Study on Integrating Digital Transformation with China's Carbon Peak and Carbon Neutrality Goals

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1. Carbon emissions and digital economy developments

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China's total carbon emissions are relatively large, but its emission intensity is decreasing.

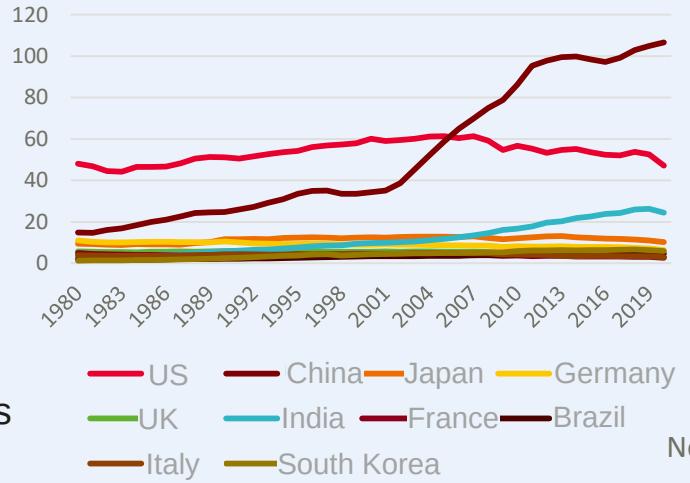
Overview: China's carbon emissions

- Total carbon emissions: Since the reform and opening up, China's economy has seen rapid growth and a corresponding rapid growth of carbon emissions. In 2020, China's carbon emissions totaled 10.67 billion tons, 7.14 times that of 1980.
- Carbon emissions per capita: From 1990 to 2019, China's carbon emissions per capita increased three-fold from 1.9 tons to 7.6 tons. In 2019, China's CO_2 emissions per capita were lower than that of Canada, the US, South Korea, Japan, the Netherlands, Belgium, and Germany, ranking 32nd in the world.

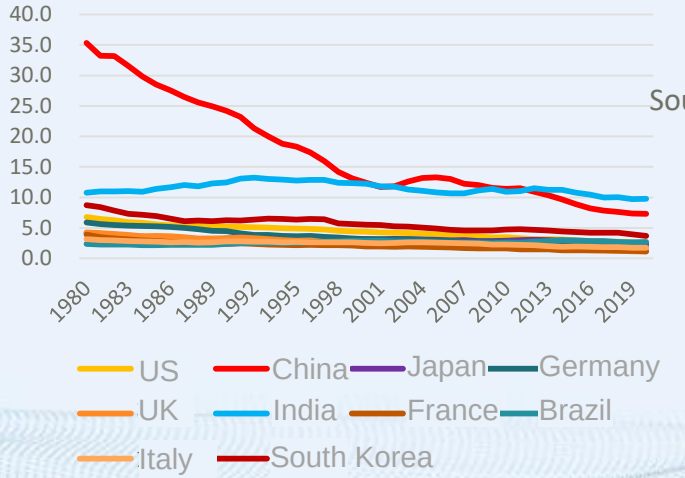
Overview: China's carbon intensity

- While China's total carbon emissions are increasing, its overall carbon intensity is trending downward, reaching 7.3 tons carbon emissions/US$10,000 of GDP in 2020, about one-fifth of that in 1980.
- Compared with the world's top 10 countries by GDP, China's carbon intensity in 1980 was about **5.2** times that of the US, **3.3** times that of India, and **4.1** times that of South Korea, but it decreased to **3.0** times, **0.7** times and **2.0** times respectively in 2020.

