China Telecom's Sustainable Digital Transformation towards Green and Low-carbon Goals

China Telecom Research Institute

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October 2022

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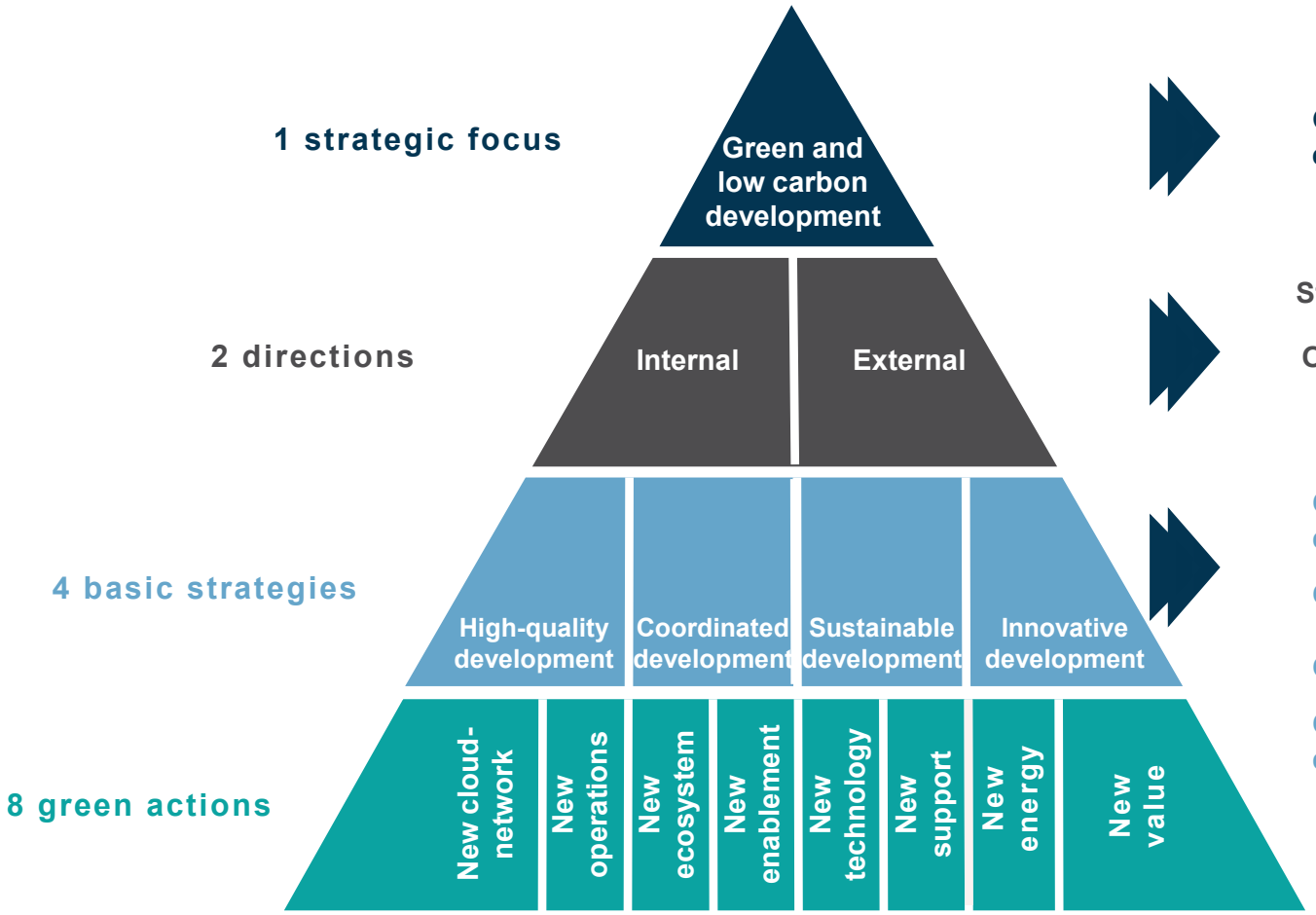
China Telecom's green and low carbon action plan (1/2)

"1 2 4 8" carbon peak and carbon neutrality model



Green and low carbon development as an important part of enterprise development strategy

