

Decarbonisation Action 2030

—— Journey to Net Zero



ENN Energy Decarbonisation Action 2030

PANORAMA

City Gas Business

Methane Emission (ME) Management ①

- Align with MGP and other international transparency standard
- Upgrade methane management system and relative measures taken
- Advance onsite methane monitoring technologies
- Cooperate with eco-partners to reduce methane emission

Energy Transportation Decarbonisation ②

- Use clean energy vehicle
- Activate effective emission reduction with intelligent system
- Advance low-carbon operation with eco-partners

Green Office ③

- Energy Conservation in Office Buildings
 - Renewable energy
 - Smart energy control
 - Lighting and air-conditioning system
 - Green Building standard
- Low-carbon travel

Integrated Energy Business (IEB)

Energy Generating Facilities for IEB ④

- Increase the proportion of renewable and zero-carbon energy used to 36% by 2030
- Improve energy generating efficiency by 5% by 2030
- Establish CCUS pilot projects for IEB around 2025, which is expected to neutralise 5% carbon emissions generated from natural gas consumption

Low-carbon Industrial Parks & Green Factories ⑤

- Help our customers build 50 green factories and 50 low-carbon industrial parks by 2025
- The number of green factories and low-carbon industrial parks we served for customers will increase to 200 respectively by 2030

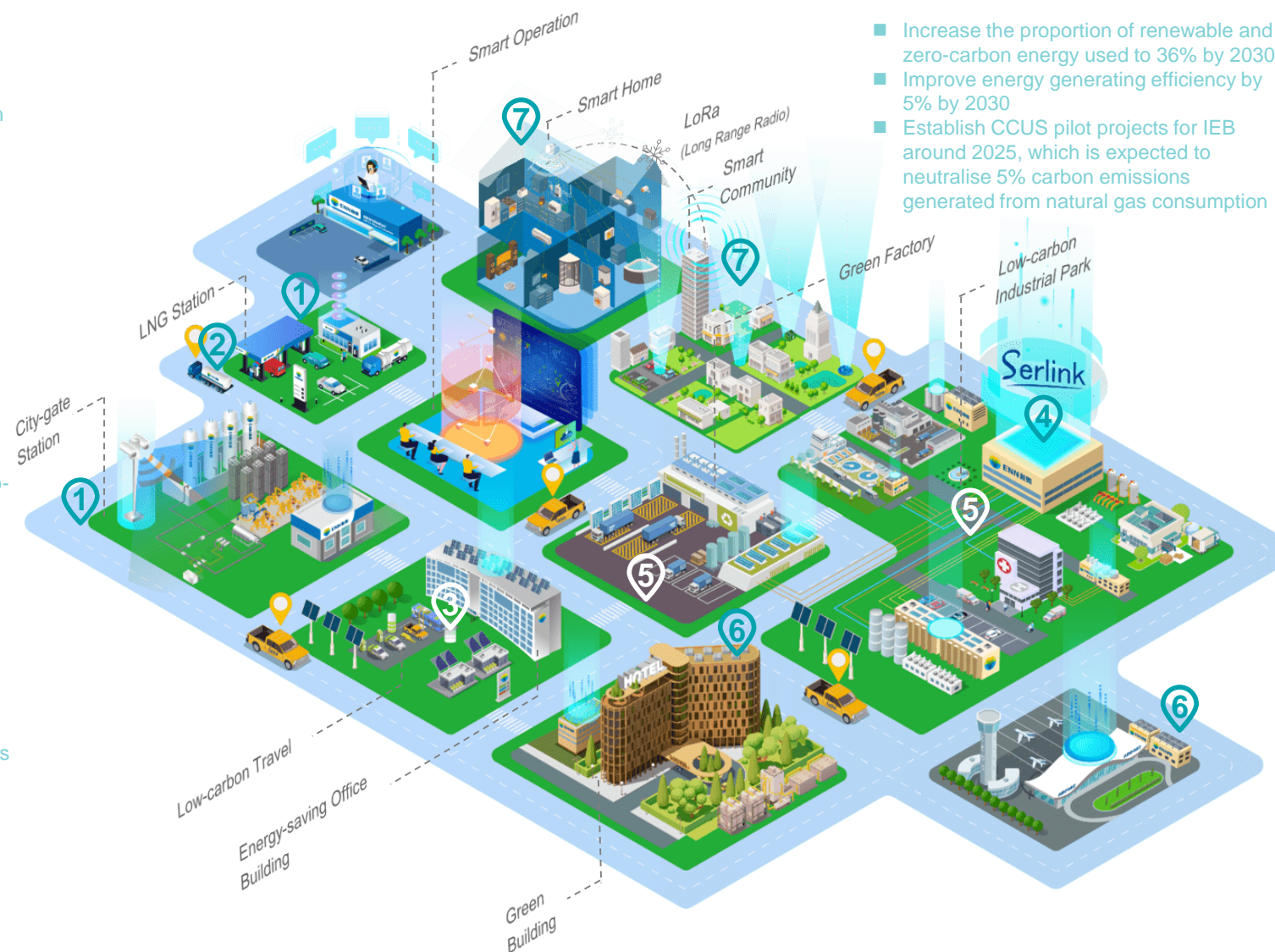
Green Buildings ⑥

- Leveraging on our IE technologies and experiences of energy management for customers, we provide green buildings solutions and building energy-saving services for architectural customers

Value Added Business

Green Households ⑦

- We identified household customers' pursuit of smart energy usage, safety and low-carbon life, and served them with digital and intelligent technologies such as LoRa, IoT, big data, etc.