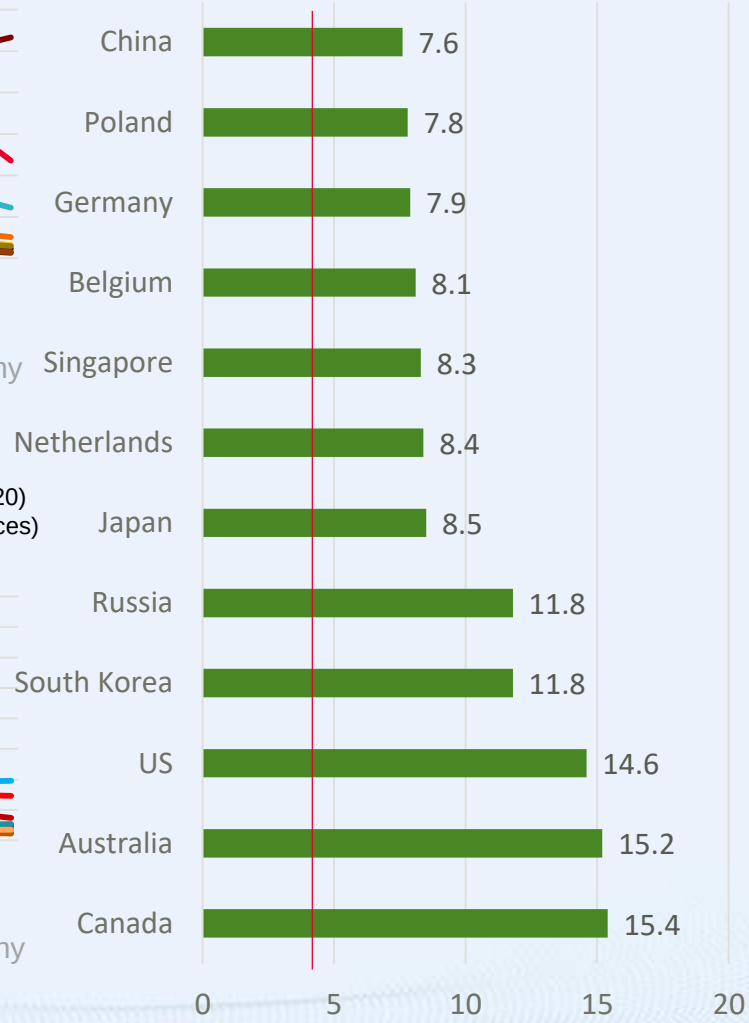
Carbon emissions of major countries worldwide (1980–2020)
Unit: 100 mn tons; source: Global Carbon Project



Carbon intensity of major countries worldwide (1980–2020)
Unit: 1 kg carbon emissions/US$10,000 of GDP (2015 prices)
Source: Global Carbon Project and the World Bank



World average: 4.5 tons/person



CO_2 emissions per capita by country in 2019
Source: World Bank

1. Carbon emissions and digital economy developments

China's dual carbon goals and measures to achieve these goals

China's dual carbon goals

2030: Carbon emission peak

2060: Carbon neutrality

Measures

Achieving carbon reduction through energy transition

- 2025: Non-fossil energy will account for 20% of total energy consumption.
- 2030: Non-fossil energy will account for 25% of total energy consumption.
- 2060: Non-fossil energy will account for 80%+ of total energy consumption.

Carbon reduction through energy conservation and efficiency improvement

- 2025: The energy efficiency of key industries will be significantly improved.
- 2030: The energy efficiency of key energy-intensive industries will be among the highest in the world.
- 2060: China's overall energy efficiency will be among the highest in the world.

Promoting carbon reduction efforts through the measurement systems

- Establishing a standard measurement system for carbon peak and carbon neutrality.
- Improving the energy statistics collection and measurement systems of key industries like electric power, steel, and construction.
- Strengthening CO2 emissions accounting.
- Establishing a monitoring and accounting system for ecosystem carbon sinks.

Formulating laws and policies on taxes, prices, etc. to guide and promote energy conservation and carbon reduction efforts throughout society.

1. Carbon emissions and digital economy developments

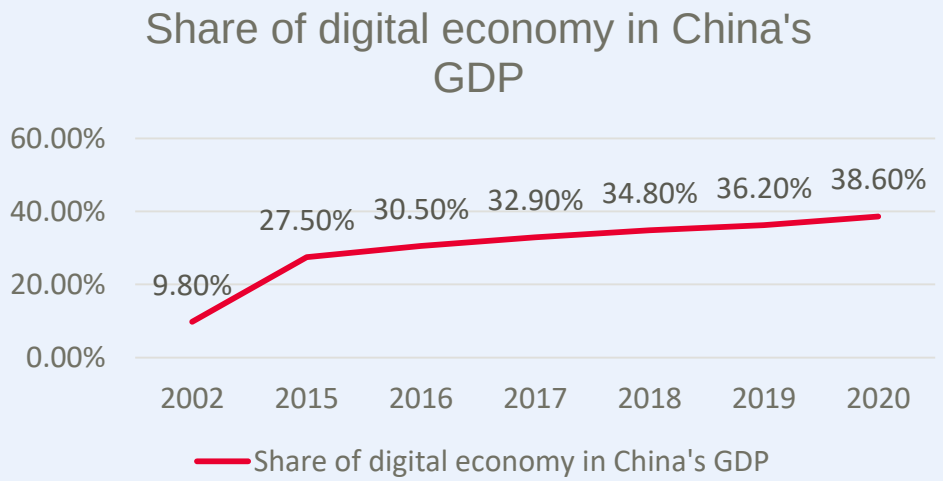
Digital economy: A new driver for China's economic growth

