hydrogen into IE business.

Sectors in industry chain	Our attention
Hydrogen production	The low cost technology of hydrogen production from water electrolysis by renewable energy (green hydrogen) Layout hydrogen production technology from CCS and CCUS (blue hydrogen)
Storage and transportation	Pipeline hydrogenation: hydrogen embrittlement mechanism and reliability of material Low-cost storage and transportation technology on land
Utilisation of Hydrogen energy	EPC technology of hydrogen refuelling station Low-cost SOFC fuel cell Micro and small hydrogen gas turbine technology and products

Insight into the progress of hydrogen energy technology







It is the common task for all of u fundamental approach to deal v

advance renewable energy in corporate GHG managemen providing clean and low-carbo other renewable energy sourand green solutions for down technology innovation. These energy in the region, facilitating

A journey of a thousand miles to the pursuit of green and low proactively, strive to achieve th our customers, the society, eco periods and beyond. We strive of a civilised ecological system.

Feedback

We welcome your views and questions on our Decarbonisation Action 2030. Please contact: Investor Relations and Sustainability Email: ir@enn.cn to cope with climate change. Green and low-carbon development, the n this crisis of mankind, has been the irreversible trend globally.

ing diversified approaches to reduce carbon emissions, vigorously anologies and low-carbon technologies, and continuously enhance apacity to give a full response to climate transition. We stand fast to nergy for customers, tapping solar, industrial waste heat, biomass and according to local conditions and providing low-carbon, zero-carbon am clients through complementary use of multi-energy sources and enhance energy efficiency and the proportion of clean and low-carbon are energy transition of the ecosystem.

gins with a single step. We should maintain strategic focus, stand fast arbon development, continue to adopt climate policies and take actions emission reduction targets set, contribute to the green development of stem partners as well as ourself during the 14th & 15th Five-Year-Plan be an important participant, contributor and leader in the establishment