Strengthening technological innovation and management upgrade

Optimizing product supply and service quality

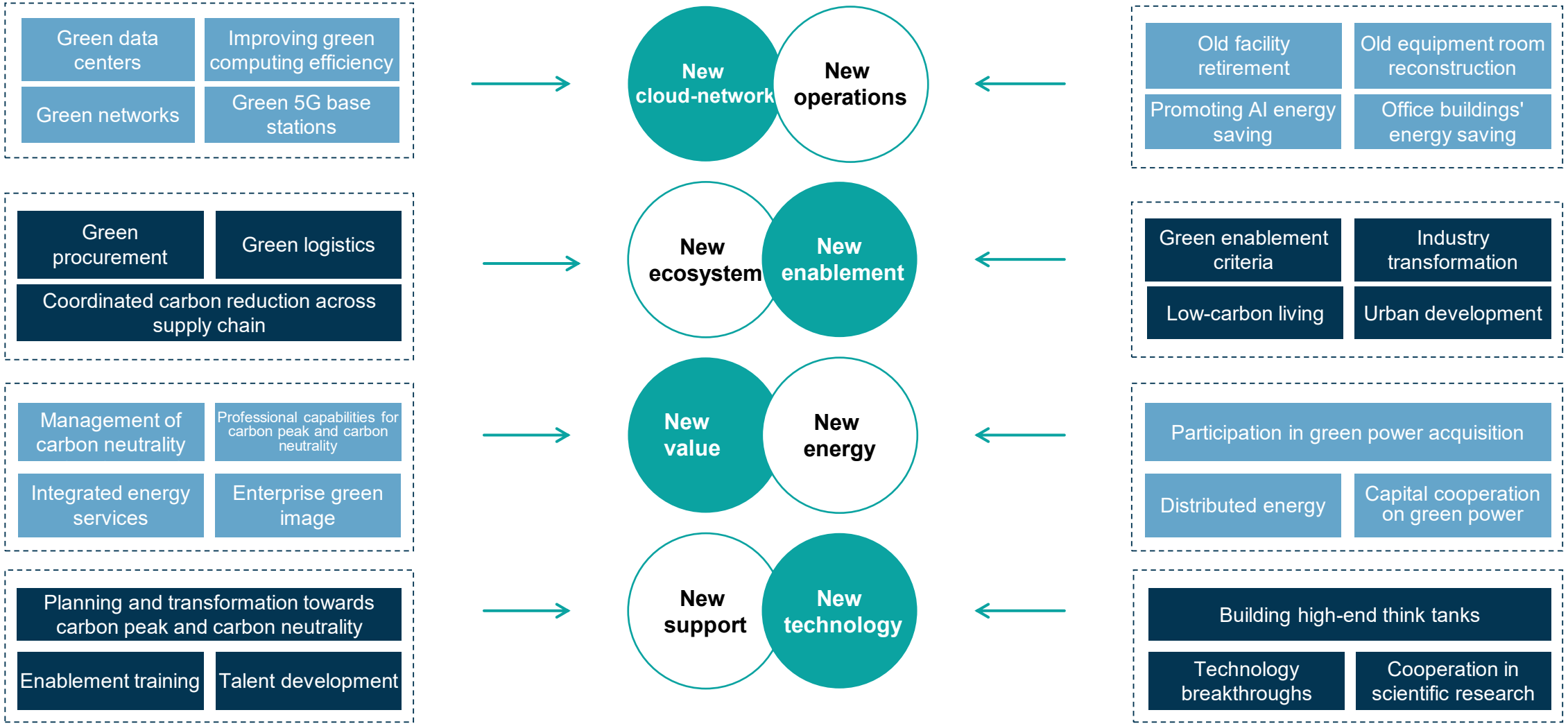
Coordinating energy saving and carbon reduction and the rapid development of 5G and IDCs

Coordinating full competition, openness, and cooperation

Coordinating technological innovation and sustainable development

Coordinating established and new practices in enterprise development

China Telecom's green and low carbon action plan (2/2)



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Energy saving and carbon reduction of 5G base stations (1/2)

Co-construction and sharing of 5G base stations

World's first full-lifecycle 5G network co-construction and sharing

850,000+ co-constructed and shared 5G base stations

CO_2 emissions down **3.7 million+** tons per year

Tech innovation

3GPP R16: Technology standards **10** Granted patents **30+**

3GPP RAN: Top carrier in project initiation **1**

Key technologies such as the **world's first** single and dual anchor points technology for smooth evolution from NSA to SA