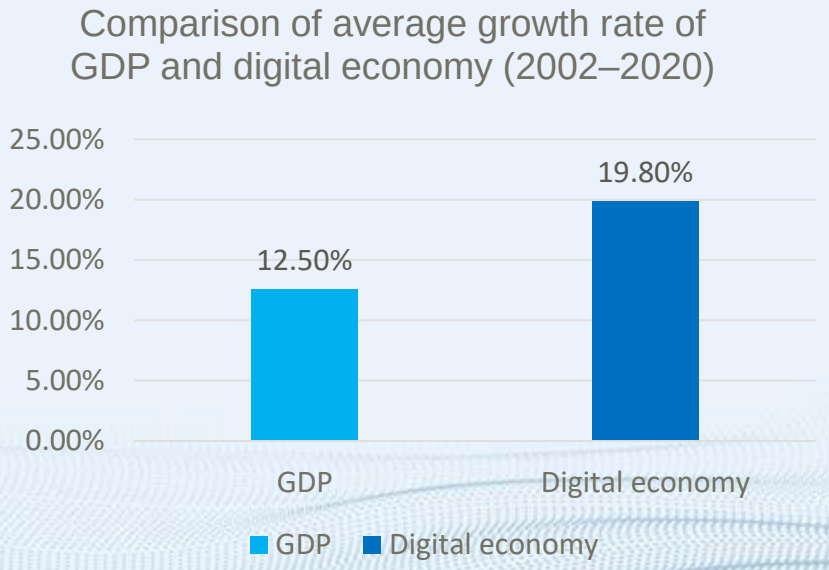
Digital economy developments

- Proportion of GDP: The digital economy's share of China's GDP increased from 9.8% in 2002 to 38.6% in 2020.
- Growth rate: In the same period, China's GDP grew at an average rate of 12.5% annually, compared to 19.8% for the digital economy.

Positioning of China's digital economy

- China's *Outline of the 14th Five-Year Plan (2021–2025) for* National Economic and Social Development and Vision 2035 calls for building new strengths by developing the digital economy, accelerating the construction of the digital economy, digital society, and digital government, and driving the transformation of production, lifestyle, and governance through digital transformation.
- The interpretation by Chinese government agencies of the *Plan for Development of the Digital Economy During the 14th Five-Year Perio*d states that the digital economy will become a powerful driver of the country's development.





1. Carbon emissions and digital economy developments

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China's dual carbon goals and emission control strategies supported by the digital economy

Coordination of digitalization and green development

- In the medium and long term, the digital economy and the dual carbon strategy will become two major engines for China's development.
- We should make full use of the technological infrastructure developed in the digital economy to provide new means, tools, and models for energy conservation and emission reduction, and coordinate digitalization and green development to help achieve China's dual carbon goals.

China's two major engines of development

Digital economy

Dual carbon strategy

A 3-layer definition

- **1. Green development of the digital industry**

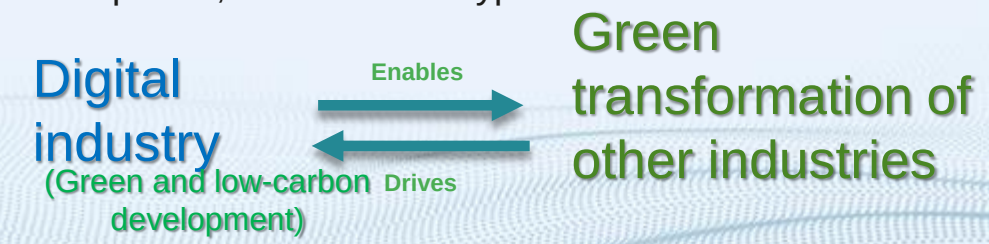
This includes use of green energy and energy efficiency improvement for digital infrastructure, upgrade of the digital industry through green technologies, etc.

- **2. Digital technologies enable industries to become greener**

Digital technologies enable industry carbon reduction. Technologies such as big data, IoT, 5G, and industrial Internet are applied in manufacturing, transportation, construction, energy, and other traditional industries to optimize resource allocation, achieve transformation and upgrade, save energy, and reduce emissions.

- **3. Green transformation of other industries drives the development of the digital industry**

The green transformation of other industries will create new applications for the digital industry, which will drive its technology development, and business type and model innovation.



2. China's carbon peak and carbon neutrality goals: New requirements and challenges for digital transformation

In October 2021, the Chinese government released the *Action Plan for Carbon Dioxide Peaking Before 2030*, which proposes 10 actions to reach the 2030 carbon peak goal and specifies requirements for digital technologies.

- Establish a digital monitoring and measurement system to provide technical support

Build a real-time, accurate, traceable, and secure monitoring and measurement platform to support objective setting and path planning for China's dual carbon goals.

- Provide "smart brains" for industries that are important for carbon reduction efforts

Help key industries such as electric power, manufacturing, construction, and transportation improve their energy use efficiency and facilitate new energy accommodation.