Building a Low-carbon Society

ENN Energy's Net-zero Roadmap

The 2030 target covers emissions from city gas business, IEB energy generating facilities and office operations

2021

Decarbonisation Action 2030

City Gas Business Operations

Achieve a decrease of 20% by 2030 based on the GHG emission intensity¹ in 2019

ME Management

- International transparency standard
- Completed ME policy and actions
- Onsite detection technologies
- Co-reduction with eco-partner

Energy Transportation Decarbonisation

- Clean energy vehicle
- Intelligent measures improving reduction efficiency
- Co-operation with eco-partners

Green Office

- Energy conservation in office building
 - Renewable energy use
 - Smart energy management in office
 - Lighting and air-conditioning system upgrading
 - Green building standard
- Low-carbon Travel

IEB Energy Generating Facilities

Target to reduce GHG emission intensity by 48%² by 2030 compared to 2019

- Increase the proportion of renewable and zero-carbon energy used to 36% by 2030
- Improve energy generating efficiency by 5% by 2030
- Establish CCUS pilot projects for IEB around 2025, which is expected to neutralise 5% carbon emissions generated from natural gas consumption

2030

Intensive Action

Become a leading low-carbon IE eco-operator in China

Scale up renewable energy consumption

Higher net-zero energy consumption ratio

Wider use of green, carbon-negative technologies

2050



Our Target

Net-zero Emission

Self-operation coverage (scope1&2)



Significant emission reduction



Neutralise unavoidable emissions with advanced technologies and nature-based solutions



Not rely on purchased carbon offset

Serve and Progress Low-carbon and Clean Development of the Society

Low-carbon Industrial Parks and Green Factories

- Help our customers build 50 green factories and 50 low-carbon industrial parks by 2025
- The number of green factories and low-carbon industrial parks we served for customers will increase to 200 respectively by 2030

Green Buildings

- Leveraging on our IE technologies and experiences of energy management for customers, we provide green buildings solutions and building energy-saving services for architectural customers

Green Households

- We have identified household customers' pursuit of smart energy usage, safety and low-carbon life, and served them with digital and intelligent technologies such as LoRa, IoT, big data, etc.

Green Technology

- Pay attention to the development and progress of biomass, geothermal, energy storage, hydrogen energy and CCUS technology

¹ Emission Intensity = Scope 1&2 Emission from City Gas Operations & Office / Natural Gas Sales Volume

² Emission Intensity = Scope 1&2 Emission from Energy Generating Facility / Integrated Energy Sales Volume from Energy Generating Facility

01

Background



Identify Opportunities of Carbon Peak and Neutrality Trend

Our destination:
A net-zero future in 2050

Opportunities

Advanced energy structure transformation and increasing demand for low-carbon and zero-carbon energy



- As a clean energy, natural gas can be widely used in industrial production, transportation, building operation, and regional energy system upgrade, etc.
- The integrated energy business, which applies multi-technologies and energy sources to form a complementary pattern between renewable energy and gas, has become an irreversible trend under the carbon peak and neutrality trend.

Low-carbon and digitally intelligent technological transformation will accelerate service capability upgrading



- ENN Energy is experienced in applying low-carbon technologies including solar energy, biomass and geothermal, and will pay close attention to the development of hydrogen energy, energy storage and carbon-negative technology.
- We attach great importance to the development of digital intelligence, and apply big data, IoT, simulation technologies, etc. to build up digital intelligence tools for business empowerment and capabilities enhancement.

New business opportunities brought by the carbon trading market



- Emissions-intensive industries are facing rising carbon price and compliance risks. This creates opportunities for us to provide "energy + carbon" management services to our customers.
- Methane and renewable energy utilisation and other low carbon projects are potential carbon assets, which can earn incremental gains through carbon market

Decarbonised industry chain and new opportunities



- More opportunities to provide decarbonise solutions and services, thus building the low-carbon industry chain with governments and customers.

Green Action 2030

Self Decarbonisation :

We focus on scope1 and scope2 emissions generated in our city gas business and energy generating facilities of IEB, and also include carbon emissions related to office building and transportation.

Social Decarbonisation :

We pay attention to manage decarbonisation value brought to customers and the society through our integrated energy business and value-added service, which are strictly linked to our scope3 emission management.

Five Principles for Guidance

Service Strategy: All action shall serve the "Building a modern energy system and innovating clean energy" strategy

Coordinated Promotion: Governance, management, policy making, execution and KPI setting shall be coordinated with the action for further sustainable development

Comprehensive Balance: Green development of ENN Energy and social decarbonisation shall both be considered

Operability: Objectives and actions shall be formulated with full consideration of the feasibility and operability

Continuous Improvement: Given dynamic changes in external environment and internal business planning, periodically (every three years) review shall be taken

ENN Energy's
ambitions



Concept to develop
Green Action 2030



Opportunity comes to
those who are prepared



02

ENN Energy's Journey to Decarbonisation



Our Target:

Achieve a decrease of 20% by 2030 based on the GHG emission intensity in 2019

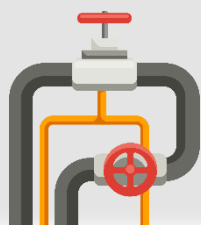
2021

2023

2025

2030

Methane Emission Control



Align with International Standard

- We officially joined MGP in 2021 to adopt best practices for methane emission source identification, data management, calculation and disclosure

- We are going to disclose methane emission data in accordance with international standard

- Continue to improve transparency of the data

Upgrade methane management system and relative measures taken

- We have initiated daily methane management, conducted ongoing methane emission reduction measures, and will gradually integrate methane control into performance evaluation and compensation management

Advance onsite methane detection technologies and improve related data quality

- Conducted pilot study in 2021 and will install all gas projects with laser methane monitoring system by 2022
- We will continuously investigate and apply advanced technologies, equipment and materials to improve data quality of methane monitoring and enhance efficiency of methane emission reduction measures

Cooperate with eco-partners to reduce methane emission

- As a founding member of China Oil and Gas Methane Alliance, ENN Energy is committed to the 2025 methane control and emissions targets, and will engage and advocate more eco-partners to work together on methane emission reduction, including technology and transparency advancement in data disclosure

Use clean energy vehicle

- Oil-fueled vehicle will not be purchased while all diesel vehicles will be cleared in 2025, thus reducing 28.3% emission generated by trade and transportation
- Clean energy such as hydrogen and biofuels will in used by 2030

Optimise emission reduction measures with intelligent system

- To shorten travel distance of vehicle, lower idling rate, reduce emission and improve operation efficiency, we will upgrade Yuntu Cloud, smart scheduling and other intelligent tools

