Chongming Eco–island International Evaluation Report

March, 2014

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Chongming Eco-Island
International Evaluation Report

PREFACE

Ecosystems today face unprecedented pressure, threatening food security, poverty eradication and a sustainable future. The Millennium Ecosystem Assessment Report (2005) indicates that “Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history.” While the challenges are daunting, they provide opportunities for local communities, businesses and governments to innovate for the benefit of all. Ecosystem management and ecological construction in the context of sustainable development is an integrated approach to enhance natural-resources utilization, economic progress and social welfare so as to meet both ecological and human needs in the future.

It is uplifting to see that regions and states are employing this approach by tailoring it to local conditions, and strategic consideration for future development. The Chongming Eco-Island Construction Project serves as one model of such a development pathway. This project applies China’s Eco-civilization concept with an ecosystem approach to identify an innovative and localized development model, which has proven effective in integrating social, environmental and economic perspectives to manage synchronic development-providing concepts and experiences that can be shared with others.

The Chongming Eco-Island Evaluation Report evaluates this project and its benefits. Driven by science and technology innovation, Chongming eco-development is supported by various stakeholders, including governments, academia, business sectors and the public. Demonstration projects include the restoration and protection of Dongtan Wetland as an example of natural eco-construction, the residential eco-renovation of Yingdong village as an example of habitat eco-construction, and the green and organic agricultural industrial chain development as an example of industrial eco-construction.

The core values of Chongming Eco-development reflect the green economy vision of the United Nations Environment Programme (UNEP), which identifies ecosystem management as one of its seven thematic working priorities to ensure that the natural capital of ecosystems are valued and integrated in decision making.

In 2011, UNEP and the Science and Technology Commission of Shanghai Municipality (STCSM) signed an agreement, in which UNEP was invited to evaluate the construction of Chongming Eco-Island. This review marks two years of cooperation and the success of three Chongming Eco-island Forums, which have become an international platform for exchanging ecosystem management and sustainable development concepts and practices.

This report follows on from a collaborative environmental assessment of the Shanghai Expo 2010 . UNEP continues to welcome this kind of collaboration and aims to provide our services to the international community as it strives to implement effective ecosystem management and continues down the path to a global green economy.

Achim Steiner
United Nations Under-Secretary-General
Executive Director, United Nations Environment Programme

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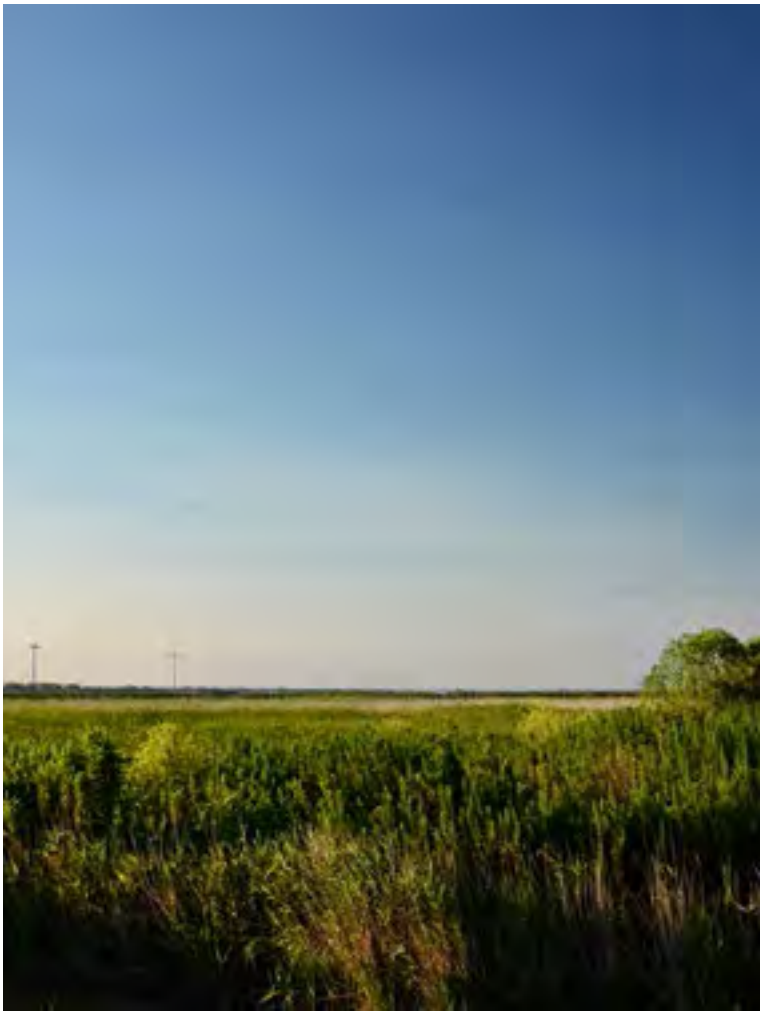

CONTENTS

ABBREVIATIONS

AIESEC:	Association Internationale des Etudiants en Sciences Economiques et Commerciales
CCS:	Carbon Capture and Storage
COD:	Chemical Oxygen Demand
CPU:	Central Processing Unit
CYN:	Chinese Yuan
EIA:	Environmental Impact Assessment
EPA:	Environmental Protection Agency (United States)
GDP:	Gross Domestic Product
GHGs:	Greenhouse Gases
ILO:	International Labor Organization
InVEST:	Integrated Valuation for Ecosystem Services and Trade-Offs
IOE:	International Organization of Employers
IPM:	Integrated Pest Management
ITS:	Intelligent Transport System
ITUC:	International Trade Union Confederation
IUCN:	The World Conservation Union
NEZSD:	National Experimental Zone for Sustainable Development
PES:	Payments for Ecosystem Services
SEA:	Strategic Environmental Assessment
SEPA:	State Environmental Protection Administration of China
SHDRC:	Shanghai Municipal Development and Reform Commission
SIDS:	Small Island Development States
SIIC:	Shanghai Industrial Investment (Holdings) Co., Ltd
SJTU:	Shanghai Jiao Tong University
STCSM:	Science and Technology Commission of Shanghai Municipality
STI:	Science, Technology and Innovation
STP:	Sewage Treatment Plant
TEEB:	The Economics of Ecosystems and Biodiversity
TESSA:	Toolkit for Ecosystem Service Site-based Assessment
UNEP:	United Nations Environment Programme
VRV:	Varied Refrigerant Volume
WCED:	World Commission on Environment and Development

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction and Background

The rapid growth of China's economy has not only created economic progress and enormous material wealth, but also brought about great challenges to natural resources and environment. It is in this context that the Chinese government put forward the concept of "eco-civilization" which was proposed in 2007 at the 17th National Congress of the Chinese Communist Party. The idea behind eco-civilization is to form an energy- and resource-efficient and environmentally friendly industrial structure, economic growth model and consumption pattern. Since then, there has been a wide eco-civilization campaign in China, with discussions on how the idea should be practically implemented at different levels.

Shanghai, one of China's largest and most populous cities, took a first step towards actualizing the eco-civilization concept in the development of its rural and suburban Island of Chongming which has a unique setting as a rural county in the highly urbanized municipality. Lying on the estuary of the Yangtze River and the western coast of the Pacific Ocean, Chongming Island is strategically important for Shanghai's sustainable development because of its unique island ecosystem. Although it is developing rapidly in recent years, Chongming Island currently remains one of the least developed parts of Shanghai. With the completion of Shanghai Yangtze River Tunnel-Bridge and the development of cross-river facilities, Chongming is facing new challenges of eco-environment protection and tremendous opportunities for socio-economic development. It is in this context that Chongming is actively exploring and implementing a path towards eco-civilisation beyond the traditional industrialization.

The construction of Chongming Eco-Island draws a lot of attention from Shanghai and Chinese government. In January 2010, Shanghai promulgated the "Chongming Eco-Island Construction Outline (2010-2020)" which provided the framework and set the targets for the construction of a world class eco-island by 2020. It also released the index system and phased targets to provide a step by step guide to the construction of Chongming Island. In March 2010, Chongming was officially approved by the Chinese government as a National Experimental Zone for Sustainable Development (NEZSD). Chongming's construction follows its own circular mode of development, namely, "Establishing a shared vision; Understanding the current situation; Setting targets; Developing action plans; Implementing plans and support system; and Monitoring and evaluating the performance". After the first round of "Three-year Action Plan (2010-2012)", it has invested a total amount of 14 billion CNY in the following six fields: sustainable utilization of natural resources, circular economy and comprehensive utilization of waste, energy efficiency and emission reduction, pollution control and eco-environment construction, development of ecology-oriented industries, infrastructure and public services. By the end of 2012, 96% of the phased targets were completed.

The United Nations Environment Programme (UNEP) acts as a catalyst, advocate, educator and facilitator to promote the wise use and sustainable development of the global environment by working on assessing global, regional and national environmental conditions and trends; developing international and national environmental instruments; and strengthening institutions for the wise management of the environment. UNEP and the Science and Technology Commission of Shanghai Municipality (STCSM) signed an agreement, in which UNEP was invited to evaluate the construction of Chongming Eco-Island and to summarize the relevant experiences arising from this ecological construction to serve as a model and provide guidelines for wider dissemination to other developing countries and regions. This report is part of UNEP's contribution to the international evaluation of Chongming Eco-Island Construction.

Summary of Findings and Recommendations

Specific Recommendations and Action Plans

Listed below are the specific recommended action plans for each of the seven themes evaluated:

1. Society, life and culture: After several years of construction, Chongming has established an eco-industrial system dominated by organic green agriculture, environment-friendly industries and ecological services, while developing an intensive urban construction system based on advanced technologies and renewable energy sources. The green building system is based on the "low-carbon building guidelines" for coastal islands and a building evaluation system that includes energy-saving and environmental assessment. To fully develop the cultural heritage, the unique ecological advantages have been combined to build a unique Chongming brand. As an ecological demonstration area in the Shanghai metropolis, the development direction of society, life and culture on Chongming Island has become clear with some progress already realized, including in infrastructure construction. Chongming Island is devoted to achieve the ecological harmony of natural habitats, culture and industry, becoming a new development engine for the Shanghai metropolis.

The following recommended action plans are proposed for Society, life and culture;

1. Green Jobs: Administer government stimulus packages in the form of tax exemption and subsidies to accelerate the expansion of a green job market, and encourage Science, Technology and Innovation (STI) centers (research and higher education institutes) on the island to build and

expand capacity in highly skilled human resources.

2. Building a knowledge economy: Establish a University City on the Island, to be integrated with Chongming Dongtan International Education Campus, the National Modern Agriculture Demonstrative Area, the Intelli-Island IT Park and the Eco-Industry Park to form Chongming Research and Development (R&D) Commerce Park.
3. Yangtze Eco-Art Development Space: Explore the possibility of establishing and supporting a green creative industry and public eco-art development space for the Yangtze Delta region.
4. Eco-Tourism Information Management Center: Assess the feasibility of establishing a tourism information management center. This center should ideally be located at the entrance of the Yangtze River Tunnel-Bridge highway to Chongming Island.
5. Green Building Evaluation: Conduct regular Island-wide green building evaluations to continually assess their status using suitable assessment tools such as the Energy Audits and Green Star Building Ratings developed by the Chinese Ministry of Housing and Urban-Rural Development and others. Carry out awareness campaigns among the local residents to educate and help them understand the environmental impact of public and residential buildings.
6. Environment Science Demonstrative Center: Assess the feasibility of establishing a family oriented environment science demonstrative center in addition to the existing science education institutions.

2. Biodiversity and Protected Areas: There has been marked progress in Chongming Island in terms of biodiversity and ecological protection. This has been achieved through a range of interventions including the establishment and expansion of protected areas in both terrestrial and wetland ecosystems, increase in forest cover rate and expansion of public green spaces. Chongming Island has established long-term safeguard mechanisms for wetlands, forests and green lands and has achieved the 2012 goals for ecological protection ahead of schedule. Wetland conservation was realized through the proper management and control of invasive species, restriction on wetland reclamation for agriculture, and water pollution control. Other measures to protect Chongming Island's biodiversity and ecosystem have included the protection and management of habitats, especially for waterfowls in critical habitats along the East Asian-Australasian Flyway, the construction of green island infrastructure network, the development of ecosystem services and ecological compensation mechanisms, comprehensive control of pests and enhanced ecological education.

The following recommended action plans are proposed for Biodiversity and Protected Areas;

1. Research to support action on Ecosystem Services development approach: Carry out research to support ecosystem services development approach, including assessment and valuation of ecosystem services using available toolkits, planning and zoning for industrial development, environmental pollution monitoring, and ecological carrying capacity. Specific toolkits for ecosystem service assessment at local and landscape levels that could be used are Toolkit for Ecosystem Service Site-based Assessment (TESSA) and the Integrated Valuation for Ecosystem Services and Trade-Offs (InVEST).
2. Biodiversity Conservation Compatible Agriculture (Eco-agriculture): Promote the construction of agricultural circular economy demonstration to realize eco-agriculture and ensure conservation compatibility while improving the livelihoods in rural areas.
3. Consolidate the "Win-win pattern practice area of wetland protection and utilization" by strengthening the management of ecological risks, control of invasive species (Spartina alterniflora and Solidago canadensis), and the reclamation and restoration of degraded wetlands.
4. Strengthen eco-compensation programme: through Payments for Ecosystem Services (PES) and compensate for the loss of habitats and wetland ecosystems to develop projects through habitat banking and/or restoration of other degraded wetlands and habitats to ensure "No net loss" in biodiversity.
5. Yangtze Delta Ecology Conservation Park: Conduct a feasibility study towards establishing a Yangtze River Ecology Conservation Park in Chongming Island.
6. Managing sea level rise: Optimize the land planning and utilization process (wetland protection, eco-agriculture), construct the levees, and plan urban system (population concentration) to cope with the challenges of rising sea levels.
7. Ecological Education: Develop ecological education programs for Dongtan and Xisha wetlands applicable to primary, secondary and tertiary level students.

3. Water management and conservation: Chongming has made large investments towards enhancing drinking water safety, water pollution control and water saving, laying a solid foundation to realize a virtuous circle of water resource utilization. In the aspect of water quality improvement, Chongming promotes early warning monitoring and evaluation system, and has implemented a comprehensive rehabilitation programme to improve water quality of backbone rivers. It has also invested in the construction of centralized wastewater treatment facilities together with the conveying pipelines, and in the establishment of a new decentralized rural sewage treatment system. In the aspect of improving water resource utilization efficiency, Chongming Island constructed 'one reservoir plus four water treatment plants' to promote centralized water supply to support the ecological island

construction and to ensure the safety and the sustainable utilization of Island's water resources. Other measures adopted to support water management and conservation include farmland water conservancy projects through facilities equipped vegetable and grain fields for improved capacity for agricultural irrigation, information and educational campaigns and public participation programmes.

The following recommended action plans are proposed for Water management and conservation;

1. Water intake management: Protect water sources especially the water catchment areas, strengthen monitoring efforts nearby and expand the terrestrial water pipe network.
2. Water supply management: Build and upgrade the water supply pipe network, continue to shut down small water plants, implement water safety plans to realize intensive and efficient water supply.
3. Water use efficiency: Encourage factories to carry out clean production; improve industrial water recycle rate; cut chemical fertilizer and pesticide usage; promote water-saving agriculture; call for water saving; evaluate the possibility of using water-saving appliances and technologies.
4. Drainage development and maintenance: Improve the drainage network, upgrade municipal drainage facilities, and enforce water discharge standards.
5. Water pollution control: continue to promote the comprehensive regulation of rivers, lessen the volume of wastewater and contaminated content whilst treating it as an opportunity for reuse.
6. Water planning: explore the possibility of integrating "water sensitive city" design.
7. Water management: Establish an information sharing and communication platform to enhance public participation in water resource management and conservation.

4. Solid waste management: Chongming Island has formulated several measures and plans to strengthen source reduction, collection, transfer, treatment and disposal of solid waste in the Island and has adopted the Principle of 2RH: Reduction, Resource and Harmlessness in comprehensive solid waste management. It has already established a comprehensive system framework for resource-oriented utilization. Chongming Island is actively promoting the application of solid waste classification and source reduction in different ways. Confined transition and transportation systems have effectively avoided secondary pollution during the transition. The Chongming Solid Waste Disposal Site was rated as Grade I hazardous-free disposal site. A kitchen waste treatment plant has been built and put into operation. The Chongming Solid Waste Disposal Utilization Center has been launched to further promote resource utilization. Recycling and reuse of both agricultural and construction waste is also steadily increasing in the Island. Chongming Island plans to continue implementing the reduction, hazardous-free, resource-oriented utilization principle to further improve on the whole process of solid waste collection, transportation, and disposal to ensure an ecological and sustainable solid waste management system in future.

The following recommended action plans are proposed for Solid waste management;

1. Goal of "zero solid waste": Promote measures towards the realization of the goal of "zero solid waste", including the reduction, re-use, recycling and recovery of solid waste materials.
2. Comprehensive management of solid waste: Promote hierarchical management following the priority of reducing, reusing, recycling, energy recovery and terminal disposition of solid waste. Systematize the strategy of sustainable solid waste management for Chongming Island
3. Resource utilization of solid wastes: Set-up and operationalise the Solid Waste Comprehensive Utilization Centers to continually improve the solid waste resource utilization in Chongming Island. Promote and expand the mechanization of straw returning for agricultural waste. Reconstruct small and medium size biogas engineering treatment areas for pig farms.
4. Cutting edge technologies for the comprehensive utilization and management for solid wastes: Support the development and application of solid waste management and utilization technologies and the spread of industry knowledge. To achieve this, set-up a Cluster of Solid Waste Management Technology Centers among private sector (industry companies), research institutes and academic institutions.

5. Low-carbon economy and energy efficiency. Through the application of Science, Technology and Innovations (STI), Chongming Island has followed a path of low-carbon economy and energy efficient development model. This path has been based on several strategies, which include (1) a low-carbon energy structure mainly supported by clean electricity and supplemented by renewable energy and smart grid, (2) a low-carbon industrial structure framed by advanced eco-agriculture and service industries, (3) a low-carbon infrastructure system through the localization and application of green building designs and low emissions energy vehicle technologies, (4) a natural carbon sinking system supported by forests and wetlands, and (5) a relatively low-carbon lifestyle anchored on the Chinese traditional philosophy of unity of nature and human-being. The continuation of these strategies will make Chongming Island to reach the target of "decoupling of GHG emissions and economic growth" during its 12th Five Year Plan period. As part of Chongming Eco-Island development, a more effective approach to promote regional low carbon development is recommended with the priority being on "controlling carbon demand", "improving carbon productivity", "reducing carbon dependency", and "expanding carbon neutral", in that order of priority.

The following recommended action plans are proposed for low carbon economy and energy efficiency;

1. Controlling carbon demand
   i. Low carbon industry: Consolidate low carbon agriculture and tourism demonstration base, and industrial park.
   ii. Management capacity enhancement: Build a cross-sector and systematic management system to keep evaluating the actual performance of energy consumption and emission reductions.
2. Increasing carbon productivity
   i. Energy saving in secondary industries: a) Phase out the pollution intensive enterprises, and strengthen energy conservation management in key enterprises; and b) establish environmental and low carbon access threshold for new industrial development opportunities.
   ii. Energy efficient buildings: a) Enhance energy efficiency requirement for new buildings, and accelerate energy saving renovation for existing buildings; b) Promote the establishment of integrated renewable energy technologies.
   iii. Sustainable transportation: a) optimize the public transit network and encourage public transport and low carbon emission vehicles; b) introduce a zero carbon emission public transport system in Chongming Island.
   iv. Resource utilization: Accelerate the construction of facilities that support waste separation, transport and disposal.
   v. Energy saving in other fields: Promote energy saving and emission reduction actions led by public service entities.
3. Reducing carbon dependence
   i. Energy structure optimization: Promote clean electricity generation supported by gas-fired power plant; Establish and expand wind farms; Promote the establishment of integrated solar photo-voltaic (PV) system and solar water heating system; and Develop biomass and other renewable energy.
4. Increasing carbon neutral
   i. Enhance and maintain the carbon sink capacity of natural ecosystems: Strengthen the protection of local forest and green land while providing a better environment for local residents; Strengthen the protection and restoration of wetland resources; and Initiate research on the potential for agricultural carbon sink.
   ii. Explore advanced technologies such as Carbon Capture and Storage (CCS).

6. Agriculture and organic products. Several changes have been implemented in the agricultural and organic products domain as part of Chongming Island's agricultural construction. These include a gradual transformation from a traditional extensive agriculture to a high efficient ecological agriculture, a shift from scattered agriculture operation to green organic system construction, from a single production-oriented peasant economy to a multi-functional large-scale urban agriculture, from the a first industrial production with low value added industry to a high value added, first and third combined industry. These changes have contributed towards ecological conservation and low-carbon growth in the Island.

The following recommended action plans are proposed for Agriculture and organic products;

1. Reduction in the utilization of chemical fertilizer and pesticides: Actively promote the use of environmentally-friendly pesticides, encourage the planting of green manure crops and expand the use of commercial organic fertilizers.
2. Circular agriculture: Improve farming facilities to better treat and utilize agricultural wastes.
3. Organic farming: Establish demonstration sites to promote facility agriculture with high standards and use technologies that minimize use of pesticides.
4. Urban low-carbon agriculture: Promote low-carbon agriculture development in the construction of Chongming Modern Agriculture Zone and DFXS Low Carbon Agriculture Zone.
5. Agriculture standardization system: Establish modern agriculture demonstration base and strengthen comprehensive standardized agricultural management.
6. Leisure agriculture tourism: Develop leisure agriculture tourism (agro-tourism), including the rehabilitation of the Beiyan Boulevard.

7. Transportation: As part of developing a low-carbon transport system, Chongming Island is promoting a shift from private motorized transport to non-motorized and public transport system in the Island. This is done through a range of approaches, including optimizing the design of the transportation network, prioritizing people over vehicles, maximizing accessibility by non-car modes (including bicycle), popularizing public transport, developing new energy transportation system, adopting advanced technology of low-emission and promoting international cooperation in energy saving and emissions reduction. The development of low carbon transport system in Chongming Island is also heavily underpinned by science, technology and innovation (STI) to pilot and demonstrate advanced energy-efficient transportation system. The completion of the north and south channel means that Chongming Island now has a smooth traffic connection with the mainland, and the construction of a number of backbone roads in the Island has expanded the road network and improved access to the rural areas. Chongming Island has just commenced the construction of a 120-kilometer rural highway which will be part of the county tube highway network linking the artery of rural roads and village-to-village road network to promote sustainable economic development in rural areas. These have established a solid foundation for the realization of a modern comprehensive and ecological transportation system with convenient connection of the three islands within Chongming and connection between Chongming Island and Shanghai city.

The following recommended action plans are proposed for Transportation;

1. Improvements to the internal and external transport carrying capacity: Connect Chongming Island to the main national highway and establish a comprehensive public transport network.
2. System of green transport infrastructure: Establish and construct walking and cycling transportation network as a part of green multi-functional transport infrastructure.
3. Intelligent Transport System (ITS): Develop and deploy an Intelligent Transport System for Chongming Island.
4. Promote new energy and low-carbon transportation system: Promote private and public use of low-carbon and new energy fuelled vehicles through policy incentives, education and awareness measures. Also, introduce the zero-emission bus in Chongming Island.
5. Policy framework for low carbon transport system: Design the construction of the bicycle park and enhance publicity and education for low carbon transport.

General Recommendations

In addition to the specific recommendations above, the following general recommendations are also proposed for Chongming Island:

1. **Establish Chongming Special Ecological Zone for Eco-Civilization:** Chongming Island is planned to be a world-class eco-island and can serve as an ideal ecological demonstration area in Shanghai City. Chongming Island could be treated as a special region which focuses on ecological civilization to serve as a world model. This could follow the pattern of the special economic zones created for export oriented economic development. Innovation and Knowledge Management (KM) will be critical for Chongming during the ecological civilization construction to continuously document, synthesize and share experiences, lessons, tools, processes and accumulated knowledge on eco-island construction. This can be done through an expanded international network, including exchanges and cooperation with other cities, islands and countries. In this way, Chongming could inspire other developing countries and regions to construct ecological civilization.

2. **Accelerate the dissemination of transformative scientific achievements through a systematic promotion of demonstration projects to amplify the role of science, technology and innovations (STI):** As part of the construction of Chongming Eco-Island, the Shanghai Municipal Government and the Chongming County Government have facilitated and invested a lot of resources to develop, integrate and apply cutting edge technologies, and in the process have accumulated vast knowledge, scientific achievements and demonstration experiences. In order to amplify the role of STI to benefit more stakeholders, Chongming should expand the dissemination of these transformative scientific achievements into practice through the promotion of demonstration projects in a wider range of places, tailored to local contexts.

3. **Strengthen and expand the Chongming Eco-Island International Network as a platform for exchanging best practices, lessons and promoting Chongming Eco-Island Construction Model.** The Chongming Eco-Island International Network was established through the Chongming Eco-Island International Forum held biennially in cooperation with the United Nations Environment Programme (UNEP) and other international organizations. This network should be strengthened and expanded to serve as a platform for sharing experiences, lessons and ideas on eco-civilization and green economy. Through this platform, Chongming could learn from other countries and regions and at the same time share its own experiences with the international community about the Chongming model and the process of constructing a world-class eco-island. This platform can also allow Chongming to benefit and share its expertise with the international community, for example, in the area of evaluation. Currently the Shanghai city plans to evaluate the progress of Chongming eco-island construction every three years but it is also necessary to conduct an international evaluation to identify and assess the progress, challenges and opportunities from different perspective and to draw on the international experiences that could be applicable to the Chongming model. It is thus recommended to strengthen the long-term cooperation with UNEP and establish a five-year international assessment mechanism. During the next phase of development of Chongming Eco-Island, UNEP would then provide technical support specifically on its focus areas of climate change (adaptation and mitigation), disaster preparedness and management, ecosystem management, resource efficiency, chemicals and waste, and environmental governance.

4. **Strengthen human resource capacity, build support system and enhance stakeholder coordination and collaboration.** Chongming Island has identified operations management and policy support as the key pillars of a supporting system for Chongming Eco-Island Construction. As part of this process, there is need to focus on the following: i) strengthen human resource capacity, particularly in the area of infrastructure operations and facilities maintenance; ii) Enact and implement policies, regulations, laws and rules to guide, regulate and supervise the orderly advancement and construction in Chongming Eco-Island, including implementing a security system to support eco-island development; and iii) encourage and co-ordinate the participation of local and regional stakeholders, including local residents, Island enterprises, the scientific communities, neighboring provinces and cities and with relevant government ministries to better motivate the enthusiasm of all parties.

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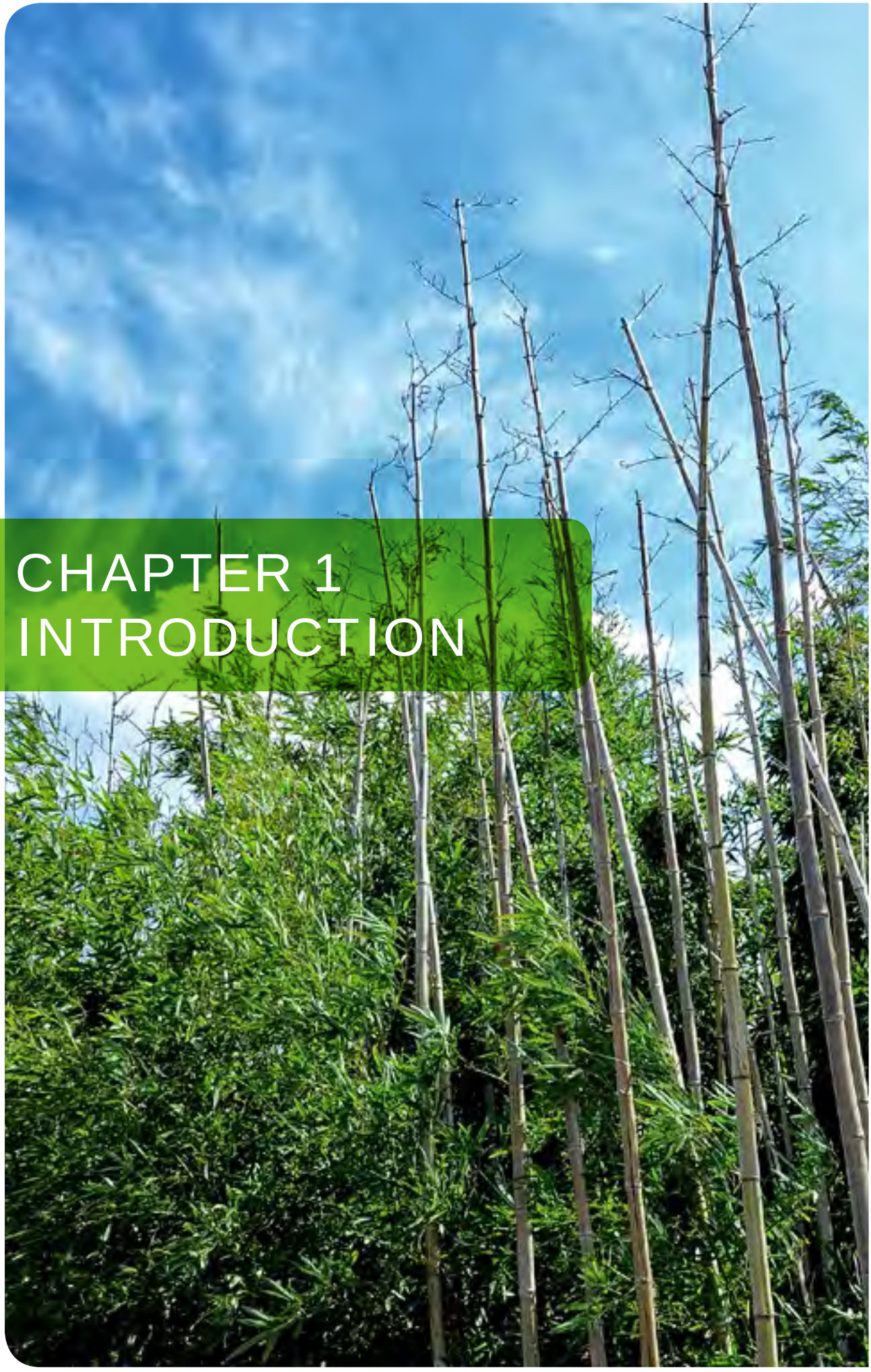


CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 United Nations Environment Programme and Chongming Eco-Island

The United Nations Environment Programme (UNEP) was established in 1972 as the subsidiary organ of the United Nations General Assembly responsible for leading and coordinating action on environmental matters. UNEP acts as a catalyst, advocate, educator and facilitator to promote the wise use and sustainable development of the global environment by working on assessing global, regional and national environmental conditions and trends; developing international and national environmental instruments; and strengthening institutions for the wise management of the environment. UNEP's core objective over the period 2014-2017 is to catalyze a transition towards a low carbon, low-emission, resource-efficient and equitable development based on the protection and sustainable use of ecosystem services, coherent and improved environmental governance and the reduction of environmental risks. The ultimate goal is to contribute to the well-being of current and future generations and the attainment of global environmental goals. UNEP's current work is focused on six priority areas, namely climate change, disasters and conflicts, ecosystem management, environmental governance, harmful substances and hazardous waste, and resource efficiency in sustainable production and consumption. [1]

Chongming Island is the largest alluvial island in the world covering an area of 1,267 km^2. It is located on the estuary of the Yangtze River and the western coast of the Pacific Ocean, residing at the midpoint of China's north–south coastal line. The Island is sandwiched between the north and southern branch of the Yangtze River and is bordered to the east by the East China Sea. The island is isolated from Shanghai City by the south branch of the Yangtze River. Chongming Island has special and unique ecosystems, which include the Dongtan wetlands designated as a Ramsar Convention site because of its strategic location in the midpoint of the Asia–Australia bird migration route and global importance for waterbird conservation.

The Shanghai government has actively explored an "ecological development path" for the Chongming Island. In 2001, it proposed to develop Chongming as an Eco-Island – a special concept for sustainable development in a small Island (Huang et al., 2008). This development approach provides an opportunity for Chongming Island to become a model of ecological Island and to share valuable experiences with other similar eco-regions in China and around the world, particularly the Small Island Development States (SIDS). Chongming has subsequently initiated international collaboration to support the goal of eco-island construction, including with the United Nations Environment Programme (UNEP).

UNEP is also developing wider partnerships with different institutions in China to promote green economy for sustainable development. These partnerships include the present collaboration with the Shanghai government. The relevant highlights of these partnerships include the following milestones;

- **2007:** Partnership agreement signed between Achim Steiner, the Deputy Secretary General of the United Nations and Executive Director of UNEP and the Mayor of Shanghai City.
- **2010:** Shanghai City invited UNEP to evaluate the environmental impact of the 2010 World Expo in Shanghai. The evaluation included an assessment of the environment effects of Expo's preparation and operation on Shanghai and China (UNEP, 2010).
- **2011:** The signing of a Memorandum of Cooperation between UNEP represented by Achim Steiner and the Ministry of Science and Technology represented by Wan Gang.
- **2011:** UNEP together with Chinese Academy of Sciences launched the 'International Ecosystem Partnership Project' to providing support for ecosystem management to contribute towards green economy and poverty reduction in developing countries.
- **2011:** The signing of an agreement between UNEP and the Science and Technology Commission of Shanghai Municipality (STCSM), which addressed the construction of Chongming Eco-Island as an important issue. As part of this agreement, UNEP was requested to evaluate the construction of Chongming Eco-Island and to summarize the relevant experiences arising from this ecological construction to serve as a model and provide guidelines for wider dissemination to other developing countries.

1.2 Conceptual base: Sustainable Development, Green Economy and Eco-civilization

This international evaluation of the Chongming Island is underpinned by three broad concepts of development namely; sustainable development, green economy and eco-civilization. These are briefly described below;

Sustainable development: The concept of "sustainable development" also commonly referred to as "sustainability" emerged at the end of the 20th century to address humanity's

[1] UNEP Medium Term Strategy 2010-2013. Available online http://www.unep.org/PDF/FinalMTSGCSS-X-8.pdf

concern of balancing economic progress with environmental conservation. There are numerous definitions of sustainable development, but the most commonly used definition was provided by the World Commission on Environment and Development (WCED) as " the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs' (WCED, 1987). Since the 1992 Rio Earth Summit which adopted Agenda 21 as the blueprint for sustainable development, many governments and non-governmental organizations have embraced sustainable development putting in place new development patterns and practices to balance economic growth with the social and cultural progress and environmental conservation.