- Provide innovative means to promote low-carbon lifestyles for all

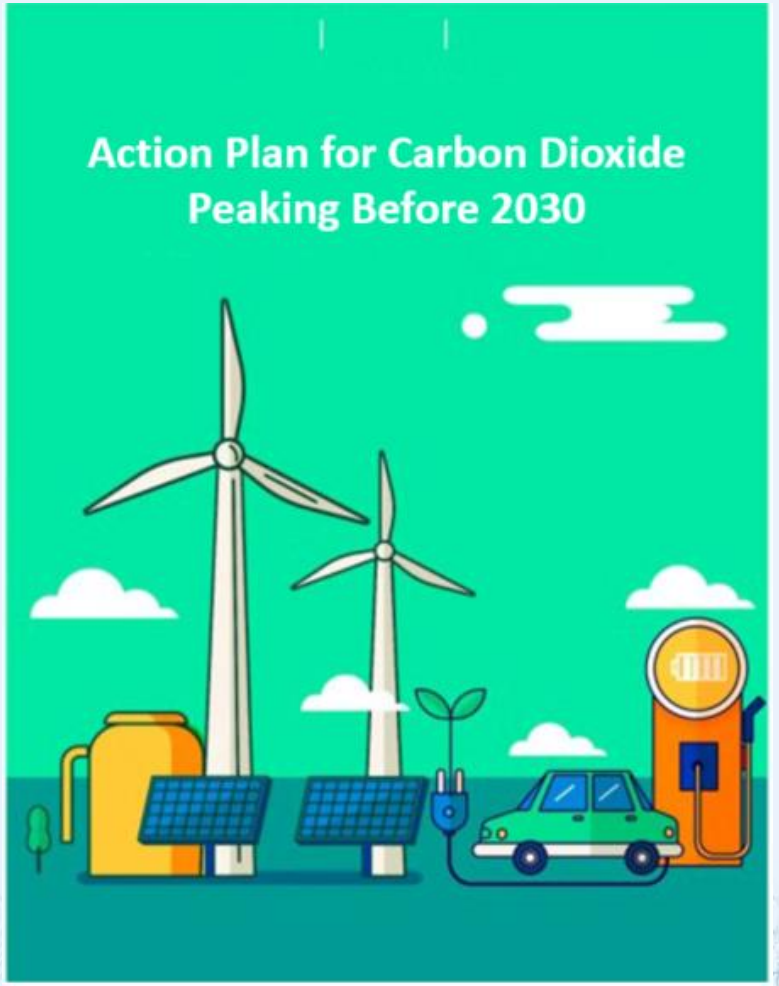
Use technologies such as blockchain and VR/AR to guide and encourage the public to develop low-carbon habits.

- Provide important tools for efficient resource recycling

Build a resource recycling system and a corresponding management system shared by players across the industry value chain to achieve traceable and centralized management of renewable resources.

- Achieve green development of digital technologies themselves

Optimize the energy mix of new infrastructure, strengthen the management of energy used by new infrastructure, and improve the energy efficiency of infrastructure.



2. China's carbon peak and carbon neutrality goals: New requirements and challenges for digital transformation

Challenges posed by China's dual carbon goals

Digital transformation is more urgent

The dual carbon goals must be achieved within a limited time frame. China aims to achieve carbon neutrality within 30 years after its carbon peak, while the EU and US plan to achieve the same goal in about 70 years and 40 years, respectively. Therefore, China seeks to achieve a more challenging over a shorter period.
This time frame requires acceleration of digital transformation.

A lagging carbon emission measurement system hinders industry development

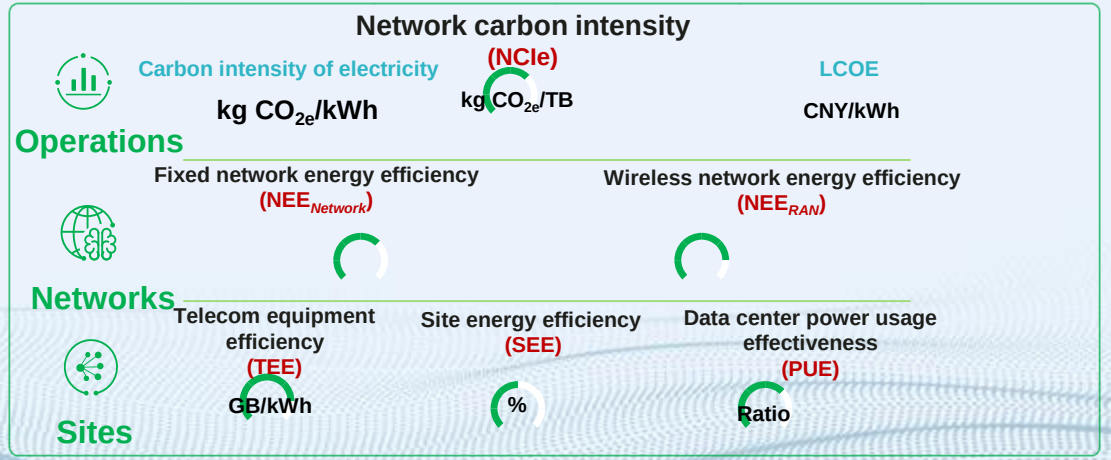
ICT technologies for digital transformation help achieve China's dual carbon goals in two ways:

