2026 Best Practices of Carbon Neutral Cities in East Asia

Guangzhou: Ma Ke Village's Integrated Smart Clean Energy System in Nansha District



1. Background

Located in the Nansha District of Guangzhou City, Ma Ke Village was once a small village with about 6,500 residents, covering approximately 4.9 km^2. Its local economy was traditionally driven by manufacturing industries, particularly hardware, garments and coatings, alongside agriculture and fishery.

As part of its efforts to revitalize rural areas, Guangdong Province launched the High-quality Development Project for Counties, Towns and Villages (commonly known as the Hundred, Thousand and Ten Thousand Project), with Ma Ke Village selected as a pilot. With the project's support, Ma Ke Village expanded rural tourism and further diversified its income sources. As of June 2025, residents' annual income had doubled compared with the pre-project level.

Despite this progress, Ma Ke Village still faces several challenges to achieving sustainable development. These include inefficient energy use, a relatively low share of renewable electricity in the local energy mix, and an underdeveloped low-carbon industry for green economic transition. Meanwhile, expanding tourism and emerging sectors such as electric mobility call for a more resilient, reliable local energy system. To address these challenges, **Ma Ke Village Low-Carbon Rural Grid Demonstration Project** has been launched to improve energy efficiency and further provide a scalable and replicable model for other villages.

2. Key Components



Ma Ke Village
Source : Tianhe Institute of Economic Research

A key highlight of the demonstration project is a source-grid-load-storage electricity system deployed for daily electricity consumption. The project features three key components.

Tailored Village-Scale Integrated Energy System

Ma Ke Village has developed a locally tailored, village-level integrated energy system that connects electricity generation, grids, consumption, and storage. By retrofitting existing public spaces into multi-purpose hubs for renewables, tourism, and civic services, the village avoids costly new construction while establishing a village-scale source-grid-load-storage energy system tailored to local needs.

Market-Oriented Operation with Multi-Stakeholder Collaboration

To support smooth collaboration and project implementation, the Zero-Carbon Technology Joint Innovation Laboratory has been established. The laboratory is a platform for technology advancement, field testing, and collaborative innovation. To ensure long-term financial sustainability, Ma Ke Village has consulted and consolidated ideas from village collectives, local government, energy enterprises, and end-users. Stakeholder communication creates a self-sustaining value loop: governments provide



Ma Ke Village
Source : Tianhe Institute of Economic Research

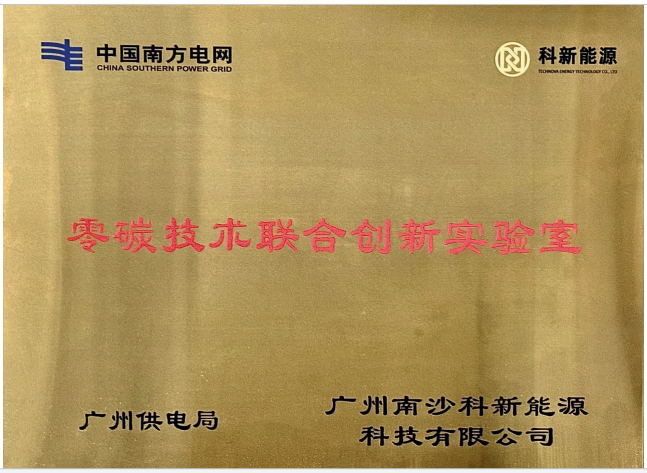
policy support and oversight; village collectives identify local needs and resources; enterprises provide capital and technical investment; and end-users drive demand for low-carbon products and services. This multi-stakeholder solution enhances profitability in rural green infrastructure projects.

Smart Energy Management with Innovative Energy Infrastructure

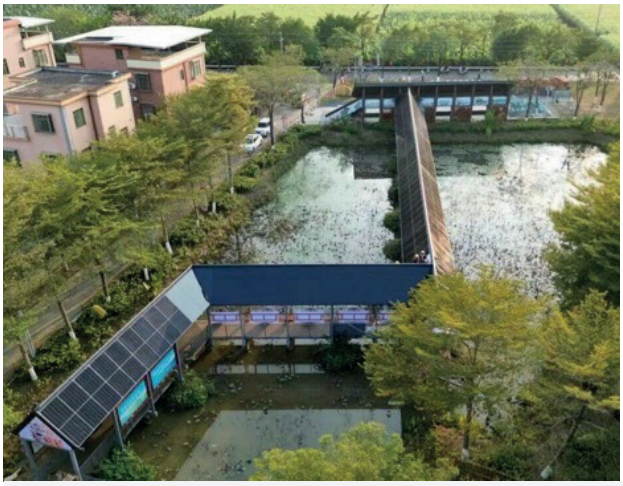
Smart digital management is at the core of this pilot project, delivering real-time monitoring and optimization of electricity generation, storage, charging facilities, and power consumption. The smart energy management relies on an IoT sensing network for real-time data. The village has retrofitted its streetlight poles into IoT hubs equipped with LED screens, environmental sensors, surveillance cameras, BeiDou CORS (Continuously Operating Reference Stations) positioning, and drone docking stations. Beyond automated lighting control, these poles collect multidimensional data and use a centralized backend platform to display and manage energy flows. Beyond energy and environmental tracking, this smart network is an essential civic infrastructure to support public safety, asset management, and emergency response.