Green economy: In 2008, UNEP published the report Global Green New Deal presenting green development as a pathway towards sustainable development. This is in recognition that ecological resources are the essential inner driver of economic and social development. In its 2011 publication Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, UNEP defines a green economy as one that results in 'improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities' (UNEP 2011:16). From the practice in the world, the principle of the green economy is to optimize economic, social and ecological benefits. UNEP is currently working with member states, the private sector and civil society to adopt "green economy" as a path towards sustainable development. It is envisaged that a green economy will promote low-carbon, resource efficient and socially inclusive growth while contributing to the protection of biodiversity and ecosystem services.

Eco-civilisation: In 2007, the 17th National Congress of the Chinese Communist Party promoted the idea of "Eco-civilisation" that is forming an energy-and resource – efficient and environmentally-friendly industrial structure, economic growth model and consumption pattern. The idea of Eco-civilisation is not new in China. It was used by the government in the mid-1990s, but it is not until 2007 that environmental issues were for the first time included in the Party's political report in China (Liu et al., 2014). The testing and practical application of the eco-civilisation concept is becoming widespread in China especially in cities. According to Guo et al. (2009), eco-civilization is the integral product of material achievement, spiritual achievement and regulations. It is the cultural and ethical manifestation of the harmonic coexistence of humans and nature, balanced development, sustainable prosperity. The key ideology is the harmony and equality between nature and humans, the co-existence of multi-species and the re-production of resources.

Human society has experienced primitive civilization, farming civilization and industrial civilization, of which industrial civilization has changed the world a lot. These civilizations however did not sufficiently account for the fact that human welfare relies on the ecological system under which resources are limited and the likelihood that the over-use of natural resources will result in irreversible damage to ecosystems. Eco-civilization is thus a new kind of civilization which values natural capital and encourages the conservation and wise use of nature and natural resources. It is characterized by independence, integrity, relativity, reflection and process, and is considered as superior to other kinds of civilization. The idea of Eco-civilisation is an attempt to find a way out of present ecological crisis despite the many challenges that still hinder the integration of Eco-civilisation in the development process. The construction of Chongming Island is a case of exploring Eco-civilization construction in China. Although it was first proposed in 2001, the history of eco-civilisation and eco-development in Chongming Island dates back to before 2001, as summarized in Box 1.1.

Box 1.1. History of Eco-civilisation and Eco-development in Chongming Island before 2001

- 1970s: Dongfeng Eco-farm, livestock and poultry manures utilization
- 1980s: Qianwei Village, Eco-agriculture, biogas utilization
- 1997: An article entitled The Advantages and the Concept of Cross-Century Development for Chongming Island was published in the Journal of Shanghai Comprehensive Economy, in which the concept of building a national green eco-island with international influence in Chongming was put forward.
- 1998: Drafting Shanghai Master Plan
- 2000: A research on How to build Chongming into an ecological and green island of Shanghai carried out.
- 2000: The State Council organized a meeting, 13 major departments agreed that Chongming must fulfill the requirement of eco-island development.
- 2001: Shanghai Master Plan was approved, in which the orientation of Chongming as an Eco-Island is stated.

1.3 Ecosystem Management of Metropolitan Regions

1.3.1 Ecosystem Management

Scientific evidence indicates that globally, ecosystems are severely degraded and are under unprecedented pressure, threatening the prospects for sustainable development hence the need for urgent action. For example, a comprehensive report published by UNEP, The Economics of Ecosystems and Biodiversity (TEEB) notes that if the current rate of deforestation continues to 2050, the world will lose US$ 2-4.5 trillion worth of natural capital every year. Recognizing the values of ecosystem services is a critical step towards achieving transformation and growth. The TEEB report for example notes that the annual value of ecosystem services provided by plant pollinators, including bees, is estimated to be about 153 billion Euros, which accounts for close to 10% of the world production of agricultural products. The global community will thus pay a huge price to replace these pollination services if they are lost. The ecosystem is the cornerstone of green economy and sustainable development, and ecosystem management mutually support and develop with green economy.

Ecosystem management has been identified as one of the six priority areas of UNEP. It is considered as a process which can provide ecosystem services by maintaining and improving ecosystem health to help improve human well-being. In 2011, UNEP together with the Chinese Academy of Sciences (CAS) launched the 'International Ecosystem Partnership Project' with the mission to provide science, policy and capacity support to developing countries to integrate ecosystem management approach into their national policies and development plans to enhance the delivery of ecosystem services for human well-being.

1.3.2 The ecosystem linkages between Shanghai City and Chongming Island

Shanghai City is one of the largest cities in the world and a major economic center in China. It is located in the Yangtze River Delta, and covers an area of 6,340 Km2. Due to the increasing urbanization in China, Shanghai city has witnessed an unprecedented growth in human population; in 2011, and the population was estimated to have reached 23.47 million people, making it among the most populous cities globally. The city's economy is also growing rapidly. In 2011 it recorded a GDP of 1.9196 trillion CNY ($304.7 billion). Such rapid economic expansion and population growth require strong environmental leadership hence the pressing need for Shanghai to transition from a traditional development pathway to a sustainable one in which maintaining its ecosystem is essential.

Chongming is the largest alluvial Island in the world and is also the largest ecological demonstration area in Shanghai. Chongming is characterized by unique wetland landscape and abundant biological resources which provide essential ecosystem services supporting local residents and residents of Shanghai City. The opening up of the Yangtze channel has diminished the isolation of Chongming from the mainland. It has enhanced population, material and information flows between the Island and Shanghai, thereby creating several linkages and connections between Chongming Island and Shanghai that span economic, socio-cultural and ecosystem domains. Chongming is strategically important for the sustainable development of Shanghai because it is an integral part and an important ecological service function zone for Shanghai City. It plays a prominent part in enhancing the competitiveness of Shanghai, cultivation of new growth points and the construction of Shanghai world city in the era of globalization and Eco-civilization. The effective management of Chongming Eco-Island ecosystem not only plays an important role to maintain the ecological balance of Shanghai, but also to China's construction of Eco-civilization. In addition, it has great demonstration effect to the synchronization between ecosystem protection and development in the less developed regions. Relying on the strong economy and technological prowess of Shanghai, Chongming ought to actively explore pathways of Eco-civilization construction. Already, the efforts and practices that have been undertaken in Chongming are expected to enlighten other developing regions and countries, and to demonstrate possible pathways of Eco-civilization construction.

1.4 Overview and Approach to the Evaluation

This environmental evaluation report aims to establish an environmental baseline for Chongming Eco-Island to provide an assessment of challenges and opportunities associated with its development. It gives a comprehensive assessment of Chongming Island based on the social, economic and environmental aspects of the Island. The beneficial experience of promoting the construction of a "world-class" ecological island is summarized with the aim to provide demonstration effect of "Eco-civilization" to other parts of China, and the development of ecological economy in the less developed regions of the world.

The broader objectives of the evaluation report are to:

i. Identify the baseline scenario and key value of Chongming ecological development.
ii. Identify the current status and construction plans for the Chongming Eco-Island Construction.
iii. Identify key performance indicators to evaluate progress of the eco-island construction.
iv. Identify opportunities for developments, and how these can be successfully implemented.
v. Identify threats to key values associated with the development of the eco-island and how these may be mitigated.
vi. Identify the challenges and opportunities in existing plans and provide recommendations for their modification and enhancement.

1.5 Structure of the Report

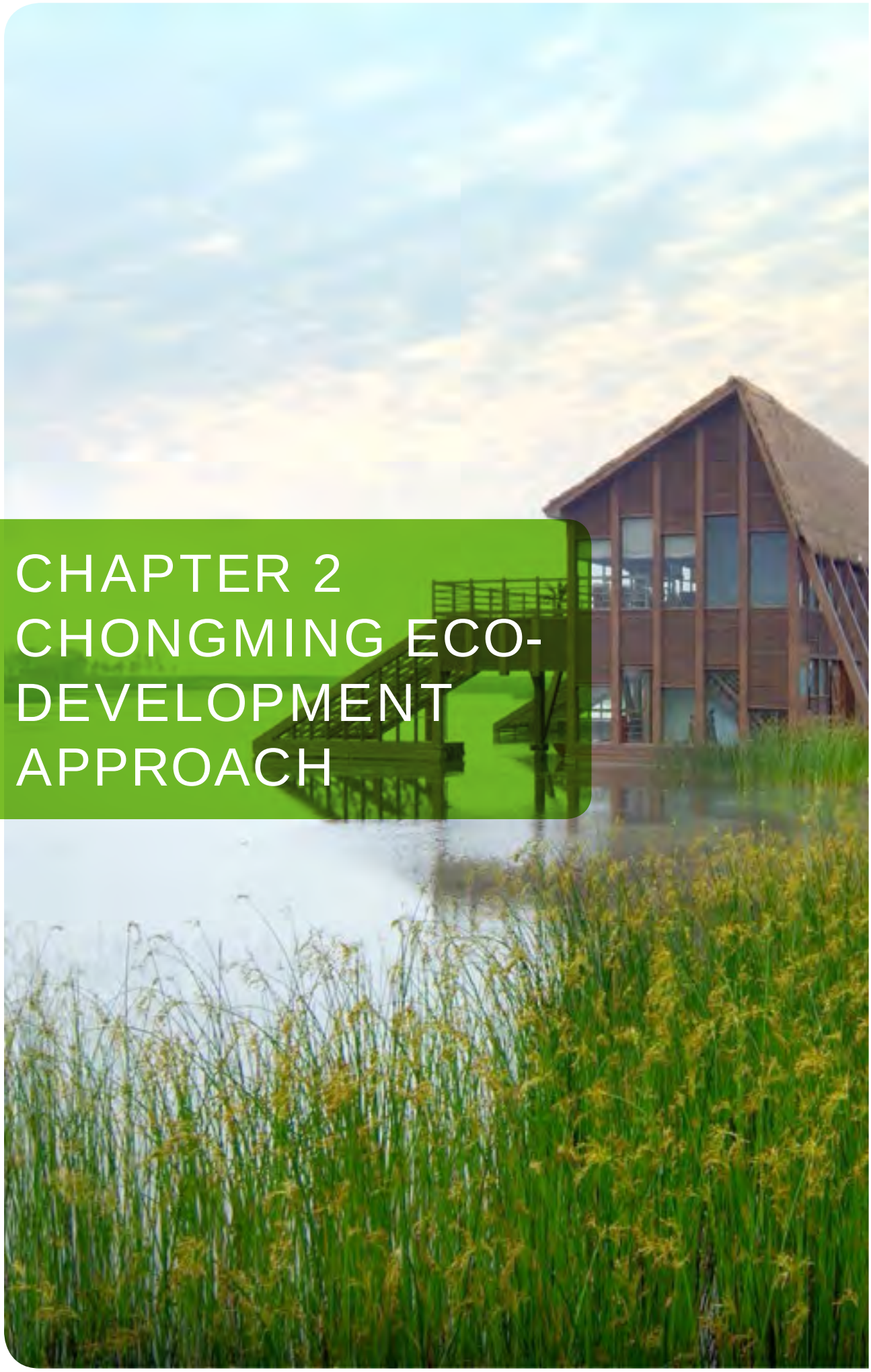
This report provides an evaluation of the development path of Chongming Eco-Island construction based on the activities carried out in seven major theme fields. For each of the theme field, the report is structured to include the baseline scenario, the progress to date, challenges and opportunities and a summary of the recommended action plans. The action plan is meant to act as a guide towards the future development of the Island. Star symbols are used to show the degree of importance attached to the recommended activities listed in the action plans. The evaluation of the importance is based on the expert judgment of the reports' initial author. The designated symbols are described in Table 1.1 below. The report's recommended action plans also identifies a time horizon for implementation in the immediate, short-term (2-3 years), medium term (5-10 years) and long-term (over 10 years).

Table 1.1 Symbols used to show the degree of importance of recommended action plans in the evaluation report.

Symbol	*Explanation*
☆	Relatively important
☆☆	Important
☆☆☆	Very Important

The report consists of the executive summary, the introduction, nine substantive chapters and conclusion as outlined as below:

- Chapter 1: Introduction
- Chapter 2: Chongming Eco-development Approach
- Chapter 3: Society, Life and Culture
- Chapter 4: Biodiversity and Protected Areas
- Chapter 5: Water
- Chapter 6: Solid Waste
- Chapter 7: Low-Carbon Economy and Energy Efficiency
- Chapter 8: Agriculture and Organic Products
- Chapter 9: Transportation
- Chapter 10: Conclusion



CHAPTER 2
CHONGMING ECO-DEVELOPMENT APPROACH

CHAPTER 2 CHONGMING ECO-DEVELOPMENT APPROACH

2.1 Background to Chongming Eco-Island

2.1.1 Geography and ecology

Chongming Island occupies an area of area of 1,267 km2, and is sandwiched between the north and the southern branch of Yangtze River and bordered by the East China Sea to the east. It is the largest alluvial island in the world and the third largest island in China. Chongming Island has a typical mild and humid maritime climate with an average temperature of 15.20C, an average rainfall of 1,025 mm per year and a relative air humidity of around 80%. The major ecosystem types on Chongming Island are agro ecosystems and natural wetland ecosystems. Agro-ecosystems dominate most of the land use and provide most of the food supply (Huang et al., 2008); agriculture is the largest form of land use in the Island, comprising 70% of the land cover. The whole island is flat in terms of terrain, with fertile soil, luxuriant forests and abundant natural resources. Other relatively important land uses include water area (11.9%), residential areas (9.7%) and Shoals (5.9%: STCSM, 2011). Natural wetland ecosystems are widely distributed along the coastline and provide important habitats for many wildlife species. To the east of the Island is the Chongming Dongtan Nature Reserve, which is recognized as a wetland of international importance under the Ramsar Convention.

2.1.2 Culture and socio-economy

The name Chongming has a special meaning in Chinese. The word “Chong” means worship while the word “Ming” means justice. Chongming has a long history with a solid culture dating back to 1,300 years. The residential population in Chongming Island in 2010 was estimated at 575,000 people, with 22% of the population residing in the urban areas. The majority of the Islands residents depend on agriculture for their livelihoods; it is estimated that 75% of the employed people are engaged in commercial and subsistence agriculture (Huang et al., 2008). The average life expectancy in Chongming is 80.26 years, which is higher than the national average of 72 years, making it to be selected as “The longevity town in China” in 2012. Chongming is ranked as China’s 15th town of longevity and was the first island of longevity in 2010. The economy of Chongming Island has developed rapidly in the recent years with consecutive double-digit GDP growth rate. In 2011, Chongming’s GDP reached 13.55 billion CNY (around US$ 2.15 billion).

2.2 The process of Chongming Island eco-construction

Being a small Island that is geographically isolated and with limited terrestrial natural resources, Chongming is also highly vulnerable to environmental disturbances, including susceptibility to climate change and sea level rise, salt water intrusion, exotic species invasion, and sensitivity and exposure to natural disasters. However, as the third largest island of China, Chongming Island is faced with unprecedented development opportunities. It is a national strategy for the Chinese government and a mission for the Shanghai government to construct Chongming into a world class eco-island, which is of distinct character and far-reaching historical significance. This requires putting in place strategies and plans to realize the vision of an Eco-Island. The Master Development Plan for Chongming Island (MDPCI) states this perspective as follows (STCSM 2011);“By 2020, Chongming will be built as an eco-island and “offshore garden” with a beautiful environment, developed economy, prosperous culture, strong social security, and urban-rural integration. Chongming will become a leading national and first-class international demonstration island for human eco-environment and eco-activity”

2.2.1 Development orientation of Chongming

The Chongming development goal of building a “National Sustainable Development Experimental Zone” reflects its strategic choice of orientation of ecological civilization and transition of development model, driven by low-carbon economic development and showing the level of the global leader in eco-technology, to realize the following five functions: harmonious society; economic development; environment-friendly; ecological civilization and scientific management. The main goal of Chongming Island is to become a “World-class urban eco-island and offshore garden” (STCSM, 2011). This will be achieved through realization of the following four (4) goals a) Research and Development Island, b) Resort Island, c) Residential Island, and d) Garden Island. Thus far the development orientation of Chongming Eco-island has met several milestones, which include;

- 2001: The concept to develop Chongming as a comprehensive eco-island was proposed
- In October 2005, the **Master-plan for Chongming Island** was published, setting up the basic principle of environment and ecological priority.
- In January 2010, the **Chongming Eco-Island Construction Outline (2010-2020)** was published to provide an overall strategy for Chongming Eco-Island Construction. As a rural area in the largest economic center Shanghai, Chongming could through eco-civilization maintain its superiority in ecological environment based on its unique advantages. The development of Chongming Eco-Island is expected to open up opportunities for

developing a green economy and to improve the living standards of its local residents, while maintaining the integrity of the island's unique ecosystems and biodiversity.

- In March 2010, Chongming Eco-Island was approved as a **National Experimental Zone for Sustainable Development** in China, with the goal of building a world-class ecological island (Box 2.2). The core is Eco-civilization, practicing 'coordinating in a systematic way, developing in low-carbon way and cooperating in full range of aspects'. In addition, it will actively explore practical process of the idea of Eco-civilization and green economy, which is meaningful and valuable.

Box 2.1: Chongming National Experimental Zone for Sustainable Development (NEZSD)

Background: the construction of Chongming National Experimental Zone for Sustainable Development (NEZSD), a local comprehensive demonstration for sustainable development, is promoted by Chinese Ministry of Science And Technology and the local government, which aims at improving science technology and system and innovating mechanism. Furthermore, it will improve sustainable development in experimental zone, study different mechanisms and patterns about economy, society and coordinated development of resources and environment in different areas. On March 16, 2010, Chongming Island became the National Experimental Area for Sustainable Development approved by China National Ministry of Science and Technology.

Goal of development: highlighting the strategy selection of the Eco-civilization development, through a low-carbon economy, the realization of a 'harmonious society, economic development, friendly-environment, Eco-civilization and scientific management' that underpin a world-class ecological technology.

Core development areas: This includes the four aspects below:

a. Adjusting the industrial structure and developing the low carbon economy.
b. Promoting social improvement and creating a harmonious society.
c. Carrying out further environmental management and promoting friendly environment.
d. Setting up the idea of low carbon life and advocating low carbon way of life.

2.2.2 Governance and Stakeholder Engagement

The construction of the Chongming Eco-Island involves many stakeholders, including the following;

- The Chinese national and the local governments (Shanghai Municipal Council and the Chongming County Council).
- the local residents of Chongming Island, some of whom are involved in project demonstrations such as eco-farms.
- The private sector and business owners in Chongming Island.
- the Science and Technology (S&T) community including scientist working in the labs running the demonstration sites.
- The local universities in Shanghai.
- International institutions and organizations that have collaborative arrangements in various aspects of with Chongming Island development processes.

The views of these stakeholders are taken into account through several processes, especially public consultations that include attitude surveys, meetings and as part of the Environmental Impact Assessment (EIA) undertaken prior to construction of projects. A public survey on the Action plan of Chongming Eco-Island carried out in 2009 by a research group elicited attitudes of different stakeholder groups (Table 2.1). The three top concerns in order of priority for the people in the villages were social security (64%), improvements in environmental conditions (59%), and employment opportunities (54%). As for the residents, the majority were concerned with improvements in economic development (67%), provision of employment opportunities (61%) and social security (56%).

Table 2.1. The Discrepancy of the Focus on Chongming Eco-Island Construction (unit :%)

Focus	*County*	*Town*	*Village*	*Resident*	*Total*
Economic Development	64.04	57.47	51.28	66.67	59.03
Employment	42.11	63.98	53.85	61.11	57.18
Environment Condition	57.89	51.34	58.97	50.00	53.70
Social Security	46.49	50.19	64.10	55.56	50.69
Government Management	41.23	58.62	28.21	38.89	50.46
Ecological Safety	42.11	49.43	51.28	38.89	47.22
Infrastructure	42.11	43.68	41.03	38.89	42.82
Wetland Protection	38.60	42.15	48.72	33.33	41.44
Others	2.63	0.77	0.00	5.56	1.39

The survey also revealed a number of critical issues in relation the stakeholder's perspectives. Most of the interviewees actively participated in the survey and showed their great concern about the Chongming Eco-Island Construction. Suggestions are mainly focused on the two aspects as follows:

Firstly, people pay attention to the policy implementation. Most of the interviewees emphasize that Chongming Island shall stick to the implementation of indicator system and action plan and accelerate the construction pace. In this way, Chongming will become the focus of China and the world and attract more and more people to come to Chongming, which is the promising future for everyone. Therefore, it is necessary to actively promote the indicator system and action plan of Eco-Island Construction, helping every resident to fully understand the deep meaning of Eco-Island Construction and encouraging them to take part in the process of construction. Chongming need to enhance infrastructure and road traffic construction, especially the way to Shanghai to enlarge communication, which also promotes economic development. Chongming will introduce foreign advanced technology, management and all kinds of projects to develop a world-class eco-town, eco-village and theme park. To pay attention to ecological protection and restoration and environmental remediation, at the same time, Chongming will improve the quality of residents themselves. Therefore, Chongming can make great progress towards material and spiritual construction together. Chongming should focus on economic development and tourism and develop some low-pollution and non-pollution industries to increase residents' income, realizing the development of economy and ecology. In other words, residents can benefit a lot from the ecological construction both in living condition and living environment.

Secondly, they pay attention to the people's livelihood. Interviewees were anxious to improve the present condition of the people's livelihood. In one way, Chongming makes a great contribution to the economic development, moving industries and enterprises to park zone under the unified management of the government. In another way, minimizing the environmental and ecological damage is also required. Chongming will accelerate the construction of waste water treatment facilities and improve water quality. It is limited to burn the straw in large-scare, in order to improve air quality. Chongming shall invest more to new socialist countryside construction and increase social welfare of farmers. It is urgent to solve the employment issue resulting from many closed enterprises for ecological construction. The construction and management of the cemetery island should be under unified planning rather than scattered distribution, avoiding negative influence on tourism and land waste. The construction of effective renewable self-generated energy system is mentioned gradually. Chongming should strengthen the management of temporary habitant population, improve the social security and build a harmonious society. Improving government management and making financial budget more transparent is also necessary.

2.2.3 Indicator system of Chongming Island Eco-construction

In order to provide a scientific basis for government decision making and to promote the process of the construction of Chongming Ecological Island, there was need to set up a scientific indicator system with three major functions; to guide the direction of Chongming Eco-Island's construction, to standardize the practice of Chongming Eco-Island's construction, and to control the process of construction in the Island. Consequently, in 2007, the Shanghai government organized and supported studies to develop an indicator system for the Chongming Island Eco-construction. The indicator system is based on the sustainable development conceptual framework of the United Nations and is derived from the China's existing indicator system. The process involves the collection and documentation of experts' suggestions at both the regional and international fields and the public participation in Chongming Island to format this unique development indicator. The target is to build a scientific, rational and comprehensive evaluation system, making the development direction of Chongming Island towards the world-class sustainable ecological island. The indicator system has been developed to comply with the following four principles:

- Advancement: establish a world-class ecological island;
- Scientific: explore methods and rules to achieve the further development;
- Operability: fit with the current situation and future development needs;

- Guidance: guide the design and implement of detailed indicators in each department.

To make special goals for each stage of development and achieve the above goals, the project team set up an Expert Advisory Committee to work with Chongming officials to provide dynamic monitoring and supervision to ensure a sustainable ecological development guided by the index system requirements.

The Chongming Eco-Island Construction Outline (2010-2020) published by the Shanghai government in January 2010 is based on the strategic thinking that the ecological island construction should adhere to the three concepts of systematic coordination, low carbon development, and an all-around cooperation concept. The index evaluation system is established for better ecological security, environmental protection, industrial structure, livelihood and management according to the general conception of improving ecological civilization, environmental friendship, economic soundness, social harmony and scientific management, combining international ideas and Chongming's practices so as to push forward the construction of Chongming eco-island.

A set of 22 evaluation indices are identified in the Chongming Eco-Island Construction Outline (2010-2020). The Actions for the Chongming Eco-Island Construction objectives for the period 2010-2012 are focused on six action areas, 16 action items, and 95 construction projects, which together involve a total investment of about 14 billion CNY. The six Action Areas (Table 2.2) are; Natural resources protection and utilization; Circular economy and comprehensive waste utilization; Energy utilization, savings and emission reduction; Environmental pollution control and eco-environment construction; Eco-industrial development; and Infrastructure and public services.

Table 2.2. The Chongming Eco-Island Construction Action Plan (2010-2012)

Key field	*Category*	*No. of projects*	*Total*
1) Protection and sustainable utilization of natural resources	The protection, development and utilization, of water resources	9	17
	Protection of the ecological island natural wetlands, woodlands, greenbelt	8	
2) Circular economy and comprehensive utilization of waste	Recycling garbage utilization	3	11
	Comprehensive utilization and management of agricultural waste	8	
3) Energy efficiency use, energy conservation and emission reduction	Optimize the energy structure	3	10
	Energy conservation and emission reduction	4	
	Green building and building energy saving	3	
4) Environmental pollution and ecological environment construction treatment of pollution and ecological environment creation	Water environment protection and management	24	30
	Solid waste management	3	
	Comprehensive management of environment	3	
5) Eco industrial development of ecology-oriented industries	Modern ecological agriculture	12	19
	Clean production and eco industry in environmental protection	4	
	Modern service industry	3	
6) Infrastructure and public service	Urban construction and infrastructure	2	8
	Traffic construction	3	
	Public service	3	
Total	16	95	

2.2.4 Science, Technology and Innovation (STI) Support for Chongming Eco-Island Construction

The construction of the Chongming Eco-island is a process that is strongly driven by STI application and support, co-ordinated by the Science and Technology Commission of the Shangai Municipality (STCSM). The overall goal of the technological support is a “high and new technology development, application and dissemination” supporting the construction of an eco-balanced and environmental security system; the establishment of eco-industrialization and an industrial ecologinization system, and the development of an ecological infrastructure and residential environment (STCSM, 2011). The milestones highlighted below have so far been achieved in respect of the use of S&T in the Chongming’s development process.

- In August 2004, more than 100 experts drawn from colleges and research institutions participated in the program of Science, Technology and Innovation (STI) support for the construction of Chongming Island.

- In March 2005, the implementation scheme of Science, Technology and Innovation (STI) for Chongming Eco-island was officially established. This was in addition to a committee of experts that was also constituted through a cooperative arrangement between the ministry and the municipality to provide specific scientific advice to the project.

- In December 2005, the technological center of Chongming Eco-island was built, establishing both the role of leadership and the role of coordination for the construction of Chongming Eco-island. With a hierarchic mode of “village-town–island”, the work of technology support was incorporated as part of Chongming Island development, putting the emphasis on research in the area of natural ecology, habitat ecology and production ecology.

- In March 2006, the outline of Chongming Eco-Island Construction (2006-2010) was published, taking the demonstration project of Chongming Eco-island as a major special project, making a technologic foundation for the development of ecological civilization.

- In March 2010, Chongming Island was designated by the Ministry of Science and Technology as an experimental area for sustainable development, defining the direction of the construction of Chongming Island.

Currently, Chongming Island is considered a preliminary practice area of ecological technology, the zone of ecological industrial cultivation, and an "ecological civilization demonstration zone". The Island continues to explore and practice a sustainable development path to balance the development between ecological protection and economic growth.

2.2.5 The Performance and Achievements of Chongming Eco-Island Construction

As part of the evaluation of the performance of Chongming Eco-island Construction, the Shanghai Municipal Development and Reform Commission issued a report based on the methodology outlined in Chongming Eco-island Construction Index System. The report evaluated the difference between target and baseline. It showed that 96% of the indicators have reached phased target. Since the initiation of the eco-island construction, Chongming strengthened environmental infrastructure capacity which focuses on "water, lands and forests" and Chenjia Town, the environmental quality has been significantly improved. Stakeholders in municipal and county level developed a shared vision on construction promotion, taking a solid step to world-class eco-island.

2.3 Chongming Mode and Experience

Chongming’s construction follows its own circular development mode, namely, establishing a shared vision, understanding current situation, setting targets, developing action plans, implementing plans and support system, monitoring and evaluating the performance. This process is outlined in Figure 2.1. below.

Fig. 2.1 Chongming’s Circular Development Mode

a. Shared Vision: The vision of building a world-class eco-island is shared among the stakeholders, especially the government (local and national) and the general public. This helps concentrate resources (financial, technical etc) for the eco-construction. The plan to make Chongming an eco-island has been identified in a series of official documents, including the Shanghai Master Plan (1999-2020) which was approved by the State Council, the Chongming Three-Island Development Master Plan (2005-2020), and the Chongming Eco-Island Construction Outline (2010-2020).

The main functions of Chongming Eco-Island as envisioned in this vision are shown in Box 2.3.

Box 2.2 Chongming Eco-Island Development Goals and Functional Orientation

Forest Garden Island: To form an ecological-conservation island with an emphasis upon the Yangtze River Estuary Wetland Reserve, the International Migratory Bird Reserve, the Plain Forest and the River Estuary Water System.

Ecological Inhabitation Island: To form an ecological-inhabitation island that is well-designed, quietly-surrounded, conveniently-located and culturally-advanced.

Leisure Vacation Island: To form an eco- tourism island that caters for leisure, sports and entertainment, relaxation, training, conferences and exhibitions.

Green Food Island: To form an eco-agriculture island featuring the local organic farming produce industry and aquaculture industry as well as the green food processing industry.

Science and Technology Innovation Island: To form a knowledge-based economy island promoting professional environmental services, technology research and development, international education and consultation forums

(Source: Chongming County Government, 2010).

b. Understanding the Current Situation: Reasonable targets are based on the understandings of current situation. Data collection is preliminary task of eco-island evaluation. Therefore, the Shanghai government gathers expert resources, establishes index system to help obtaining accurate status data on the following fields; natural resources, environment, industries, infrastructure and public service. Based on these data, the Shanghai government has carried out the evaluation on the first round of Chongming Three-Year Action Plan.

c. Clear Target Setting: Under the shared vision, Chongming has set targets at multiple levels to measure whether the overall goals are being met. In addition, combined with long-term and short-term goals, dynamic adjustment has been realized during the implementation with the aim of achieving the shared vision. Chongming has set concrete targets in six fields consisting of natural resources protection, circular economy and comprehensive utilization of wastes, energy utilization and reduction, environmental pollution control and eco-environment construction, development of ecological industry, infrastructure and public service.

d. Feasible Action Plan: A proper plan should be feasible and adjustable. Chongming has carried out promotion mechanism for feasible action plans. These plans focus on the six fields mentioned in c above. During the first round of Chongming Three-Year Action Plan, 16 secondary plans and 95 practical programs have been carried out (Table 2.1) and these have a total investment worth 14 billion CNY. Long-term planning and the current construction should be combined throughout the world-class eco-island construction.

e. Implementation and Support System: In order to ensure the implementation of the plans, Chongming has taken measures in technology development, multi-stakeholders engagement and educational awareness. The first measure is to initially build technical support system through Science, Technology and Innovation (STI) and integrated demonstration. Since 2005, the Chongming Eco-island Construction Science and Technology Project has provided technology innovation and integrated applications. Chongming has initially built several demonstration programs. Examples include the Yingdong Eco-village, the International Ecological Community of Chenjia Town, Dongtan Wetland Restoration, Beiqiyao Modern Agricultural Park and demonstrating of ultra-capacitors car.

The second measure is multi-stakeholder participation and international cooperation. This includes the government departments, private sector enterprises, research institutions and the public as stakeholders involved in the Eco-Island Construction. In addition, Chongming has paid much attention to the cooperation with international community and organizations in order to further enhance the technology level and international influence, particularly through the “Chongming International Forums”. During the 2010 Forum held alongside the Shanghai World Expo, Chongming signed cooperation agreements with many foreign institutions, among them Hawaii State, Japanese Environment Art and Culture Studies. These agreements have helped place Chongming at the international stage and to build international cooperation networks. An important international cooperation process involved the signing of a Memorandum of Cooperation with the United Nations Environment Programme (UNEP) which included support for the evaluation of Chongming Eco-Island Construction. This will allow Chongming’s construction model and its effectiveness to be evaluated based on international standards, and could potentially make it possible for Chongming to serve as an international ecological demonstration area.

The third measure is to strengthen education and publicity, and to create a conducive atmosphere of building ecological island. Ecological education system is the first consideration. Publicity and education of eco-island can be strengthened through public service advertising, teaching material and training. Through the use of the media, including TV, broadcast, newspaper and the internet, Chongming has organized some activities such as call for Chongming’s theme

words on the internet and Public Environmental Satisfaction Survey. These actions have explored the wisdom of the public, and form an atmosphere of constructing eco-island among the whole people.

f. Monitoring and Evaluation: The monitoring and evaluation system of Chongming Eco-island construction consists of three steps. The first step is to build a world-class eco-island construction index system. This index system is developed and prepared by a large number of experts through a combination of discussions and field research. The second step is to establish a monitoring network system. The network involves monitoring environmental qualities including land use, water quality, atmospheric environment, acoustic environment and solid quality. The monitoring network also involves aquatic and wetland ecosystems in order to realize comprehensive monitoring and evaluation. The third step is to establish a dynamic performance evaluation mechanism of eco-island by enhancing feedback. Chongming has pursued an assessment appraisal system ruled as "assess every year and evaluate every three year". Dynamic monitoring and annual assessment work will be implemented by establishing early warning monitoring and evaluating system. Through the 3-year performance evaluation, a dynamic feedback mechanism can be built to identify problems and realize optimization during the construction. Based on the above, Shanghai Municipal Development and Reform Commission has completed the evaluation of the first round of Chongming's action plan (2010-2012). This international evaluation report is a part of this periodic evaluation.

2.4 Chongming Eco-Island's Future Developments

The major future developments both planned and in progress on Chongming Eco-Island include the following:

- Initial developments of Chenjia Town Ecological City
- Extension of two metro routes to reach points on Chongming Island from Shanghai
- Establishment of a world class sporting precinct in Chenjia Town
- Construction of the Dongfeng Xisha Pointbar Reservoir
- Extension of sewage treatment services
- Increasing the proportion of certified organic farms on Chongming Island.

Additional details of the planned developments and targets are provided in the proceeding thematic chapters 3 – 9

Chongming Eco-Island
International Evaluation Report

CHAPTER 3
SOCIETY, LIFE AND CULTURE

CHAPTER 3 SOCIETY, LIFE AND CULTURE

3.1 Baseline Scenario

The Chongming Island is home to an estimated at 575,000 resident population (based on data for 2010). As a world class Eco-Island, Chongming should exemplify natural eco-health, residential eco-harmony, advanced industrial ecology, rich cultural ecology, demonstrative purpose and strong international competitiveness all geared towards the realization of sustainable development in the Island. This chapter will focus on detailing the development of industrial, residential and cultural ecosystems.