- **Green development of ICT:** Only a handful of top enterprises have conducted research and exploration on **measurement indicators in this regard**. An industry consensus and unified standard system are urgently needed.
- **Carbon handprint measurement**: There is still no system to measure and evaluate how ICT technologies enable other industries to reduce carbon emissions ("carbon handprint").

Digital transformation is more expensive in the short term

Using digital technologies to control carbon emissions requires more initial investment.
Enterprise-level: Continuous investment by large enterprises will pose various long-term risks, while small enterprises cannot afford to invest.
Regional-level: Carbon control will impact the economic development of underdeveloped regions and inhibit their digital capabilities and investments.

Network Carbon Intensity (NCI) proposed by the industry is used to measure carbon emissions per unit of data service, which is more suitable as a measurement indicator for green networks. This indicator can track the carbon intensity of specific operators and be used to manage the carbon emission reduction roadmap of the ICT industry.



3. Models and practices: How digital technologies enable carbon emissions reduction in key industries

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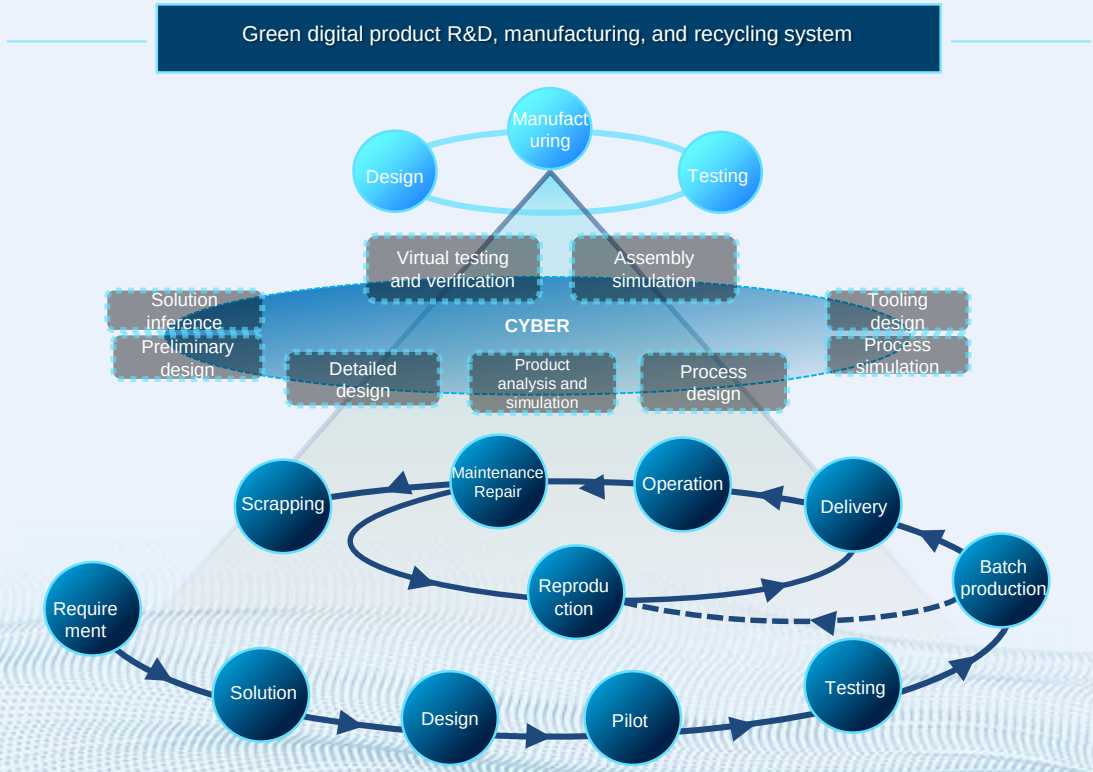
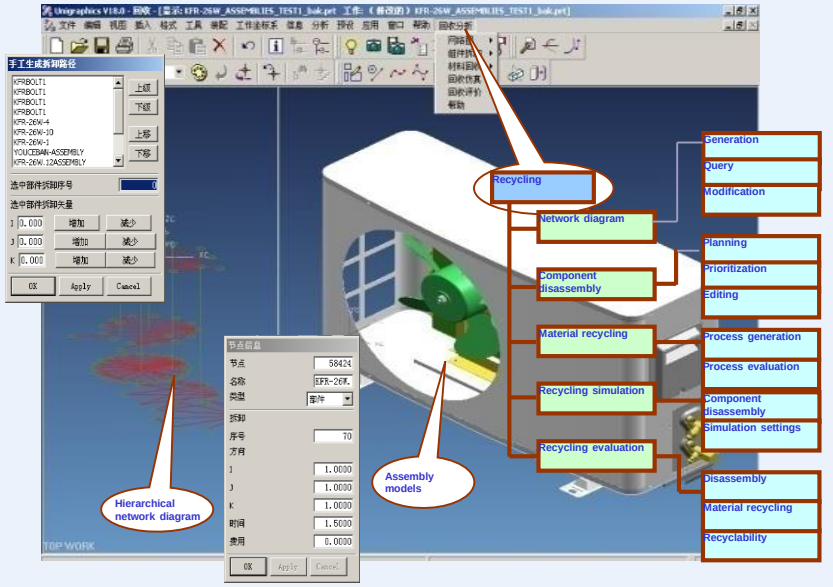
Models and practices of carbon reduction in the manufacturing industry