Self-developed AI energy saving technology for base stations

Managing **1.3 million+** 5G sectors in 31 provinces

5G energy saving efficiency **up 15%+**

CO_2 emissions down **500,000+ tons** each year

Four innovation capabilities

Network-wide digital awareness	Aggregating network-wide data and processing massive amounts of information in a unified manner
Intelligent decision analysis	Scenario-based and customized energy saving strategies by site
Secure, automatic control	Dedicated security policies for hassle-free user experience
Digital operations	Automatic analysis of energy saving and automatic monitoring of energy-saving operations

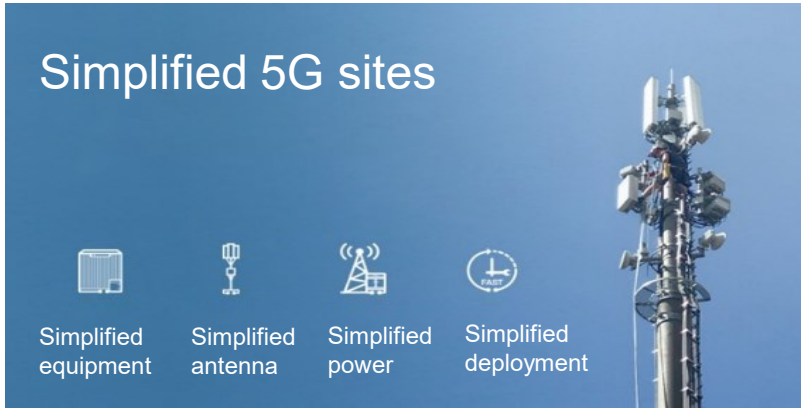
Energy saving and carbon reduction of 5G base stations (2/2)

Simplified sites & Site PV

Simplified equipment + Simplified antenna + Simplified power + Simplified deployment

Simplified sites reduce carbon emissions by **45%**

All-scenario site PV can further reduce carbon emissions by **15%+**



Simplified 5G sites

Self-developed 5G BBU vertically installed in subracks

Greatly reducing the energy consumption of equipment and air conditioners by fully using the aerodynamic principle

Average power of each 5G BBU **down about 40 W**

CO_2 emissions down nearly **3,000 tons** per year

Example of the 5G BBU vertically installed in subracks

Building green data centers (1/2)

Integrated low carbon scheme combining indirect evaporative cooling and CO_2 cooling

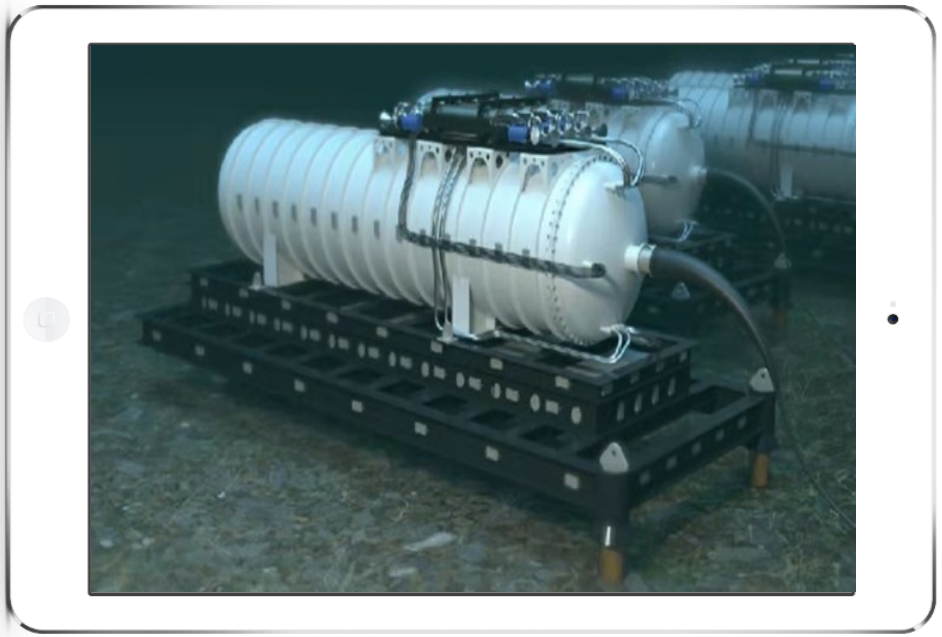
- **First** reconstruction showcase of indirect evaporative cooling and composite mechanical refrigeration in China
- **First** large-scale application of CO_2 cooling technology in China
- Data center PUE **decreased from 1.4 to 1.3**
- CO_2 emissions reduced by **2,500+ tons** per year