3.1.1 Eco- Industrial Development

According to Deschenes and Chertow (2004), Islands are systems are closed and bounded in many respects which lead to the challenges for the Island populations such as limited resource availability, tenuous resource security and limited natural carrying capacity. While every human population faces these challenges, the need to find solutions for sustainable development is much more immediate in island systems. The tools of industrial ecology, a growing field that examines industry embedded in nature in a systems approach, can present an opportunity for sustainable solutions to human development in Island systems (Deschenes & Chertow 2004; Dunn & Steinemann, 1998).

The "Chongming Eco-Island Construction Outline (2010-2020): Overall Strategy for Chongming Eco-Island Construction" lists three components for Chongmings Eco-industrial development: Modern ecological agriculture development and green agricultural base construction; Cleaner production and hi-tech environment-friendly eco-industrial system construction; and a modern service industry system for economic restructuring. Thus, unlike the conventional industrial development pattern that is common in many developing regions, Chongming Island takes advantage of its special locale and diverse ecological systems by planning for development that is guided by the principles of industrial ecology. The future industrial development of Chongming Eco-Island will focus on market expansion, infrastructure, building knowledge resources and other high level factors of production, while maintaining the ecological and ecosystem services of the Island. The development of Chongming Eco-Island will therefore be centered on an eco-industry system that is constituted primarily of eco-agriculture, eco-tourism, eco-real-estate and creative industry with an aim to realize industrial ecology by constructing industry cluster and embedding an innovation network.

3.1.2 Harmonized Residential Ecosystem

Urbanization is associated with increased demand for and expansion of infrastructure supporting human settlements, mobility and commerce, including trade in goods and services. These infrastructures include, but are not limited to standardized buildings, convenient transportation networks and an enabling environment to support the provision of public services, more comfortable lifestyles, more diverse culture and a better living environment. In forested and coastal areas, amenity migration (also called "Tree-Change" and "Sea Change") has become a common phenomenon mainly used to express revulsions at the high-paced, pressured lifestyle of mega metropolis, and a yearning to return to simplistic and naturalistic lifestyles. On the Eco-Island, people can relish in the leisure of vast open space, enjoy clean air and water, in the meantime establishing family farms, eco-farms and developing agritainment in order to realize the dreams of budding rural entrepreneurs.

3.1.3 Rich Cultural Ecosystem

The core value of a cultural ecosystem is the continued development of local culture, which helps to strengthen regional characteristics, improve residents' sense of belonging and pride, concentrate Eco-civilization results and fundamentally enforce the goal of Eco-civilization construction. A world-class Eco-Island should be the embodiment of social culture and eco-technologies. Chongming Eco-Island possesses diverse and unique cultural heritages, such as artefacts, religions, holidays, folklores and arts that should be maintained. A culturally rich community could be an effective foundation to spread technology and culture as a means towards environmental and socio-economic development.

3.2 Progress to date

In the Yangtze River Delta, Chongming Eco-Island stands out because of its natural ecology. As a suburb area of the Shanghai metropolis, Chongming possesses a tremendous regional comparative advantage. In 2011, it generated an added value of approximately 13.55 billion CNY to the local economy, and has maintained a rate of economic growth that is higher than Shanghai's average in recent years, with a steadily improving quality of economic operations and steadily reducing the quantity of polluting enterprises. The government has implemented a series of policies to ensure sustainable development in the Island and invested in a number of projects to facilitate and improve the residential and cultural eco-system.

3.2.1 Eco-Industrial Development

By the end of 2012, Chongming industrial ecosystem had achieved preliminary progress as evidenced by the gradually improving industrial infrastructure. High efficiency eco-agriculture continued to develop and food production remained stable in the Island. The progress in terms of eco-agriculture include; the establishment of 494.22 acres of green leaf vegetable plant which fully fulfills the vegetable demands from the city, the creation of over 100 agriculture

demonstrative districts, the certification of 129 agricultural products as organic, green and pollution-free, and the establishment of 102 new Chongming agricultural products department stores (counters), generating 610 million CNY of revenue from the city.

Progress has also been made in cleaner production through application of science and technology (S&T). These include structural readjustment for industry clustering, the stimulation of an IT industry which has led to the development of Intelli-Island IT Industrial Park that is already attracting investments, and the formation of a framework for headquarter economic park.

There is also progress in the development of a modern service industry, spearheaded by eco-tourism. Chongming Eco-Island now welcomes about 3.7 million tourists annually generating 600 million CNY worth of revenue. Some other progress includes the consolidation of the science and tourism collaboration in the management structure of Dongtan Wetlands Parks, the ongoing renovation of the phase 2 of the Dongping National Forest Park and of the Mingzhu Lake Park cultural activities center projects, the construction of eco-villages in Qianwei, Yingdong, Lvgang, and the successful implementation of holiday festivities such as forest-fest and bicycle carnival in the Island.

3.2.2 Residential Eco-System

Riding on the wave of urban development in Shanghai and newly constructed infrastructure, Chongming Eco-Island has entered the phase of rapid urbanization. Chongming New Town, along with the four towns of Xianghua, Bao, Xinhe and Miao are situated around the southern riverbank of Chongming Island, also known as Chongnan (South of Chongming) subarea, collectively forming the largest and most dense chain-shaped urban agglomeration area. Chenjia Town is located at Chongdong (East of Chongming) subarea with a composite structural characteristic, becoming a nodal town along the Chinese costal great pathway (Box 3.1). In addition, the planned Mingzhuhu Town and Beihu Town are located at Chongxi (West of Chongming) and Chongbei (North of Chongming) subarea respectively.

By 2012, the urbanization rate of the entire island had reached 40%. According to the overall plan, the number of village-level settlement will be contained at 188, and the urbanization rate will go above 70% by 2020.

The average life expectancy for residents in Chongming Eco-Island is estimated at 80.26 years In September 2010, Chongming was successfully certified as one of China's "Villages of Longevity"; places with over 75 centenarians among every one million people. The Island's natural environment and close proximity to the mega metropolis of Shanghai and China's eastern coastal rapid economic development belt confers positive influences to the longevity of Chongming residents. By June 2010, there were 95 elderly residents above 100 years of age representing 0.02% of the Islands total population. In addition, there were 29,000 elderly residents above 80 years of age, comprising 5.04% of the total population (See Box 3.2. for details on the Elders Community).

Box 3.1 Chenjia Town "Community-Neighborhood" System

The scale and distribution of the current population of the town formed the basis of the "community-neighborhood" system. Targeted at the strategic goal of island garden village, Chenjia Town is spearheaded by the four primary functions of eco-living, knowledge discovery, recreational sports and clean production. The layout is characterized by "four pieces intermingle, Y-shaped combination" of rural and urban area distributions. As the next layer of the "community-neighborhood" system of Chenjia Town, neighborhood units are designed to be located within five minutes of comfortable walking distance between each other, with the population controlled between 5,000 and 10,000 in each unit. The entire "community-neighborhood" system revolves around solving the current issue of sparse connections among countries, limited scale of construction and reliance on commuting. The system establishes foundation for the configuration and refinement of local public infrastructure.

Box 3.2 Elder's Community

As the society becomes increasingly urbanized and aged, the care of the elderly population has become an issue of great policy and public interest. The "elder community" approach in CEI explores positive alternatives to care of the elderly population. An elder community tailored for chronologically gifted residents is under construction at the eastern part of Chongming Dongtan Eco-City and is projected to be completed in 2015. This community will take up 444.8 acres (2,700 mu) of land and estimated capacities of more than 10,000 elders. When operational, the community will be fully equipped with multi-purpose business, commute and fitness facilities.

By the end of 2020, Chongming Island is scheduled to reach the target value of 15,000 CNY of social affair development expenditure per capita. So far, the social affair development funds have supported the projects outline below, which help to improve the level of education, fitness, culture and ultimately quality of life of Chongming's local residents;

- Chongming Museum: The history of Chongming Museum dates back to the Qing Dynasty. Officially founded in 1959, the museum contains a collection of 1,000 pieces of artifacts, among which 300 are considered cultural heritage of Chongming. Tourists may learn about the history and culture of Chongming in the museum.

- New Chongming Library: The Library was officially opened to public on December 28 2012 and currently attracts over 1,000 daily visitors. It contains a collection of more than 600,000 books and 1,200 types of journals and magazines. The library also functions as a social education center which provides residents with lifetime education, continued education and training in various trades.

- Chongming Xianda College of Shanghai International Studies University: This College was completed in 2010, thus making it possible for Chongming Eco-Island to become a knowledge hub for sustainable development and urban ecology.

- Shanghai Genbao Football Base: The Football Base was constructed at a cost of 30 million CNY and formally opened in 2001. It encompasses three standard football grounds, one indoor football pitch and a hotel. It is the training ground for the Shanghai East Asia Football Club, which is a member of the Chinese Super League.

- Tour of Chongming Island World Cup: The history of cycling races in Chongming started with the Yingtong Cup National Cycling Race in 2003. Since then, it developed into the Tour of Chongming Island World Cup, as part of the UCI Women's Road World Cup in 2010. It is an important event for tourism and to help promote cycling as a leading form of transport on Chongming Island.

3.2.3 Cultural Ecosystem

Chongming Eco-Island possesses diverse and unique cultural remnants such as artifacts, religions, holidays, folklores and arts. Currently it has eight non-material cultural heritage items such as Yingzhou Gudiao Style Lute, Mudan Ting and Shoulder Pole Play. In recent years, Chongming Eco-island has invested in the promotion, preservation and popularization of a number of local cultural projects, utilizing local cultural diversity as an important asset of tourism development with a certain degree of success, some of which are highlighted in Box 3.3 below. The Chongming has made investments in the following three projects as part of supporting the cultural heritage in the Island.

- Chongming Culture Center: Officially opened on the 29th of October 2012, the Chongming Cultural Centre offers the Island's residents and visitors the opportunity to experience an array of cultural performances which are an important aspect of Chinese society and the styles are distinct to every region.

- South Sanmin Culture Village: This facility was opened in 2010 and is located in north-central Chongming Island. The Culture Village is a museum that exhibits a wide collection of folk culture of the South Yangtze River Regions in an area of about 16.31 acres, which is regarded as an important base for the preservation of non-material cultural heritage.

- Lvgang Eco-Village: The village is situated near the famous scenic spots Mingzhu Lake Park, Xisha Wetland, Chongxi Sluice and Taoyuan Waterland. It is the host of many attractions such as the interactive, multi-media enabled Demonstrative Museum of World Delta Water Culture that is themed "Yangtze River Water Culture".

Box 3.3 Non-Material Cultural Heritage of Chongming

Yingzhou Gudiao Style Lute is the collective name for the Lute songs and playing styles originated from Chongming Island. It is one of the most prominent Lute styles in China and is included in the national list of non-material cultural heritages.

"Mu Dan Ting" is a unique style of folk music that is mainly played by string and gongs that is only found in Chongming.

"Chongming Shoulder Pole Play" boasts a history of more than 150 years. It is a solo puppet play with puppetry and performance techniques at the same time. A mere bamboo shoulder pole is enough for putting up a stage, making performance possible at moment's notice.

Figure 3.2 Chongming Shoulder Pole Play


Figure 3.3 Chongming Cultural Performances

3.3 Challenges and Opportunities

In an effort to strike a balance between ecology, economy and society, Chongming Eco-Island faces numerous challenges, but also some opportunities by combining the traditional cultural heritages and modern technologies to enable the local residents to benefit from clean air, water, green space and healthy lifestyle. These are outlined below.

3.3.1 Eco-Industrial Development

A major challenge for Chongming Eco-Island comes from the fact that the Island has hitherto been geographically isolated which made it an exception from the wave of industrialization in mainland Shanghai and allowing it to preserve its pristine natural ecosystem. The challenge now is how to ensure that Chongming Islands still retains its great natural ecosystem despite being located within close proximity to the metropolis of Shanghai, while faced with unprecedented pressure for development particularly with the creation of transport infrastructure linking Chongming to Shanghai. Chongming Island is addressing this challenge by building a green economy, which present the following associated opportunities;

- Green investment and efficient business districts: Chongming Island seeks to attract both national and international investors so that it can become a hub of green business investment and eco-industry. This will be achieved through the provision of attractive incentives for green businesses to establish themselves on the island supported by the development of high quality sustainable transport linking the Island to the mainland Shanghai city and Jiangsu province.

- Building a knowledge economy underpinned by world class eco-think tanks: This will be achieved by establishing Universities on the island and collaborating with Chongming Dongtan International Education Park, National Demonstrative Modern Agricultural Region, Intelli-island IT industrial park and Eco-Industry park. Through these collective efforts, Chongming Island will form a research, development and commerce complex, potentially encouraging universities, clean technology and other environmental organizations to establish a presence on the island, developing Chongming Island as a worldwide ecological think tank for sustainable development. Already, a number of Chinese universities are establishing campuses on Chongming Island to bring the best and brightest talent to Island. These universities can play a major role in encouraging business start-ups, similar to how Stanford University contributed to the establishment of Silicon Valley, USA in the 1940s and 1950s.

- Green jobs: To attract businesses, the island must also attract highly qualified employees because an expansion of job opportunities on the island is central to the successful development of Chongming as an Eco-Island. The anticipated increase in economic growth and human population in the island can create opportunities for green jobs across multiple sectors, including work in agricultural, manufacturing, research and development (R&D), administrative, and service activities, which contribute to enhancing or preserving environmental quality (UNEP et al., 2008). According to UNEP, the creation of green jobs is expected to change the job market in the four ways listed below, for which Chongming can take advantage of: In some cases, additional jobs will be created- as in the manufacturing of pollution-control devices added to existing production equipment; Some employment will be substituted, for example in the shifting from fossil fuels to renewables, or from truck manufacturing to rail car manufacturing, or from landfilling and waste incineration to recycling; Certain jobs may be eliminated without direct replacement- as when packaging materials are discouraged or banned and their production is discontinued; and Many existing jobs (especially such as plumbers, electricians, metal workers, and construction workers) will simply be transformed and redefined as day-to-day skill sets, work methods, and profiles are greened.

- Green creative industries: Chongming Eco-Island has the potential to be established as the cultural and historical heart of Shanghai, building on the creative industries which include, but are not limited to advertising, architecture, art and antique, computer games, crafts, design, designer fashion, film and music, performing arts, publishing, software and TV and radio. As a potential hub for green creative industries, Chongming Eco-Island can foster a space for artists to exhibit eco-arts based on furniture, sculptures, artworks, software and games (See Figure 3.4 for an example). To help realize this potential, Chongming may consider developing the Yangtze Eco-Art Space Center to provide an exhibition space for local green designers to be displayed, and for international eco-artists to exhibit designs in recycled art festivals.

Figure 3.4. An Example of Eco-Art

Another challenge for Chongming in building eco-tourism is the lack of a co-coordinated service provision and management of visitors and tourists to the Island, including information, communication, transport, marketing and other services. An opportunity presented to address this challenge is to construct and operate Chongming Eco-Island Visitor Information Center. Such a center, which can be located near the highway entrance to Chongming Island, can serve the anticipated increases in tourist numbers to Chongming Eco-Island by providing information materials and offering a range of services such as souvenir shopping, car rental and maintenance, shuttle services, fine dining and local cuisine, information booth regarding the different attractions, tour guides and a law enforcement services to respond to various needs of tourists during their stay.

3.3.2 Residential Ecology

A key challenge for residential ecology in Chongming Eco-Island is to manage urbanization and to build housing infrastructure to cater for the human population that is increasingly largely due to immigration to the Island, while also maintaining the unique local biodiversity, ecosystems and green spaces. The construction of the Shanghai-Yangtze River Tunnel Bridge has increased the flow of people, goods and capital to Chongming presenting the potential for urban sprawl. There exists for Chongming Eco-Island, several opportunities arising from this challenge. These include;

- The development of higher density urban centers as a partial solution for Chongming Eco-Island to cope with increasing populations while maintaining open green spaces in the Island. This can be realized by concentrating population density in designated zones with public transport facilities and other services in a form of mixed use development, where residential areas are located in close proximity to services, facilities and amenities to support the development of vibrant, self-sufficient communities.

- Design and construction of green buildings. It is estimated that buildings contribute almost a third of all greenhouse gas emissions (GHGs) and consume 40% of energy globally, primarily from the use of fossil fuels in the operational phase of a building's life cycle. As such, there is an opportunity to reduce emissions by constructing green buildings; structures which have a low impact upon the environment, are aesthetically pleasing and are increasingly integrated with ecological services to make them efficient and positive contributors to the environmental landscape. The greening of the building sector through new construction and retrofitting is a relatively low cost process, due to the availability of technologies and the green evolution of energy supply and demand. Indeed, energy efficiency is one of the key considerations in green building design, with multiple options for installations to reduce emissions including, including solar panel installation, curved building shape to deflect wind to turbines, improved insulations to reduce heating and cooling costs, protective blinds to keep buildings cool, living green roofs and/or walls to improve air quality and control temperature, and utilization of recyclable materials in the constructions of the building. In China, an impact of 76% improvement in building energy efficiency through a series of design and management interventions (such as better insulated building envelope, apartment level temperature controls and electricity sub-metering) can be realized in typical blocks of multi-family buildings (WBCSD, 2009).

- Chongming Eco-Island has already embarked on the design and implementation of green buildings based on the Islands guideline for low-carbon building - the Chongming Chenjia Town Guideline for International Eco-Community Development. This guideline incorporates key technologies in building energy conservation, resource reuse and intelligent control whose practical application have already yielded 75% building energy conservation, 60% resource reuse, and 50% recyclable energy (Box 3.4) Chongming should aspire to reduce energy consumption of commercial and residential personnel on the island by conducting regular energy audits and establishing a database for energy and greenhouse gas statistics. It is recommended that Chongming Eco-Island could continually assess the status of the green buildings and can do so by using the Energy Audits and Green Star Building Ratings developed by the Ministry of Housing and Urban-Rural Development of China or any other suitable rating systems. The system assesses buildings based on the following six environmental categories; Sustainable sites, Energy efficiency, Water efficiency, Materials and resources, Indoor air quality, and Maintenance and operations. To encourage participation, communities may host competitions for the lowest average power consumption within the neighborhood in order to reinforce the idea of energy conservation.

Box 3.4 Yingdong Village Residential Eco-Development

In accordance with traditional Chongming island architectural styles, the residential eco-development in Yingdong Village has been realized by the ecological renovation of residential buildings and application of green building technologies. Currently 45 of the existing two-story residential houses have gone through low cost eco-renovation, reaching a 57% overall rate of energy conservation while retaining their native architectural styles, thus effectively improving both the villagers' indoor living conditions and mental experiences towards the environment.

Figure 3.3 Comparison of residential building eco-renovations

Meanwhile, 34 new ecologically designed buildings are planned at Yingdong Village, forming an integrated technology system for green architecture. This type of buildings is characterized by passive architectural design, integrated efficient energy conservation technology, prefabricated integrated thermal insulation structure (wood structure, decorative integrated thermal insulation, etc.), embedded photovoltaic roof, high-performance water conserving appliances, high-performance energy conserving air conditioning systems (VRV, ground source heat pump system), energy audit and display platforms, resource reuse (rainwater catchment, water permeable pavement and mud brick insulation). The use of an ecological technology system for green architecture not only creates comfortable, economical and healthy residential environment, but also helps Yingdong Village become a demonstrative village for integration of local culture and ecology technologies.

3.3.3 Cultural Ecology

A major challenge for cultural ecology in Chongming Eco-Island is how to preserve and maintain the local and native culture in the face of globalization, rapid urbanization and influx of international tourists to the Island. This however presents considerable opportunities in terms of cultural education, recreation, and ecotourism. These opportunities could be realized through the following projects;

- Yangtze River Cultural Park: The development of a Yangtze River Cultural Park could open up an opportunity to highlight Chongming Island and the Yangtze River Region providing visitors with an historical account of the region and a cultural experience of early China. The Cultural Park could be established as an outdoor museum, to showcase the story of the hardships and triumphs of early societies, and show how the Yangtze River Region has grown. It could be established in the style of a traditional village, displaying the intricacies of the traditional farm houses found in some parts of Chongming Island, providing an engaging experience with opportunities for visitors to participate in traditional activities, including farming, fishing and weaving. This would offer an ideal venue to showcase performances of dance, acrobatics, and Chongming dialect through shoulder pole puppet plays.

- Chongming Eco-Island Scientific Demonstration Center: It is anticipated that Chongming Eco-Island will utilize cutting edge technologies to improve environmental efficiency towards eco-industrialization. To demonstrate these technologies, Chongming could consider establishing a family-oriented Scientific Demonstration Center to complement the existing establishments such as Chongming Eco-Science Center (Box 3.5), the Chongming New City Planning Display Center, the Chongming Xisha Demonstrative Museum of World Delta Water Culture and the Chongming Dongtan Ornithology Education Center. The Scientific Demonstration Center can be designed to help the public understand how technology has integrated with daily human life through a series of interactive displays in reusable power generation, water and pollution management, energy efficiency and eco-services.

Box 3.5 Chongming Eco-Science Center

Chongming Eco-Science Center is an ecology exclusive science center occupying an area of 5,000 m2, with more than 2,500 m2 of exhibition area. The Eco-Science Center is created with the idea of a modern, scientific and human-oriented establishment. The purpose to exhibit, educate and entertain through multi-media and mechatronic interactive displays. The center can become a public gateway to learn about the history, ideology, progress and future of Chongming's eco-development. The center targets all levels of domestic and foreign visitors, especially primary and secondary school students.

3.4 Summary and Lessons Learned

Taking advantages of the local ecology and resources, Chongming has formed a preliminary industrial system centered on organic agriculture, green industry and eco-friendly service sectors through recent years of development. An intensive rural-urban development system of proper scale has been established with a focus on low-carbon technologies and reusable resources. The two-pronged approach on simultaneous culture and nature development has become Chongming's unique identity. A summary of the experiences in Chongming Eco-Island that may be applicable to other developing areas are provided below:

- Planning is pivotal to the origin and direction of a city's early stage urbanization efforts. As the reserved land of Shanghai's strategic development, Chongming has a relatively low degree of urbanization, which provides opportunities for it to develop with a unique pattern. An Overall Plan for Chongming Tri-Island Development proposed the three-tiered structure of "New City-New Town-Central Village". This will help increase population density, concentrate public transit and other service amenities and reserve spaces for green areas. Furthermore, one of the new towns, Chenjia Town, is poised to establish a "Community-Neighborhood" system that will aid in building a vigorous and self-sustained community by interlinking various functional areas within close proximities to each other. Such efforts form the green foundation for Chongming's eco-development.

- Lead and demonstrate with limited resource. It is impractical to pervasively promote a certain new technology or concept in an underdeveloped area. A practical approach is to achieve leading and demonstrative purposes by establishing test areas. Furthermore, the process of establishing test areas accumulates experiences for future success. This strategy is employed in promoting green building and creating eco-communities in Chongming. Chongming Island demonstrated energy-efficient building renovation and construction in Yingdong Village, integrated key technologies of building energy conservation, resource recycle and intelligent control in Chenjia Village and compiled Development Guidelines for Chongming Chenjia Village Low Carbon International Eco-Community.

- Taking advantage of the locale and making gradual progress. How to fully realize the local economic potential is a common concern for both the public and government. This concern is especially significant in underdeveloped areas, and it is also the key factor that determines sustainable eco-development. Developing a clean tertiary industry is a rather optimal alternative for eco-island development. However developing a third industry requires the prior establishment of many complimentary infrastructure. Chongming's approach is to first develop projects that are tangential to the island's objective situations, such as building family farms, eco-farms and developing agritainment. These efforts will not only encourage development of agriculture and tourism, but they will also create jobs for local farmers. This easy-to-hard approach should be borrowed elsewhere when applicable.

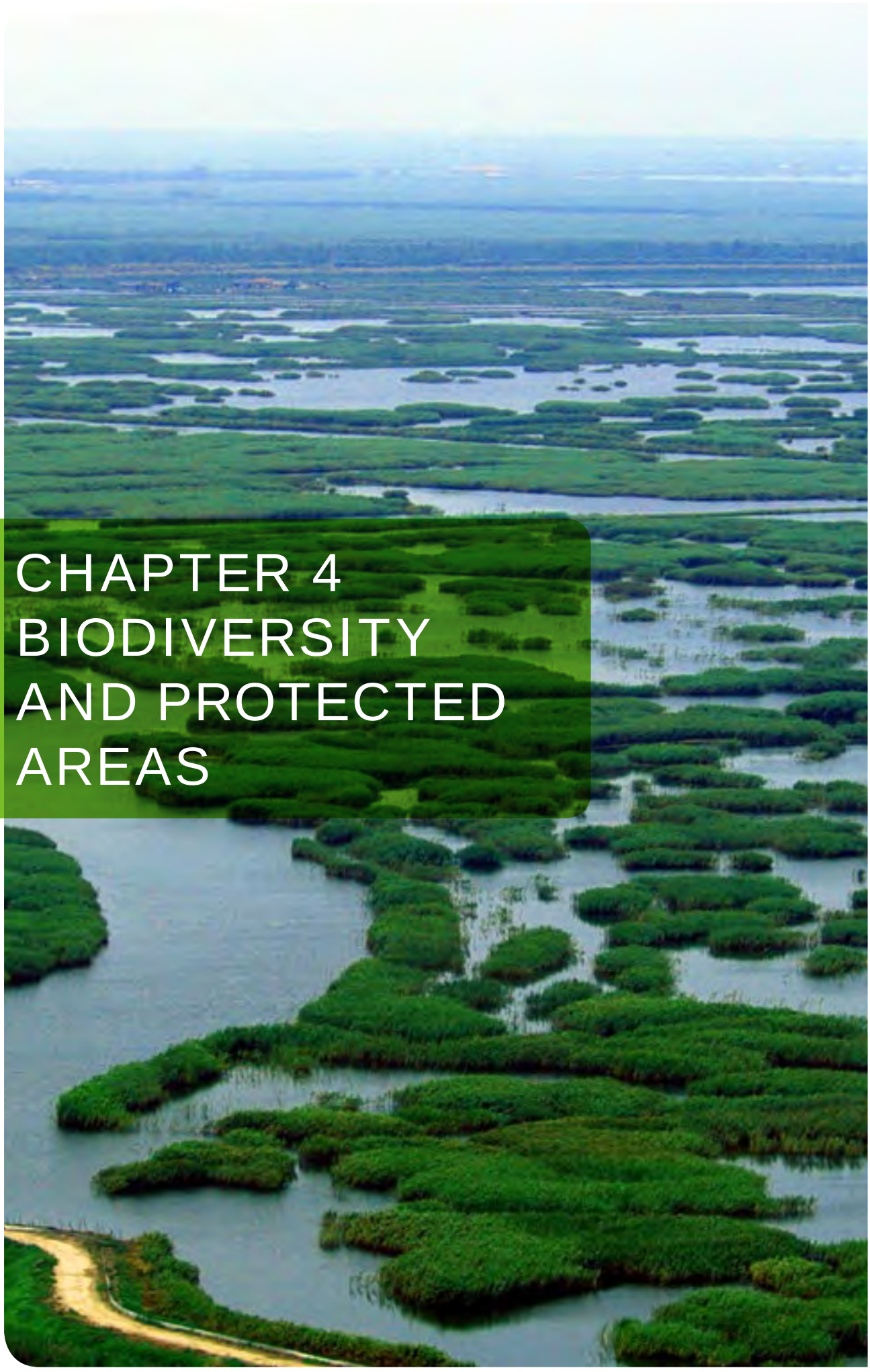
The future development for Chongming should take systematic management and pathway of green economy. By widely benefitting public welfare and realizing industrial, residential and cultural ecology, Chongming is well poised to become the powerhouse of the next phase of development in Shanghai, and a leading example for many other underdeveloped areas in developing countries.

3.5 Recommended Action Plans

Table 3.1. Action Plan for Society, Life and Culture

No.	*Issue*	*Recommended Actions*	*Timeframe*	*Significance*
3.1	Green Jobs	Administer government stimulus packages in the forms of tax exemption and subsidies to accelerate the expansion of a green job market, and encourage Science, Technology and Innovation (STI) centers (research and higher education institutes) on the island to build capacity in human resources.	Short-term	☆☆☆
3.2	Building a Knowledge Economy through a R&D Commerce Park	Establish University City on the island. Integrate with Chongming Dongtan International Education Campus, National Modern Agriculture Demonstrative Area, Intelli-Island IT Park and Eco-Industry Park to form Chongming R&D Commerce Park.	Medium-term	☆☆☆
3.3	Establishment of Cultural Centers (Yangtze Eco-Art Development Space and Yangtze Village Culture Park)	Explore the possibility of establishing and supporting a green creative industry and public eco-art development space. Also assess the feasibility of establishing Yangtze Village Culture Park and its compatibility with existing cultural tourism attractions.	Medium-term	☆
3.4	Eco-Tourism Information Management Center	Assess the feasibility of establishing tourism information management at the entrance highway (Yangtze River Tunnel-Bridge) to Chongming Island.	Short-term	☆☆
3.5	Regular Green Building Evaluation	Conduct Island wide green building evaluations regularly to continually assess their status using the Energy Audits and Green Star Building Ratings developed by the Chinese Ministry of Housing and Urban-Rural Development. Carry out awareness campaigns among the local residents to educate and help them understand the environmental impact of public and residential buildings	Short-term	☆☆☆
3.6	Environment Science Demonstrative Center	Assess the feasibility of establishing a family oriented environment science demonstrative center on top of existing science education institutions.	Medium-term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ = “very important”



CHAPTER 4
BIODIVERSITY AND PROTECTED AREAS

CHAPTER 4 BIODIVERSITY AND PROTECTED AREAS

4.1 Baseline Scenario

Natural wetland ecosystems are widely distributed along the coastline of Chongming Island and these provide important habitats for many wildlife species, in addition to many essential ecosystem services such as fisheries resources, nutrient recycling and habitat and food for migratory and resident animals. Chongming Island and the larger Yangtze Delta forms an important sanctuary for endangered species, including the Jiangtun (Yangtze finless porpoise) and also serve as a spawning site for species such as the Chinese Sturgeon (Acipenser sinensis). A range of biodiversity, geological and ecosystem features found in Chongming Island are exemplified by the Chongming Island National Geo-park, which was established in 2005 to illustrate seventeen kinds of geological traces found on the Island, highlighting its geologically diverse landscape as the world's largest alluvial island. The National Geo-park runs 76 kilometers from east to west, covering a total area of 1,200 km2. It encompasses various sites of significance, including the Dongtan Wetlands Park, Xisha Wetlands Park, Dongping Forest Park, Jin'ao Hill Park and State-level Bird Reserve Area on East Tidal Flat (Chongming County 2010). The Chongming Eco-Island Construction Outline (2010-2012) identified three areas for the conservation of biodiversity in the Island; protection and construction of the natural wetland, forest land and Greenland on the eco-island, and waterbird species.

4.1.1 Wetland habitat conservation

Wetlands in Chongming can be classified according to their distribution, into north, south, east, and west. The east and north wetlands are saltwater, and the south and west wetlands are freshwater. These wetland ecosystems play an important role in maintaining both ecosystem health and ecological security of the island (Huang et al., 2008). Chongming Island has the typical estuarine tidal flats wetlands, tidal river ecosystem, and a variety of tidal flats woodland, wetland vegetation, birds and benthic animals, all of which are valuable for the conservation of the wetland biodiversity. By 2020, Chongming Island targets to have a natural wetland conservation rate of 43%, and 83.1% proportion of protected ecological areas.

4.1.2 Bird conservation

In general, birds have been widely used as indicators of biodiversity for several reasons; they are sensitive to anthropogenic changes, they are well known, excellent time-series data exist, and they have a resonance and connection with people and their lives (Gregory & Strien, 2010). Chongming Island is a special habitat for birds, the most prominent being the Chinese merganser (Mergus squamatus). The Island lies in the East Asian-Australasian flyway and thus serves as a critical site for migrant birds during their north-south migration (Birdlife International, 2010). Thus, one of the goals for the construction of Chongming Eco-Island is to ensure the conservation of 10 or more species of waterbirds accounting for 1% of the global species population.

4.1.3 Terrestrial ecosystems conservation

As an alluvial island, Chongming Island mainly has an artificial ecosystem, where animal and plant species are relatively rare. The construction of the ecological island will contribute to protecting the terrestrial biological resources, especially forest and green spaces by controlling interference from human activities. By 2020, Chongming Island targets to have a forest cover rate of 28% and public green areas of 15 m2 per capita.

4.2 Progress to date

By 2012, Chongming Island had met all the targets set in the Chongming Eco-Island Construction Outline (2010-2020) for the natural wetland conservation ratio (42% against a target of 43%), public green areas per capita (10 m2 against a target of 15m2), forest cover rate (20% against the target of 28%), the waterbird species accounting for 1% of global species population (more than 7 species against a target of 7 species), and the proportion of protected ecological area (69% against a target of 68.7%) (Figure 4.1)

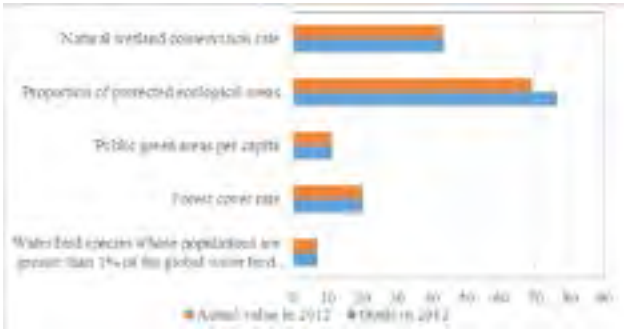


Figure 4.1 The comparison between biodiversity goals and actual values for Chongming Eco-island in 2012

The progress and performance of Chongming Eco-Island in biodiversity conservation are as follows:

4.2.1 Wetland conservation

The wetland ecosystems in Chongming Island include shallow open waters, mudflats, salt marshes and brackish environments, and acts as an important habitat for different flora and faunal species. Through the construction of Chongming Eco-island in recent years, there has been significant progress in wetland conservation towards meeting

the objectives set out in the Outline (2010-2020). The wetland conservation projects that have been implemented in Chongming Island include the following:

The Dongtan Wetlands Park: The Dongtan wetlands covers an area of 32,600 hectares and were designated as a protected area by the Shanghai Municipal People's Government in 1998 (Chongming Island National Geopark 2011) for the purposes of conservation, scientific research, education, ecological tourism and recreation. In 2002, Chongming Dongtan Nature Reserve was designated as a Ramsar site under the Ramsar Convention on Wetlands (Ramsar, Iran, 1971), an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character and wise use of Wetlands of International Importance located within their territories. There are currently 2,064 Ramsar sites in 163 countries, including 41 Ramsar sites in China with the Dongtan Wetlands as the sole site in Shanghai. The designation of Dongtan as a Ramsar sire was based on the following criteria:

- It is located at the mouth of the Yangtze River, the third largest river in the world and constitutes a unique example of natural wetlands found within the region. The wetlands consist of large areas of freshwater and salty marshes, tidal creeks, and intertidal mudflats;
- It supports vulnerable, endangered, or critically endangered species of threatened ecological communities, staging 12 species of birds listed in the State and National protection categories, including the White Stork, Hooded Crane, Chinese Merganser (Box 4.1) and White-Naped Crane;
- It supports millions of birds each year, including over 30,000 geese and eight species of wading birds including the Ringnecked Plover and Little Whinbrel. It is estimated that there are almost 298 species of birds that are found in the Dongtan Wetlands at varying times of year;
- It is an important migratory channel and the spawning and feeding grounds for many fish, especially the critically endangered Chinese sturgeon (Acipenser sinensis: Box 4.2).
- It is located on an important migratory route, the East Asian-Australasian flyway, providing the staging and wintering site of a deeply diverse range of migratory birds, at a crucial stage in their life cycles (Box 4.4).