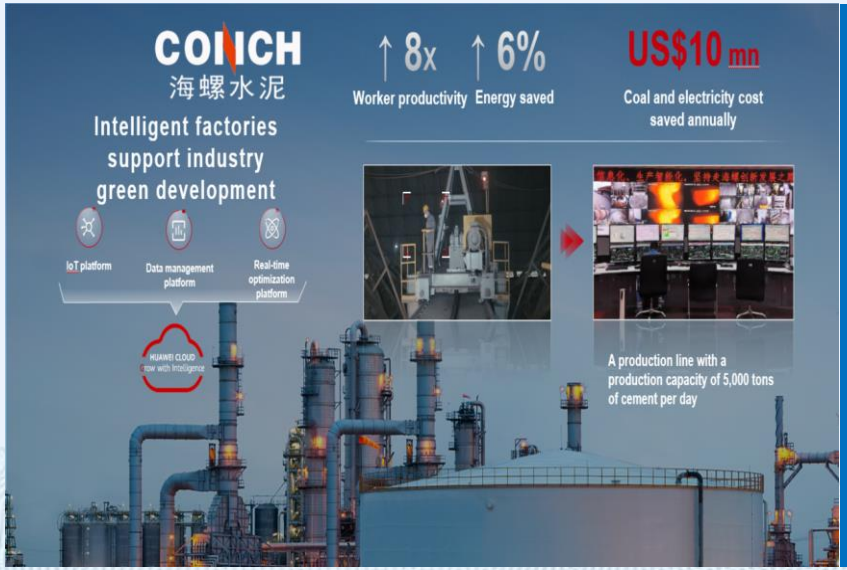
Digital technologies facilitate China's dual carbon goals by helping the manufacturing industry reduce its carbon emissions through improved energy efficiency and reduced material consumption. These efforts include: **green and intelligent manufacturing throughout the product lifecycle, energy efficiency management supported by 5G and industrial Internet, digital resource recycling and reuse for supply chains, and digital, intelligent, and carbon peaking industrial parks.**





Green design of refrigerators

A platform for green refrigerator design and process optimization can reduce design time by 30% and the cost by nearly 40%, achieving an overall product recycling rate of 85%+.



Conch Cement's smart factory

Huawei helped Conch Cement build a smart factory featuring 5G, cloud, and AI. This smart factory improved staff operation efficiency by 8 times, saved energy consumption by 6%, and saved US$10 million in annual coal and power consumption.

3. Models and practices: How digital technologies enable carbon emissions reduction in key industries

Carbon emissions reduction in buildings and cities

As urbanization increases and living standards improve, both the amount and proportion of carbon emissions from the construction sector will continue to grow. Digital technologies will be critical to controlling these emissions. Major models include: **digital and intelligent city and building design, city digital twin infrastructure building, digital assembly-like construction, smart building O&M, smart community governance, and smart planning and construction decision making.**

A city digital twin in Shanghai

All information is managed on the CIM platform that integrates BIM, GIS, and IoT, building a 3D information foundation for the city. This provides a valuable input for urban governance decisions.

Low-carbon smart campus built by Guangzhou Nantou

With the support of Huawei solutions, the developer manages energy consumption on a screen, with measurable carbon emissions and a traceable carbon footprint.