3. Implementation

The Ma Ke Village Project was launched under the national and provincial policy framework for rural revitalization and energy transition. In September 2025, the Standing Committee of the Nansha District People's Congress adopted the ***Decision on Comprehensively Promoting the Construction of a Demonstration Zone for New Power Systems to Safeguard High-quality Economic and Social Development in Nansha***, the first district/county-level legislative decision in China dedicated to advancing new energy system development. Together with Guangdong Province's Hundred, Thousand and Ten Thousand Project, the decision served as the institutional foundation for integrating clean energy into rural revitalization. Under this policy framework, Ma Ke Village was selected to host the Low-Carbon Rural Grid Demonstration Project under the Green Energy Village and Township Initiative, developed by Guangzhou Nansha Technology Financial Holding Group in 2025, to deploy renewable energy technologies and drive both low-carbon transition and rural economic development.



Zero-Carbon Technology Joint Innovation Laboratory
Source : Guangzhou Nansha Technology Financial Holding Group





The photovoltaic promenade in the Lotus Flower Park
Source : Nansha Power Supply Bureau

To support practical, on-the-ground solutions, Guangzhou Nansha Science New Energy Technology Co., Ltd. launched the Zero-Carbon Technology Joint Innovation Laboratory in September 2025, with support from Guangzhou Nansha Technology Financial Holding Group and the Nansha Power Supply Bureau of China Southern Power Grid. In the lab, technical research and development (R&D) and project deployment run in parallel. Beyond its academic research role, the Zero-Carbon Lab brings together government agencies, energy firms, technology providers, and local stakeholders to implement actionable low-carbon solutions. Key among these partners, the Nansha Power Supply Bureau has invested over RMB 20 million over three years to upgrade the village's power grid infrastructure in support of the Hundred, Thousand and Ten Thousand Project.

Aligned with its objectives, the project tailors designs to the local context. By retrofitting existing public infrastructure and underutilized spaces, the village integrates these sites directly into its source-grid-load-storage energy network and transforms them into multifunctional assets. With an investment exceeding RMB 7 million, the village has developed several key low-carbon demonstration sites. For example, with Building-Integrated Photovoltaic (BIPV) technology, a lake bridge over the Lotus Flower Park has been converted into a photovoltaic promenade; an unused space beneath the Huanglan overpass has been transformed into a smart EV charging station;





The smart EV charing station under the Huanglan Overpass
Source : Nansha Power Supply Bureau

and the local automobile club is now equipped with a smart microgrid for photovoltaic generation, battery storage, and vehicle-to-grid (V2G) charging. Smart outdoor power outlets are also ready to support local tourism and camping, while streetlights have been upgraded with solar panels and IoT devices to improve public safety and lighting efficiency.

To ensure long-term performance, the project relies on a digital energy management platform to continuously evaluate system operations. By gathering real-time telemetry from street pole sensors, the platform optimizes grid performance. With a refined data-driven solution, Ma Ke Village becomes both the primary beneficiary and the flagship testing ground for technologies designed for broader replication across Nansha's rural communities.

4. Outcomes

Enhanced Energy Infrastructure and Reduced Carbon Emissions

The project has greatly strengthened Ma Ke Village's energy infrastructure, improved power supply capacity and grid reliability and laid a foundation for the village's low-carbon transition. These upgrades allow for approximately 200,000 kWh of renewable electricity generation annually. By combining distributed photostatic, battery storage, V2G technology, and smart microgrid, the system maximizes on-site renewable consumption and boosts overall grid flexibility and resilience. With an estimated annual carbon emission reduction of 12,000 tonnes, the initiative offers a viable model for deploying distributed clean energy in rural communities and driving low-carbon economic shifts.

Economic and Social Benefits

Beyond environmental benefits, the project generates tangible economic and social value. New employment opportunities have emerged, while upgraded public infrastructure improves civic services, supports outdoor tourism, and expands local revenue streams beyond traditional industries.



A transformer decorated with Ma Ke Village's characteristic Awakening Lion design
Source - Technology Financial Holding Group

The project also integrates local culture to attract broader audiences. Transformer units at EV charging stations feature traditional Awakening Lion motifs, blending modern clean technology with local heritage to increase community acceptance.

A Replicable Model for Rural Energy Transition

The project has proven an innovative, replicable approach to embedding renewable energy systems into rural development. As a flagship project under Guangdong's Hundred, Thousand and Ten Thousand Project, Ma Ke Village offers practical ways for rural communities to combine clean energy adoption with local economic growth.

5. Conclusion

Rural energy projects often require heavy upfront investment, involve complex multi-stakeholder coordination, and carry extended investment payback periods. To address these challenges, Ma Ke Village has explored a collaborative model involving local government, state-owned enterprises, power utilities, and village collectives. The village optimizes deployment costs and generates new revenue streams via market-oriented mechanisms.

Looking ahead, sustaining momentum in the rural energy transition will require ongoing policy support, technological innovation, and cross-sector collaboration. Building on Ma Ke Village's experience, Nansha plans to advance district-wide renewable energy planning, promote village energy aggregation models, and encourage local communities to participate in virtual power plants and electricity market trading. Future efforts will focus on scaling up distributed photovoltaic deployment, advancing research and development of zero-carbon technologies, and further highlighting Ma Ke Village's position as a model of low-carbon rural development in the Guangdong-Hong Kong-Macao Greater Bay Area.

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