China Telecom Beijing's Yizhuang Cloud Computing Hub

Building green data centers (1/2)

China Telecom Hainan's underwater data center (UDC)

- Completed feasibility analysis on investment, benefits, energy saving and carbon reduction, safety, and environmental protection of the showcase project
- PUE of the prototype in the sample test **< 1.1** ①.
- Natural cooling using sea water throughout the year with almost no fresh water used
- The UDC will be used to deploy e-Surfing Cloud (Media), CDN, and cloud systems of provincial state-owned assets supervision & administration commissions.



Underwater data center prototype

① The energy consumption and environmental impact assessment tests was carried out in Zhuhai. This figure is from the Energy Efficiency Test Report on UDCs of Beijing Highlander Digital Technology issued by Tsinghua University and the Marine Ecological Environmental Impact Assessment Report of UDC Projects issued by Qingdao Huanhai Marine Engineering Research Institute.

Building a green all-optical network

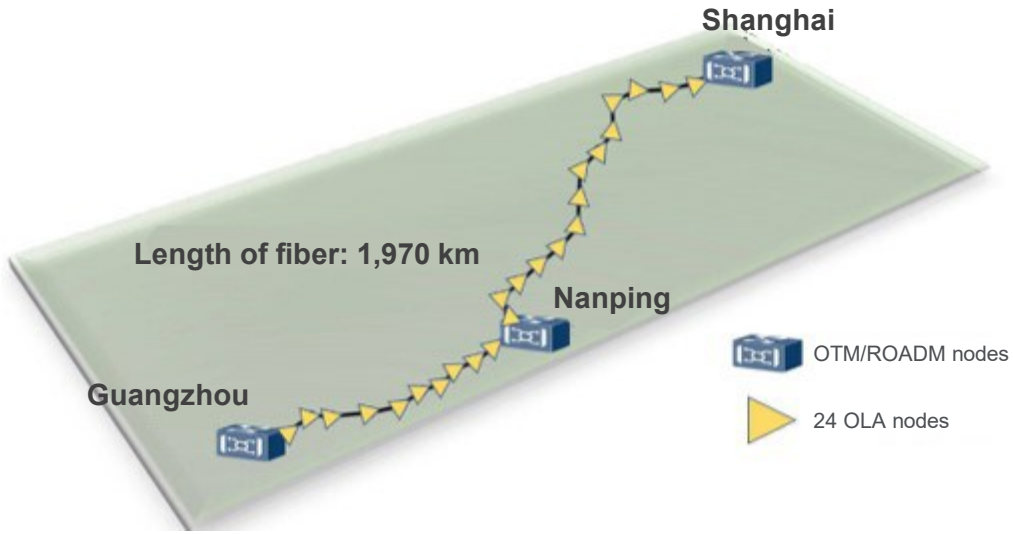
Road to All-Optical Network 2.0

The optical network has been upgraded to gigabit speed, **an industry first**. Guangxi and Shanghai are among the first gigabit provinces and cities.

The world's largest green, low-carbon ROADM network has been built with the primary and secondary backbones converged.

The all-optical switching ROADM network can reduce energy consumption by about **50%**, and facility footprint by almost **30%**.

The first to commercialize G.654E ultra-low loss optical fibers, which has enabled 400G ultra-long distance IP and transmission verification.



China’s first all-G.654E trunk line on land

Enabling green development of industries (1/2)

Facilitating the digital transformation of government

China's first integrated service platform of a provincial carbon market

China Telecom's **first** provincial project of carbon peak and carbon neutrality

The platform covers **402** supervised companies of 9 critical industries, and has allocated a total of **200 million tons** of carbon emission quotas.

In H1, **5 million+ tons** of carbon emission quotas have been traded. Trading exceeded **CNY80 million**.

On December 2, 2021, the integrated service platform of the Fujian carbon market officially went live.