Construction robots used by Country Garden

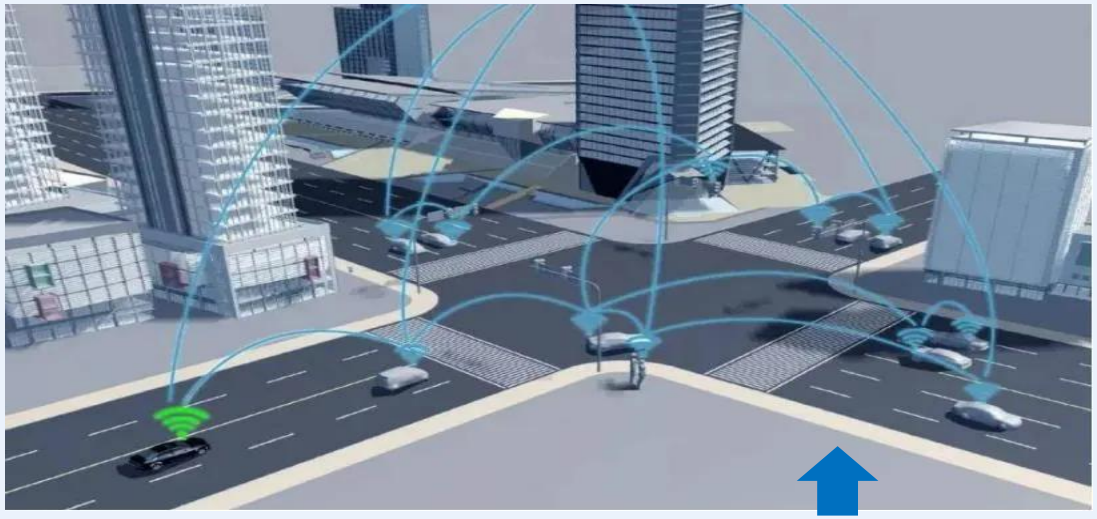
The virtual rule technology can measure a room in a short time at a precision within ±1 mm. The technology outperforms humans in both efficiency and precision. Robots are also used throughout the entire lifecycle of a building, cutting carbon emissions.

3. Models and practices: How digital technologies enable carbon emissions reduction in key industries

Carbon emissions reduction in the transportation sector

Over the past 30 years, the transportation sector has been going digital and intelligent. Reducing energy use and emissions is one of the industry's major responsibilities and goals. To contribute to the dual carbon goals, the transportation sector needs to use low-carbon equipment, manage their operations intelligently, and promote greener mobility solutions.

The transportation sector can contribute to the dual carbon goals while going digital by: **building digital, intelligent transportation infrastructure, developing electric, intelligent transportation equipment, providing intelligent mobility services, offering smart logistics services, and promoting digital and intelligent transformation of transportation governance.**



MaaS platform used in Beijing

Beijing has launched the MaaS platform – the first of its kind in China – to encourage green transport. It is also the world's first MaaS platform with 10 million+ users. From 2020 to 2021, the platform provided green mobility services for 4.2 billion+ trips, reducing carbon emissions by 24,500+ tons (according to the certified data from Sep 8, 2020 to Apr 30, 2021).

Intelligent traffic signal control in Baoding, Hebei

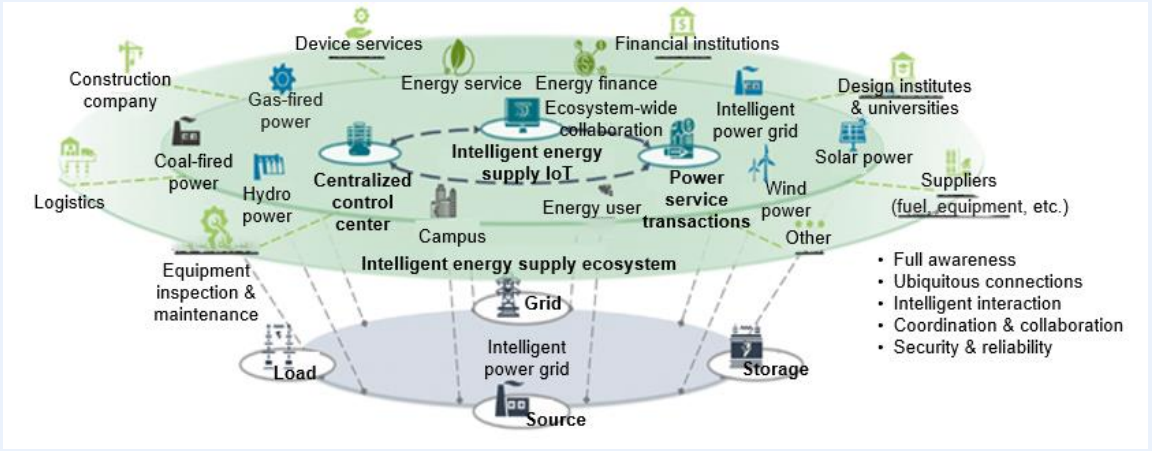
Since the smart transportation brain was deployed to optimize signal timing, major intersections in Baoding have seen significantly reduced wait times. The solution is expected to cut carbon emissions at each intersection by an average of 138.6 tons (20%–30%) each year. Assuming that there are 300 intersections in the city, the solution can cut carbon emissions by 41,600 tons per year, equivalent to pulling 14,000 cars off the road every year.