Promote low-carbon operations with eco-partners

- We advocate LNG plant, LNG terminal and other eco-partners to install BOG devices and digital system to control carbon emissions in industrial parks
- Low-carbon transport will be core entry criterion for suppliers

Low-carbon Trade and Transportation



Decarbonisation Actions of City Gas Business

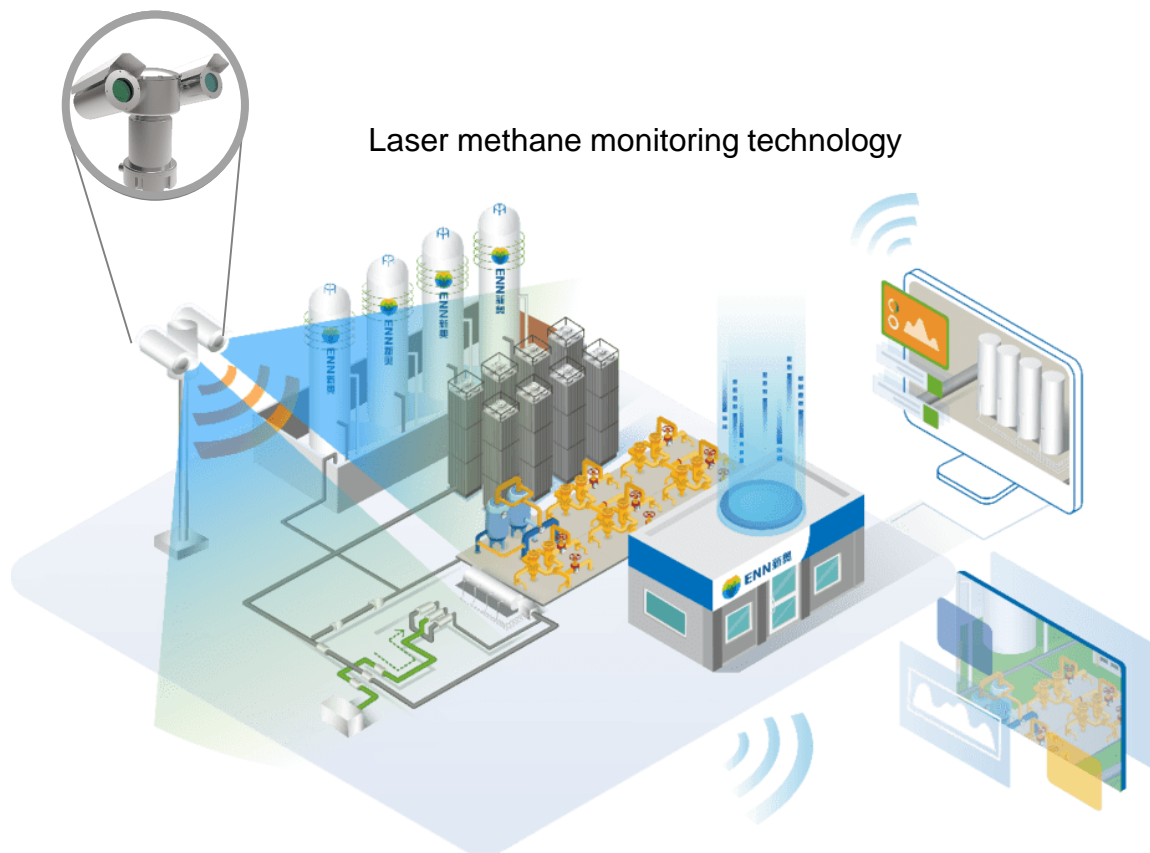
Technology to advance methane detection and low-carbon trading and transportation



Case: The laser methane emission monitoring technology

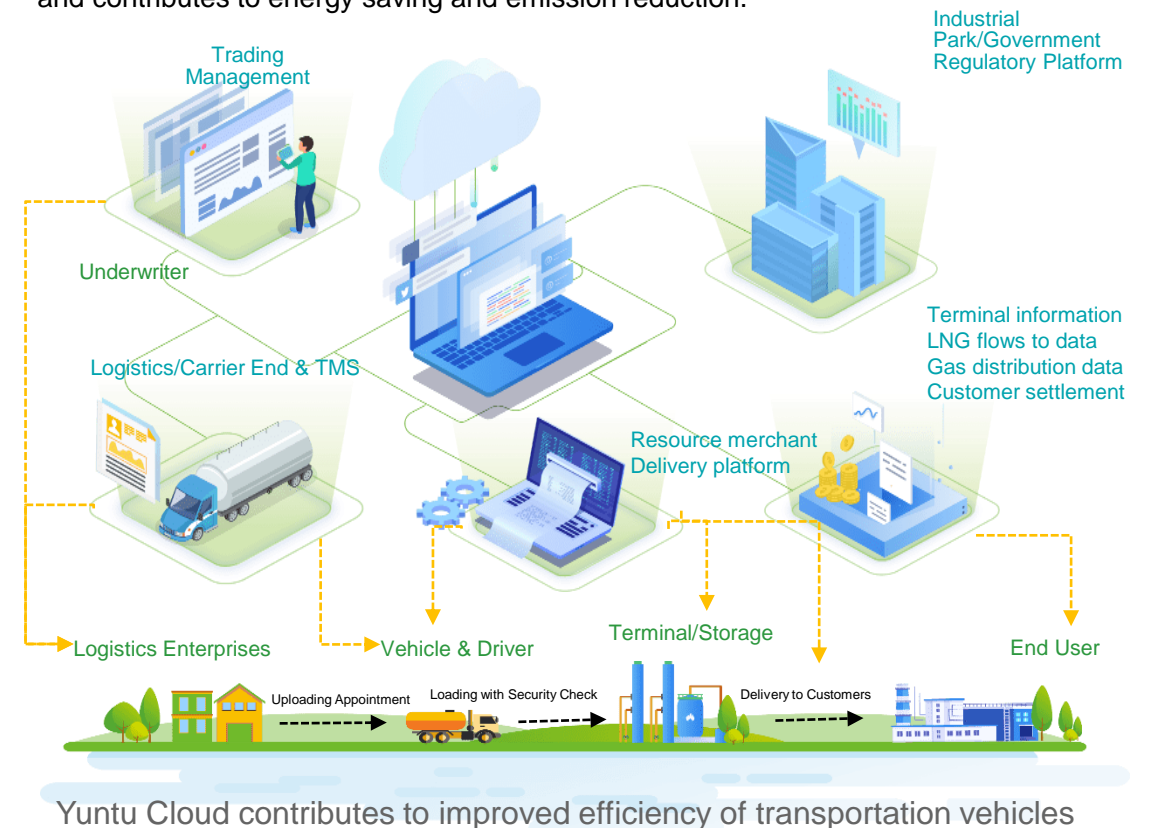
Active monitoring of methane emissions to improve data quality of methane emissions and safety management capability.