Box 4.1: The Chinese Merganser (Mergus squamatus)

The Chinese Merganser Mergus squamatus breeds in such places as north-east China and Siberia, and migrate to the south of the Yangtze River during the winter season. Due to habitat loss, illegal hunting and disturbance, the species currently has a very small population that is declining rapidly. It is listed in the state protection category and classified as endangered on the IUCN Red List of Threatened Species (IUCN, 2012).

Box 4.2: The Chinese Sturgeon (Acipenser sinensis)

The Chinese Sturgeon Acipenser sinensis is a pre-historic fish that has a long history on the earth (140 million years), which is sometimes dubbed a "living fossil." Every year, they undertake round-trips of up to 3,500 kilometers from the East China Sea to their spawning grounds in the Yangtze River, making regular stops around the Dongtan Wetlands for feeding. In recent years Sturgeon populations have been rapidly reducing, with the Sturgeon now being classified as critically endangered on the IUCN Red List of Threatened Species, thereby emphasizing the need to conserve their habitat at Dongtan (IUCN, 2012).

The Xisha Wetlands Park: The Xisha Wetland is a typical estuary tidal flats wetlands and tidal riverine system. It covers an area of 3Km2 located on the Western tip of Chongming Island. As the core part of Chongming island national geological park, the Xisha Wetland is the only natural wetland which has natural tidal phenomenon and vast tidal flats woodland. The main geological relics and landscape in the Xisha Wetland are “estuarine tidal flat geomorphic geological relics”, “wetland landscape of geological relics” and wetland vegetation, birds and benthic animals, among others. Its tidal flats play a pivotal role in the overall ecological health of the Yangtze Delta. The Shanghai Forest Bureau is currently developing the park as a multifunctional resource, covering ecological protection, scientific research, and recreation and tourism.

Mingzhu Lake Park: Central to this park is the 2Km2 size Mingzhu Lake, which is the largest natural lake on Chongming Island. Acting as a multifunctional park, Mingzhu Lake Park integrates recreation, vocation, scientific education and biodiversity conservation. An orange orchard and a forest covering 2,500 m2 attract more than 70 bird species, and the lake provides a breeding ground for many fish species including the famous Elopichthys bambusa.

Ecological control of Spartina alterniflora: In 2003 S. alterniflora, an invasive wetland grass species, was classified by the State Environmental Protection Agency (SEPA) as one of the sixteen most harmful invasive species in China (Li et al., 2009). Continued efforts on Chongming Island to control the plant are critical for protecting the Island’s native plant and bird habitats in the wetlands. Both the physical and biological control methods are used in combination to control and manage the S. alterniflora in Dongtan wetlands by enclosing, cutting, submerging, drying, adjusting and planting processes, which follow three steps. The first is to establish a polder dyke to prevent S. alterniflora from expanding outside. The second is to burn and mow the grass then flood and submerge the grass to kill the propagules from the lack of oxygen. The third is to drain away water to expose the tidal flats and plant some Phragmites australis. Then, bring in the low-saline water of Yangtze River with a certain depth into the polder dyke, to promote the P. australis to grow so as to restrain its expansion.

4.2.2 Birds conservation

The conservation projects for birds in Chongming Island include:

- Dongtan National Bird Sanctuary: This sanctuary is part of the Dongtan wetland Park. It covers a certain area of mudflats and swamps, and provides an ideal habitat for migratory birds following the reconstruction of the wetland ecosystem which has already involved an area of 1.81km2. It is estimated that 149 bird species are found in the Dongtan wetlands. The largest population of migratory birds has reached more than 2,000. In addition, research on the repopulation of wild Chinese alligator has also been successfully conducted.

- Chongming Eco-island helps to supports the restoration of the habitat of birds that supports the species of waterbird whose populations are greater than 1% of the global water. In 2012, the species of waterbirds whose populations are greater than 1% of the global water bird population were above 7, which is within the goals proposed in “Outline”.

Box 4.4: East Asia/Australasia Flyway

The East Asia/Australasia Flyway is one of the largest bird migratory zones in the world. It encompasses 37 countries extending from Arctic Russia and Alaska in the north, to its southern limits of Australia and New Zealand. Over 50 million migratory waterbirds, including eight million waders use the route annually. The Chongming Dongtan Nature Reserve is important in linking the north to the south (Birdlife International, 2010).

4.2.3 Terrestrial ecosystem conservation

The Terrestrial ecosystem conservation projects of Chongming Eco-Island include the following:

- Development and preservation of Jin'ao Hill Park: Redeveloped and restored in 2010, this is an ancient garden park of cultural and historical significance for Chongming Island.

- Yingzhou Park: This Park was first established in 1983 by Zhou Gucheng and is characterized by its Star Lake, which encompasses approximately 4,700 m2. More than 4,000 local species of trees are present in the park, which was recognized as Chongming Island's first three-star park in 2010. Since then, it has been redeveloped, and reopened in 2012 (Chongming County 2010).

- Dongping National Forest Park: Dongping National Forest Park is a man-made forest park covering 358 hectares of Chongming Island. Whilst it contains a number of forest habitats, the park is primarily designed as an amusement park, with a number of recreational activities and overnight accommodation available for visitors.

4.3 Challenges and Opportunities

The development of Chongming Eco-Island presents diverse challenges but also provide a range of opportunities for supporting biodiversity on the island to ensure the island is a key part of the wider region's ecological network. This includes keeping the integrity of existing biodiversity assets such as the internationally and nationally designated wetlands present on the island, and improving ecological networks across the island. As an estuarine alluvial island in the outskirts of Shanghai, Chongming Island also faces many common ecological problems, such as inundation of sea water. With the increase of development intensity and human activities, this island bears increasing environmental pressure.

4.3.1 Wetland conservation

Control of invasive species: The invasive plant S. alterniflora, was listed by the State Environmental Protection Agency (SEPA) in 2003 as one of the 16 most harmful invasive species in China and is a threat to the natural ecosystem in the Yangtze River estuary (Li et al., 2009). The species was initially introduced to China in 1979 in an effort to control erosion, improve soil quality and protect dykes. However, due to the species' tolerance to salinity, rapid growth rates, well developed root systems and reproductive capacity, it has taken the place of the native species and become the dominant species in the estuary. The species was first discovered in the Dongtan Wetlands in 1995, and subsequently introduced intentionally to Chongming Island in 2001 for the purpose of rapid sediment accretion. It has become a dominant species in many areas of the island. The effects of the spread of S. alterniflora include, but are not limited to the conversion of mudflats to meadows of Spartina, loss of shorebird foraging habitat, impacting on endangered species, loss of native species (including Scirpus mariqueter and Phragmites australis), and degradation of endemic ecosystems.

Restrictions on reclamation of wetland: Wetlands are the main natural vegetation in Chongming Island, and the tidal flats and estuarine wetland have important ecological value, as they possess a wealth of wildlife. Despite the vulnerability and sensitivity of the island ecosystems, wetland reclamation poses a serious threat to the wetland in Chongming Island,

which has led to habitat destruction of the wetland in some areas, loss of wetland coverage, and loss of fish breeding habitats. Wetlands are mainly transformed into farmland, fish ponds, roads and agricultural cultivation. As part of the concept of Eco-Island construction, wetland reclamation and destruction should be minimized. Chongming Island must explore the interaction of combining forest protection and ecological breeding, wetland protection and aquaculture development, organic agriculture and as well as bird conservation. Meanwhile, Chongming Island should speed up the construction of ecological conservation and restoration of demonstration area in order to realize the dynamic balance of wetland and to explore the new path of protection and development.

Water pollution management: Wetlands play a key role in the supply, regulation and purification of water. However, increasing water pollution, from point to non-point sources, is threatening the viability of remaining wetlands such as Dongtan and Xisha. With increasing use of both organic and inorganic fertilizers, excessive nutrient loading is occurring, and when combined with the inadequate treatment of wastewater, freshwater rivers like the Yangtze are becoming adversely affected, with many freshwater aquatic (and marine) species population declining in numbers and range (An et al., 2007). Changes to species composition in Dongtan and Xisha Wetlands due to water pollution are also affecting their suitability as staging and breeding destinations leading to the changes in food availability.

Managing sea level rise: As an anticipated impact resulting from climate change, sea level rise is expected to have the most serious effect on the wetlands in China, as well around the world. Sea level rise has the potential to impact coastal wetlands like those on Chongming Island by inundating salt marsh areas and displacing freshwater habitats. There is the potential to displace migratory and resident bird and fish species. Measures such as optimizing land utilization (wetland protection, etc.), constructing the levee, etc. should adopted to cope with the challenges of rising sea levels.

4.3.2 Birds conservation

As highlighted above, Chongming Island contains a number of sites of national and international importance for biodiversity, supporting a range of habitats and species. The Eco-Island concept should therefore seek to protect the sites' integrity through avoiding direct development of the sites and promoting appropriate and complementary land uses in areas adjacent and near the sites. Where required, an extension of designated areas and the introduction of buffer zones between sites and new areas of development can also support the connectivity of the sites. Combined with the international convention on wetlands protection standards, diversity and function, an optimization habitat should be built to maintain and attract "1% waterfowl species", in accordance with different requirements for food and habitat of plover dunlin, geese and ducks and cranes.

4.3.3 Terrestrial ecosystem conservation

The isolation of Chongming Island hinders the contact between islands and land ecosystems, which affects the matter and energy exchange between Chongming Island and the outside. Compared to the mainland, the island ecosystem appears more fragile, has a greater ecological risk and also has weaker system resilience. At present, except the area of east and west ends of the island that belong to natural ecological system, the others are all artificial ecosystem. As an artificial ecosystem, the plant and animal species in Chongming Island are relatively rare, with single community structure, and vulnerable to control and interference by human. The natural setting of Chongming Island makes it an ideal location for the development of a Yangtze River Ecology Conservation Park. The Yangtze River Ecology Conservation Park could be established as a showcase of Yangtze River Delta ecosystems, including bamboo forest, grasslands and eventually directly feeding into the Dongtan Wetlands. The park could also be used as a place for conserving protected species such as the Yangtze Alligator and Chinese Sturgeon through breeding programs.

Development of an Island-wide Green Infrastructure Network: Green infrastructure is a network of multi-functional green space, both rural and urban, which supports natural and ecological processes and which is capable of delivering a wide range of environmental and quality of life benefits for local communities. A high quality green infrastructure network on Chongming Island would support ecological networks across the island, promoting connectivity between habitats and species. Biodiversity gain can be achieved by safeguarding, enhancing, restoring, and creating wildlife habitat. Ecological connectivity will be established for such green corridors as watercourses, road verges, embankments and cycling and walking routes. Also, many other benefits will be provided, such as recreational opportunities, flood management, regulating climate change impacts and improving urban environment quality, among others.

Integrating Ecosystem Services approach to development: Ecosystem services refer to the benefits people obtain from the goods and services provided by healthy and functioning ecosystems. These include Provisioning services, such as the products obtained from ecosystems including fuel and food; Regulating services, such as the benefits obtained from the regulation of ecosystem processes including air quality regulation, water regulation, water purification and natural hazard regulation; Cultural services, such as spiritual, recreational and cultural benefits; and Supporting services, including soil formation, photosynthesis, primary production, nutrient cycling and water cycling (Millennium Ecosystem Assessment, 2005). Loss of habitats and wetlands can lead to enhancement or the deterioration of ecosystem services generating large economic impacts and affecting human well-

being. It is estimated for example that a 71% loss of wetlands/ tidal flats in the Dongtan wetland over the 10 year period between 1990 and 2000 contributed to a 62% decline in the value of ecosystem services worth US$855.26-981.85 million. While these losses led to a decrease in the contribution of nutrient cycling, food production, disturbance regulation, recreation, habitat/refugia and biological control, it increased the contribution of water regulation, water supply, waste treatment and raw materials (Zhao et al., 2004).

The ecosystems services approach seeks to integrate these services into decision making processes by providing a framework for looking at whole ecosystems in decision making, and for valuing the ecosystem services they provide. In the process of Eco-Island construction, the structure of existing forest green space, should be optimized, also, the ecological network which consist of road protection forests, river water conservation forests and buffers should be built to promote ecosystem service of Chongming Island. Because the actual services provided by ecosystems and the values these services are site specific, it is recommended to determine the nature and value of ecosystem services at different spatial scale to integrate these into policy decisions for ecosystem management in Chongming Eco-Island. Existing and new tools such as the Toolkit for Ecosystem Service Site-based Assessment (TESSA) (Peh et al., 2013; 2013a) and the Integrated Valuation for Ecosystem Services and Trade-Offs (InVEST) (Tallis et al., 2011) and others that may be appropriate could be used for this purpose.

Integrated Pest Management (IPM): This method is considered an effective and environmentally sensitive approach to pest control. IPM harnesses the comprehensive information that is available on the life cycles of pests and their interaction with the environment to manage pests in an economical way that minimizes health hazard to people and the environment.[2] IPM programs firstly assess whether pest populations and environmental conditions warrant control action to ensure that any measures that are undertaken are necessary and will not compound the problem. IPM programs then monitor and identify pests accurately, removing the possibility that incorrect control measures will be implemented. Once monitoring and identification of pests has been undertaken, prevention is no longer a feasible option, IPM programs then evaluate the most appropriate method for both effectiveness and risk (EPA USA 2013).

Ecological Education: In order to instill the awareness of appreciation for the value of the Dongtan and Xisha wetlands and the effort required to maintain them as healthy, viable ecosystems for the current and future generations, Chongming Island has the opportunity to develop ecological education programs at all levels of education from primary and secondary to tertiary levels in colleges and universities. Already, a Lecture on environmental protection was conducted at the Chongming High School in mid 2012 by volunteers from Green Power Now of AIESEC SJTU to educate school children on the importance of environmental protection. Additional means of eco-education that may be considered by Chongming include exploring the development of the 'Junior Scientist' program for primary school children. A 'Junior Scientist' would participate in environment monitoring activities to identify what kind of animals and plants live in the wetlands, learn how to take water samples for monitoring, identify different micro-organisms and search for different species, while learning more about the environment and the role protected areas play in conservation. Junior Scientist Programs could be run as school excursions, as well as other activities that allow parents to join in on weekends. Chongming Island also has the opportunity to promote environmental education through the establishment of an environmental camp programme, to be run in conjunction with the Junior Scientist Program. This offers an opportunity to secondary school students showing promise in the sciences to foster ecological appreciation, as well as be used as a research base for tertiary students who may choose to continue their ecological studies.

4.4 Summary and Lessons Learnt

The actions taken to establish and develop the Dongtan Wetlands Park, Xisha Wetlands Park, Jin'ao Hill Park, Mingzhu Lake Park, Yingzhou Park, and the State-level Bird Reserve Area on East Tidal Flat, demonstrate Chongming Island's commitment to achieving the objectives of the Chongming Eco-Island Construction Outline (2010-2020). These parks are very important for the biodiversity of Chongming Island. The indices of forest coverage, public green area per capita, and proportion of protected ecological areas have achieved the goals of 2012. Thus, higher goals should be put forward in the future. The index system of construction in Chongming Eco-Island should be revised and updated to keep its roles in leading, standardizing and regulating Eco-Island Construction. After years of biodiversity conservation and natural reserve construction, ecological environmental quality in Chongming Island improved significantly, and phased goals of ecological protection have been achieved. Through managing invasive species, limiting the wetland reclamation, limiting water pollution, and strengthening ecological education, the wetland was conserved. Through building diverse and function optimized waterfowl habitat, "1% waterfowl species" were maintained and attracted. And through developing an island-wide green infrastructure network, undertaking an ecosystem services approach to development, and integrated managing pest, terrestrial ecosystem was conserved effectively.

Chongming Eco-Island provides a beneficial attempt in biodiversity conservation and protected areas construction for metropolitan regions in developing countries. The

[2] Environmental Protection Agency (EPA)- US website: http://www.epa.gov/pesticides/factsheets/ipm.htm#what

"Chongming model" in ecology, biodiversity and protected areas will also be a useful reference for China and other parts of the world. Experiences are summarized as follows:

- Integration of ecological conservation and production. The integration and interaction was explored in forest conservation and ecological breeding, wetland protection and aquaculture, organic agriculture and the conservation of birds. Biodiversity and protected areas should be combined with scientific research, education, tourism and entertainment.

- Establish and improve the ecological compensation mechanism. Since the eco-compensation mechanism was established in 2003, eco-compensation for Chongming was improved, the scope of eco-compensation was broadened, and special funds for Chongming Eco-Island construction were provided. Thus, a stable financial support mechanism and measures to support ecological protection and environmental construction project were formed. At the same time, the wetland ecological benefit compensation policy should be explored to compensate the loss of habitats and wetlands in Chongming Island through habitat banking and other measures. This will help to achieve "No net loss" in biodiversity and wetland habitats.

- Integrate the ecosystem service approach to development through establishing an island-wide green infrastructure network on Chongming Island, and safeguarding, enhancing, restoring, and creating wildlife habitat and biodiversity. Also, such ecosystem service as recreation, climate regulation and environment quality improvement were provided. At the same time, based on Dongtan Wetlands Park, Chongming Island established ecological education bases to explore and promote various forms of ecological education for students, and residents and visitors in Chongming Island, so as to engage the public in ecological protection.

4.5. Recommended Action Plans

Table 4.1. Action Plan for Biodiversity and Protected Areas

No.	*Issue*	*Recommended Actions*	*Timeframe*	*Significance*
4.1	Research to support action on Ecosystem Services Approach	Carry out research to support ecosystem services approach, including assessment and valuation of ecosystem services using available toolkits (e.g. TESSA, InVEST etc), planning and zoning for industrial development, environmental pollution monitoring, and ecological carrying capacity.	Short-term	☆☆☆
4.2	Biodiversity Conservation Compatible Agriculture (Eco-agriculture)	Promote the construction of agricultural circular economy demonstration to realize eco-agriculture and promote biodiversity conservation compatibility while improving people's livelihood in rural areas	Medium-term	☆☆
4.3	Wetland protection and utilization	Consolidate the "Win-win pattern practice area of wetland protection and utilization" by strengthening the management of ecological risks, control of invasive species (Spartina Alterniflora), and the reclamation and restoration of degraded wetlands	Medium-term	☆☆☆
4.4	Wetland ecological benefit compensation policy	Strengthen eco-compensation programme and promote compensation for the loss of habitats and wetland ecosystems in Chongming Island to development projects through compensation measures such as habitat banking and/or restoration of other degraded wetlands and habitats to ensure "No net loss" in biodiversity	Medium-term	☆☆
4.5	Yangtze Delta Ecology Conservation Park	Conduct a feasibility study towards establishing a Yangtze River Ecology Conservation Park in Chongming Island.	Medium-term	☆☆
4.6	Managing Sea Level Rise	Optimize the land planning and utilization process (wetland protection, etc.), construct the levees, plan urban system (population concentration). to cope with the challenges of rising sea levels.	Medium-term	☆☆
4.7	Ecological Education	Further develop ecological education programs for Dongtan and Xisha Wetlands applicable to primary, secondary and tertiary level students.	Medium-term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means "very important"

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CHAPTER 5 WATER

CHAPTER 5 WATER

5.1 Baseline Scenario

The construction of Chongming Eco-Island will be largely determined by its ability to secure a clean, reliable and adequate supply of potable water through a multifaceted water management strategy to improve water use efficiency across all sectors, lessen the volume of wastewater and contaminated content whilst treating it as an opportunity for reuse, and preserve water dependent natural systems. In the current climatic regime the mean annual precipitation in Chongming Island is 1,050 mm, of which 62% occurs between May and September. The water system on the Island is mainly man-made with two trunk canals; the south diversion canal (77km) and the north diversion canal (34km). Much of the freshwater available in the Island comes from the south branch of the Yangtze River. The Economic development and the increasing number of migrants and the over-exploitation of groundwater have led to scarcity of water resources against the backdrop of water pollution. Meanwhile, the expanding concrete building and roads in the urbanization process are exacerbating the imperviousness of the ground. It is vital to initiate a comprehensive and integrated water system management in order to address the looming water shortage predicted in Chongming Island (Ni et al., 2012).

5.1.1 Drinking water safety

Chongming Island is surrounded by water all around it. The Nanhengyin River and other small rivers provide water source for all water treatment plants, except Nanmen water treatment plant, which extracts water from Yangtze River. Every January to March is dry season affecting the Yangtze River, leading to serious saltwater intrusion and water quality decline in these plants. In order to enhance the safety of drinking water and the centralized water supply in Chongming Island, a reliable water source and water supply system is needed.

5.1.2 Water pollution control

Chongming Island is short of high-quality water due to the pollution of the upstream of the Yangtze River and Taihu area, and local agricultural point source pollution. Through channel improvement and management, sewage interception and strengthened water diversion, Chongming Island has been improving the level of urban sewage treatment and promoting the construction of sewage treatment facilities. The centralized waste water treatment (treated in STPs) was 34.90% in 2008. Most of the urban sewage was directly discharged into rivers and ditches, seriously impacting the water quality of rivers. By 2020, the centralized waste water treatment (treated in STPs) is estimated to reach 90%.

5.1.3 Water use efficiency

Comprehensively improving water use efficiency in both industry and domestic use can greatly reduce the pressure of water shortage, and it is also an inevitable approach to develop a water-saving city. Shanghai is exploring a water-saving society construction pattern that takes water conservation, emission reduction and environmental improvement as the leading solutions for quality-induced water shortage area. Chongming Island, in the suburb of Shanghai, should seize the opportunities for construction of water-saving city, and maximize the utilization efficiency of water resources in the whole life cycle of water, including water intake, water supply, water usage and drainage.

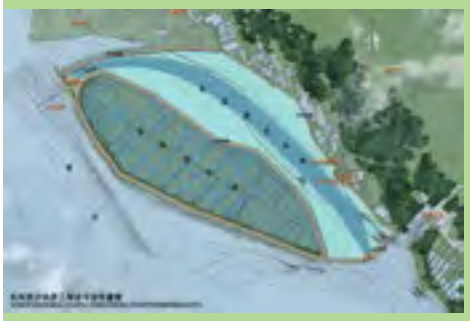
5.2 Progress to date

Chongming Island is taking steady measures to improve water efficiency and quality.

5.2.1 Develop water source, provide intensive water supply, and ensure the safety of water supply

In order to ensure the safety of drinking water sources, Dongfeng Xisha reservoir (Box 5.1) was built in 2011, and environmental monitoring within 1,000 m from upstream to downstream of water intake has been strengthened. A terrestrial pipe network and two water treatment plants are under construction. Chengqiao water plant and Chenjia Town water plant have already begun to operate, replacing 11 small plants in this area. After the above mentioned infrastructure construction, quality compliance from drinking water source areas has increased from 12% in 2008 to 86.5% in 2012, exceeding the target of 50% by 2012 as proposed in the Chongming Eco-Island construction outline.

Box 5.1 Dongfeng Xisha Reservoir and Qingcaosha Reservoir



DongfengXisha reservoir (left picture) is located in southwest Chongming Island, with good fluidity and water quality, forming a natural reservoir that can store freshwater and avoid salty water. Dongfeng Xisha reservoir was planned for Chongming's new water source, as well as the alternative source for Shanghai. This project has a total investment of 755 million CNY and the Shanghai Municipal Water Affairs Bureau is responsible for its implementation. After 5 years of preparation, DongfengXisha Reservoir began partial operation in November 29, 2011. The whole project is expected to be completed by 2014, with a designed capacity of nearly 10,000,000m3. In the near future (2015), the water supply is estimated at 215,000 m3/day, and long-term (2020) target is 400,000 m3/day. Thence, Chongming residents can enjoy drinking class III water instead of class II. (Source: Shanghai Chongming County Water Affairs Bureau)

Qingcaosha reservoir (right picture) is located in the alluvial shoal of north western Changxing Island. The Qingcaosha reservoir has a huge amount of high-quality fresh water. In 2006, the Shanghai Municipal Government decided to build the Qingcaosha as a water source for Shanghai, in order to change the situation that more than 80% of Shanghai tap water comes from the Huangpu River. In June, 2011, the Qingcaosha reservoir had been fully completed, and begun to supply water. The water quality reaches the national standard class II, and provides more than 7,190,000 m3 water per day, accounting for more than 50% of the total water supply in Shanghai. 16 water plants get the water supply, benefiting a population of more than 11 million people. The Qingcaosha water source changes the history that drinking water in Shanghai mainly depends on the Huangpu River and the inland rivers. (Gu et al., 2008).

5.2.2 Comprehensive renovation to improve the water quality of main channel, sewerage treatment adapted to local conditions is effective to improve water quality

Chongming Island is taking measures to improve the water quality of the main channel of the rivers (Box 5.2).These include the following measures;

- Promote early warning monitoring evaluation system of ecological environment, carry out comprehensive renovation of main channel, which is called "a ring, two lakes, and ten verticals" project.
- Enhance the effort to change sluices in a state of disrepair;
- Improve the long-term management of the river channel;
- Carry out scientific water diversion;
- Strengthen the supervision of the sewage outfall into the rivers;
- Promote rural sewage treatment works;
- Accelerate the construction of infrastructure field and peripheral greenhouse water system; improve agricultural irrigation and water conservancy, in order to further increase the coverage of water saving irrigation;
- Accelerate construction of sewerage interception pipe and centralized treatment facilities.

Box 5.2 Ecological Regulation On Rivers

Chongming Island is an alluvial island with heavy grittiness and low viscidity; so rainfall washing and soil erosion easily affect its banks. Traditional scheme for integrated river renovation works pays more attention to revetment and solid the earth. However to some extent, it ignores the need for eco-construction. The vertical revetment structure, or using stones and cement plates to cover the river slope and pointing, has imperceptibly affected the environment for creatures.

According to the modern ecological river channel design concept, the river channel treatment does not simply mean building cement revetment, but also consider restoration of water ecological system. River slope should have a close contact with water, making the water and gas exchange smoothly between water, animals and plants. In the Chongming Ecological River Design Scheme, full range of plants including terrestrial plants (arbor, shrub, grass) and wetland plants were planted from the top of embankment to the bottom, forming a multi-level ecological protection system with both ecological and landscape functions. Chongming County (Chongming Island, Changxing Island, Hengsha Island) carried out pilot work of Chongming River Channel Eco-construction Project from the beginning of 2011. At that time, Wanping River in Dongping Town, Xiangyang River in Gangyan Town were selected for ecological management pilot channels. Measures include sediment dredging, embankment construction on both banks, construction of ecological purification system and ecological greening construction, and all these efforts have achieved good results.

In the aspect of sewage treatment, Chongming adopts both centralized treatment and decentralized treatment processes. In the aspect of urban sewage treatment, Chongming has built four sewage treatment plants, namely Chengqiao, Baozhen, Xinhe and Chenjia Town. The amounts of water that can be treated by these plants are 25,000 tons/day for Chengqiao sewage treatment plants 12,500 tons/day for the Baozhen and 5,000 tons/day for the Xinhe plant. The Chenjia Town sewage treatment plant became operational in 2013. The urban sewage centralized treatment rate of Chongming Island has been significantly improved, increaseing from 34.90% in 2008 to 80.4% in 2012, which exceeded the target value set for 2012. In the aspect of rural sewage treatment, Chongming Island combines with the spatial distribution characteristics of rural settlements, carries out rural decentralized sewage treatment research, and has successfully applied it in practice.

COD/ NH-N discharge (Fig 5.1). After these measures, Chongming Island, COD emissions decreased from 52,800 tons in 2008 to 49,500 tons in 2012 and the NH-N emissions decreased from 3,500 tons in 2008 to 2500 tons in 2012.

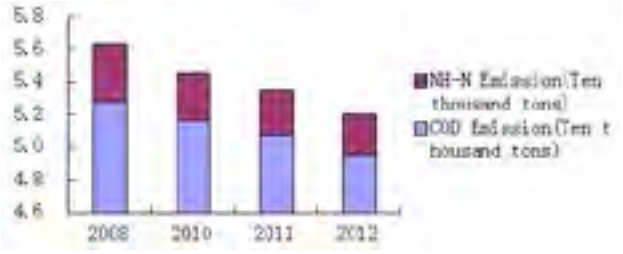


Fig. 5.1 COD/NH-N Emission (Ten thousand tons)

Box 5.3 explore new modes of rural sewage treatment to suit local conditions

Chongming Island is a large island with a relatively small population. In recent years, rural areas have installed flush toilets. However, due to the lack of appropriate treatment facilities, sewage was directly discharged, and it is too costly to intensively collect the remote sewage in the near future. Considering the spatial distribution of rural settlements, Chongming Island carried out rural domestic sewage decentralized treatment research, applied technology innovations such as compound biological filter technology, constructed wetland treatment technology and on-site processing technology for fecal sewage of high concentrations, in order to improve the rural ability to control sewage pollution. Since 2009, Chongming County (Chongming Island, Changxing Island and Hengsha Island) started construction of the distributed rural sewage treatment facilities, rural domestic sewage treatment facilities have been built in around 5,000 households every year since 2010, gradually realizing the full coverage, combining centralized with distributed processing. A total number of 315 processing system throughout 32 administrative villages in 15 towns have been built, benefiting 17,893 households. (Source: Chongming County of Shanghai Municipal Water Affairs Bureau)

5.2.3 Popularize water-saving knowledge, promote demonstration and transformation, and improve the water-use efficiency

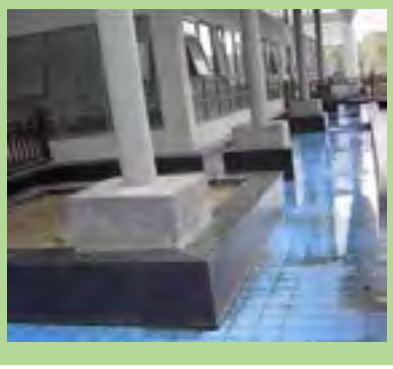
In 2012, the quantity of water supply on Chongming Island was 58.38 million, among which 34.5% was industrial water and 38.1% was domestic water (Data for agricultural water are not available due to the over-dispersion). Agriculture irrigation consumes a large quantity of water resources; thus, water-saving irrigation engineering can bring about optimal economic benefits with limited irrigation water conditions. By the end of 2011, the effective irrigation area of Chongming Island reached 59,600 hectares, including 45,100 hectares of water saving irrigation area, which covered 75.7% (Source: Shanghai Municipal Chongming County Water Affairs Bureau)

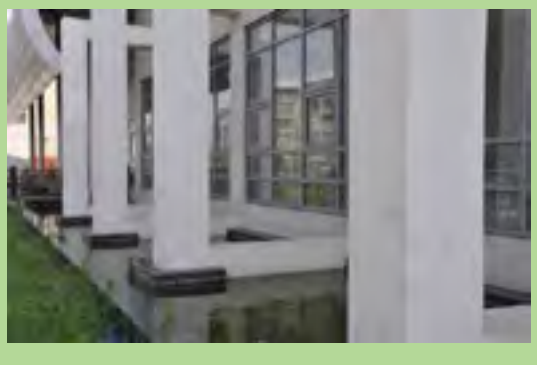
The recycle rate of industrial water (the ratio of recycling industrial water to the total water consumption) is the main index of industrial water-use efficiency. From 2010 to 2012, Chongming Island completed the pipeline transformation in water plants, purchased seepage detection equipment, and achieved circulated water modification in Yusheng Company, Hubao Steel, and Chongming special electromagnetic wire plant.

Chongming Island strengthened the publicity and education of water resources protection, and enhanced the public awareness of water saving. For example, during the World Water Day and China Water Week, the officials from the local government imparted water saving tips to the public through activities such as laws consultation. In addition, Chongming Island takes the point as a breakthrough, and conducted research on low carbon water treatment technology for the local community. The rainwater collection and reclaimed water recycling demonstration of Chenjia Town is a good case, as shown in Box 5.4.

Box 5.4 Recycling Water Resource-- The Ecological Community Construction In Chenjia Town

Chenjia Town is one of the pilot towns of new rural construction in Shanghai. During ecological community construction, Chenjia Town Company took resources recycling as a major objective, and carried out the research and demonstration on rainwater collection and reclaimed water-recycling technology. The recycling water could be used for toilet flushing, sprinkling and landscape, among other uses. In addition, according to the "General Construction Specification of Chenjia Town", Chenjia Town sets standard for all kinds of planning water use. For example, the water consumption on residential land is 30 ~ 40m3/ha•d, water consumption on offices, commercial finance center, culture and entertainment center is 40m3/ha•d.





5.3 Challenges and Opportunities

The challenge for Chongming is to ensure consistent improvement in water quality and efficiency in use. With municipal and prefectural interaction and multilateral Stakeholder's engagement, Chongming Island has invested a lot of resources and efforts towards the improvement of water quality and the water utilization efficiency. At the same time, Chongming Island's environmental carrying capacity and resource renewal capability are limited as a fragile island ecosystem (Ni et al., 2012). Various external surroundings change, such as economic and social development, policy environment change, science and technology progress, will put forward new requirements and challenges on the eco-island construction.