3. Models and practices: How digital technologies enable carbon emissions reduction in key industries

Carbon emissions reduction in the electric power sector

The electric power sector is responsible for 40%+ of China's carbon emissions. As the country's economy continues to grow and living standards improve, electric power demand will continue to increase. To contribute to the dual carbon goals, the electric power sector needs to move towards green supply, digital twins, intelligent operations management, and fine-grained business decision-making.

The electric power sector can contribute to the dual carbon goals while going digital by: **building digital power plants, developing an industrial Internet for power generation and an energy Internet, and integrating power generation, grid, load, and storage**.



5G-enabled highly scalable power grid of SGCC Zhejiang

SGCC Zhejiang and a local carrier jointly built a highly scalable power grid enabled by 5G, supporting 14 types of services and applying 5G slicing services to over 2,000+ devices and base stations. This is China's first large-scale commercial deployment of 5G slicing, first integrated wireless communication management service platform, and first R&D project for 5G security applications. The solution has cut costs by CNY1.5 billion and reduced carbon emissions by 13 million tons.

Digital Datang

Datang has unveiled its digital vision: building a digital Datang and a world-class energy company. This will include developing digital-driven and smart planning, construction, production, maintenance, and marketing capabilities and systems to support massive development of new energy and specialized operations and making full use of both traditional and new energy. Datang aims to increase its non-fossil fuel installed capacity to over 50% and reach peak carbon emissions 5 years ahead of plan.

4. Further integrating digital transformation with dual carbon goals

Building a stronger innovation ecosystem

- Promote the right level of openness and sharing of technologies and data resources.
- Facilitate collaborative innovation between government, industry, and academia, and encourage digital and traditional enterprises to work together to develop digital solutions for carbon emissions reduction.
- Build platforms that allow for the development of integrated digital and low-carbon technologies, focusing on joint innovation and interdisciplinary talent cultivation.
- Establish innovation alliances and industry organizations that promote the integration of digital technologies and traditional industries to facilitate technology exchanges and connect supply and demand.

Ramping up R&D and application of digital technologies in different sectors

- In the energy sector, promote the application of digital technologies, build an integrated intelligent energy system, and realize real-time energy monitoring, intelligent decision making, flexible scheduling and allocation, and multi-energy complementarity.
- In the industrial sector, use more virtual and intelligent technologies, such as digital twins, in design, process optimization, production, and operations. This will save input and consumption of materials and reduce carbon emissions.
- In the construction sector, use digital technologies to modernize existing buildings to reduce their carbon emissions, and introduce digital design and construction for new buildings to shrink their carbon footprint.
- In the transportation sector, reduce carbon emissions by using digital technologies to enable energy substitution, road network optimization, and intelligent management and control.

4. Further integrating digital transformation with dual carbon goals

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Furthering the development of a measurement system

- Encourage industry organizations, standards organizations, carriers, and industry partners to promote and verify existing carbon reduction effectiveness indexes, such as Network Carbon Intensity (NCI), catalyze consensus step by step while exploring applications, and ultimately develop a unified measurement system at the national level.
- Strengthen research on the measurement system for carbon handprints. Conduct pilot studies on measuring ICT-enabled energy saving and carbon emissions reduction in key sectors such as manufacturing, power, construction, and transportation, focusing on energy-intensive processes with high carbon emissions, and explore common models and measurement methods.

Investing more in interdisciplinary talent cultivation

- Develop interdisciplinary talent through joint cultivation programs, joint projects, and exchange and study programs.
- Develop the right talent pipelines and cultivate talent for the entire value chain involved in reducing carbon emissions with digital technology, from production and research to application. Focus on developing jacks of all trades that know both technology and business.
- Establish more disciplines related to reducing carbon emissions with digital technology and ramp up on-the-job training for students at vocational schools and workers in factories. This aims to develop more senior workers who are both skilled and understand management well.

Promoting international exchanges and collaboration

- Strengthen exchanges and collaboration with countries and regions worldwide, learn from each other, enhance mutual understanding and trust, and jointly promote the development and application of digital technologies for carbon emissions reduction.
- Regularly organize exchanges and workshops to promote the wider use of advanced and mature digital solutions for carbon emissions reduction in more industries.
- Work together to develop international standards for digital technologies used for carbon emissions reduction, focusing on the establishment of statistical indicators for measuring the effectiveness of digital technologies in enabling carbon emissions reduction.

Thank you!