- ◆ **Precise real-time monitor:** The 24/7 integrated camera and laser head can complete station inspection within 10 minutes, covering 150 meters' detection radius with high precision as 2.5ppm.
- ◆ **Prompt risk demonstration with record:** The system can trigger risks demonstration in seconds, locate leakage point precisely, and record the entire process for further analysis.



Case: The integration between Yuntu Cloud and smart dispatching leads to emission reduction

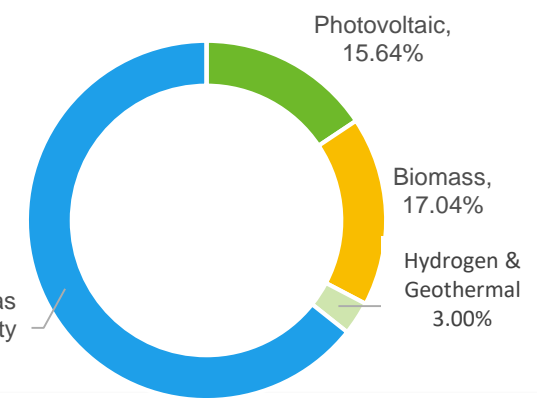
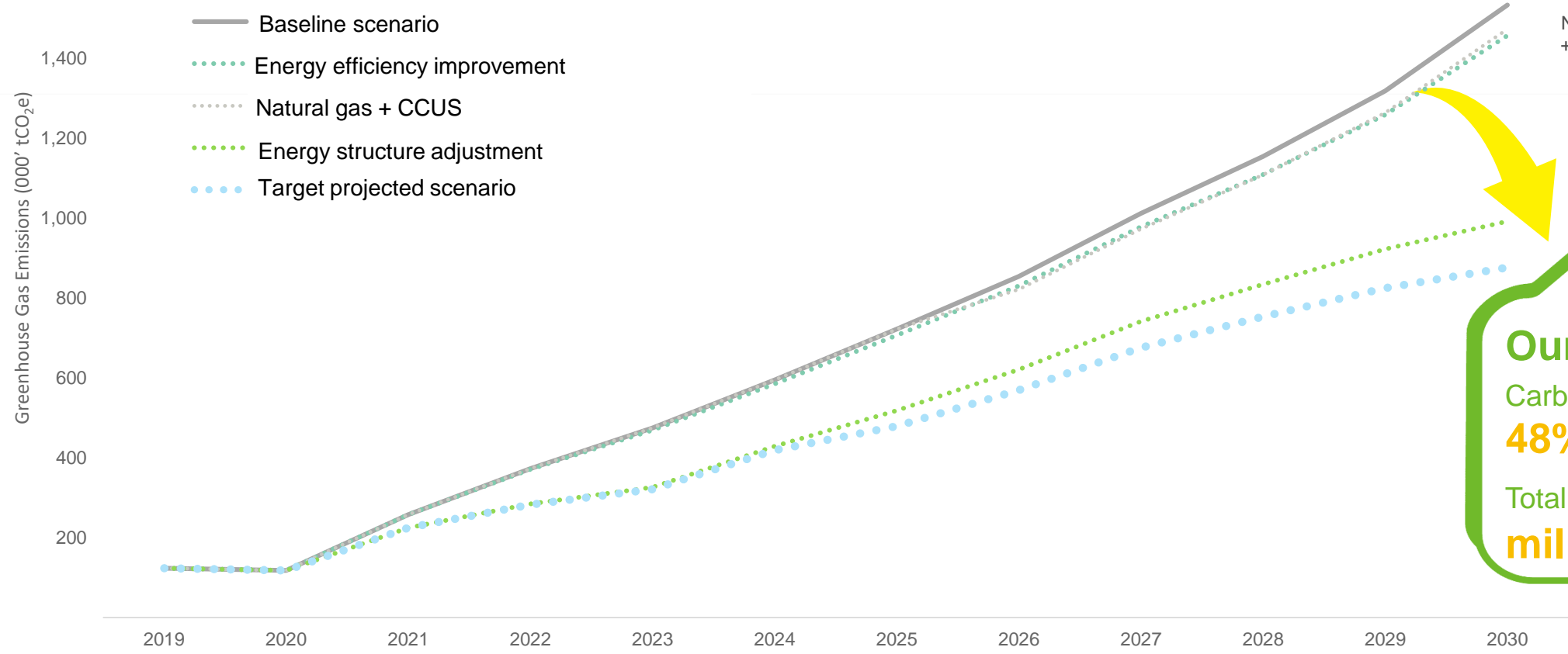
- ◆ The platform, which is tailored for energy trade and transportation, is a self-developed integration of systems such as SAP system, Greatgasnet, Yuntu Cloud System, customer big data system and IoT technology.
- ◆ Being compared to traditional mode, it provides data support and management for saving loading time, improving vehicle dispatching efficiency, reducing transporting time thus decreasing emissions. It also effectively shortens and optimises vehicle travel distance, reduces the idling rate of vehicles, improves the utilisation rate of vehicles, and contributes to energy saving and emission reduction.