5.3.1 Drinking water safety and water pollution control

Chongming Island has invested in the water environment construction, so that residents' drinking water safety gets guaranteed. As the rolling implementation of the fifth round three-year' environmental action plan (2012-2014), Chongming Island continues concentrating on protecting the safety of drinking water supply and improving water quality, further strengthening the construction of water sources, intensive water supply and risk prevention. Chongming needs to focus on river regulation, especially controlling water blackening and eutrophication. Also, promoting the sewage treatment plants and pipe network construction to improve sewage treatment capacity is important. To be prepared to deal with sudden environmental accidents, Chongming

should take as an opportunity, the need to improve on its environmental risk control system and emergency pollution response system.

5.3.2 Adaptive water system planning and water sensitive city design

Chongming Island faces a challenge of being vulnerable to climate change effects such as rising sea level (Tian et al., 2010). The development of Chongming Eco-Island therefore presents several opportunities for adaptive water system planning. The first would be to strengthen Chongming's adaptation ability to cope with the frequent extreme weather, and promote the sustainable development of the hydrology ecosystem of Chongming Island in the early urban planning. Examples of specific measures here could be to improve the drainage network in the island, improve the discharging standard and water supply capacity, and update municipal drainage facilities.

Secondly, there is an opportunity for the Chongming eco-island to integrate within its water management planning, the concept of water sensitive city design, drawing on the experience from Australia. This concept originated in the 1990s in Australia, as a response to rainwater management issues under long-term drought conditions. It is mainly through urban design (reasonable physical space planning) the negative impact on water environment can be reduced and avoided. Through interdisciplinary means, a water sensitive city design can protect urban natural water body, improve drainage water quality and reduce the city's rainwater runoff (Wong and Brown, 2009). Lastly, the development of Chongming Eco-Island presents an opportunity to put in place adaptive measures to address climate change impacts, hence the need to bring together experts to conduct special research on climate change adaptation and capacity-building and provide recommendations for Chongming Island planning to cope with climate change in the long term.

5.3.3 Water efficiency throughout the life cycle

Shanghai is actively creating a water-saving city. As a result, it is exploring a water-saving society construction pattern; that is, taking water conservation, emission reduction and environmental improvement as the leading objectives in areas with a shortage of quality water. Chongming Island, in the suburb of Shanghai, aims to build a world-class ecological island, so that advanced concepts could be integrated into the early construction stage. The key challenge here therefore is how to achieve the maximization of water efficiency throughout the water life cycle, including water intake, supply, use and drainage, has become a new challenge. Addressing this challenge presents several opportunities. These include; first, further promote existing water-saving measures such as pumping station construction for agricultural water-saving irrigation and closure of small water plants; second, gradually improve aging water pipe network, reduce the leakage, and conduct a feasibility study on integrated intelligent water distribution network; and lastly, assess and generalize the water saving measures in the pilot, in order to expand technology demonstration.

5.3.4 Information dissemination and public participation

The ecological environment, economic construction and social welfare in Chongming have been greatly improved since Chongming eco-island construction. Relying on this excellent opportunity, Chongming uses modern multimedia technology and platform to show acquired achievements to other developing regions, and promote the communication of sustainable development.

Water supply and water quality affect every citizen's daily life because citizens are both the beneficiaries of water environmental construction and protection and are also the actors in water conservation. Citizens should be encouraged to take up their responsibilities in reducing water consumption and improving water quality. Individual actions, such as saving water on a daily basis, recycling and reusing kitchen and bathtub waters, changing to water efficient toilet systems, buying local and organic vegetables, avoiding chemical products and using phosphorus-free detergents might be trivial but are most effective when taken together. A more active citizenry, concerned about the environment and willing to report illegal discharges, will also help the regulators to monitor the polluting factories more effectively.

5.4 Summary and Lessons Learned

Water is a critical natural resource for the development of Chongming Eco-Island. The sustainable development of Chongming Eco-Island will be largely determined by its ability to secure a clean, reliable and plentiful supply of potable water. Chongming has devoted a lot of efforts to drinking water safety, water pollution control and water conservation. Water pollution has been effectively controlled, NH-N discharge was reduced by 1,000 tons between 2008 and 2012. Currently residents in Chongming Island enjoy drinking clean portable water. Until June 2013, four water plants have been built and put into use. All the measures laid a solid foundation to realize a virtuous circle of water resources.

The outstanding experience and lessons learned from Chongming Island in the sustainable use of water resources is as follows:

- Provide intensive water supply and guarantee water safety. Relying on its own advantage on ecological resources, Chongming Island opened up new water sources: Dongfeng Xisha Reservoir, planned water supply system overall and closed small water plants while building centralized water plants, so that drinking water safety is guaranteed.

- Systematically promote sewage treatment and pollution reduction suiting local conditions. Chongming Island constructed municipal wastewater treatment plants for concentrated urban wastewater treatment, explored scattered wetland treatment system for rural areas and made great efforts to carry out comprehensive main channels regulation. Meanwhile, the awareness of environmental protection continues to be strengthened by training; water pollution in Chongming Island is thus remarkably controlled.

- Improve water use efficiency led through the application of science and technology. Pilots and promotion of water-saving irrigation help to improve agricultural water use efficiency. Chenjia Town rainwater harvesting and reuse of reclaimed water projects in hotels set an example to improve the comprehensive utilization of water resources in the community. These projects not only demonstrated the feasibility of improving the efficiency of water use, but also subtly spreading water saving ideas.

Taking into account the fact that Chongming Island, as a fragile island ecosystem, has a limited self-renewal water capacity and is subject to rising sea levels and other climate change impacts, the following measures are recommended for Chongming Island. Chongming Island should strive for water efficiency in the full life cycle and continue to maintain and promote the safety of drinking water and water pollution control program, improve environmental risk control system, improve response to sudden environmental incidents, explore the opportunity to integrate the concept of water sensitive urban design into the new city planning, make adaptive water system adjustment in the early stages, and actively promote sustainability of urban water use and urban hydrological ecosystem. Considerations should be placed on research to inform adaptation planning for climate change.

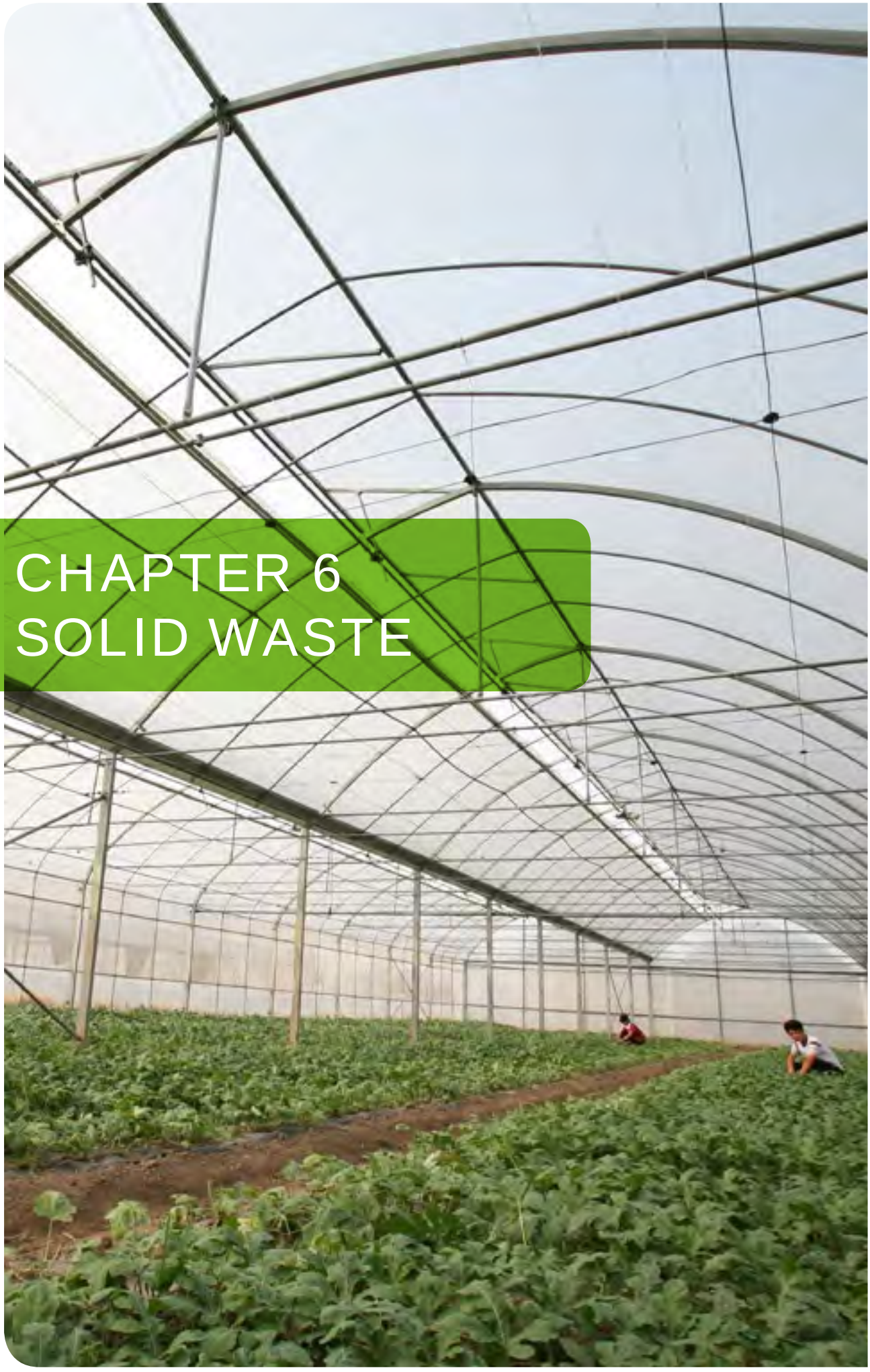
5.5. Recommended Action Plans

Table 5.1. Action Plan for Water

No.	*Issue*	*Recommended Actions*	*Timeframe*	*Significance*
5.1	Water intake	Protect water sources, strengthen monitoring efforts nearby and push terrestrial water pipe network	Immediate	☆☆☆
5.2	Water supply	Build and update the water supply pipe network, continue to shut down small water plants, realizing intensive water supply	Immediate	☆☆☆
5.3	Water use	Encourage factories to carry out clean production; improve industrial water recycle rate; cut chemical fertilizer and pesticide usage; promote water-saving agriculture; call for water saving; evaluate the possibility of using water-saving appliances	Immediate	☆☆
5.4	Drainage	Improve the drainage network, update municipal drainage facilities, improve the discharging standard and	Mid-term	☆☆
5.5	Water pollution control	continue to promote the comprehensive regulation of rivers, lessen the volume of wastewater and contaminated content whilst treating it as an opportunity for reuse	Immediate	☆☆☆
5.6	Water planning	Explore the possibility of a water sensitive city design	Mid-term	☆
5.7	Water management	Establish an information sharing and communication platform to enhance public participation in water resource management and conservation	Mid-term	☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means “very important”

CHAPTER 6
SOLID WASTE



CHAPTER 6 SOLID WASTE

6.1 Baseline Scenario

A key challenge for cities around the world is in the treatment and recycling of the municipal solid waste. Chongming Island is relatively isolated, as it is surrounded by the Yangtze River in three directions and by a sea on one side. The collection, treatment and systematic management of solid waste present a significant opportunity for eco-development in the island. The solid waste in Chongming Island mainly includes household waste, food waste, agriculture waste, general industrial solid waste, construction waste, green garbage, etc. At present, terminal treatment facilities on the island include the local comprehensive disposal site (landfill) and Chongming food waste disposal plant.

To construct an Eco-Island, according to current conditions and the requirements of low-carbon economy, Chongming has adopted the Principle of 2RH: Reduction, Resource, Harmlessness. Chongming Island will give priority to the environment factor, considering all kinds of solid waste, having an overall plan and vigorously promoting the waste reducing from source and treating them in a better way to reuse, as well as starting reduction actions targeted at rural inorganic wastes.

Chongming Island has the opportunity to produce less waste and re-use more wastes produced and recycled. In the short term, the key point for the disposal and management of the solid waste lies in increasing the resource utilization rate of household waste and agriculture waste, and improving the comprehensive utilization rate of other wastes. Through optimizing facilities and the layout, and integrating value chain among all kinds of solid waste, conducting sustainable management aimed at reducing, recycling, transferring, transporting comprehensively reusing and every aspects of terminal treatment, Chongming Island can realize the potential to achieve “zero solid waste” in the future

6.1.1 Household Waste

The quantity of household waste generated in Chongming Island is low with a per capita value of only 0.48kg per day in 2010. Household wastes are collected in a mixed way by garbage room and garbage can, and then sent to transit stations or disposal sites by garbage collection cars. Landfill is the most common treatment method. The solid waste comprehensive utilization center project (Waste Incineration Power Station) was launched in 2012. In the future, household waste treatment will follow the 2RH Principle of “Reduction, Resource, and Harmlessness”. The recyclable material in wastes will be reused; food waste, bulky waste and electronic waste will be classified and managed separately. Other wastes will be mainly incinerated or sent to a sanitary landfill. Moreover, Chongming Island has set a separate collection target of 85% and 80% utilization of household refuse by 2020.

6.1.2 Agricultural Wastes

Chongming is actively building and re-modelling standardized livestock, poultry and aquaculture farms. Furthermore, the implementation of large-scale biogas project, planting and raising production modes and organic ecological restoration, are highly promoted. In terms of straw utilization, the local government has already banned unorganized incineration of straw or other wastes, and encourages farmers to return crop straw to the field, as well as guide them in the industrialization of straw utilization. In addition, It will continue to promote testing soil for formulated fertilization and green manure planting, actively develop high efficiency, low toxicity, low residual pesticide experiment demonstration and to further strengthen collection and disposal of abandoned pesticide bottles, agricultural film and other agricultural waste.

6.1.3 Industrial and Construction Waste

General industrial waste of Chongming Island mainly comprised of scrap iron and slag stone, Most of them are selected and reused, while other non-profitable materials are treated in the terminal processing. Construction wastes are mainly from Chengqiao Town, Bao Town and Chenjia Town. Due to Chongming’s low terrain, it is profitable to backfill the engineer muck. Most of construction and demolition waste is reused to pave the ground and road. Coming from construction waste temporary transit site, decoration waste is selected and reused. Chongming Island proposes to further strengthen the comprehensive utilization of industrial solid waste and construction waste. By 2020, 90% of industrial waste will be reused comprehensively and 95% of construction waste will be recycled.

6.2 Progress to date

The waste management of Chongming Island mainly targets household waste, agricultural waste, general industrial solid waste and construction waste with suitable at source reduction, reasonable resource utilization and comprehensive treatment plan. In optimising solid waste facilities layout and equipment configuration, Chongming Island has developed a preliminary, independent and characteristic system of collection, treatment and utilization of solid waste.

6.2.1 Household Waste

Household waste in Chongming Island mainly includes food waste, plastic, paper and fruit. All towns are equipped with garbage trucks, garbage bins and garbage collection rooms. The collection and treatment system now already covers

the whole island. Chongming Island actively promotes the construction of separate collection and treatment systems in order to reduce waste in the beginning and also increase the multipurpose utilization rate.

In view of the current situation and the plan of solid waste treatment facilities in Chongming Island, applying a separate collection rule “to distribute the major sort” and to “classify the accurate one” is proposed. The former means to specially collect and separately treat such waste, including daily household waste, decoration waste, general industrial waste, food waste, market waste, bulky waste and electronic waste, while the latter means dividing daily household waste into two, three, and four categories. Daily household waste in living area is classified as glass, hazardous waste, recyclable waste and other waste. Household waste in government, schools and enterprise and public institution is categorized as recyclable waste and other waste. ‘To distribute the major sort’ also requires people in rural area collect and treat abandoned pesticide packaging solely. Household waste in daily life is divided into hazardous waste food waste and other waste.

Box 6.1 Waste Sorting Knowledge Propaganda Activities of Chongming

Chongming Island has formed a group of teachers to advocate for waste reduction & classification, as well as environmental protection to residents to guide them in classifying and reducing waste voluntarily through ‘walking and teaching in villages’. To train and guide residents in classifying waste, Chongming Island has invested more than 2.1 million CNY, issued 35,000 manuals, 300,000 calendars, 5,000 bibs, 5,000 mouse mats and 2,000 daily supplies, inspired by the adoption of low-carbon living ideas such as handkerchiefs, folding fan, bookmarks and water bottles. Besides, Chongming Island has developed 20 electronic advertisements, 1 documentary and 50 promotional activities, assisted by County Women‘s Federation and schools. Over 400 lectures and training classes have been conducted, with 2. 5 million people involved.

There are five intelligent garbage transfer stations in Chongming Island; Sanxing garbage transfer station, Miaozhen garbage transfer station, Chengying garbage transfer station, Xinhe garbage transfer station and Chenjia Town garbage transfer station. The landfill sites in towns and villages were abolished in 2005. Household waste is transported to center transit treatment system after collecting and compression packing. The transit transportation uses compression containers and airtight transit and transportation to ensure no garbage is exposed and that there is no drop leaking.

There are two terminal treatment facilities for household waste in Chongming Island. One is the Chongming County household waste comprehensive disposal site, which has been operational since 2006. The other one is the food waste treatment plant that has been operational since 2011. Chongming household waste comprehensive disposal site which caters for all the residents in the county is located to the east of Baozhen Harbor, and covers an area of 305 acre and has a daily capacity of 300-600 tons of waste. It is the major sanitary landfill, also handling sewage treatment, fly killing and deodorization with an excellent treatment system of percolation. This comprehensive treatment site was certified as Grade I harmless treatment by China Association of Urban Environmental Sanitation.

The Chongming food waste treatment plant is located to the east of Beibao Harbor, covering an area of 10.2 acres, with a daily capacity of 20 tons of waste (County food waste refers to the waste produced by restaurants but excludes homemade wastes). It can almost ‘consume’ all the food waste in Chongming Island. This food waste treatment plant uses the subcritical hydrolysis technology using high temperature and high pressure to recombine the waste in a molecular manner. End products can then be reused as high quality organic fertilizer for fruits and vegetables, trees and crops, to produce heat, grease and other useful materials.

In addition, the Chongming comprehensive center for solid waste disposal started initial preparations in January, 2012. It uses advanced incineration power generation and flue gas treatment technology, mainly targeted at Chongming household and other solid waste suitable for incineration, with a designed management capacity of 500 tons per day. This project will substantially raise the solid waste resource rate.

6.2.2 Agricultural Wastes

Comprehensive utilization of agricultural waste is the key factor of sustainable solid waste management in Chongming Island. Agricultural waste mainly includes livestock and poultry manure and crop straw. In 2010, there were 70 large-scale livestock and poultry farms (including farms) and 2,302 small and medium-sized pig farms, producing 320,000 tons of livestock manure. Chongming started the practice of recycling livestock manure in the 1970s. According to the concept of integrating planting with husbandry as an ecological cycle, Chongming Island has gradually undertaken experiments and set up closed-loop ecological balanced systems like 'animal-gas-crops' by combining planting and fish breeding. It has developed a new circulation of biomass energy and become the highlight which Chongming Island is addressing as an Eco-Island.

Chongming Island has also created an energy and ecology model called 'four statuses and one system as a general' which links plating with fish breeding, based on land resources, solar energy and gas. Through the biomass conversion technology, the energy and ecology model puts methane tanks, pigsties, toilets and solar greenhouses together under a closed state, thereby forming Qianwei Village comprehensive utilization system. Through promoting the construction of large-scale livestock farms and standardized ecological fish breeding base, actively carrying out biogas utilization demonstration, strengthening management of small and medium-sized pig raising households and taking full advantage of livestock manure, the resource utilization rate of Chongming Island has increased steadily from 71% in 2008 to 82% in 2012 (Figure 6.1). This rate exceeds the 80% target for 2012 as set in Chongming Eco-Island Construction Outline (2010-2020).

Box 6.2 A brief description of straw briquetting

Shanghai Zhuanghe Agricultural Machine and Service Cooperatives has been working on straw briquetting fuel for three years. In this duration, it has completed 'the demonstration of straw briquetting fuel' project issued by the City Farming Committee, under the assistance and guide of city, township governments and related departments. It has formed a production process from collecting, transporting, preserving, briquetting, sale to retting organic fertilizer of abandoned fodder. There are 5,000 tons of straw that can be recycled every year.

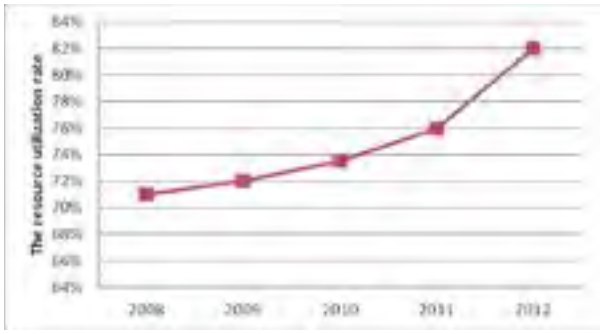


Fig 6.1 The resource utilization rate of Chongming Island

The crop straw in Chongming Island comes mainly from wheat, rice, rapeseed, corn, soybean, cotton, beans and peanuts. Chongming Island actively implements the agricultural straw resource utilization project and promotes a practice to return the straw into fields. Between 2010 and 2012, Chongming Island invested 50 million CNY, set up 10 demonstration sites dealing with straws returned to the fields in a mechanical way and purchased 162 machines. The straws had returned to 800 KMu fields in a mechanical way, which is now the most common method, and accounts for as much as 45%. The rest is used as cow feeds, substrate of edible fungi, briquetting fuel (Box 6.2) and organic fertilizer. In addition, Chongming Island launched several research and promotion programs based on the straw resource utilization method. These include a ban straw burning, advocating for use of green fertilizer to control the total number of straws, promoting mechanical way to return the straw into fields and exploring biomass energy application and other new methods to use straw resource. By 2011, there were four biomass energy projects under construction or in the planning stage. The straw resource utilization rate increased from 72% in 2008 to 80.5% in 2012 (Figure 6.2).

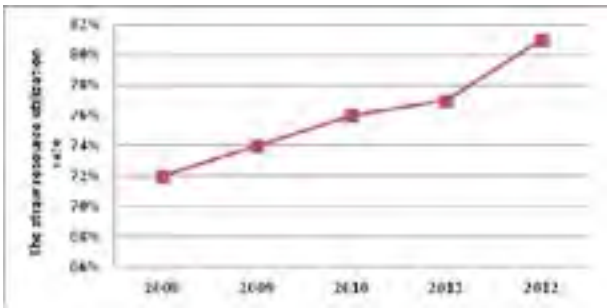


Fig 6.2. The straw resource utilization rate of Chongming

Box 6.3 The gas fermentation supply technology of a variety of organic agricultural waste

Chongming Island carried out research and demonstrations concerning gas fermentation supply technology of varieties organic agricultural waste, in order to build small sized fish breeding gas engine supplemented with straw, guaranteeing the stability of source. That resulting gas supply as well as returning residue into fields not only controls pollution, but also bring many benefits to the economy. The gas supply of organic agricultural waste provides advantages to both the environment and economy. With regard to the environment, after being processed by the gas engine, pig manure no longer has any odor. After anaerobic fermentation, the rate of poisonous, harmful bacteria and eggs killing is above 90%. This thus promotes an improved living environment nearby as well as the rural environment; also, there is a reduced emission of carbon dioxide and sulfur dioxide produced by the burning coal. For the economy, people can save 30% of their money for fertilizer and each household can earn 1,000 CNY because of the comprehensive utilization of residue. The residue from farmland irrigation can significantly improve the disease resistance and yield of crops; the prevention effect is above 60%, and yield has increased by more than 15%. Straw gasification power generation capacity is 60 kw, with a potential to bring extra income to more than 10,000 CNY a year. At the same time agricultural waste can be converted into gas or fuel, solving the cooking gas and electricity shortages in rural area and effectively improving the farmers' living conditions. The slag muck (plant ash, residue) can be used as a high-quality pollution-free agricultural product for sale. Manure, after anaerobic fermentation, killing harmful bacteria and enhancing the fertility, can improve soil structure and save chemical fertilizers and pesticides. It can increase production, improve the quality of crops, form the closed-circuit ecological balance system, reduce the occurrence of diseases and create suitable conditions for the production of pollution-free agricultural products. It is a win-win situation both for the environment and economy to develop the technology to generate gas from mixed agricultural waste, build ecological hometown, captive pig in the sty and reuse the residue in the fields.

6.2.3 General Solid and Construction Waste

In general, the industrial waste produced in Chongming Island is not substantial. It mainly comprise of scrap iron and slag stone. Most of these are selected and reused, while other non reusable materials are treated in the terminal processing. Sewage sludge goes into the landfill disposal after dehydration. The sludge from ditch and dredging is mainly returned into fields.

Construction waste mainly includes waste from construction and demolition, most of which is produced in Chengqiao Town, Bao Town and Chenjia Town. There are four construction transit sites in these towns taking in decoration waste and some little deconstruction and demolition waste for moment. The demand of engineering residue in market is huge and most of them are backfilled. The construction and demolition waste is reused to pave the ground and road, with some of it remaining unused. Presently, the construction wastes are basically reused in accordance to the needs of the market. Decoration waste is sorted then reused in construction waste temporary transit site.

6.3 Challenges and Opportunities

6.3.1 The Hierarchy System of Solid Waste Management

Chongming Eco-Island has adopted a Hierarchy System of solid waste management. The system is mainly implemented through community service and other auxiliary means, to comply with the priority level of "reduction, reuse, recycling" "recovery", and "terminal disposal" (Figure 6.3). This hierarchical strategy is helpful to the island's sustainable solid waste management.

Fig. 6.3 the Solid Waste Hierarchy Management System in Chongming Eco-Island

6.3.2 The Resource Utilization of Solid Waste

The construction of the Eco- Island offers a great opportunity for the comprehensive management of household waste, food waste and industrial waste, as well as the accomplishment of the closed-loop waste management system and could make Chongming Island to be a model of sustainable solid waste management. Separate collection is the key to improving solid waste resource utilization. For household waste, food waste, general industrial waste, construction waste, agricultural waste and green waste, it is better to take different measures to enhance resource utilization, integrate value chain among all kinds solid waste and promote comprehensive utilization in all ways. The planning and operation of comprehensive utilization of the solid waste disposal center makes the waste incineration the main direction of future terminal disposal, which can effectively improve the resource utilization level of household waste in Chongming Island.

The notion that construction is resource-intensive, and restricted by time and design, easily causes the wastage of construction resources. Chongming Island encourages reusing of construction waste, as this can reduce costs and stimulates new financial opportunities related to resource management. In the construction of the Eco-Island, Chongming Island encourages to build a construction waste treatment plant and promote recyclable building material in order to improve the supply chain in Chongming Island.

Green waste recycling presents a range of opportunities for Chongming Island, as characterized by agriculture. The collection and recycling of household, agricultural and commercial organic waste provides a large-scale opportunity for the processing of composting and organic fertiliser production. Due to the ready availability of green waste on Chongming Island, opportunities for the production, manufacture and sale of organic fertilizer or feed is likely to prove viable on the island. The recycling of organic matter into fertilizer or feed to support the agricultural industry can both close the loop on green waste production and contribute to improved water quality as a result of a decrease in the application of inorganic fertilizer. It also has the potential to reduce the demand for the importation of high cost inorganic fertilizer.

Shanghai has encouraged the implementation of a renewable energy strategy over recent years, investing in waste-to-energy projects across the province. With a vibrant agricultural economy, bio-energy generation on Chongming Island represents an opportunity to utilize existing organic wastes. A range of approaches can be taken for bio-energy generation on the island. For example the installation of methane capture and storage systems for livestock farming (that is piggeries) presents opportunities for localized energy generation. On a wider scale, other materials, such as green waste from vegetable processing and domestic or commercial food wastes can be used as inputs for larger scale energy generation technologies.

6.3.3 Chongming Island as a Hub for Sustainable Waste Management Technology

The development of a waste technology cluster can be promoted through the provision of incentives for companies, organizations and academic institutions with an interest in waste technology and management to invest and establish on the island. The clustering of innovative companies with similar interests can have the benefit of attracting others with technological and business expertise, and an interest in sharing the risks and benefits of collaborative research. A cluster benefits strongly from the presence of a local science and technology anchor, such as a prominent research organization or university that can work with local companies to transfer technology and encourage new enterprises. In this context, universities in Shanghai have expressed an interest in establishing campuses on Chongming Island. Likewise, there is a potential to attract universities from other parts of the world to establish a presence on the island. This will support the development of a research and innovation cluster for clean technologies, including sustainable waste management technologies.

Overall, the promotion of a successful waste technology cluster on Chongming Island will support the creation of a critical mass of companies and organizations, as well as a wide range of ancillary service providers. This will support a range of benefits, including improving potential access to capital, facilitating a critical mass of sector knowledge, as well as providing access to a large pool of high quality talent.

6.4 Summary and Lessons Learned

Chongming Island is following the path of transformation to become an Eco-Island. Considering the current situation and low-carbon requirement, Chongming Island has developed a preliminary, independent and characteristic system of collection treatment and utilization of solid waste.

In recent years, Chongming Island has promoted waste separate collection in ways that realize waste source reduction. The closed transit and transportation system effectively avoids the secondary pollution in the waste transportation. A comprehensive household waste treatment plant (landfill) has been certified as Grade I harmless treatment; a food waste treatment plant has also been put into operation; the Chongming solid waste comprehensive utilization centre project (incineration power generation) has been launched; and construction waste can basically meet the requirement of market with no surplus. Chongming Island specifically formulated and implemented a series of measures and plans, from all aspects of waste source reduction, collection, transit, transportation, treatment, disposal and comprehensive utilization.

These experiences in Chongming Island provides several lessons worth sharing, some of which are presented below:

- The improvement and upgrading of the waste treatment facilities is the foundation. The landfill sites of towns and villages were abolished in 2005. Chongming household waste comprehensive treatment site has been put into operation in 2006 (being certified as grade I harmless treatment), which can help avoid and reduce environmental pollution in the landfill process. The construction of 5 intelligent waste transits helps realize closed transit and transportation system effectively, thereby avoiding the second pollution in the waste transportation. In addition, the food waste treatment plant, which has been put into operation, and the Chongming solid waste comprehensive utilization center that will be operated, can help promote resource utilization.

- It is critical to improve the resource utilization rate of agricultural waste where farming is the common source of finance. Livestock manure and straw burning are the main sources of pollution in these systems and the key to reducing pollution is through improvements in the resource utilization rate of agricultural waste. The idea to integrate crop planting with livestock husbandry as an ecological cycle, and the demonstration engine can help increase the resource utilization rate of livestock manure. By banning the burning of straws, advocating for green fertilizer to control the total number of straws, promoting the mechanical way to return the straw into fields and exploring biomass energy applications and other new methods of using straw resource can help solve the straw problem.

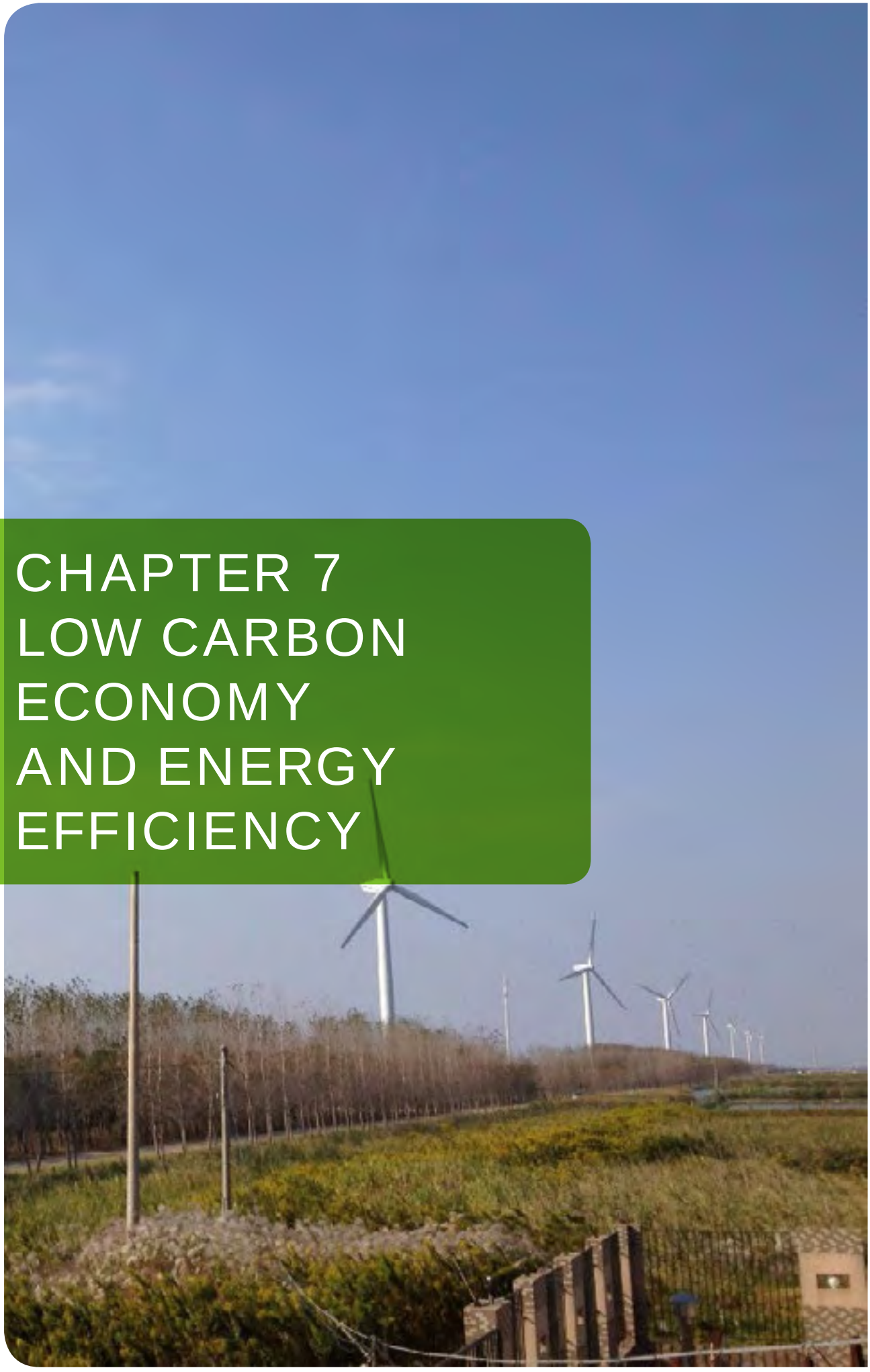
- In the future, Chongming Island will constantly follow the principle 'to minimize, to be harmless and to recycle from the waste'. It also will further improve the sustainable solid management level in all aspects of collection, transit, transportation in Chongming as Eco-Island.

