GSMA
Foundry

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CASE STUDY

Green networks in action: **China Mobile**

Highlights

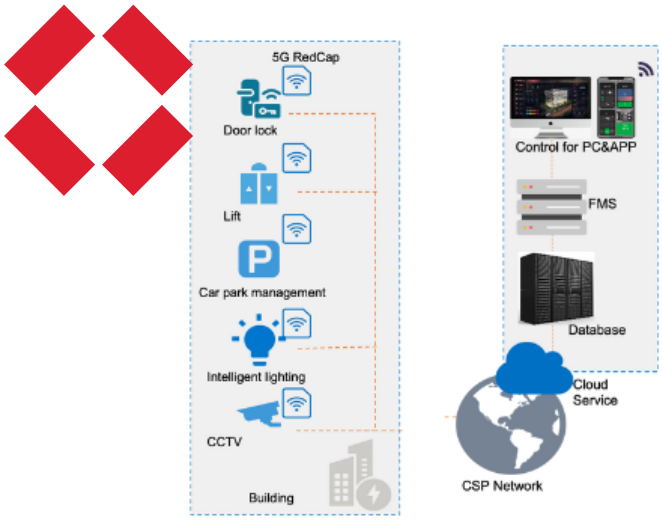
- China Mobile's 5G-A technology is transforming Shanghai, Shenzhen, and Xiong'an into smarter, greener, and safer places to live, connecting people and infrastructure in new ways.
- In Shanghai, 5G-A networks powered by AI-driven energy management and new MetaAAU antennas are cutting energy consumption by 30-35% while enhancing mobile network efficiency.
- In Shenzhen, China Mobile's 5G-A and Red Cap technology is improving skyscraper management, saving over 47% in energy per building and creating safer, more efficient spaces.
- In Xiong'an New Region, China Mobile's low-carbon initiatives like cooling cubes and outdoor base stations are saving hundreds of thousands of kWh annually, making a big impact on energy savings.
- By enabling faster data speeds and better connectivity, China Mobile's 5G-A solutions are helping industries like logistics and environmental monitoring operate more sustainably and efficiently.

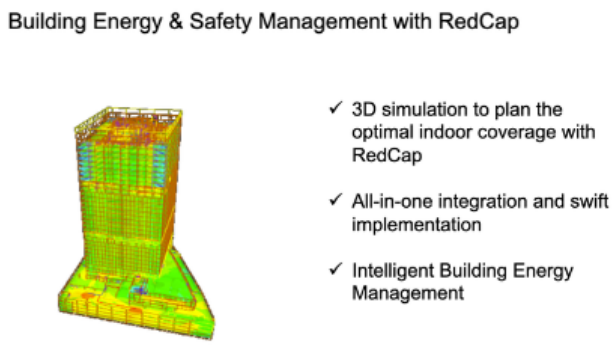
Context and energy environment

By 2021, the National Development and Reform Commission (NDRC) of China approved the new urbanization implementation plan during the 14th Five-Year Plan period (2021-25). One of the initiatives is to construct smart cities and digital villages.

The urban development is of top priority and takes institutional innovation as a fundamental driving force. The plan is to promote healthy, liveable and safe urban development, further modernize urban governance systems and capabilities.

To promote the high-quality development and improvement of people's well-being, it is necessary to accelerate the construction of digital infrastructure, appropriately deploy the next-generation intelligent





facility system in advance, deepen the 'Intelligentization' and upgrading of public facilities, and comprehensively promote the improvement of infrastructure capabilities.

One such digital infrastructures is to build up the 5G/5GA commercial networks constructed by the ICT industry to connect Internet of Things (IoT) and people, enabling AI computing and data analytics to support various applications. These smart cities organize the construction and demonstration pilot of the Gigabit City network, and constantly promote upgrading urban broadband networks to high-speed and intelligence. Now in China, more than 500 cities are pushing for their infrastructure development.

The ICT (Information, Communication, Technology) industry accounts for 3 to 4% of global CO2 emissions, about twice that of civil aviation.
Still the communications service providers (CSP) has an additional opportunity to help other industries become more energy efficient. Smart products and solutions from telcos—e.g., smart agriculture and smart logistics—are already available that can help other industries reduce their carbon emissions by an amount up to 10 times the telco industry's own emissions. And that is what China Mobile is doing – helping the government to build smart cities' digital infrastructure and green enablement to other industries.

Deployment and impact

For this project, three cities were selected to demonstrate its joint effort to build all-round clean society from network to buildings to cities. This paper starts from Shanghai city in building the most advance 5G-A network and how it is affecting the people of Shanghai in enjoying a healthy, liveable, safe and energy efficient city. Then, the city of Shenzhen, using the 5G-A & Red Cap to support skyscrapers to become Green Smart Buildings. The third city to share is the Xiong'an New Region (within Hebei Province), the Green Low Carbon City. The city is planned to run entirely on renewable energy sources and it is integrating advanced technology like 5G/5G-A, AI and the IoT to create a smart urban environment.