Green Development Planning of IEB

Forecast of Carbon Emissions from Energy Generating Facilities of IE Projects



2030 Energy Structure
Share of renewable energy 36%

Our Target
Carbon emission intensity in 2030 to be **48%** lower than that in 2019
Total emission reductions **28.68 million** tons CO₂e

- Action 1**

Improve system efficiency by 5% by 2030 by adopting intelligent system
- Action 2**

Energy structure adjustment: Share of renewables in the energy mix in 2030 increase to 36%
- Action 3**

CCUS to offset 5% of carbon emissions from natural gas consumption each year from 2025

- Solar**

Photovoltaic installation reaching 9900 MW in 2030, contributes to **16%** of IEB energy mix
- Biomass**

Increase in annual biomass consumption from 0.5 million tons in 2021 to 3.27 million tons in 2030, which will be **17%** of IEB energy mix
- Hydrogen & Geothermal**

Introduce hydrogen energy since 2025 and increase its proportion of IEB energy mix to **3%** by 2030




Green Development Planning of IEB

Advocate energy structure tailored to clean energy and local resources to maximise emission reduction potential

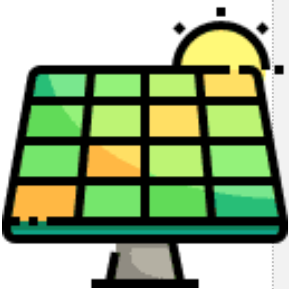
Solar

Increase Capacity through Installing Distributed Photovoltaic

- Installed capacity of current 19 projects reached 55MW
- Installed capacity will reach 400MW by the end of 2021
- Installed capacity will reach 9,900MW by the end of 2030



18
Times




Application

- ▶ Distributed Photovoltaic is widely installed
- ▶ Roofs and other vacant areas are fully used
- ▶ Improve self electricity supply with energy storage equipment
- ▶ Achieve real-time monitoring of energy dynamic and multi-energy projects complement relying on the intelligent energy management system


Biomass

Turn waste biomass resources into treasure

- About 500,000 tons of biomass used in the energy generating facilities for IEB in 2021
- It is estimated that the biomass consumption in the energy generating facilities for IEB will reach 3.27 million tons in 2030
- Based on local resource conditions, turning waste straws, wood into treasure to maximise resource utilisation
- To replace fossil energy thus achieve zero-carbon



6.5
Times




Hydrogen Geothermal

Pay attention to technological development and introduce new energy

- Follow and invest in hydrogen and geothermal energy technology for IEB
- Formally introduce hydrogen energy technology in the energy generating facilities for IEB projects in 2025
- Hydrogen and geothermal energy will account for 3% energy generating facilities for IEB projects
- Conduct in-depth research on hydrogen production technology from natural gas and hydrogen-rich gas technology from biomass

Proportion
up to 3%





Green Office

To build energy-saving office buildings and advocate low-carbon travel with our own technologies

Renewable Energy Use

- ◆ By the end of 2022, the roofs, carports and open spaces will be fully deployed with distributed photovoltaic facilities
- ◆ Photovoltaic power generation will occupy 5% of the electricity consumption
- ◆ New office buildings, plant roofs will fully consider the reservation of new photovoltaic system load



Building Standard

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



Energy Conservation

- ◆ Office lighting: All new office will use LED lamps while existing buildings will be fully equipped with LED lamps within 3 years
- ◆ Air-conditioning: all existing air-conditioners will be changed to ones with first-class energy efficiency within 5 years
- ◆ Paperless office
- ◆ Energy conservation: Buildings with more than 10,000m² will apply energy management system by 2025. The targeted energy reduction rate is 10%.



Green Travel

- ◆ We encourage the use of new energy vehicles to replace fossil fueled car, By 2025, we will transform 50% of shuttle buses for staff, shuttle buses in the parks, and patrol vehicles into clean energy vehicles



Case: Pilot energy-saving project in ENN Energy's headquarters office building



Emission Reduction

Out-come

- ◆ 45% of the lighting facilities are fluorescent lamps
- ◆ Electric water heaters are running all day long
- ◆ Heat pump units consuming excessive electricity
- ◆ Demand-side energy conservation
- ◆ Improving energy efficiency
- ◆ Using renewable energy as alternatives
- ◆ Energy saved: 28, 024 kWh
- ◆ Efficiency improvement: 59,904 kWh
- ◆ Renewable energy: 187,561 kWh

Expected outcome:
Annual Energy Saved
275,489 kWh

Annual Emission Reduced
168.076t

Reduction Rate
50%



03

Building A Low-carbon Society



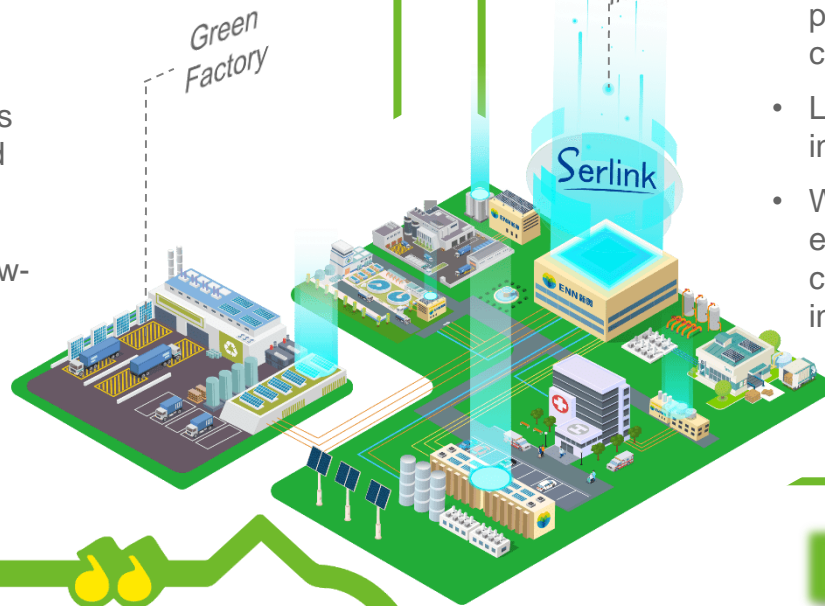


Low-carbon Industrial Park and Green Factory

Develop smart, local circumstance adaptive, energy conservative, renewable energy oriented and multi-energy complementarity smart energy system, and support government and industrial customers to achieve carbon peak and neutrality target