6.5 Recommended Action Plans

Table 6.1. Action Plan for Waste Management

No.	*Issue*	*Recommended Action*	*Timeframe*	*Significance*
6.1	Zero solid waste	Promote measures towards the realization of the goal of "zero solid waste", including the reduction, re-use, recycling and recovery of solid waste materials.	Long-term	☆☆☆
6.2	Comprehensive management of solid waste	Promote hierarchical management following the priority of reducing, reusing, recycling, recovery and terminal disposition of solid waste. Systematize the strategy of sustainable solid waste management for Chongming island	Short-term	☆☆☆
6..3	Resource utilization of solid waste	Set-up and operationalise the Solid Waste Comprehensive Utilization Centers to continually improve the solid waste resource utilization n Chongming Island. Promote and expand the mechanization of straw returning for agricultural waste. Reconstruct small and medium size biogas engineering treatment areas for pig farms.	Short-term	☆☆☆
6.4	Cutting edge technologies for the comprehensive utilization and management for solid waste	Support the development and application of solid waste management and utilization technologies and the spread of industry knowledge. To achieve this, set-up a Cluster of Solid Waste Management Technology Centers among private sector (industry companies), research institutes and academic institutions	Medium-term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means "very important"



CHAPTER 7
LOW CARBON ECONOMY AND ENERGY EFFICIENCY

CHAPTER 7 LOW CARBON ECONOMY AND ENERGY EFFICIENCY

7.1 Baseline Scenario

Promoting low carbon development is considered a critical objective for building Chongming Island into the national sustainable development experimental area and the world-class eco-island. This has been variously expressed in the following planning documents for the Island;

- The Shanghai Urban Master Plan (1999-2020), approved by the State Council. This clearly outlined the goal of constructing Chongming Island as an eco-island, and placed low carbon development as one of the main strategies for fulfilling this target.

- The Chongming National Sustainable Development Experimental Area Planning (2009-2014) issued in 2010. This document stated that in order to realize sustainable development in economy, society, environment, and ecology, Chongming Island should develop low carbon agriculture, build a low carbon infrastructure, and advocate for a low carbon lifestyle.

- In 2011, Chongming was listed as one of the low carbon development pilot areas in Shanghai. As a result, the 12th Five-year Development Plan of Chongming County set clear targets to carry out low carbon development, including in the fields of industry, energy, building, transport, agriculture and ecology development.

Several targets and approaches have thus been developed as a path for Chongming Eco-Island to move towards a low carbon economy, and increase energy efficiency. These include targets in the following specific sectors and areas;

- Industrial structure optimization: To continue promoting high-efficiency and ecological agriculture and leisure tourism, and consolidating its modern service industry with Chongming's own features, aiming at setting up a green industrial framework to support the eco-island construction target.

- Energy saving in secondary industry: To continue phasing out backward production capacities, promoting energy-saving technologies and encouraging local enterprises to apply energy saving or advanced technologies and equipment.

- Low carbon energy supply system: Chongming Island has the potential to become a leader in renewable energy utilization. Renewable energy, including wind power, solar photo-voltaic (PV), geothermal, and biomass, is expected to account for 6% of Chongming Island's energy portfolio by 2015. The fuel substitutes from coal to natural gas for the local power plant will also contribute significantly to the island's energy portfolio optimization.

- Green building: By 2015, the standard of energy saving rate of new, renovated or expanded construction projects is expected to increase from 50% to 65%, and around 300,000 m2 public buildings and 150,000 m2 private buildings will have energy-saving retrofit undertaken on them.

- Sustainable transportation system: To continue promoting the shift from private vehicle oriented to public transportation orientated system, and encourage the use of low emissions vehicles.

- Low carbon agriculture. By 2015, the certified area of pollution-free, green, organic agricultural products will reach 70%. 80% of livestock and poultry manure produced and 85% of the crop straws will be recycled and reused. Fertilizers and chemical pesticides application per hectare are expected to be reduced to below 350 kg and 10 kg, respectively.

- Ecology protection: By 2015, it is estimated that the forest coverage rate and natural wetland retention rate will reach 24% and 43% respectively; the per capita urban public green area will reach 12 m2. The local municipality will achieve a 50% sorting out rate for solid waste (MSW) and resource-oriented utilization rate are expected to reach 50%.

If the above targets and approaches are realized then it is estimated that Chongming Island is capable of reaching the target of Decoupling of GHG Emissions and Economic Growth during the 12th five-year-plan period.

7.2 Progress to date

7.2.1 Energy consumption

Chongming Island has dedicated itself to promote energy saving in the fields of industry, building, and transportation. During the preparation towards the World Expo 2010 in Shanghai, China, a series of actions were taken to stimulate economic structure optimization in Chongming Island, with many outdated industries phased out. This action on its own saved the Island more than 150,000 tC-eq in energy consumption in 2010 compared to the 2005 rates. The proportion of energy consumption in secondary industry was

decreased by 10% between 2005 and 2010 (Figure 7.1). Meanwhile, significant efforts have been made to support low carbon infrastructure construction. In the field of sustainable transport, this includes encouraging public transport and clean energy vehicles, and cycling (for details please refer to Chapter 9). On the front of green building construction, the newly constructed buildings were designed strictly based on the 50% energy saving standard. In the six year period from 2010 to 2011, 82,967.82m2 of existing buildings in Chongming County installed energy saving retrofits, resulting in Green House Gas (GHGs) emission reduction and improved living conditions for the dwellers.

The total energy consumption in Chongming Island in 2010 was estimated at 1.01 million tC-eq. In terms of the distribution of consumption, the primary industry accounted for 13.9% of energy consumption, secondary industry for 43.5%, tertiary industry for 13.3%, and residential sector accounted for 27% (Figure 7). Per capita energy consumption in Chongming Island was around 1.89 tC-eq by 2010, equivalent to only 40% of the average level in Shanghai. Energy use in primary industry and secondary industry was less efficient, however, whereas the tertiary industry was more efficient than Shanghai's average level, with the energy intensity per 10,000 CNY of GDP around 0.63 tC-eq, 1tce and 0.14 tC-eq, respectively.

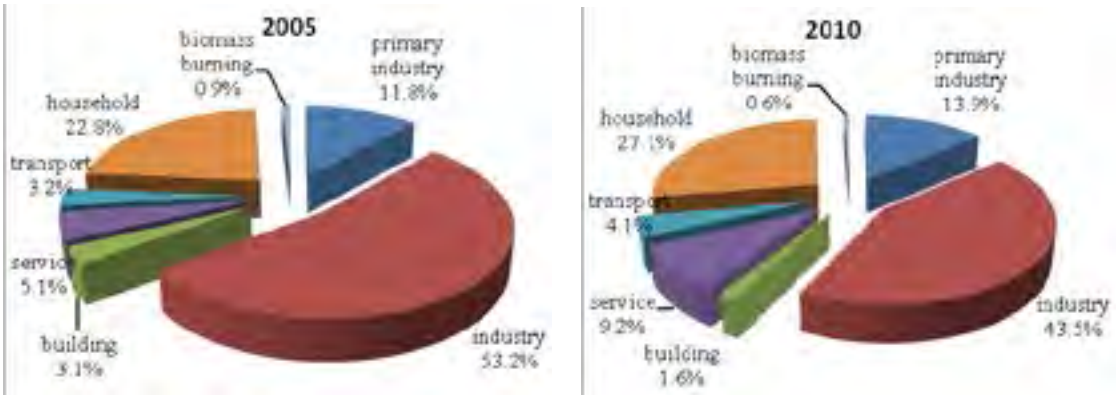


Fig. 7.1 Sector breakdown of energy consumption in Chongming Island in 2005 and 2010

7.2.2 Energy consumption structure

As shown in Figure 7.2, in 2010, Chongming Island's energy mix was dominated by coal, which accounted for 41.6% in total energy consumption, followed by oil, with a share of 26.9%. Since the natural gas pipelines in Chongming Island had not yet been completed by 2010, it was not able to introduce natural gas in the island. In rural areas, biomass, including firewood and straws were normally used for cooking.

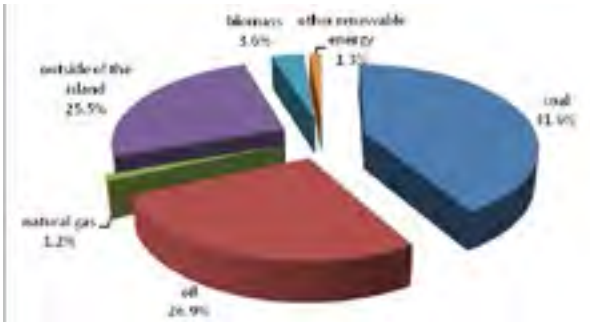


Fig. 7.2 Energy consumption structure in Chongming Island

The total electricity consumption in Chongming Island reached 1.537 billion KWh in 2010, an increase of 11.3% in 2010 compared to 2005. In addition to the local thermal power plant and local renewable energy generation, part of electricity was introduced from outside the island. The proportion of electricity from outside the Island increased from 10% in 2005 to 55.7% in 2010 (Figure 7.3). It should be noted that this sharp increase was mainly due to the closure of the local coal-fired power plant, which will be transformed into a natural gas fired power plant. In 2011, renewable energy generation, including from wind power (Box 7.1) and solar power (Box 7.2) accounted for 3% of electricity generation (Figure 7.3)

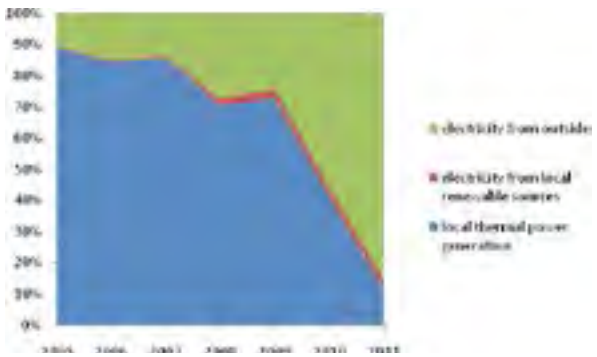


Fig. 7.3 Electricity supply structure in Chongming Island

Box 7.1 Wind power generation in Chongming Island

Completed in 2011, The Qianwei Village Wind Farm is one of Chongming Island's largest wind farms generating enough power to supply almost 40,000 households. The Qianwei Village Wind Farm consists of twenty 2,000 kilowatt turbines, creating a total installed capacity of 40 megawatts and generating 80.8 million kilowatt hours of electricity every year (Bureau Veritas 2012). This being the case, Qianwei Village Wind Farm will continue to play a critical role in achieving Shanghai City's objective to power 4 million houses with wind energy by 2020.

Dongtan Wind Farm is situated in eastern Chongming Island near the Dongtan Wetlands Park, and this project is slightly smaller than the Qianwei Village Wind Farm. It now consists of 13 wind turbines after being expanded from 10 wind turbines in 2008 (UNEP 2010). It has a total installed capacity of 19.5 megawatts and an annual generation potential of 42.9 million kilowatt hours.

Box 7.2 Solar power in Chongming Island

Solar photovoltaic power generation is currently the most common form of solar power generation globally. Small semiconductor cells, which are usually made of silicon, trap sunlight and convert it into electricity. PV cells are the most productive in direct sunlight, and they can continue to generate electricity in cloudy days. Electricity generated can be stored, used directly, or fed into a power grid. The Chongming Island solar PV Project located in Chenjia Town was completed in 2009. It has an installed capacity of 75 kilowatts and an annual electrical output of 83 megawatt hours (Zhenfa Solar Power 2013). Alongside this, another solar power plant has been established in Qianwei Village that has an installed capacity of 1,054 kilowatts with power generation of about 1.2 million KWH per year, which has the potential to save 337 tons of coal consumption and avoid 643 tons of CO2 emissions annually.

7.2.3 Greenhouse gas emissions

Figure 7.4 presents the breakdown of the GHG emissions in Chongming Eco-Island, showing that energy account for the largest share (73%) followed by agricultural activities (23%). With the application of bottom-up sector-based GHG inventory methodology, total energy related to CO2 emission in 2010 was calculated as 2,491,000 tC-eq, among which emissions from local power plant accounted for 33.3%, with indirect emission generated by external electricity accounting for 28.3% in 2010. The total Greenhouse gas emissions, including those from agricultural activities and waste disposal were calculated as 3,433,000 tC-eq in 2010. It should be noted that Chongming Island is bestowed with rich woodland and wetland resources, with a high capacity of carbon sequestration, which can offset 10% of the total GHG emissions; thus the net GHG emission in Chongming Island was about 3,085,000 tC-eq in 2010, with per capital net GHG emission around 5.8 tC-eq.

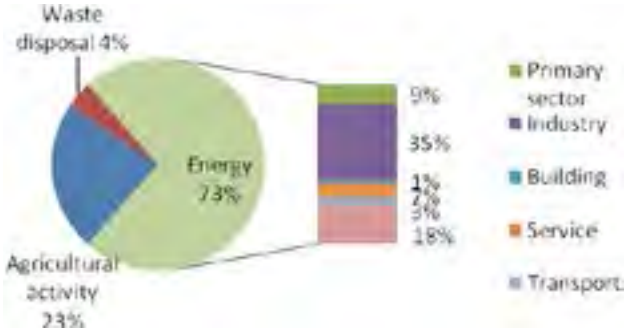


Fig. 7.4 Breakdown of GHG emissions in Chongming Island in 2010

7.3 Challenges and Opportunities

7.3.2 Challenges

- Population increase and the growth of economy leading to improved living standards will lead to continued increase in energy consumption and rise in GHG emissions.

- Relatively slow development of high-end manufacturing and modern service industry will bring challenges to further low carbon development.

- The difficulties faced by continued industry technology modification will exert pressure on energy savings and emission mitigation in the 12th five year period and beyond. Meanwhile, the rapid development of transport and service sectors will lead to fast increase in energy demand.

- Agricultural activities accounted for nearly 25% of the total GHG emissions in Chongming Island in 2010. This will not be reduced if the current planting and farming scale and structure are to be maintained.

- Land shortage, plant structure adjustment, wetland reclamation, and the reduction of Yangtze River water flow, together with the wash out of current wetland by seawater, will place adverse impacts on forestry and wetland protection in Chongming Island.

7.3.3 Opportunities

The commitment of the Chongming to pursue a low carbon economy pathway as demonstrated by the series of development plans have been released from the beginning of the 21st century, aiming at building Chongming into an eco-island presents a significant opportunity, especially on the front of energy infrastructure development. It is evident that GHG reduction measures in the whole process of energy exploitation, utilization and distribution have been well considered in recent years, with continuous optimization of energy mix, development of local smart grid, among others. During the 12th Five Year Plan period, further actions will be implemented, including to maintain relatively low energy intensity of local tertiary industry, and to improve energy efficiency in industrial sectors, construction and transportation sectors, among others. Alongside these, the needs to further strengthen protection of the forests and wetlands as a means towards maintaining their carbon sequestration capacity in Chongming Island remains a priority focus. Chongming Island should further capitalize on the following strategic advantages;

- Compared to the average level in Shanghai, Chongming Island has a lower per capita carbon emission, and higher energy efficiency for the tertiary industry. The local residents consume less energy, especially electricity compared to the average residents of Shanghai. This is due to their relatively traditional lifestyle, which has laid a solid foundation to promote low carbon development in Chongming Island.

- The electricity supply structure in Chongming Island will be further optimized due to the closure of local coal-fired power plant to be substituted by rapid growth of natural gas and renewable energy application.

- Low carbon infrastructure development in public transportation and clean energy vehicles, green building, as well as in resources-oriented solid waste utilization, will be further promoted. The successful experiences learnt from a series of pilot demonstrations will contribute greatly to the low carbon development in the island.

- Forests and wetlands provide critical ecological benefits, including carbon sequestration. It has been shown that carbon sinks from forests and wetlands can offset 10% of total GHG emissions in Chongming Island. These ecosystems should therefore be safeguarded to ensure their continued provision of ecosystem services.

7.4 Summary and Lessons Learned

With the accelerated "Eco-Island" construction of Chongming in recent years, positive results have been realized in green and low-carbon development. Underpinned by a strong utilization of science and technology innovations, Chongming Island has established marked progress in the following areas for which lessons can be learned:

- A low-carbon energy structure mainly supported by clean electricity and supplemented by renewable energy and smart grid
- A low-carbon industrial structure framed by advanced eco-agriculture and service industries
- A low-carbon infrastructure system featuring localization and application of green building and new energy vehicle technologies
- A natural carbon sequestration system supported by forests and wetlands
- A relatively low-carbon lifestyle originating from Chinese traditional philosophy of "Unity of nature and human-being".

Based on continued implementation of these approaches, Chongming Island is set to reach the target of decoupling of GHG emissions and economic growth during the 12th Five Year Plan period.

To realize further improvements, explore an innovated pattern of integrating economy, social livelihood and ecological development, and to fulfill the low carbon development target, it is recommended that a more systematic mechanism be established and incorporated in the overall planning and construction of Chongming eco-island. Furthermore, a more effective approach to promote regional low carbon development is recommended with the priority being on “controlling carbon demand”, “improving carbon productivity”, “reducing carbon dependency”, and “expanding carbon neutral”, in that order. These will help to accelerate the construction of a world-class eco-island and serve as a reference to other developing countries or regions that would like to pursue a low carbon development.

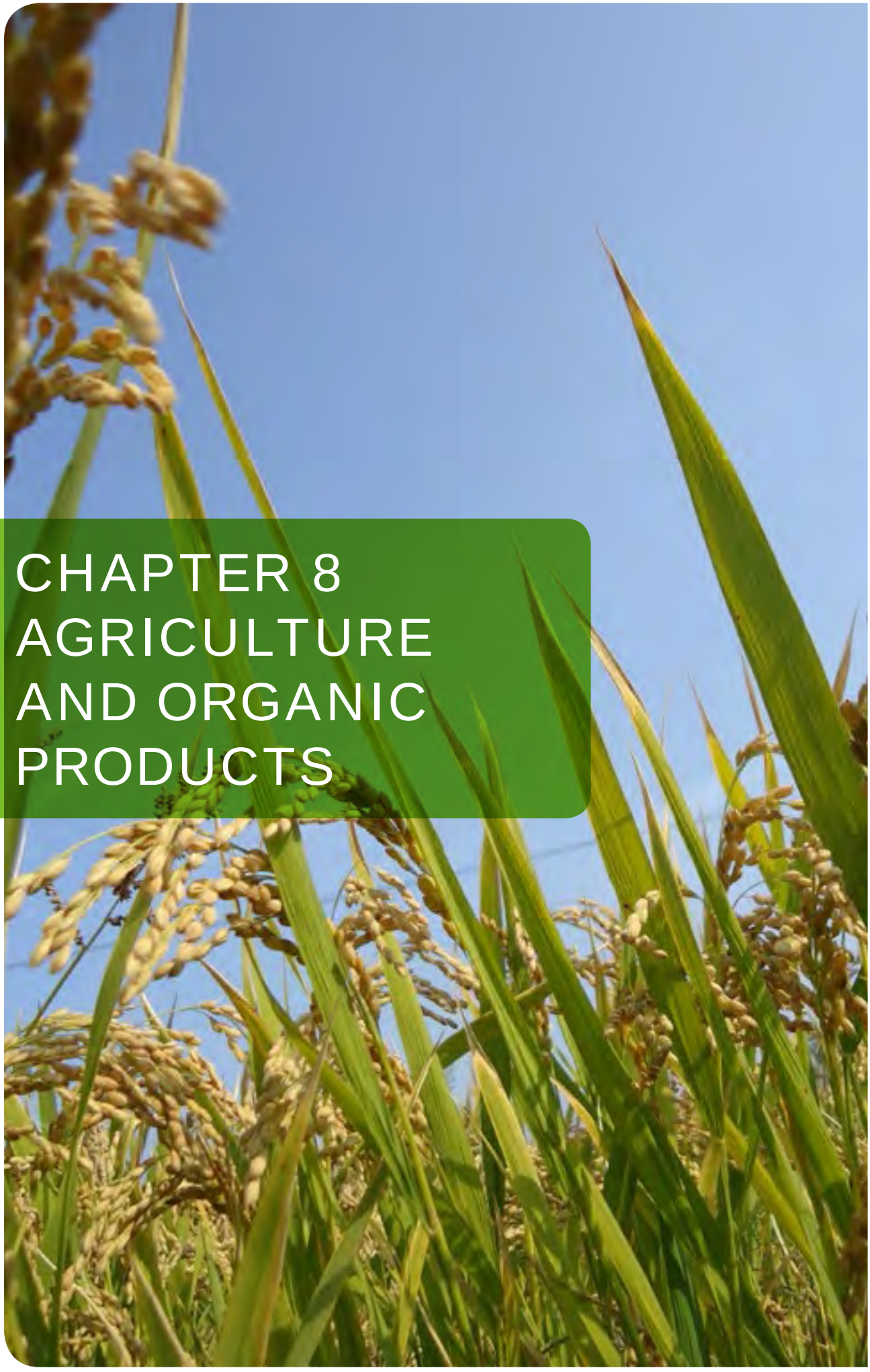
7.5. Recommended Action Plans

Table 7.1. Action Plan for Low Carbon Economy and Energy Efficiency

No	*Objective*	*Issue*	*Recommended Actions*	*Timeframe*	*Significance*
7.1	Controlling carbon demand	Low carbon industry	Consolidate low carbon agriculture and tourism demonstration base, and industrial park.	Immediate	☆☆☆
		Management capacity enhancement	Build a cross-sector and systematic management system to keep evaluating the actual performance of energy consumption and emission reductions.	Medium-term	☆☆☆
7.2	Increasing carbon productivity	Energy saving in secondary industries	Phase out the pollution intensive enterprises, and strengthen energy conservation management in key enterprises.	Immediate	☆☆☆
			Establish environmental and low carbon access threshold for new industrial development opportunities.	Immediate	☆☆
		Energy efficient buildings	Enhance energy efficiency requirement for new buildings, and accelerate the progress of energy saving renovation for existing buildings.	Immediate	☆☆☆
			Promote the establishment of integrated renewable energy technologies.	Medium to long-term	☆☆
		Sustainable transportation	Optimize the public transit network, and encourage public transport and low carbon emission vehicles.	Immediate	☆☆☆
			Introduce a zero carbon emission public transport system in Chongming Island.	Medium to long-term	☆☆
		Resource utilization	Accelerate the construction of facilities that support waste separation, transport and disposal.	Immediate	☆☆☆
		Energy saving in other fields	Promote energy saving and emission reduction actions led by public service entities.	Immediate	☆☆
7.3	Reducing carbon dependence	Energy structure optimization	Promote clean electricity generation supported by gas-fired power plant.	Short-term	☆☆☆
			Establish and expand wind farms	Short-term	☆☆
			Promote the establishment of integrated solar PV system and solar water heating system.	Immediate	☆☆
			Develop biomass and other renewable energy	Immediate	☆☆
7.4	Increasing carbon neutral	Carbon sink capacity in natural ecosystem	Strengthen the protection of local forest and green land, while providing a better ecological environmental for local residents.	Immediate	☆☆☆
			Strengthen the protection and restoration of wetland resources	Immediate	☆☆☆
			Initiate research on agricultural carbon sink	Short-term	☆☆
		Exploring advanced technology	Explore advanced technologies such as Carbon Capture and Storage (CCS)	Medium to long term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means “very important”

Chongming Eco-Island International Evaluation Report



CHAPTER 8
AGRICULTURE AND ORGANIC PRODUCTS

CHAPTER 8 AGRICULTURE AND ORGANIC PRODUCTS

8.1 Baseline Scenario

Located in the outer suburb of Shanghai, Chongming Island enjoys the largest and the most concentrated agricultural land resources, as well as the best agricultural eco-environment in Shanghai. As a pillar industry of Chongming Island, agriculture has played a vital role in the construction of the Eco-island, and also serves as a practical and effective security for Shanghai's food supply. In 2012, Chongming County was conferred a “National Modern Agricultural Demonstration District” award by the Chinese Ministry of Agriculture.

The agricultural development in Chongming Island is aimed at improving agricultural efficiency and increasing rural incomes. In this context, the construction concept of "high-efficiency and ecological agriculture" was adopted. As a matter of priority, Chongming Island has been vigorously promoting this concept, making necessary structural adjustments, and transforming the economic development mode. Organic agriculture, modern agriculture and featured agriculture have been developing through large-scale, organized, standardized operations, in order to greatly improve the value of agricultural products, and pioneer agricultural development in Shanghai, and throughout China. Establishing a "green, environmental-friendly and ecological" industry will add new vitality to the island's development, while at the same time set a good example for promoting green development in similar areas, as articulated in the Chongming agricultural development planning (Box 8.1 and 8.2).

Box 8.1 Chongming Three Islands' overall planning of modern agriculture

According to Chongming Three Islands' Overall Planning of Modern Agriculture (2008-2020), from 2008 to 2020, Chongming County will establish one featured farming area at Yangtze River estuary, one circular agriculture area, one green food special supply base, one international bonded port area for agricultural products, and one modern agricultural leisure tourist area, making Chongming a high-efficiency and ecological agriculture development zone with international influence.

Box 8.2 Modern, highly efficient and ecological agriculture experimental area in North Chongming

Scope of planning: the reclamation area (including State-owned and collectively-owned land) in the northern area of Chongming Island covers an area of 62,000 hectares.

General target: to become the antecedent area of Chongming Island's high-efficiency and ecological agriculture, the cluster region of brand new agricultural technology, and the production and processing area of high quality agricultural products.

Functional layout: the agriculture functional layout of “one core, two belts, three areas” will be formed in the experimental area. “One core”, taking Chongming's modern agricultural park as the core area, refers to the featured fruit and vegetable production exhibition area and agriculture products processing exhibition area. “Two belts”, with the ring river and the north Hengyin River as the axis and relying on the forest park, Qianwei village and other tourism resources, refers to the agricultural tourism industrial belt in the mid-east reclamation area and the livestock and aquaculture industrial belt which supports the key farming area in the east-central-west reclamation area, “Three areas” refers to the featured fruits and vegetables and provenance industrial area from Wuxiao reclamation area in the east to Shuxin reclamation area in the west; the organic food industrial area from Xinhe reclamation area in the east to Chengqiao reclamation area in the west; circular agriculture industrial area from Miaozhen reclamation area in the east to Xincun reclamation area in the west.

Source: 12th Five-Year Planning Outline for Chongming County's National Economic and Social Development.

8.2 Progress to date

While maintaining the traditional agricultural non-point source pollution control work, Chongming Island has made progress in promoting the construction of high-efficiency and ecological agriculture in recent years, including exploring new modes of circular agriculture, promoting urban agriculture demonstration, advancing green product certification and developing rural tourism. The agricultural value added reached 2.07691 billion CNY in 2012, accounting for approximately 13.7% of the total gross value added to the island. The agricultural targets for 2012 outlined in the Chongming Eco-Island Construction Program 2010-2020 have already been achieved. The goals and targets related to agriculture include:

- The Certification proportion of pollution-free, green, organic food of agricultural products reached 60% by 2012 and is expected to exceed 90% by 2020
- The Chemical fertilizer intensity was reduced to 350kg/ha by 2012 and is expected to be reduced to 250kg/ha by 2020
- The Nemerow index of farmland soil was reduced to 0.76 by 2012 and is expected to be reduced to 0.7 by 2020.

8.2.1 Agricultural structure

Figure 8.1 shows the changes in the agricultural structure of Chongming Island between 2005 and 2010. In terms of output value, crop production takes the largest share and has been steadily increasing from around 44% in 2005 to about 47% in 2010. This is followed by fisheries, animal husbandry, forestry and agricultural service respectively (Figure 8.1).

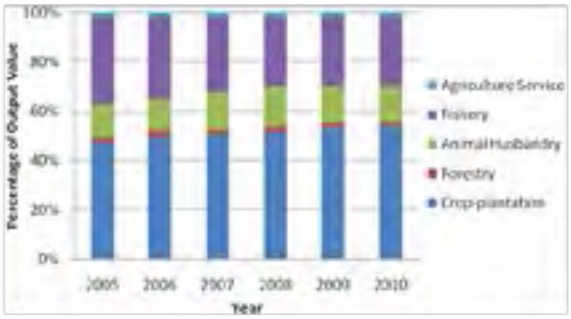


Fig. 8.1 The change of agriculture structure from 2005-2010

8.2.2 Reducing the chemical fertilizer and pesticide application intensity

In order to tackle the problem of overusing chemical fertilizer and pesticide on the farmlands, Chongming has taken a series of effective measures, including promoting the rice soil testing technology of applying fertilizer, organic fertilizer, high-efficiency and low-toxicity pesticides, and advancing vegetable diseases and insect pests prevention and control technology (Box 8.3). As of 2012, the chemical fertilizer intensity has been reduced to 350kg/ha from 487.6 kg/ha in 2008, and the pesticide intensity has been reduced to 10 kg/ha from 16.05 kg/ha in 2008. Furthermore, as shown in Figure 8.2, the use of organic fertilizers increased more than two-fold from about 14,000 tons in 2005 to close to 35,000 tons in 2010.

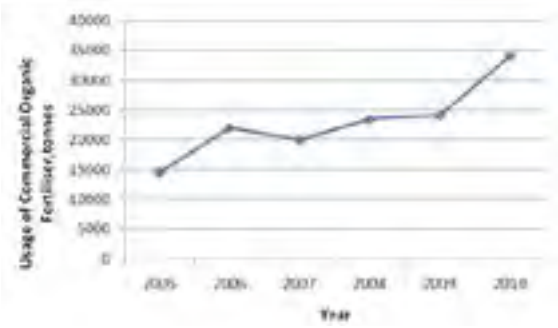


Fig. 8.2 Utilization of organic fertilizer of Chongming County from 2005-2010

Box 8.3 Chongming's pollution control and prevention technology helps create "quality-assured vegetable farm"

Green prevention and control technology, is a technology to effectively control crop diseases and pest, reduce the chemical pesticide use, increase agricultural production, as well as ensure products safety, by using agricultural control, physical control, biological control, ecological regulation and the scientific, rational and safe pesticide use technology according to the concept of "green plant protection". Since 2006, Chongming County has been promoting the application of green prevention and control technology, which is not only a concept consistent with the Eco-island construction, but also an important initiative that tallies with the eco-efficient agricultural development. Currently, Chongming County's green prevention and control technology applications are light attraction (insecticidal lamps), color attraction (color boards), sex attraction (sex attractants) and insect proof nets. Experience has proved obvious benefit on the prevention of pest and disease damage proper these methods in vegetable production.

So far, the county has built five green prevention and control technology demonstration areas using combined control techniques, with a large-scale area of more than 33 hectare each, and 26 areas of more than 13 hectare each with single control technique. Jianlu Cauliflower Cooperative farm, located in Zhongxing town, was rated as the national green prevention and control technology demonstration base. More than 10 varieties of vegetable such as asparagus, yams and Chinese little greens, are growing healthily under the protection in an area of 733 hectare. Also, owing to vigorous promotion of the efficient and low toxicity biological pesticides, the quality of "Green vegetables" of Chongming County and has been favored by increasingly more Shanghai residents.

(Source: Farmers' Daily, 20/08/2013)

8.2.3 Launch of Circular Agriculture Pilot Programs

In accordance to the circular agriculture concept of integrating planting and breeding, Chongming Island is gradually creating pilot programs of closed ecological balance mode, such as "livestock – biogas - crop", "livestock - fertilizers - crop". It also involved the creation and promoting the ecological agriculture technology system such as shrimp and crab breeding in rice field, creating the "four in one" energy supply model of Qianwei Village to achieve sustainable development of agriculture, income growth of farmers, and a win-win situation of agriculture development and environment protection. The examples are shown in Box 8.3 and 8.4 below.

Box 8.4 Zhongxin Agriculture Taisheng Demonstration Farm

Zhongxin Agriculture Taisheng Demonstration Farm is located in the north of Chongming Qixiao Modern Agricultural Development Zone, with a total area of 45.3 hectares, of which agronomic and horticultural crops area covers 28.6 hectares, while pig sty covers eight hectares. The farm is a circular and ecological leisure farm, which has achieved the organic combination of pig breeding and crop planting. There are multimedia auditorium, horticultural crops area, biochemical treatment ponds, wetlands and wildlife conservation land in this farm. The demonstration farm has now been listed as "Shanghai science education base", and has jointly established "national public benefiting industry (agriculture) research project" with Shanghai Jiaotong University

Unlike traditional farms, aimed at keeping the sustainability of soil resources, Zhongxin Agriculture Taisheng Demonstration Farm commits to providing fresh, pesticide and chemical fertilizer-free and nutritious vegetables, fruits and meat for customers. Besides, the farm is open to the public and allows people to get close to the nature, by riding bicycles, feeding animals, planting and other recreational activities.

Box 8.5 Launching of "Flying Bird Programme" to build agricultural green port

According to Dongtan development 3-year Action Plan formulated by SIIC (Shanghai Industrial Investment Co., Ltd), SIIC will build a Dongtan ecological demonstration zone in Chongming, applying natural environmental protection and low carbon practices through the construction of basic infrastructure, ecological park, elderly community, green port agriculture, and wetland park, to set an example for the construction of the whole Chongming Eco-island.

SIIC Dongtan Green Port Agriculture Park, with an area of 67 Km2, will promote the construction of a national modern demonstration zone as the core industry in Dongtan. To this end, SIIC Dongtan Green Port Agriculture Park will collaborate with Shanghai Academy of Agricultural Sciences to promote the "Flying Bird Programme." The first part of the 'Flying Bird' is a low-carbon circular agricultural park, including improved seeds breeding, an ecological orchard, duck breeding and rice planting, agricultural waste recycling systems as well as agricultural sensing internet research and application, and various types of agricultural waste material recycling. Low-carbon circular agricultural park is featured by the gas, heat, electricity, fertilizer co-generation project, also called as Central Processing Unit (CPU) which was completed in October 2010. This technology could maximize agricultural resources utilization and minimize the discharge of wastes.