Enabling green development of industries (2/2)

Conch Group

Made the factory an innovation benchmark by integrating ICT technologies, such as 5G, AI, cloud, and MEC, with the core system of "device + network + cloud + user".

Significantly improved resource utilization. Enabled Conch Group to improve quality and efficiency, and reduce energy consumption and carbon emissions. The company's emissions were reduced by nearly **1 million tons**.

Jiangsu Yonggang Group

Built a smart factory with 5G, and developed an energy management platform.

40% higher production efficiency and **20%** better energy utilization efficiency than the traditional manufacturing method, leading to a **30%+** reduction in OPEX.

Jiangsu Sunra EV

Developed Sunra X Cloud, an industrial IoT platform.

The 5G-enabled energy management use case helped Sunra save electricity costs by **10%** and energy consumption by **20%**. The annual energy costs are reduced by **CNY1 million+**.

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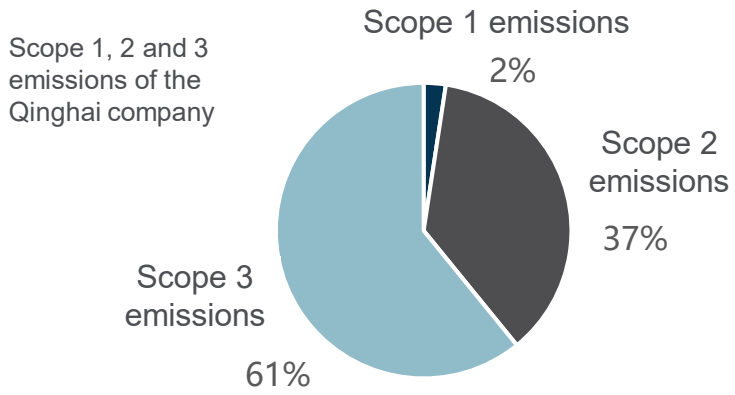
Initiative to make Qinghai branch zero carbon

Carbon emission breakdown

Total CO_2 emission in 2021: ~298,000 tons

Scope 1 + scope 2 emissions from self operation: 117,000 tons

Scope 3 emissions from the supply chain: 181,000 tons



Scope 1 emissions: Direct emissions from owned or controlled sources

Scope 2 emissions: Indirect emissions from the generation of purchased energy.

Scope 3 emissions: Other indirect emissions that occur in the value chain of the reporting company

8 key initiatives

01 Improving zero carbon management	02 Comprehensively upgrading infrastructure
05 Building a green, low carbon, intelligent network	06 Building a low carbon, high efficiency ecosystem
03 Making full use of renewable resources	04 Building zero carbon, intelligent data centers
07 Implementing nature-based solutions	08 Digitally enabling green living

Building zero carbon smart data centers

Zero carbon data centers can **intelligently manage the generation, grid, load and storage of power. Making sure all power used can be traced back to green sources**. **Data centers' PUE is lower than 1.2.**

Key initiatives of building zero carbon data centers

Choosing the right location

- Dry air. Annual average temperature: 7.6℃.
- Abundant water resources
- Easy to reach. Will become part of the zero carbon industrial park of Qinghai Province.

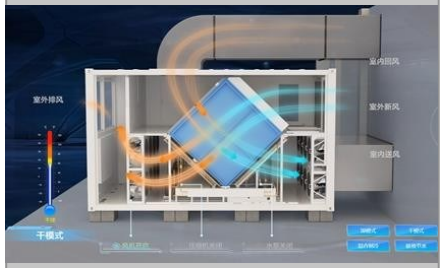
Low carbon construction

- Reducing water consumption and waste during construction by 90%.
- Recycling more to cut carbon emissions by 90%.

Adopting green energy

- Data centers powered only by clean energy.
- Deploying on our own PV panels that can produce 1% to 2% of electricity needed.
- Storing solar power for load shifting.

Implementing energy-saving technologies



- In addition to natural cooling sources, liquid cooling techniques are used, including chilled water cooling and indirect evaporation. This can save energy by up to 27%.
- Mains and high-voltage DC are converged in the power supply links, improving efficiency by 5%.
- Other technologies

Smart operation

- Digital twin makes operations visualized, manageable, and controllable.
- AI systematically optimizes energy efficiency, saving 8% to 15% energy.

Thank you!

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October 2022