Industrial Customer

- Looking for index and ways to improve and optimise operations
- Lower costs, requests from government and supply chain, and operational pressure have co-motivated low-carbon transition



Government

- Want to figure out industrial parks' emission for designing carbon target
- Looking for a balance within industrial parks
- Want to mitigate carbon emission and energy consumption issues and solve industrial restructuring

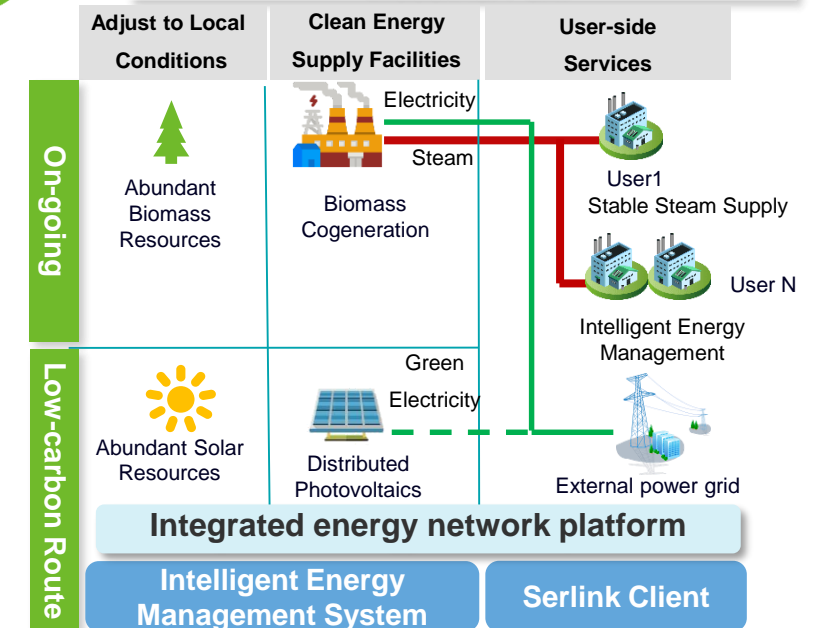
IE Service

- **Satisfy clients' multi-category energy needs** Satisfy customers' multi-energy needs and carry out energy measurement services to help users improve efficiency and reduce emission
- **Support regional low-carbon transition** Help the government develop carbon data management system to design regional IE programs that are energy efficient, low-emissions, low-investment, and low operating costs
- **Develop the IE coordination with operations and carbon trading services**

Our Target

- ❑ Help our customers 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

Case: Low-carbon solutions for the Shanxu Industrial Park



Traditional Application

Annual Needs:
Steam: 560,000 tons
Electricity: 93 million kWh
The traditional energy supply of coal-fired boiler and municipal electricity fail to meet the demands of low-carbon parks

Low-carbon Route

Renewable Energy Use: Make use of biomass, solar energy and other renewable energy endowments to build biomass energy supply system with distributed photovoltaic

Smart Energy Management: The smart energy management system can optimise the operation efficiency of equipment and energy used in industrial park

Carbon Trading Potential: Transfer renewable energy to green power, develop carbon assets and earn benefits through carbon trading

Effectiveness of Reduction

Expected emission reduction
16.8
000' tCO₂e/y
carbon emissions decreased by **90%**



Green Building Services

Building green low-carbon solutions for customers with our own building energy saving experience