Currently the CPU can convert 4,000 tons of straw from the farming land into biogas, and the crushed straw can produce organic fertilizer through anaerobic fermentation process. Electricity power generated by biogas can be used by the Park, and the heat generated by biogas combustion can be provided to facilities for heating. Biogas residue can produce organic fertilizer, and part of slurry can be recycled and the rest can be applied to fruit trees and vegetable crops. If operated well, all the straws in the agriculture park will be recycled and utilized in the future; this model will also be promoted in the whole county. The main part of the "Flying Bird" includes growing of rice, wheat and corn; breeding industry, pig breeding and aquatic product base, as well as horticulture industry of vegetables and fruits. The last part of the "Flying Bird" includes the extended industries such as tourism and leisure agriculture, agaricus bisporus industrialized production and agricultural products deep processing. In the future, grain, vegetables, fruits, poultry in the demonstration area will be self-sufficient by the Green Port Agricultural Park, which in the meantime could provide 7,000 tons of vegetables and 4000-5000 scatter-fed chickens for the city each year.

Source: http://xmwb.xinmin.cn/xmwb/html/2012-02/18/content_25_1.htm

8.2.4 Establishing an Organic Brand

After years of development, a series of the local special agricultural products have been successfully developed in Chongming Island. These include the following;

- The Chongming Hairy Crab, Chongming Old White Wine and Chongming White Goat have been labeled as Geographical Indications by the Ministry of Agriculture.
- The Chongming Taro, Chongming White Haricot, Chongming Narcissus, Chongming Golden Melon (Box 8.6) and Chongming White Goat have been awarded the certifications of National Geographic Logo.
- The river crab branded 'Baodao', the citrus branded 'Feidao' and the duck product branded 'Laodu' have been granted the Shanghai Famous Brand.
- The total area for high quality rice has reached 10,667 hectares, thus becoming the biggest rice manufacturing base in Shanghai.
- Standardized and large scale fruit planting bases have been gradually established, including oranges from Luhua Town, pears from Miao Town, grapes from Xinhe Town and Shuxin Town. In addition, there are many traditional vegetables planting on Chongming Island, such as Cauliflower and Chinese cabbage. Recently, the proportion of featured vegetables planting has been increasing. Chongming Island has become Shanghai's biggest vegetable planting base, which significantly contributes to stabilizing the vegetable price and securing food safety for Shanghai.
- Chongming Island has also engaged in developing organic farming and promoting certification of pollutant-free, green and organic agricultural products. Organic food such as rice and asparagus has been gradually introduced into the high rank of healthy food. By the end of December 2012, 449 products from 118 companies in Chongming County had been labeled as pollutant-free, green or organic agriculture food. Also, the planting area of this kind of food has reached 78.09% of total agriculture area, among which the green and organic food area has reached 16.97%.

Box 8.6 Chongming Golden Melon

The Chongming Golden Melon is a local delicacy renowned for its golden color and egg shape. The melons are planted in spring, harvested in autumn and are eaten cooked, rather than fresh. The melon is sometimes described as the 'vegetable jellyfish', with a fresh, delicate and crispy taste.

Chongming Golden Melon has great nutritional value, rich in protein, vitamins, carbohydrates and 18 kinds of amino acid. Besides, the tartronic acid contained by golden melon can hinder the transformation process from carbohydrate to fat, so that it works as a natural diet pill. It is said that the trigonelline in the melon has the ability of anticancer. Chinese medical theories suggest it provides therapeutic benefits, for regaining energy, curing constipation and syndrome of excessive eating, tonifying spleen, helping digestion, etc. (Source: Baidu Encyclopedia 2013).

8.2. 5 Advancing Urban Modern Agriculture

Following the adoption of the plan in 2010 to develop Chongming as an Eco-island, a number of local and foreign based professional elites became attracted to the ecological agriculture industry in Chongming Island, including such enterprises as 'YMT', 'Dorey Farm' and 'Eco-Agricultural Park of Island". These combine modern agriculture with commercial expertise, promoting low-carbon agricultural demonstration based on planting and breeding, eco-tourism based on facility agriculture and processing industry based on high quality agriculture products. These approaches contribute both to environmental protection as well as to more added values for eco-agriculture products.

Box 8.7 Chongming Agriculture Demonstration Base of National Facility Agriculture Engineering Technology Research Center, established in Gangyan Town

Chongming Agriculture Demonstration Base of National Facility Agriculture Engineering & Technology Research Center, covering 14.6 hectare, is in Gangyan Town, Chongming Island. Since its establishment six months ago, this project has been promoted consistently, and will be an effective measure to build Gangyan into an eco-agriculture town, as well as transforming the industrial structure by attracting business and investment. This base, which is a joint investment by the National Research Center of Facility Agriculture Engineering & Technology and Shanghai Urban Green Engineering Co., Ltd., will become the window and platform for attracting and demonstrating new agricultural technologies from home and abroad.

With the advantage of flowers and asparagus planting, Gangyan town will fully implement agricultural technology to enlarge its featured industry on the basis of this research center during the agriculture intensification and standardization process;

Box 8.8 The YMT Organic Farm

The YMT organic farm was established by professionals who worked as senior executives in the private sector enterprises such as General Electric (GE), SIEMENS, Alcatel-Lucent, Sandoz, RT-Mart, among other. These professionals gave up their high salaries and create the farm to pursue their dream and passion. Located in Chongming Island, YMT organic farm started an interactive platform of planting vegetables and fruits, promoting a new life style and health concept. Consumers as the members of YMT, could purchase the organic vegetables directly or 'rent' a land to plant their own vegetables, which would be tended by the farm staff and delivered to their home. Using the internet, the renters can see the growing progress of their crops and learn the process of 'from field to table' of vegetables. Therefore, YMT will be a dream place for families during holidays to experience the happiness of getting close to natural farm. Meanwhile, consumers can enjoy healthy and safe food while staying at home. In early 2012, YMT has had more than 5,000 regular clients, as well as the number of total consumers has been over 60,000. And the sales revenue of 2011 has exceeded 30 million CNY.

Source: http://cmb.shcm.gov.cn/html/2012-02/15/content_3_2.htm

8.2.6 Promoting Farmers Cooperative Unions

The first farmers' cooperative union, Sanxing Organge Cooperative Farm was established in 2007 and since then, several other cooperative farms have been established with the number rising fast. Cooperatives are a means to support the increase in the benefits derived from agriculture production, and also enable better regulation of the agriculture sector, in order to ensure the high quality of Chongming agriculture products is maintained. Up until 2012, 997 cooperative farmers unions had been established, with 150 of them being the key cooperatives and four being municipal demonstration cooperatives. The scope of cooperatives covers vegetables, fruits, rice, livestock, aquatic products, agricultural services, farmhouse and agricultural marketing, among others. In 2012, the sales revenue of all the cooperatives reached 0.61 billion CNY, benefitting 100,000 farmer families. It was on this basis that the first cooperative farming union of Shanghai, Chongming Asparagus Cooperative Farmers Union (Box 8.9), was established in May, 2012, with the support by Agriculture Committee of Chongming County. Afterwards, four other cooperative farmers unions, including Chinese green vegetables, golden melons, grapes and hairy crab were established. This has provided social, economic and environmental benefits.

Box 8.9 Shanghai Lusun Asparagus Cooperative Farming Unions

In March, 2010, Chongming asparagus cooperative farmers union was established, combining the 'Lusun' cooperative as the core with eight other farms that have similar products. So far, the whole planting area has reached 233.3 hectare, accounting for 65% of the asparagus area on Chongming County.

'Baigou' is taken as the trademark of this union whose annual sales revenue has broken through 20 million CNY. The investment, contract, planting, managing, harvesting, finishing and accounting are operated individually while supplying material, technical guidance, preventing pest, cooperative regulation, agricultural insurance, purchasing and sales, packaging and trademark, standard price, check and transportation, financial accounting are operated in an unified mode.

The products of this union have been certified as 'National Green Product' and the brand 'Baigou' is granted as Shanghai Famous Trademark, Shanghai Famous Brand and China Good Agriculture Standard Certification by the Ministry of Agriculture. Meanwhile, the project is named as one of pollutant-free demonstrations zone in Shanghai by Shanghai Municipal Supervision Bureau. The success of asparagus union inspires the farmers in Chongming Island that the development of cooperatives requires upgrading to enhance the competitiveness in the market (Source: Agricultural Committee of Chongming County).

8.2.7 Improving Quality of Agricultural Leisure Tourism

A practical way to develop the economy in Chongming Island is to integrate agriculture with tourism, which conforms to the concept of green economy in Chongming Island. This model could also provide the benefit of transitioning a mass of rural population from Primary Industry to Tertiary Industry. According to most recent survey data, the number of tourists to Chongming Island increased from 960,000 in 2008, to 1.95 million in 2009 and eventually to 3.8 million in 2010 (Figure 8.3), generating a tax revenue of 1.46 million CNY, 3 million CNY and 6.85 million CNY respectively. .

Taking the lead in leisure agriculture and countryside tourism, Chongming Island is making every effort to develop into an ecological tourism gathering spot based on its natural resources. Xisha Wetland Practical Zone of Win-win Mode for Protecting and Utilizing has been established as an ideal place for relaxation and sightseeing, with a capacity of 32,000 visitors a day, through which the tourism industry has improved, both in scale and quality. Chongming agricultural tourism brand has also been gradually developed by a series of special festivals, such as Chongming Forest Tourism Festival, Chongming Orange Festival, Chongming Hairy Crab Festival and Luhua Cricket Festival. Meanwhile, the quality of agricultural tourism has also improved in places such as in Qianwei Village (Box 8.10), Yingdong Village, Lvgang Village and Nanjiang village.

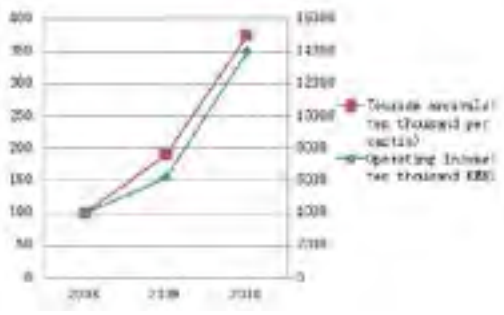


Fig. 8.3 Tourism Arrivals and Income of Chongming County

Box 8.10 Qianwei Ecological Village

Established in 1969, Qianwei Ecological Village was the first group of towns developing 'leisure agriculture' in Shanghai and was awarded recognition of 'National agricultural tourism demonstration sites' by Chinese government. Presently, agriculture, industry, business, tourism, as well as education are soundly developed in all aspects. Many tourists who want to experience the traditional countryside and receive natural science education would like to come and stay overnight at farmer's homes. The tourist attractions include a fishing center, an environmental science education base and wild animals domesticated base, among others. Besides, the renewable and clean energy demonstration project, including solar, wind, biogas and geothermal energy utilization, with the investment of approximately 100 million CYN, is the largest project in China.

Fig. 8.4 Chongming Agricultural Tourism Festival System. (Top to bottom, left to right: Chongming Hairy Crab Festival, Luhua Cricket Festival, Chongming Forest Tourism Festival, Chongming Orange Festival)

8.3 Challenges and Opportunities

- Maintaining the strategic importance of agriculture on Chongming Island and promoting high-efficiency and ecological agriculture. Agriculture plays an important role in the construction of Chongming Eco-island. Substantial experiences have been accumulated from a series of pilot projects on high-efficiency and ecological agriculture, which should be widely promoted on the island, and the county as a whole. Sustainable and sound agriculture development could also act as a driving force for the growth of service industry on the island, through which local community would be able to enjoy more benefits to improve their livelihood.

- Establishing favorable incentives to attract both domestic and foreign investment for the development of modern urban agriculture on Chongming Island. It has been observed that 'white collar' elites are increasingly reverting to this rural island to improve their quality of life, with which new vitality has been brought to the agriculture development on Chongming Island. More favorable incentives should be put in place, supported by technological, personnel, information and financial advantages of Shanghai City, to attract more investment, advanced mechanisms, management patterns, and large enterprises from home and abroad, to continue improving the overall agriculture development on Chongming Island.

- Further improving of the brand system to enhance the overall competitiveness of green and organic agricultural products on Chongming Island. Successful practices, such as reducing utilization of fertilizer and pesticide, alternating crop mixes and rotations, cultivating special local products and resource-oriented utilization of agriculture wastes, should be further promoted on the island to enhance the comprehensive competitiveness of its green and organic agricultural products. Meanwhile, the overall commodity circulation chain should also be further improved, to better sell Chongming brands to Shanghai, Yangtze Delta area, China and even other areas around the world.

- Continuous strengthening of leisure agriculture tourism on Chongming Island to better contribute to the sustainable development of the tourism industry. Opening of the Shanghai-Chongming tunnel, Chongming- Qidong bridge and the Disney Land in Pudong area, in the near future, will bring unprecedented development opportunities for Chongming Island, especially for its tourism industry. High level infrastructure and services would be a key factor to

ensuring sustainable tourism development. In tandem, further development of a local food festival or gourmet district on Chongming Island will contribute to the common development of its agriculture and tourism industry.

- Improvement of rural communities in the course of its agriculture development will set good examples for other cities and regions in China. Development of high-efficiency and ecological agriculture will further enhance the construction of brand new rural villages with more green buildings, clean energy utilization and low carbon communities. While still in the process of development, necessary theoretical and hands-on training should be better designed and organized, aiming at enhancing public awareness and capacity building for local residents. Coordinated hardware and software building on Chongming Island will not only contribute to the development of an eco-island, but also serve as a good example for other cities and regions in China.

8.4 Summary and Lessons Learnt

With continuous efforts made in recent years, the agriculture development on Chongming Island has achieved substantial progress, with a fundamental transformation from traditional farming to high-efficiency and ecological agriculture, featuring in the establishment of a sound green and organic brand system. The development of multi-functional modern urban agriculture will also play an important role in encouraging fast growth of local service industry, especially on leisure agriculture tourism. All these endeavors will contribute to the ecological and low carbon development of Chongming Island, which will not only explore practical approaches for greater Shanghai City, but also set good examples for other cities and regions around the world.

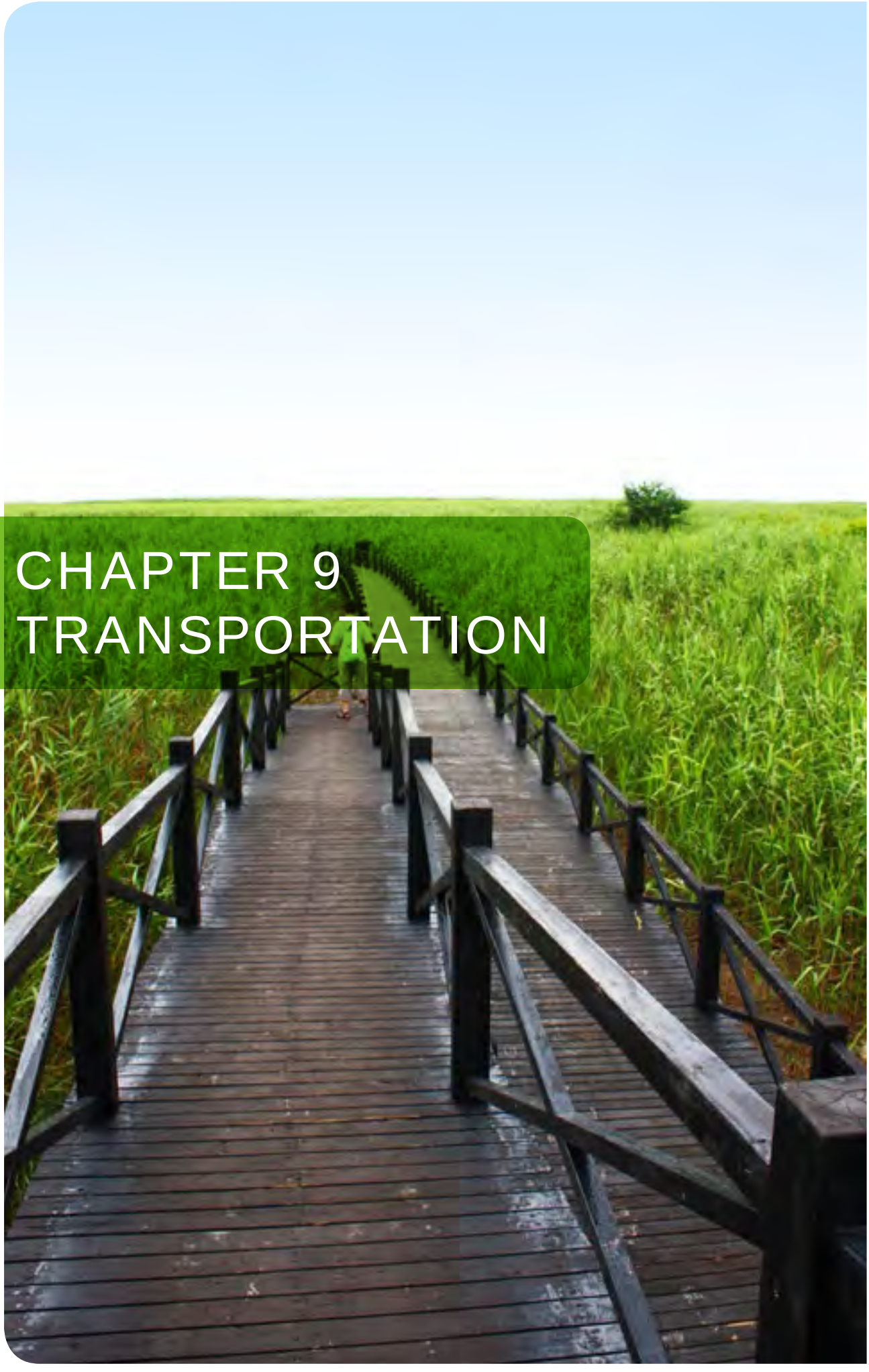
8.5 Recommended Action Plans

Table 8.1. Action Plan for Agriculture and Organic Products

No.	Issue	Recommended Action Plans	Timeframe	Significance
8.1	Reduction in the utilization of chemical fertilizer and pesticide	Actively promote the use of environmentally-friendly pesticides, encourage the planting of green manure crops and expand the use of commercial organic fertilizer.	Immediate	☆☆☆
8.2	Circular agriculture	Improve farming facilities to better treat and utilize agricultural wastes	Immediate	☆☆
8.3	Organic farming	Establish demonstration sites to promote facility agriculture with high standards	Immediate	☆☆
8.4	Urban low-carbon agriculture	Promote low-carbon agriculture development in the construction of Chongming Modern Agriculture Zone and DFXS Low Carbon Agriculture Zone.	Medium-term	☆☆☆
8.5	Agriculture standardization system	Establish modern agriculture demonstration base and strengthen comprehensive standardized agricultural management	Immediate	☆☆☆
8.6	Leisure agriculture tourism	Develop leisure agriculture tourism along with the rehabilitation of Beiyan Boulevard	Medium to long term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means “very important”

CHAPTER 9
TRANSPORTATION



CHAPTER 9 TRANSPORTATION

9.1 Baseline Scenario

The central part of achieving the Eco-Island concept for Chongming Island is the shift from private motorized to non-motorized and public transport. This can be realized through a range of approaches, including optimizing the design of the transportation network, prioritizing people over vehicles, maximizing accessibility by non-car modes, popularizing public transport, developing new energy transport, adopting advanced technology of low-emission and promoting the international cooperation in energy saving and emission reduction. The development of low carbon transport depends on long-term research on significant technology and the pilot work on low carbon system which is conducted primarily in towns. The development of sustainable transportation on Chongming Island is mainly comprised of planning and construction of a road network and the development of public transport.

9.1.1 Road network construction

The construction of bridges and tunnels that connect Chongming Island to mainland has been part of the road network plans. The Chongqi Bridge was constructed to connect the north of Chongming Island to Qidong in Jiangsu Province while the Chonghai Bridge connecting Chongming Island to Haimen in Jiangsu Province is currently under construction. Additionally, plans for roadways networks between Chongming, Chanxing and Hengsha Islands have been established, with a view to develop a road network on Chongming Island with one ring road, three roads crosswise and fifteen main roads lengthways, which aim to form an ecotype integrated modern transport system.

Currently, the major means of accessing Chongming Eco-Island from Shanghai is across the Shanghai Yangtze River Tunnel, leading from the south of Chongming Island to Pudong via Changxing Island, or via ferry. In 2009, with the opening of the Yangtze River Tunnel Bridge, the effect from the construction of Eco-Island has been extended and many new ideas have been taken, which is helpful to explore a new model adapted to Chongming Island on the basis of the positive ecological system development. In the meantime in order to improve the public transport connecting Chongming Island and Shanghai, it is anticipated that metro line will be extended across Hengsha and Changxing Island to Chenjia Town on Chongming Island. A further route is planned to connect Metro Line 1 to Chengqiao New Town. In 2010, 301,000 vehicles and 2.55 million passengers used ferry services. With passenger ferries between these three islands being developed simultaneously, it is anticipated that new tourism terminals will be developed at Chengqiao New Town, Chenjia Town and Hengsha Island.

9.1.2 Public transport strategy:

Due to the developing orientation, industrial structure adjustment and the increasing needs on business, tourism and exhibition transport, it is necessary to develop a multifaceted transport system. In order to realize the goal of “zero-emission” in the demonstration area, the EXPO new energy bus should be used sequentially, take actions to develop a green transport system with “Low-emission, Low-noise Low-energy consumption “and formulate the new energy automobile application plan and its infrastructure plan, which is adapted to Chongming Eco-island’s transport demands.

According to the master-plan of Chongming Island (2005-2020), it is a requirement for the plan to put the emphasis on protecting, recovering and rebuilding the ecological system of Chongming Island, in order to ensure that the natural environment maintains the capacity to support the further development in the Island. The construction of the transport system on Chongming Island places high priority on people following n the principle of “human-oriented and environment-protected”. This illustrates Chongming’s aspirations to become a leader in sustainable transportation development and surpassing the goals of global environmental institution.

9.2 Progress to date

Chongming Island has undergone several transport infrastructure developments to improve the interconnectivity among Chongming Island, Shanghai and Jiangsu province with the goal of enhancing employment opportunities, better lifestyle and recreation. Some of the progress registered includes the following:

9.2.1 Shanghai Yangtze River Tunnel Bridge

Completed in 2009, Shanghai Yangtze River Tunnel is the largest tunnel in the world, with a total length of 8.95km; the length which passes through the water is 7.5km (Figure 9.1). Its runs from suburban interchange looping around the Fifth River in Pudong, crossing from the water of southwest habor, landing at Changxing Island Xinkaihe, and then linking to Changxing Panyuan road interchange. The diameter of the tunnel shield is 15.2km, which is the largest diameter of shield tunnel in the world, therefore making the Changjiang tunnel achieve candidature of world’s largest diameter shield tunnel program in the World Record Association. Shanghai Yangtze River Bridge leads from the landing place of the Changjiang Tunnel , via the northeastern side of Changxing Island to Chengjia Town, crossing the northeastern harbor of Yangtze delta, with a total length of 16.65km (junction road is 6.68km, bridge crossing over is 9.97km, designed speed is 100km/h). A width of 4.15m is reserved on the both sides of the bridge

for the future use of rail transport. Shanghai Yangtze River Tunnel connects Chongming Island and Shanghai region, which is critical for maintaining connectivity with downtown Shanghai in order to promote the island's development.

Fig.9.1 Shanghai Yangtze River Tunnel Bridge

9.2.2 Chongqi Bridge

Chongqi Bridge, also known as Chongqi Tunnel Program, is one part of the highway between Shanghai and Xi'an, which belongs to the National Highway Network and was completed in 2011. It starts from Chengjia Town in Chongming Island, connects with Shanghai Yangtze River Bridge and ends at Huilong Town of Qidong in Jiangsu province, and links to the Ningqi highway. As a significant part of the National Highway between Shanghai and Xi'an, Chongqi Bridge offers a convenient way from the coastal areas in eastern China middle China and western China to Shanghai.

9.2.3 Operation of Shen-Chong bus station and Chongming-Qidong intercity bus

The construction of Shen-Chong Bus Station at Southern Water-land Transfer Centre was completed in 2012, offering spacious and comfortable waiting conditions. Seven bus lines utilize this station, including two linking Chongming Island to downtown Shanghai. The intercity bus commenced operation in early 2013 and was developed in order to strengthen the communication and exchange between Chongming and Qidong.

9.2.4 100% bus coverage rate among each village

In order to improve the infrastructure construction and make it more convenient to travel, the program "each village arrived by bus" has been conducted since 2006, and as a result, there are now 272 administrative towns that have bus lines in Chongming Island. Since 2009, the goal of "each village arrived by bus" was achieved in the whole Chongming County after bus service commenced operation in five administrative towns in the Island (Tiaoyuan Village, Baoyu Village in Bao Village, Sanlie Village in Xinhe Town, Donghai Village and Xianfeng Village in Chenjia Town)..

9.2.5 New energy automobile development

A plan of Chongming demonstration of new energy vehicle was implemented. It involves the deployment of a Chongming-adapted application model of new energy cars and its related infrastructure construction with a consideration on reuse of 10 new energy motivated buses used during the World EXPO in Shanghai. In 2011, the operation of Chengqiao No.1 super capacitor city bus (Figure 9.2) promoted the introduction of new energy cars in Chengqiao Town.

Fig.9.2 Super-Capacitor Public Transportation in Chongming Island

9.2.6 Chenjia Town electro mobile recharging station

In 2012 Chenjia town had a total of 400 re-charging stations, which are projected to double to 800 by 2015 (Figure 9.3). The electro mobile Charging Station in Chenjia Town was completed in 2013 and provides eight charging posts for electro mobiles. The station is designed to serve 140 electro mobiles per day, both private and public, from Chenjia Town and adjacent areas.

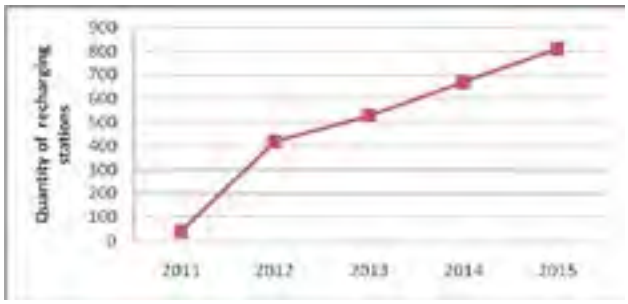


Fig.9.3. Quantity of Electro mobiles recharging Stations in Chenjia Town

Source: "Study of Chongming New Type Low-carbon transport system"

9.2.7 The collaborative Development of Chenjia Town

The idea of collaborative development, which also means combining villages with towns, has been introduced into the development of Chengjia Town, with the expectation that people have experiences of both the modern town and the scene of fields. Chenjia Town covers an area of 224 Km2, including 38.5 Km2 for allowed construction. Moreover, the control volume rate and ratio of greenbelt are well higher than the average level of Shanghai.

9.3 Challenges and Opportunity

There are several challenges as well as opportunities for the process of transport development in Chongming Eco-Island. These are highlighted below.

9.3.1 Connectivity to the Greater Shanghai Transport Network

There is a significant potential for Chongming Island to be fully integrated with Shanghai's wider public transport system. Non-car modes of transport can play an important part in Chongming Island, and linked to the wider regional transport network through feeding into key transport links into Shanghai. Transport Network, with high quality and various modes covering the whole island, thus promoting the connectivity between Chongming and Shanghai.

9.3.2 Designing low carbon transport, optimizing the distribution of transport

The geographical condition of Chongming Island makes it relatively isolated. Residents on the island tend to moderate distance trips, and their trips are relatively concentrated in some special areas. The design of activities both supports the use of sustainable modes of transport and reduces the need to travel by optimizing the distribution. The design of the Eco-Island concept can also recognize that significant changes to land use are likely to take place over the longer term on Chongming Island. In this respect, the design of development would accommodate regional land-use, ensuring the design of land-use and transport can promote the low carbon transport. Residential developments can include or be closely associated with facilities that are used on an everyday basis, including shops, schools, health facilities, eating places and internet access points. New development would similarly be readily accessible by walking and cycling routes to services, facilities and amenities, and key public transport links. In addition, the inter-regional trip can be reduced through improving the function of every region and establishing industrial clusters, ensuring that people can be employed nearby. The "Community-Neighborhood" System in Chengjia Town is a demonstration for this respect.

To support the Eco-Island concept, transport master-planning on Chongming Island should have a compositive consideration on walking, cycling and public transportation. Through appropriate master-planning activities, there is significant opportunity for a modal hierarchy of walking, cycling, public transport and then other vehicles to be encouraged on the island through an integration of walking and cycling linkages with public transport networks. It is necessary to undertake activities to establish a transportation junction-centered space and support the use of non-motorized vehicles such as walking and cycling to reduce the need to travel by car.

9.3.3 Leading by low carbon technology, distributing and managing transport flow, enhancing the control of environmental noise

Chongming Island is making progress in promoting low carbon technological means of transport, and the challenge is to maintain this trajectory even as it develops. For example, the growth rate of motor vehicles in the Island has been decreasing since 2002 (Figure, 9.4). Research is also ongoing on carbon emission reduction as part of the "Eleventh Five-Year Plan" national scientific and technological support project of Chongming Island. This research takes a comprehensive consideration of the transport system engineering, road engineering and vehicles. It seeks to develop some advanced technology including titanium dioxide-based additive used to decompose automobile exhaust and neutralizing technology, confirms low-emission vehicles for different trip purpose, provides application and operation mode of low-emission vehicles.

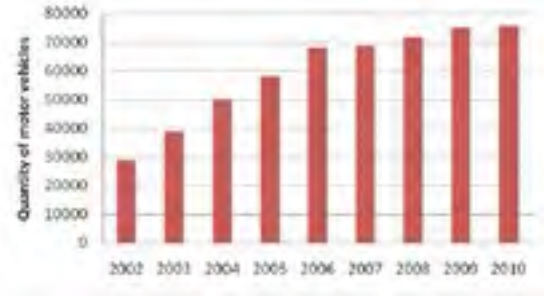


Fig.9.4. Quantity of electro mobiles in Chongming Island

However, with the economic development, automobile exhaust brings new challenge to control air pollution. It is a requirement for Chongming Island to give priority to special planning, optimize the transport networks and distribute the source of noise properly. The transport planning should adjust to the traffic flow when the construction of Yangtze River Tunnel-Bridge is completed. Also, the phenomenon that major roads such as Chenghai Road are crowded with too much traffic can be addressed through optimizing the transport system, thus ensuring that regional noise can be controlled.

The source of noise can be restrained through making the policy of public transport a priority. It is also advised to develop BRT system as a major public transport system within Chongming Island, and promote the environment-protected public transport as improving the public transport service. At the same time, the management should be enhanced for cars coming to or within the island to prohibit overloaded vehicles and vehicles that cannot reach the standard of environment protection. The management of horn prohibition should also be enhanced.

In addition, some measures should be taken in the engineering domain to reduce the noise, including constructing noise-reduced roads, setting green belt and noise-reduced pavement for the coastal roads and other main roads, enhancing the standard of transport construction and popularizing the noise-reduced pavement. Consequently, is advised to develop intelligent transport.

Box 9.1 Intelligent Transport Systems (ITS)

Intelligent Transport Systems (ITS) is an increasingly utilized tool designed to maximize the efficiency of transport networks at a local, regional and national level. The ITS utilizes information and communications technologies to support the planning, management and operation of transport systems. ITS brings forth a range of benefits for public transport users by facilitating high quality travel information through real-time traffic and travel information services, supporting reliability enhancements through public transport priority, and by promoting integration between different transport modes. Car users benefit from ITS through improved driver information, an enhancement of the efficiency of traffic flows, improved congestion management and effective freight (Fengqi and Jun, 2010).

9.3.4 Developing new type of Low-carbon transport system, promoting walking and cycling

There is significant support to the operation of new energy vehicles from policy, geography and circumstance on Chongming Island, including the goal of international Eco-Island, independent location and booming tourism. This would take a public area for example, expanding to island-wide from transport junctions such as Chenqiao Town, Chengjia Town and Bao Town, and improving the demonstration effect, which is helpful in popularizing new energy vehicles in private areas and provide advice to new energy car users. The non-emission goal in public areas can be reached by the development of high technology, showing the advanced application technology and the innovation of commercial modes. The popularization of new energy vehicles both in public area and private area can be accompanied with the implementation of “one thousand new energy vehicles per town” program and the pilot of private cars. Currently, the implementation of new energy vehicles is still in its infancy, and more in-depth research is required on land use planning of new energy transportation infrastructure, which includes charge station, parking and public transport junctions. In addition, significant attention is required on subsidy calculation, management system, monitoring and controlling technology and incentive measures (car allowance, license subsidy, toll subsidy etc.)

The promotion of walking and cycling on Chongming Island has the potential to be a central facet of the Eco-Island concept. There is a significant opportunity for new developments on Chongming Island to be accompanied by an expansion of high quality walking and cycling networks across the island. These would be easily accessible to all users, link residential and commercial areas with services, facilities and amenities, and be fully integrated with regional and island-wide public transport networks. The development of traffic-free walking and cycling links, integrated with green spaces such as linear and neighborhood parks have the potential bring a range of additional benefits for the island, including supporting island-wide biodiversity networks and promoting a strong social and community ambience.

Box 9.2 Green infrastructures for sustainable transport

Green infrastructure is the network of multi-functional green space, both rural and urban areas, which supports natural and ecological processes and is capable of delivering a wide range of environmental and quality of life benefits for local communities. The integration of walking and cycling routes and public transport linkages with green infrastructure networks can help connect green spaces, supporting access, enabling recreation movement and facilitating leisure opportunities. Through increasing utility for pedestrians and cyclists, and improving access to public transport links, high quality green infrastructure networks can therefore play a key role in promoting sustainable transport use and reducing the private car travel needs.

The expansion of an island-wide walking and cycling networks can be accompanied by the creation of a public realm that encourages walking and cycling. The design of streets and places can therefore support pedestrians and cyclists through promoting a high quality built and natural environment which maximizes the safety of vulnerable road users. An example of this is the proposed Chenjia Town bicycle park. Chenjia Town’s transport network is planned based on low speed traffic means such as cycling and walking. As part of this network, a bicycle park has been proposed for construction. The bicycle park will be located at the south-west part of Chenjia Town. The park will cover an area of 111.5 ha, and upon its completion, it will be the largest bicycle theme park in China, and also function as a training base for cyclists. The initial construction has already been completed.