Solution: Shanghai

Shanghai is the most aggressive city within China to build a full 5G-A coverage and this also helps itself to go green. Already, China Mobile and Huawei developed various use cases to reduce energy consumption.

One development is the 'Site simplification and equipment integration' to make the base station more energy efficient. This includes using outdoor Remote Radio Unit (RRU) equipment and MetaAAU (Active Antenna Unit) with large antenna dipoles. Additionally, the use of MIMO (Multiple Input, Multiple Output) configurations is being expanded: for example, low band configurations are moving from 2T2R (2 transmit antennas, 2 receive antennas) to 4T4R, and mid band configurations from 4T4R to 8T8R. Furthermore, some scattered sites are planned to be reconstructed at more strategic locations, where equipment will be centrally managed.

With the use of **5G-A plus 3CC technology,** consumers can enjoy average downlink speeds (DLS) of 1Gbps, maximum up to 5 Gbps. For phase 2, adding the mmWave, consumers can enjoy DLS up to 10Gbps. The introduction of AI into the mobile network enables AI-based intelligent management of time, space, frequency, and power consumption. This intelligent adjustment is based on load, customer experiences, and off-peak hours in various areas. Features include on-demand dormant devices, no-load millisecond shutdowns, and "0" service loss. This implements "0 Bit 0 Watt" green communication networks, achieving a win-win situation for both user experience and energy savings.

In addition, AI brings **Intelligent performance optimization**. China Mobile indicated this approach is already automatically identifying 60% of network

issues and self-healing 40% of them. This improvement not only eliminates major or crisis-mode outages but also reduces regional outages and degraded experiences, such as video freezes or voice break-ups. Overall, it enhances energy efficiency by intelligently managing equipment and reducing the extra time needed to process tasks on mobile devices due to network issues.

Solution: Shanghai

China Mobile is leveraging 5G-Advanced and Red Cap for cross industry green enablement. In addition, using APIs, it can provide necessary information to the skyscraper management to run traffic control and help shopping mall companies with marketing and promotion.

Through the solution, a 'Building Energy and Safety Management Platform' is established to gain data information from 'Door Lock', 'Lift/Escalator', 'Car Park Management', 'Lighting', 'Air Conditioning' and 'CCTV' via the 5G-A and Red Cap device.

Using real-time monitoring on the amount of people within each floor and each grid, it can switch off and switch on escalators, lighting and air conditioning to improve energy efficiency. In addition, China Mobile is using APIs to pass the necessary information to Building Management for crowd safety management. In future, China Mobile plans to migrate this API to GSMA Population Density Data API. In addition, TM Forum Open API (TMF642 Alarm Management API) is being used to pass the alarm message detected through RedCap back to Building Management Control Platform to record the alarm message for further analysis.

The installation of the 5G-A plus Red Cap does not require using a lot of energy. However, the energy saved within skyscraper can be enormous. Through an actual case calculation, the vertical enablement index (the CO2 emission reduced within the skyscraper against the CO2 emission used by the 5G-A + Red Cap) can be over 200 times.

China Mobile has implemented this solution in over 20 commercial buildings in Shenzhen and already controls over 1 million IoT sensors and devices.

Solution for Green Low Carbon Xiong'an New Region

Before 2017, Xiong'an New Region was not yet formed, and the region only used old network equipment with basic mobile connectivity services. This changed as Beijing became saturated, with the government viewing the new region as being an ideal test bed for a Green Low Carbon City. China Mobile also sees this region for deploying dual-carbon action plan with the most advance mobile infrastructure to support the super datacentres that will be built.

Besides building a green and advanced network for Xiong'an New Region, China Mobile also sees the actual applications upon this green network – supporting the low latency linkages between super data centres and providing millions of IoT connections for firms and government units. In addition, building up green office & public transportation, green supply chain, green energy and green culture. In order to support the formation of the Green Low Carbon City, China Mobile established a short-term initiative with the following five items:

1. **Full Service Architecture (FSA) Planning:** The network architecture needs to rationalized by the latest AI technology according to new requirement with appropriate ROI support. COs can be located very close to each other due to various services support
2. **Deploy 5G-A green base stations:** provide high quality service with increased energy efficiency through AI control according to actual traffic demand

3. **Equipment modernization at Central Offices:** as a part of network architecture improvement, old PSTN and copper equipment is to be replaced by Optical Transport Network (OTN). Also, the latest equipment development has built in passive cooling features to reduce external cooling requirements. In addition, renewable energy sources and AI-driven in maximize renewable energy tools are deployed at both base stations and COs
4. **Central Office Power Utilization Efficiency (PUE):** China Mobile target Data Centre and Central Office to have a low PUE by introducing renewable energy sources and cooling cubes that can confine the cooling within the closed cabinets
5. **Energy Management Platform:** With green measurement standards embedded in the platform, it can gather all the relevant data via API, MQTT...etc) to evaluate the status and using AI and digital twin to recommend optimization suggestion with ROI. The platform will show actual energy indexes and provide forecast trend.