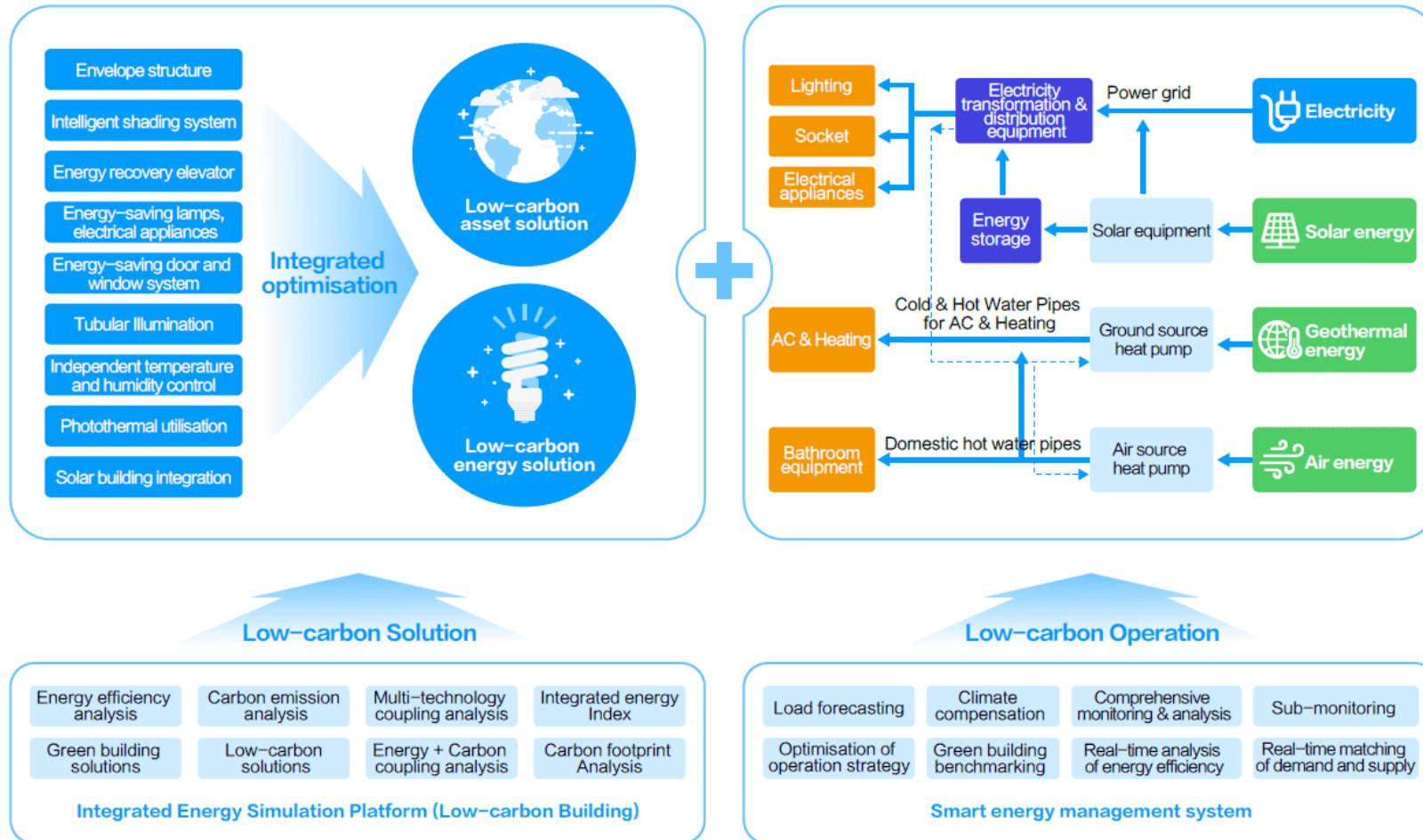
Service Mode

Building Stock

With a focus on existing energy-intensive buildings such as hotels, shopping malls and offices in urban areas

Incremental Buildings

The overall low-carbon solution will be carried out as part of the integrated energy planning



Case: Energy conservation for the Mangrove Tree Resort World in Qingdao

The Mangrove Tree Resort World is the largest seaside resort complex in northern China with a planned construction area of 770,000 m², which has 3 boiler rooms, 7 heat/cold pump rooms, 2 refrigeration stations and 2 living hot water pump rooms.

Status

- Unproductive energy management
- Incomprehensive energy system
- Inefficient equipment
- Energy waste

Actions

- Renewable and waste energy use
- Energy system upgrade
- Control system intelligent upgrade

Outcome

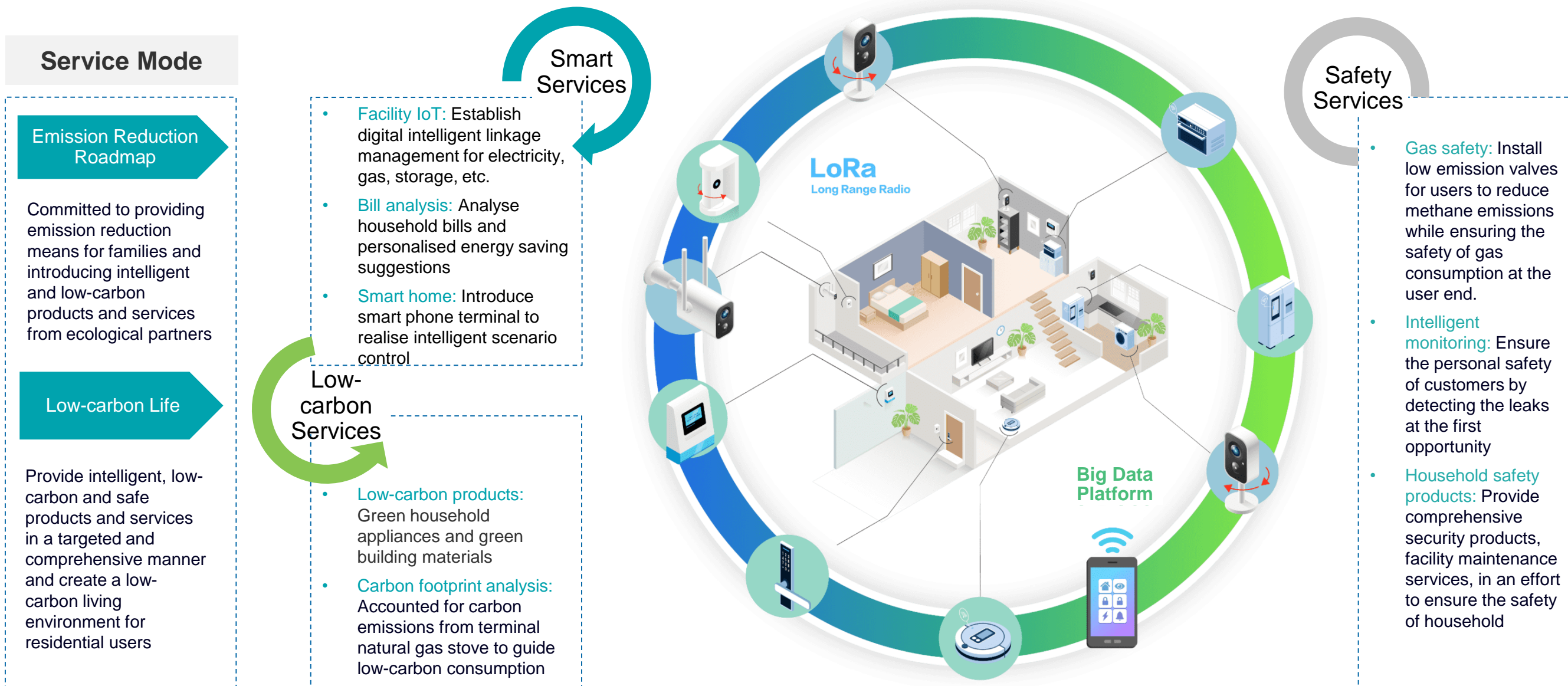
Electricity saved **693.3MWh/y**
Natural gas saved **96,000m³/y**
CO₂ reduced **601 tons**





Green Household Service

Identify residential user needs and leverage digital technologies such as Long Range Radio, IoT and big data to provide a smart, safe, and low-carbon quality life



04 ✨

Promoting Practices and Applications of Green Technology



Energy Storage, Biomass and Geothermal Energy

Better Application and Promotion to Advance A Low Carbon Pattern



Biomass Gasification and Liquefaction

- ◆ Pay attention to net-zero biomass energy development, continuously develop rapid thermolysis technology and equipment;
- ◆ Apply biomass-related technology for trigeneration, furnace gas supply and net-zero factory in industrial park;
- ◆ Integrate biomass with hydrogen production for a green development of metallurgical industry.