9.3.5 Maximizing the resilience of the transport network and people’s awareness of low-carbon transport

The transportation infrastructure of Chongming Island may be impacted in a number of ways by the effects of climate

change. Due to the low lying nature of much of the island, the predicted rise in sea levels and an associated increase in frequency and intensity of storm surges and flooding incidences have the potential to affect key transport links on the island (Tian et al, 2010). Similarly an increased occurrence of extreme weather events such as typhoons, severe precipitation events, drought and extreme heat may have adverse impacts on transport infrastructure. To address these issues, there is a significant opportunity for the development of the Eco-Island concept for Chongming Island to maximize the resilience of the island's transport network against the potential effects of climate change. This can include appropriate routing, design and management of transport infrastructure. Planning of the Chongming Eco-Island therefore needs to take into account opportunities of building the resilience of Chongming Island's transport infrastructure to climate change effects with the consideration of the potential adverse effect from extreme weather changes. This will ensure that the transport infrastructure can be used for a long time.

In addition to the above recommendations, it is necessary to improve the awareness of low-carbon transport. In this respect, Chongming has taken activities in improving environmental education, developing ecological towns and green campus, and encouraging people to participate in this process. While that is not enough, there still is a need for persistent effort by government and society to improve environmental awareness and change consumption patterns. The idea of low carbon can be enhanced through encouraging public transport for long trips, cycling for middle trips and walking for short trips. Besides just creating publicity for the low carbon transport, cycling competition hosted by Chongming can create a good atmosphere for implementing low carbon trips.

9.4 Summary and Lessons Learned

The construction of Yangtze River Tunnel Bridge and Eco-Island enhances its connection with outside regions. The construction of main roads like Chongming Great Road provides significant opportunity for the transport network to get optimized and updated. A program is being implemented for the construction of country roadways network with a length of 120km, which will facilitate sustainable development of the society and economy through forming a village roadways network extending to each village. Leading by advanced science and technology, public transport has been promoted through popularizing the new energy transport, opening demonstration lines of the super electric bus and encouraging the construction of a green transport system. In addition, the low carbon transport system is being improved by integrating the planning of transport with the nature of land-use. These approaches make significant a foundation for the modern ecological transport network with the feature of three islands connected, outside and inside combined and modes varied.

The experience of Chongming can be similarly used for other cities with similar ecological conditions. A summary of the achievements realized in the transport sector include the following;

- Improving the transport network: The construction of Chongqi Bridge and inter-city bus between Chongming and Qidong enhances the connection with the nearby cities; similarly, the Yangtze River Tunnel Bridge and Shen-Chong Bus Station link Chongming Island with the greater Shanghai region. These would facilitate its communication of culture and economy with other regions. For the Chongming area, the inter-village public transport networks cover the whole island. Such approaches make it easier and more comfortable for citizens, in both outside and inside regions .Subsequently, following the use the wide metro line network and public transport, the adverse effects to the climate and environment brought by travel have been decreased considerably.

- Integrating transport planning with the regional land-use: Integrate the transport planning with the land-use planning to realize the development of low-carbon transport. Establish a transportation junction-centered space and support the use of non- motorized vehicles such as walking and cycling to phase out car dependency. At the same time, inter-regional trip should be reduced by improving the functionality of every region, as well as establishing industrial clusters, thus ensuring that people can be employed nearby. The demonstrational construction of "community-neighborhood" system in Chengjia Town can be used for reference.

- Reusing the Shanghai EXPO new energy motivated bus, promoting the application of new energy vehicles: The reuse of 10 new energy buses used in EXPO reduces the cost of purchasing new cars. A plan was conducted for introducing new energy motivated cars and constructing related infrastructure to popularize new energy motivated cars. In addition, a subsidy policy was operated in Beijing and Shanghai for buying new energy motivated cars; citizens who bought new energy motivated car could gain a maximum subsidy of 100,000 Yuan and a free license plate. This policy would promote new energy motivated cars applying to private realm.

- With the economy developing, the number of motor vehicles tends to continuously increase in Chongming. The improvement of ecological tourism would attract more people who live outside Chongming Island to take a trip here. In this respect, Chongming can learn from Shanghai's experience: make a plan in advance to avoid the potential stress for its transport network. On one hand, special street space for public transport would be constructed. The cost of bus rapid transit is low, both in time and money; it is 5-10% less than the cost of the metro. However, it is a great choice for the city that has

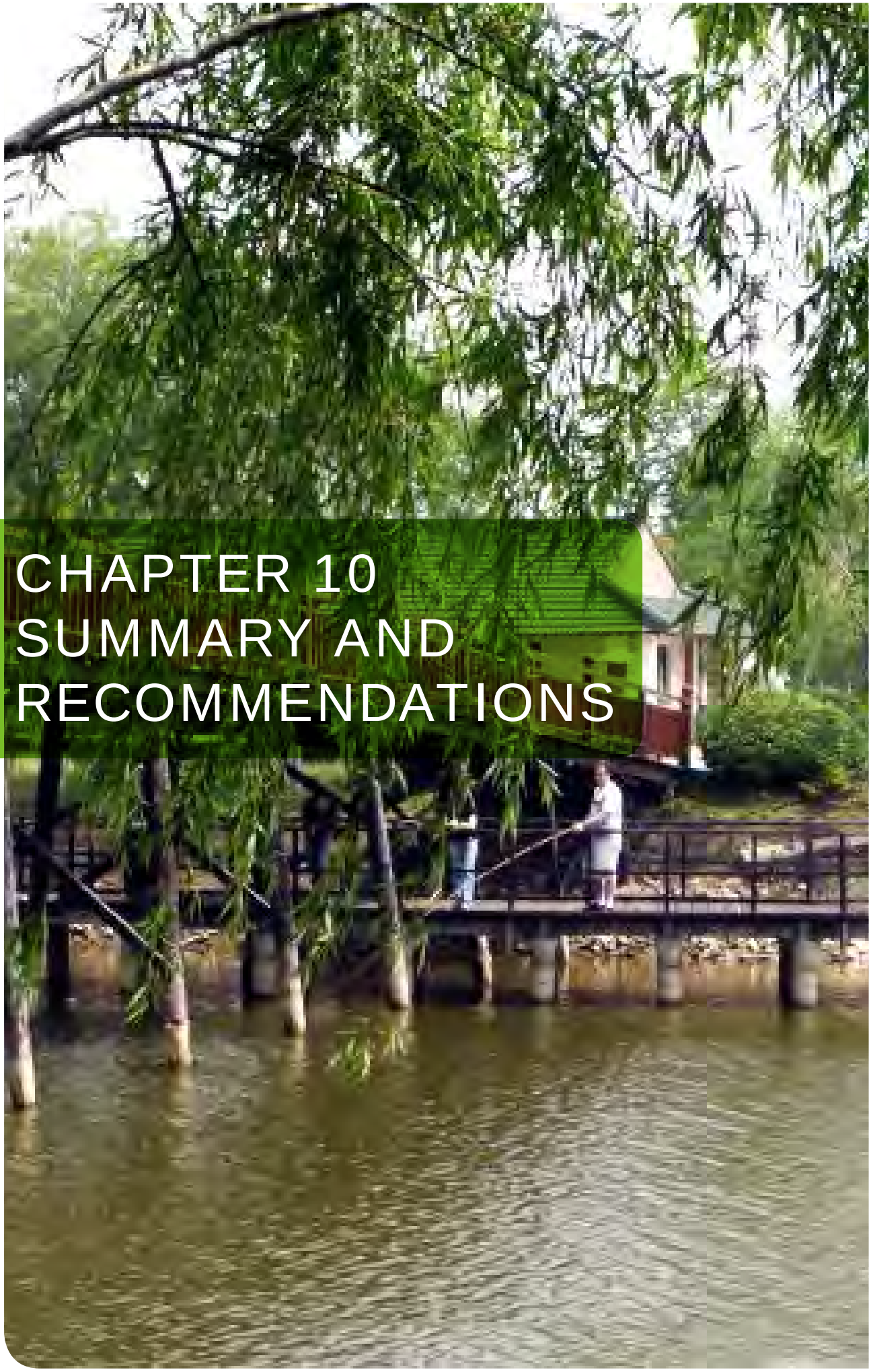
a small population and low per personal income, as well as other developing cities having these aspects. On the other hand, related institutions can be introduced into Chongming Island, if necessary, which would support the trade of license plates. Then, the revenues can be used to establish a fund for green transport, thus providing financial support for infrastructure of public transport.

9.5. Recommendations and Action Plans

Table 9.1. Action Plan for Transportation

No.	*Issue*	*Recommended Actions*	*Timeframe*	*Significance*
9.1	Improvements to the internal and external transport carrying capacity	Connect Chongming Island to the main national highway and establish a comprehensive public transport network	Short-to medium-term	☆☆☆
9.2	System of green transport infrastructure	Establish and construct walking and cycling transportation network as a part of green multi-functional transport infrastructure	Long-term	☆☆☆
9.3	Intelligent Transport	Develop and deploy an Intelligent Transport System for Chongming Island.	Medium to long term	☆☆
9.4	Promote new energy and low-carbon transportation system	Promote the private and public use of low-carbon and new energy fuelled vehicles through policy incentives, education and awareness measures. Introduce the zero-emission bus in Chongming Island	Medium to long term	☆☆☆
9.5	Create a policy framework and conducive environment for low a carbon transport system	Design the construction of the bicycle park and enhance publicity and education for low carbon transport	Medium to long term	☆☆

☆ = relatively important; ☆☆ = important, and ☆☆☆ means “very important”



CHAPTER 10
SUMMARY AND RECOMMENDATIONS

CHAPTER 10 SUMMARY AND RECOMMENDATIONS

The rapid growth of China's economy has not only created economic progress and enormous material wealth, but also brought about great challenges to natural resources and environment. It is in this context that the Chinese government put forward the concept of "eco-civilization" which was proposed in 2007 at the 17th National Congress of the Chinese Communist Party. The idea behind eco-civilization is to form an energy- and resource-efficient and environmentally friendly industrial structure, economic growth model and consumption pattern. Since then, there has been a wide eco-civilization campaign in China, with discussions on how the idea should be practically implemented at different levels.

Shanghai, one of China's largest and most populous cities, took a first step towards actualizing the eco-civilization concept in the development of its rural and suburban Island of Chongming which has a unique setting as a rural county in the highly urbanized municipality. In 2002, the State Environmental Protection Agency of China (SEPAC) confirmed Chongming County as a National Ecological Demonstration Zone (NEDZ), and in 2005, the concept of "eco-island" was adopted in the Master Development Plan for Chongming Island (MDPCI), putting forward the construction of a world-class eco-island as the main goal for the Island's future development.

Eco-Island construction can be considered as one possibility for sustainable development in small island systems but there is currently very little practical information and experience about what constitutes an eco-island or how an eco-island should be constructed. In this regard, Chongming Island can be considered as a "pace-setter" in testing and putting into practice the concept of eco-island construction. Indeed, the process of eco-island construction in Chongming has drawn worldwide attention highlighting the potential of Chongming to generate learnings and lessons for the developing world, especially in the small islands.

This report evaluates the measures in seven aspects which are identified based on the elements of sustainable development, green economy and eco-civilization. It also summarizes the relevant experiences of Chongming's eco-island construction efforts. The report puts forward a total of 43 recommendations. These include 39 specific recommendations outlined in terms of specific action plans for each of the seven thematic areas evaluated, and four general recommendations on how to develop and improve the construction of Chongming Eco-island. It is hoped that Chongming Island can serve as a model of China's eco-civilization promotion, and an excellent example of developing ecological economy for the less developed regions of the world particularly the small islands.

10.1 Overall progress to date

Chongming's measures towards eco-island contains seven main aspects including society, life and culture, biodiversity and ecological conservation, water, solid waste, energy efficiency and low-carbon economy and transport.

Society, life and culture

After several years of construction, Chongming has established an eco-industrial system dominated by organic green agriculture, environment-friendly industries and ecological services, while developing an intensive urban construction system based on advanced technologies and renewable energy sources. The green building system is based on the "low-carbon building guidelines" for coastal islands and a building evaluation system that includes energy-saving and environmental assessment. To fully develop the cultural heritage, the unique ecological advantages have been combined to build a unique Chongming brand. As an ecological demonstration area in the Shanghai metropolis, the development direction of society, life and culture on Chongming Island has become clear with some progress already realized, including in infrastructure construction. Chongming Island is devoted to achieve the ecological harmony of natural habitats, culture and industry, becoming a new development engine for the Shanghai metropolis.

Biodiversity and Protected Areas

There has been marked progress in Chongming Island in terms of biodiversity and ecological protection. This has been achieved through a range of interventions including the establishment and expansion of protected areas in both terrestrial and wetland ecosystems, increase in forest cover rate and expansion of public green spaces. Chongming Island has established long-term safeguard mechanisms for wetlands, forests and green lands and has achieved ahead of schedule, the 2012 goals for ecological protection. Wetland conservation was realized through the proper management and control of invasive species, restriction on wetland reclamation for agriculture, and water pollution control. Other measures to protect Chongming Island's biodiversity and ecosystem have included the protection and management of habitats, especially for waterfowls in critical habitats along the East Asian-Australasian Flyway, the construction of green island infrastructure network, the development of ecosystem services and ecological compensation mechanisms, comprehensive control of pests and enhanced ecological education.

Water management and conservation

Chongming has made large investments towards enhancing drinking water safety, water pollution control and water saving, laying a solid foundation to realize a virtuous circle of water resource utilization. In the aspect of water quality improvement, Chongming promotes early warning monitoring and evaluation system, and has implemented a comprehensive rehabilitation programme to improve water quality of Backbone Rivers. It has also invested in the construction of centralized wastewater treatment facilities together with the conveying pipelines, and in the establishment of a new decentralized rural sewage treatment system. In the aspect of improving water resource utilization efficiency, Chongming Island constructed 'one reservoir plus four water treatment plants' to promote centralized water supply to support the ecological island construction and to ensure the safety and the sustainable utilization of Islands water resources. Other measures adopted to support water management and conservation include farmland water conservancy projects through facilities equipped vegetable and grain fields for improved capacity for agricultural irrigation, information and educational campaigns and public participation programmes.

Solid waste management

Chongming Island has formulated several measures and plans to strengthen source reduction, collection, transfer, treatment and disposal of solid waste in the Island and has adopted the Principle of 2RH: Reduction, Resource and Harmlessness in comprehensive solid waste management. It has already established a comprehensive system framework for resource-oriented utilization. Chongming Island is actively promoting the application of solid waste classification and source reduction in different ways. Confined transition and transportation systems have effectively avoided secondary pollution during the transition. The Chongming Solid Waste Disposal Site was rated as Grade I hazardous-free disposal site. A kitchen waste treatment plant has been built and put into operation. The Chongming Solid Waste Disposal Utilization Center has been launched to further promote resource utilization. Recycling and reuse of both agricultural and construction waste is also steadily increasing in the Island. In its future development, Chongming Island plans to continue implementing the reduction, hazardous-free, resource-oriented utilization principle to further improve on the whole process of solid waste collection, transportation, and disposal to ensure an ecological and sustainable solid waste management system.

Low-carbon economy and energy efficiency

Through the application of Science, Technology and Innovations (STI), Chongming Island has followed a low-carbon economy and energy efficient development model through a range of strategies, including: (1) a low-carbon energy structure mainly supported by clean electricity and supplemented by renewable energy and smart grid; (2) a low-carbon industrial structure framed by advanced eco-agriculture and service industries; (3) a low-carbon infrastructure system through the localization and application of green building designs and low emissions energy vehicle technologies; (4) a natural carbon sinking system supported by forests and wetlands; and (5) a relatively low-carbon lifestyle anchored on the Chinese traditional philosophy of unity of nature and human-being. The continued implementation of these strategies will make Chongming Island to reach the target of "decoupling of GHG emissions and economic growth" during its 12th Five Year Plan period. As part of Chongming Eco-Island development, a more effective approach to promote regional low carbon development is recommended with the priority being on "controlling carbon demand", "improving carbon productivity", "reducing carbon dependency", and "expanding carbon neutral", in that order of priority.

Agriculture and organic products

Several changes have been implemented in the agricultural and organic products domain as part of Chongming Island's agricultural construction. These include a gradual transformation from a traditional extensive agriculture to a high efficient ecological agriculture, a shift from scattered agriculture operation to green organic system construction, from a single production-oriented peasant economy to a multi-functional large-scale urban agriculture, from the a first industrial production with low value added industry to a high value added, first and third combined industry. These changes have contributed towards ecological conservation and low-carbon growth in the Island.

Transportation

As part of developing a low-carbon transport system, Chongming Island is promoting a shift from private motorized transport to non-motorized and public transport system in the Island. This is done through a range of approaches, including optimizing the design of the transportation network, prioritizing people over vehicles, maximizing accessibility by non-car modes (including bicycle), popularizing public transport, developing new energy transportation system, adopting advanced technology of low-emission and promoting the international cooperation in energy saving and emission reduction. The development of low carbon transport system in Chongming Island is also heavily underpinned by science, technology and innovation (STI) to pilot and demonstrate

advanced energy-efficient transportation system. The completion of the north and south channel means that Chongming Island now has a smooth traffic connection with the mainland, and the construction of a number of backbone roads in the Island has expanded the road network, and improved access to the rural areas. Chongming Island has just commenced the construction of a 120-kilometer rural highway which will be part of the county tube highway network linking the artery of rural roads and village-to-village road network to promote sustainable economic development in rural areas. These have established solid foundation for the realization of a modern comprehensive and ecological transportation system with convenient connection of three islands within Chongming and connection of Chongming Island and Shanghai city.

10.2 The Chongming Eco-Construction Experience

The experience of Chongming Islands eco-construction follows on the Islands' own circular development mode, which is based on six aspects; establishing a shared vision, understanding current situation, setting targets, developing action plans, implementing plans and support system, monitoring and evaluating the performance. These six aspects are briefly elaborated below:

Shared vision: The vision of building a world-class eco-island is shared among all stakeholders especially the government and the general public. This helps concentrate resources for the eco-construction. The plan to make Chongming an eco-island has been identified in a series of official documents, including the Shanghai Master Plan (1999-2020) which was approved by the State Council, the Chongming Three-Island Development Master Plan (2005-2020), and the Chongming Eco-Island Construction Outline (2010-2020).

Understanding the current situation: Reasonable targets are based on the understanding of current situation. Data collection is a preliminary task of eco-island evaluation. The Shanghai government gathers expert resources, establishes index system to help in obtaining accurate status data on the six priority fields (natural resources, circular economy and comprehensive waste utilization, energy efficiency and emissions reduction, environmental pollution, eco-industrial development, and infrastructure and public service). The Shanghai government carried out the evaluation on the first round of Chongming Three-Year Action Plan based on the data covering these six fields.

Clear target setting: Under the shared vision, Chongming has set targets at multiple levels to measure whether the overall goals are being met. In addition, combined with long-term and short-term goals, dynamic adjustment has been realized during the implementation with the aim of achieving the shared vision.

Feasible Action Plan: Chongming has carried out promotion mechanism for feasible action plans. These plans focus on the following six fields; natural resources protection, circular economy and comprehensive utilization of wastes, energy utilization and reduction, environmental pollution control and eco-environment construction, development of ecological industry, infrastructure and public service. During the first round of Chongming Three-Year Action Plan, 16 secondary plans and 95 practical programs were implemented with a total investment worth 14 billion CNY.

Implementation and Support System: Chongming has taken measures in science, technology and innovation (STI) development, multi-stakeholder engagement and educational awareness to ensure the implementation of the developed plans.

Monitoring and Evaluation: The monitoring and evaluation system of Chongming Eco-island construction consists of three steps. The first step involves building a world-class eco-island construction index system, developed and prepared by a large number of experts through a combination of discussions and field research. The second step is to establish a monitoring network system for environmental qualities including land use, water quality, atmospheric environment, acoustic environment and solid quality, and aquatic and wetland ecosystems. The third step is to establish a dynamic performance evaluation mechanism of eco-island by enhancing feedback. Chongming has pursued an assessment appraisal system ruled as "assess every year and evaluate every three years". The Shanghai Municipal Development and Reform Commission has finished the evaluation of the first round of Chongming's action plan (2010-2012), and this international evaluation report is a part of this periodic evaluation.

10.3 Challenges and Recommendations

This part of the conclusion lists some of the challenges in the construction of eco-island and the future development of Chongming Island. Following these challenges, several specific and general recommendations are presented. It is expected that UNEP in particular will continue to engage with in the process of Chongming Eco-island construction to offer technical and scientific support based on international experience on sustainable development and green economy.

10.3.1 Challenges for Chongming Eco-Island

The construction of an eco-island as part of future development of Chongming will be confronted with many challenges that are common in developing countries and regions, including small islands. Some of these challenges include the following

- Chongming Island is still in the early stage of development with a relatively low economic base and lack of critical infrastructure. The challenge for Chongming is to build and eco-economy as the development mode for eco-island construction. This will provide a basis for Chongming

to grow economically while at the same time promoting environmental protection of critical habitats. Presently, there is need to build or upgrade energy, water, transport and communication infrastructure, but these should be done with careful planning to minimize environmental damage on ecosystems. While of the energy infrastructure of Chongming Island has been greatly improved in recent years, there is still need to invest in and improve some of the network and supporting facilities. For example, the ongoing construction of a gas pipeline and gas power plant should be accelerated to complete the natural gas pipeline coverage on the island. In addition, there is also an urgent need to maintain and upgrade the water supply and drainage system to provide the foundation to improve water supply efficiency and to better cope with urban storm water runoff. Overall, there is also a need to enhance the Island's infrastructure's adaptability to climate change and natural disasters given the increase in occurrence and severity of extreme weather events associated with climate change.

- Lack of or low public participation in development efforts is a common challenge in developing areas of the world, and Chongming Island is no exception. In Chongming, the low levels of public participation may be associated with the local long-established government-led model of development planning as well as to lack of knowledge and awareness among the local residents in the Island. Public consultations through attitude surveys have ensured that stakeholder's views are considered in the Chongming eco-construction process. Furthermore, a strategy for integration of science and technology has been maintained in the construction of Chongming eco-island, providing a strong learning for other developing countries and regions. . The Chongming Island should further expand strategies for stakeholder engagement and participation, including regular face to face and online consultations, public education and awareness campaigns, and the wider applications of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) tools. Specific initiatives should target the active participation of local businesses and residents of the Island.

- The lack of a skilled, high level human resource base to power the service-sector led eco-island construction in Chongming is one of the major challenges that need to be addressed. It is recognized that the economic vitality of Chongming will rely on high-level innovative and entrepreneurial talent, modern and high-tech service (including IT and eco-tourism) and manufacturing industry professional skills, and skills to develop advanced eco-agricultural industry. In addition, the design and operations of the eco-industrial infrastructure will need to be supported by relevant human resource capacity. Therefore, there is need to develop and attract these required human resource skills to Chongming Island to ensure the continuation and realization of eco-island construction.

- Like other small islands, Chongming Island has a highly fragile ecosystem which makes it highly vulnerable to human and natural factors. It is geographically isolated, small in physical size, has a highly unique and fragile ecology based on limited terrestrial and natural resource endowments, and is susceptible to climate change and sea level rise making it to be highly sensitive to extremely damaging natural disasters. Human activities, including resource consumption, pollution from waste discharge, wetland reclamation and modification, land use change through infrastructure construction have further increased the fragility of island ecosystem. . The construction of Chongming eco-island should therefore address the challenge of how to overcome the natural vulnerability of the Island and improve the resistance and resilience of the island's natural ecosystem.

10.3.2 Recommendations for Chongming Eco-Island Construction

The recommendations are grouped into specific recommendations based on the proposed action plans for each of the seven thematic areas evaluated, and the general recommendations which are provided at the end.

Specific recommended action plans

Society, life and culture

1. Expand green jobs: Administer government stimulus packages in the form of tax exemption and subsidies to accelerate the expansion of a green job market, and encourage Science, Technology and Innovation (STI) centers (research and higher education institutes) on the island to build capacity in human resources.

2. Build a knowledge economy: Establish a University City on the Island, to be integrated with Chongming Dongtan International Education Campus, the National Modern Agriculture Demonstrative Area, the Intelli-Island IT Park and the Eco-Industry Park to form Chongming Research and Development (R&D) Commerce Park.

3. Yangtze Eco-Art Development Space: Explore the possibility of establishing and supporting a green creative industry and public eco-art development space for the Yangtze Delta region.

4. Eco-Tourism Information Management Center: Assess the feasibility of establishing a tourism information management center. This center should ideally be located at the entrance of the Yangtze River Tunnel-Bridge highway to Chongming Island.

5. Green Building Evaluation: Conduct regular Island-wide green building evaluations to continually assess their status using suitable assessment tools such as the Energy Audits and Green Star Building Ratings developed by the

Chinese Ministry of Housing and Urban-Rural Development and others. Carry out awareness campaigns among the local residents to educate and help them understand the environmental impact of public and residential buildings.

6. Environment Science Demonstrative Center: Assess the feasibility of establishing a family oriented environment science demonstrative center on top of existing science education institutions.

Biodiversity and Protected Areas

1. Research to support action on Ecosystem Services development approach: Carry out research to support ecosystem services development approach, including assessment and valuation of ecosystem services using available toolkits, planning and zoning for industrial development, environmental pollution monitoring, and ecological carrying capacity. The specific toolkits for ecosystem service assessment at local and landscape levels that could be used are the Toolkit for Ecosystem Service Site-based Assessment (TESSA) and the Integrated Valuation for Ecosystem Services and Trade-Offs (InVEST).

2. Biodiversity Conservation Compatible Agriculture (Eco-agriculture): Promote the construction of agricultural circular economy demonstration to realize eco-agriculture and ensure biodiversity conservation compatibility while improving people's livelihood in rural areas.

3. Consolidate the "Win-win pattern practice area of wetland protection and utilization" by strengthening the management of ecological risks, control of invasive species (Spartina Alterniflora), and the reclamation and restoration of degraded wetlands.

4. Strengthen eco-compensation programme: through Payments for Ecosystem Services (PES) and compensate for the loss of habitats and wetland ecosystems to develop projects through habitat banking and/or restoration of other degraded wetlands and habitats to ensure "No net loss" in biodiversity.

5. Yangtze Delta Ecology Conservation Park: Conduct a feasibility study towards establishing a Yangtze River Ecology Conservation Park in Chongming Island.

6. Managing sea level rise: Optimize the land planning and utilization process (wetland protection, etc.), construct the levees, and plan urban system (population concentration) to cope with the challenges of rising sea levels.

7. Ecological Education: Further develop ecological education programs for Dongtan and Xisha Wetlands applicable to primary, secondary and tertiary level students.

Water management

1. Water intake management: Protect water sources especially the water catchment areas, strengthen monitoring efforts nearby and expand the terrestrial water pipe network.

2. Water supply management: Build and upgrade the water supply pipe network, continue to shut down small water plants, implement water safety plans to realize intensive and efficient water supply.

3. Water use efficiency: Encourage factories to carry out clean production; improve industrial water recycle rate; cut chemical fertilizer and pesticide usage; promote water-saving agriculture; call for water saving; evaluate the possibility of using water-saving appliances and technologies.

4. Drainage development and maintenance: Improve the drainage network, upgrade municipal drainage facilities, and enforce water discharge standards.

5. Water pollution control: continue to promote the comprehensive regulation of rivers, lessen the volume of wastewater and contaminated content whilst treating it as an opportunity for reuse.

6. Water planning: explore the possibility of integrating "water sensitive city" design.

7. Water management: Establish an information sharing and communication platform to enhance public participation in water resource management and conservation.

Solid waste management

1. Goal of "zero solid waste": Promote measures towards the realization of the goal of "zero solid waste", including the reduction, re-use, recycling and recovery of solid waste materials.

2. Comprehensive management of solid waste: Promote hierarchical management following the priority of reducing, reusing, recycling, energy recovery and terminal disposition of solid waste. Systematize the strategy of sustainable solid waste management for Chongming Island

3. Resource utilization of solid wastes: Set-up and operationalise the Solid Waste Comprehensive Utilization Centers to continually improve the solid waste resource utilization in Chongming Island. Promote and expand the mechanization of straw returning for agricultural waste. Reconstruct small and medium size biogas engineering treatment areas for pig farms.

4. Cutting edge technologies for the comprehensive utilization and management for solid wastes: Support the development and application of solid waste management

and utilization technologies and the spread of industry knowledge. To achieve this, set-up a Cluster of Solid Waste Management Technology Centers among private sector (industry companies), research institutes and academic institutions.

Low carbon economy and energy efficiency

1. Controlling carbon demand:
   i. Low carbon industry: Consolidate low carbon agriculture and tourism demonstration base, and industrial park.
   ii. Management capacity enhancement: Build a cross-sector and systematic management system to keep evaluating the actual performance of energy consumption and emission reductions.

2. Increasing carbon productivity
   i. Energy saving in secondary industries: a) Phase out the pollution intensive enterprises, and strengthen energy conservation management in key enterprises; and b) establish environmental and low carbon access threshold for new industrial development opportunities.
   ii. Energy efficient buildings: a) Enhance energy efficiency requirement for new buildings, and accelerate the progress of energy saving renovation for existing buildings; b) Promote the establishment of integrated renewable energy technologies.
   iii. Sustainable transportation: a) optimize the public transit network and encourage public transport and low carbon emission vehicles; b) introduce a zero carbon emission public transport system in Chongming Island.
   iv. Resource utilization: Accelerate the construction of facilities that support waste separation, transport and disposal.
   v. Energy saving in other fields: Promote energy saving and emission reduction actions led by public service entities.

3. Reducing carbon dependence
   i. Energy structure optimization: Promote clean electricity generation supported by gas-fired power plant; Establish and expand wind farms; Promote the establishment of integrated solar PV system and solar water heating system; and Develop biomass and other renewable energy.

4. Increasing carbon neutral
   i. Enhance and maintain the carbon sink capacity of natural ecosystems: Strengthen the protection of local forest and green land, while providing a better environment for local residents; strengthen the protection and restoration of wetland resources and; Initiate research on the potential for agricultural carbon sink.
   ii. Explore advanced technologies such as Carbon Capture and Storage (CCS).

Agriculture and organic products

1. Reduction in the utilization of chemical fertilizer and pesticides: Actively promote the use of environmentally-friendly pesticides, encourage the planting of green manure crops and expand the use of commercial organic fertilizer.
2. Circular agriculture: Improve farming facilities to better treat and utilize agricultural wastes.

3. Organic farming: Establish demonstration sites to promote facility agriculture with high standards and use technologies that minimize use of pesticides.

4. Urban low-carbon agriculture: Promote low-carbon agriculture development in the construction of Chongming Modern Agriculture Zone and DFXS Low Carbon Agriculture Zone.

5. Agriculture standardization system: Establish modern agriculture demonstration base and strengthen comprehensive standardized agricultural management

6. Leisure agriculture tourism: Develop leisure agriculture tourism along with the rehabilitation of Beiyan Boulevard.

Transport

1. Improvements to the internal and external transport carrying capacity: Connect Chongming Island to the main national highway and establish a comprehensive public transport network.

2. System of green transport infrastructure: Establish and construct walking and cycling transportation network as a part of green multi-functional transport infrastructure.

3. Intelligent Transport System (ITS): Develop and deploy an Intelligent Transport System for Chongming Island.

4. Promote new energy and low-carbon transportation system: Promote the private and public use of low-carbon and new energy fuelled vehicles through policy incentives, education and awareness measures. Also, introduce the zero-emission bus in Chongming Island.

5. Create a policy framework and a conducive environment for low a carbon transport system: Design the construction of the bicycle park and enhance publicity and education for low carbon transport.

General Recommendations

In addition to the specific recommendations above, the following general recommendations are also proposed for Chongming Island:

1. **Establish Chongming Special Ecological Zone for Eco-Civilization:** Chongming Island is planned to be a world-class eco-island and can serve as an ideal ecological

demonstration area in Shanghai City. Chongming Island could be treated as a special region which focuses on ecological civilization to serve as a world model. This could follow the pattern of the special economic zones created for export oriented economic development. Innovation and Knowledge Management (KM) will be critical for Chongming during the ecological civilization construction to continuously document, synthesize and share experiences, lessons, tools, processes and accumulated knowledge on eco-island construction. This can be done through an expanded international network, including exchanges and cooperation with other cities, islands and countries. In this way, Chongming could inspire other developing countries and regions to construct ecological civilization.

2. **Accelerate the dissemination of transformative scientific achievements through a systematic promotion of demonstration projects to amplify the role of science, technology and innovations (STI):** As part of the Chongming Eco-Island construction, the Shanghai Municipal Government and the Chongming County Government have facilitated and invested a lot of resources to develop, integrate and apply cutting edge technologies in the construction of the ecological island, and in the process have accumulated vast knowledge, scientific achievements and demonstration experiences. In order to amplify the role of STI to benefit more stakeholders, Chongming should consider promoting the wider dissemination of these transformative scientific achievements into practice through the promotion of demonstration projects in a wider range of places, tailored to local contexts.

3. **Strengthen and expand the Chongming Eco-Island International Network as a platform for exchanging best practices, lessons and promoting Chongming Eco-Island Construction Model.** The Chongming Eco-Island International Network was established through the Chongming Eco-Island International Forum held biennially in cooperation with the United Nations Environment Programme (UNEP) and other international organizations. This network should be strengthened and expanded to serve as a platform for sharing experiences and lessons and ideas on eco-civilization and green economy. Through this platform, Chongming could learn from other countries and regions and at the same time share its own experiences with the international community about the Chongming model and the process of constructing a world-class eco-island. This platform can also allow Chongming to benefit and share its expertise with the international community, for example, in the area of evaluation. Currently the Shanghai city plans to evaluate the progress of Chongming eco-island construction every three years but it is also necessary to conduct an international evaluation to identify and assess the progress, challenges and opportunities from different perspective and to draw on the international experiences that could be applicable to the Chongming model. It is thus recommended to strengthen the long-term cooperation with UNEP and establish a five-year international assessment mechanism. During the next phase of development of Chongming Eco-Island, UNEP would then provide technical support specifically on its focus areas of climate change (adaptation and mitigation), disaster preparedness and management, ecosystem management, resource efficiency, chemicals and waste, and on environmental governance.

4. **Strengthen human resource capacity, build support system and enhance stakeholder coordination and collaboration.** Chongming Island has identified operations management and policy support as the key pillars of a supporting system for Chongming Eco-Island construction. As part of this process, there is need to focus on the following; i) strengthen human resource capacity, particularly in the area of infrastructure operations and facilities maintenance; ii) Enact and implement policies, regulations, laws and rules to guide, regulate and supervise the orderly advancement and construction in Chongming Eco-Island, including implementing a security system to support eco-island development; iii) encourage and co-ordinate the participation of local and regional stakeholders, including local residents, Island enterprises, the scientific communities, neighboring provinces and cities and with relevant government ministries to better motivate the enthusiasm of all parties.

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