Impact measures

To gain wide acceptance of the technology, China Mobile starting points will be serving the consumer sector. With the wide acceptance of 5G-A and the energy efficiency enjoyed within the city, it is a strong promotion to industries to explore adoption of this technology.

> Industries with high connectivity needs to address their ESG issues but lacking economies of scales, such as the media industry, may benefit from customized solutions.

For those industries that require minimal connectivity and have relatively low carbon footprints, such as professional services (e.g., law firms), traditional connectivity services are sufficient. For industries with a strong need for green enablement but moderate connectivity requirements, such as building management, telcos can offer standardized products (e.g. 5G-A + Red Cap) to assist them as in the case of Shenzhen city.

Industries with high connectivity needs to address their ESG issues but lacking economies of scales, such as the media industry, may benefit from customized solutions. However, the development costs for these solutions can be significant and may not be profitable.

The last category includes industries with high connectivity requirements to meet their green targets and the potential for economies of scale, such as logistics. For these industries, China Mobile is proactively developing high-impact solutions. For example, in Xiong'an New Region and Shanghai, China Mobile is aggressively building 5G-A network to support low-altitude logistics to enable drone for light package delivery.

Below are some tangible outcomes from the three cities:

→ Shanghai

- As 5G-A implementation started in 2024, China Mobile has made commitment to decrease in comprehensive energy consumption per unit of total telecommunication serves was 13.0%
- The deployment of MetaAAU can save 30% energy consumption compare to traditional AAU

- Compared to earlier network generations, 5G-A is more energy efficient, therefore consuming less power. The enhanced energy performance of 5G and 5G-A technology has directly reduced energy consumption in smartphones, IoT devices, and mobile access networks
- With the additional AI supporting '0 bit 0 watts', it can decrease energy use per subscriber (EPS) by 35% across the entire network without compromising user experiences.

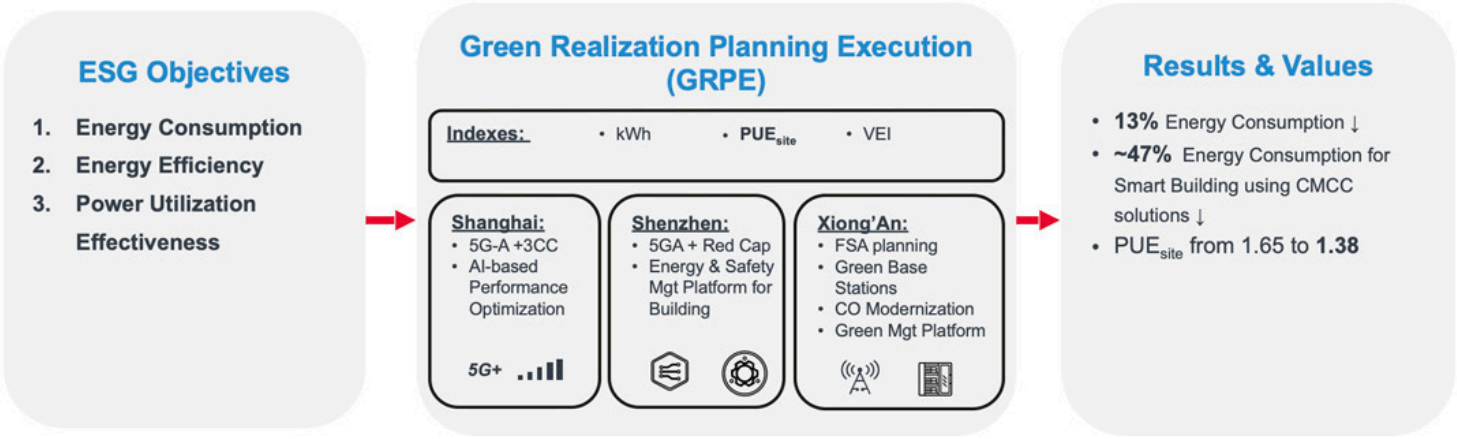
→ Shenzhen

- Vertical Enablement Index (VEI), which is calculated the saving of total energy per year over the energy consumption of the solution per year, is 122
- Energy Consumption saving per building is more than 47%. ROI is 2.3.

→ Xiong'an New Region (Rongcheng county)

- The ROI of cooling cube in testing area is below 3
- Power Usage Effectiveness (PUE) is around 1.3 and estimated to save 60k kWh/year
- Build outdoor base stations to save 100k kWh/year
- Retire 58 sets of legacy equipment and saved 97k kWh/year
- 106 base stations with energy saving features and saved 136k kWh/year

> The enhanced energy performance of 5G and 5G-A technology has directly reduced energy consumption in smartphones, IoT devices, and mobile access networks



About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at gsma.com

Follow the GSMA on Twitter: @GSMA.

About the GSMA Foundry

The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

Find out more, or submit a new project idea, at gsma.com/Foundry

About China Mobile

China Mobile (CMCC) is one of the world's largest mobile networks and customer base, with approximately 991 million mobile customers and 298 million wireline broadband customers as of December 2023. Driving China Mobile forward, the company established its strategies on 5G-A and green development to enable smart cities development.

About this case study

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