Biomass Fast Pyrolysis in Mudanjiang

- ◆ Built **50,000 tons/year** biomass rapid thermal cracking units
- ◆ Fully satisfy customers' needs for energy supply, which is equivalent to **25,800 tons** of standard coal
- ◆ Expected to reduce **67,300 tons of CO₂**
- ◆ Local farmers can increase their income of **RMB20million/year**



Geothermal

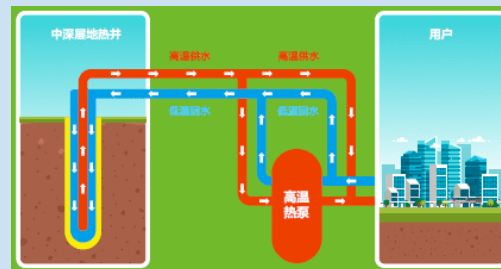
- ◆ Integrate geothermal-related technology into planning, and apply ground source heat pump technology in public buildings
- ◆ Conducted the R&D and application of underground heat exchange technology in the middle-deep layer and hot dry rock technology

Hot Dry Rock Technology

Mid-deep Underground Layer Heat Exchange Tech

Mid-deep Underground Heat Exchange Application

- ◆ A local retirement home with a total heating area of **8,100 m²**
- ◆ Reduced **137 tons** standard coal energy consumption
- ◆ Reduced **359 tons of CO₂** emission per year



Energy Storage

Start with Heat Storage

Short Term

- Prioritise northern area clean energy heating and accommodate Yangtze River basin clean energy heating
- Adopt **solid heat storage, phase change heat storage, water heat storage** and other technical routes

Advance Electricity Storage

Medium Term

- Conduct electrochemical energy storage technology.
- Develop energy storage technology for public infrastructures and introduce **sodium-ion batteries energy system** in the future.

Integration of Yuntu Cloud and Virtual Power Optical Storage Station

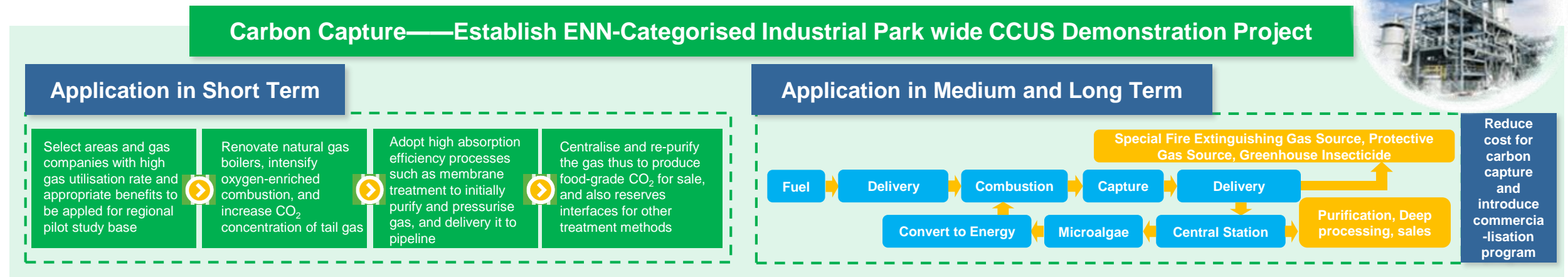
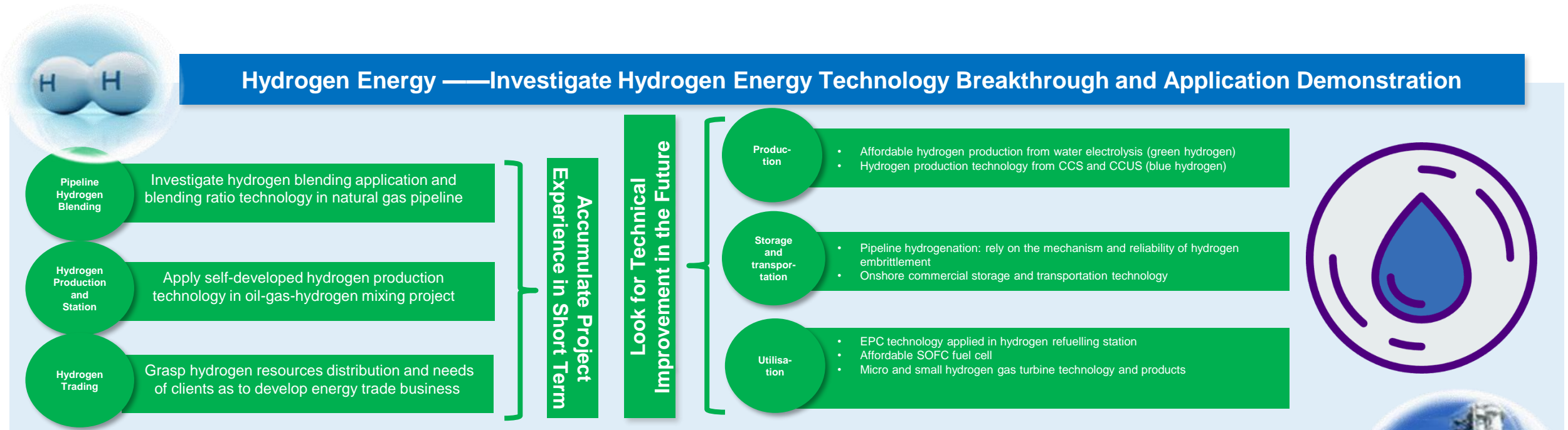
Long Term

- Achieve **cross-season peak regulation** through hydrogen storage.
- Develop the digital intelligence technique and form a resource pool to respond to the market smartly and flexibly



Hydrogen Energy and Carbon Capture

Keep Up with Trends and Explore Future Application in IEB





ENN 新奥

用我所能 善待明天

