



让我们共同打造气候中和的未来
Building a climate-neutral future together

Sino-Swiss Cooperation on Zero Emissions Building

Zero Emissions Building Demonstration Project Report

Shangxian Lake Low-Carbon Digital Industrial Park Phase II

Wuxi, Jiangsu Province

ENGLISH VERSION



JULY 2024



中华人民共和国
住房和城乡建设部



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Building a climate-neutral future together

This report has been produced within the framework Sino-Swiss Zero Emissions Building Project; an international collaboration funded by the Swiss Agency for Development and Cooperation in partnership with the Chinese Ministry of Housing and Urban-Rural Development.

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The Sino-Swiss Zero Emissions Building Project is an international collaboration funded by the Swiss Agency for Development Cooperation in partnership with the Chinese Ministry of Housing and Urban-Rural Development. The project aims to reduce greenhouse gas emissions and enable carbon neutral development of the building sector in China by sharing Swiss know-how on sustainable and zero emission building.

Implementation partners:

Intep Integrated Planning
Skat Consulting
China Academy of Building Research

WeChat:



Web:

zeb-china.org

Contents

1.	PROJECT BACKGROUND	2
1.1.	About SDC ZEB Project	2
1.2.	Selecting process of Demo Project	2
1.3.	Working process	3
2.	PROJECT INITIAL STATE	4
2.1.	Project organization	4
2.2.	Project overview	4
3.	SWISS EVALUATION AND INPUTS	6
3.1.	About the Demo Project Design Team	6
3.2.	First inputs and suggestions	6
3.3.	Reaction of DP team and concept improvement	7
3.4.	Further swiss inputs and suggestion	7
3.5.	Further improvement and knowledge received	7
3.6.	Calculations	7
4.	OUTCOME/REACHES	9
4.1.	Confirmation of ZEB demo project	9
4.2.	Testimonials from Demo Project Team	9
5.	LESSONS LEARNED	10
5.1.	Management and organization	10
5.2.	Technical solutions	10
5.3.	Communication and Cooperation	10



1. PROJECT BACKGROUND

1.1. About SDC ZEB Project

To jointly address global climate change and to strengthen cooperation between China and Switzerland in the field of emissions reduction in the construction industry, the Ministry of Housing and Urban-Rural Development of the People's Republic of China and the Swiss Federal Ministry of Foreign Affairs signed a Memorandum of Understanding (MoU) on 24 November 2020. The Memorandum focuses on fostering international cooperation in the field of building energy efficiency. Within the framework of this MoU, the Swiss Agency for Development and Cooperation (SDC) initiated and funded the Sino-Swiss Zero Emission Building (ZEB) Project. The project aims to support China in formulating the technical standard for zero carbon buildings and long-term roadmaps for reducing carbon emissions in the construction industry. Switzerland contributes by sharing know-how, showcasing demonstration projects of zero emission buildings in four different climate zones, and carrying out various forms of capacity building activities to promote the carbon-neutral development of China's construction industry.

Project Purposes:

- Upgrading existing building energy efficiency standards to zero carbon technical standards
- Implementing demonstration projects (DP) in four typical climate zones to test the new ZEB standards and finding potential for optimization
- ZEB capacity building and knowledge dissemination

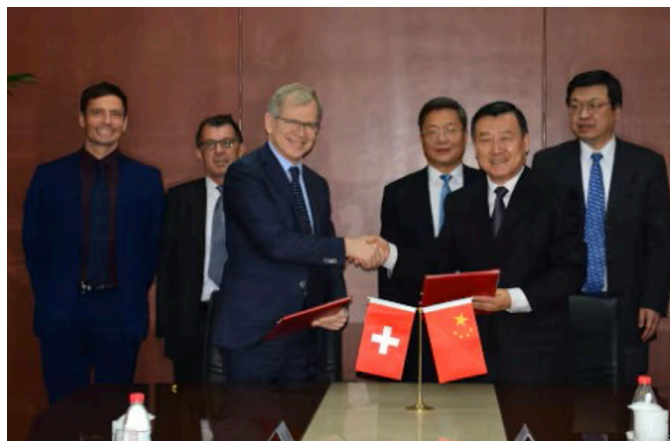


Figure 1. Ambassador Bernardino Regazzoni and Vice Minister Ni Hong, sign the project agreement. Image: Swiss Embassy in Beijing

ZEB China project duration:

Phase I: 15. Mar. 2021 – 28. Feb. 2025

Project impact on climate protection:

Reduce CO₂ emissions in China's building sector.

1.2. Selecting process of Demo Project

Demo project goals

- To reach the requirements of China's national technical standards for zero carbon buildings
- To serve as case studies to guide and educate further projects in achieving the ZEB standard
- Evaluation committee and selection process
- CABR collected applications for potential demonstration projects by an official call
- Prior to the evaluation of applications, a project presentation with Q&A was held, in which Chinese and Swiss experts participated.
- A separate evaluation based on selection criteria was carried out by Chinese and Swiss experts
- With Sino-Swiss joint feedback and recommendations, Mohurd announced the selected demo projects

Selection criteria

- ELIGIBILITY CRITERIA: Political commitment, funding commitment, possibility of intervention, potential for affordability and replicability, visibility and accessibility, diversity
- RATING CRITERIA (Evaluation weight): CO₂ emissions reduction potential and other environmental benefits (40%), number of beneficiaries (20%), light-house potential (20%), incentives by local government (20%)
- PILOT- PROJECT SUITABILITY (1st batch): Quick-starter, compatibility with draft ZEB-Standards, pilot characteristics, availability of data

Selection time

March 2022

Why selected – ZEB potential

Potential for designing and technical improvement, as well as emission reduction

- The building shows very strong character of Demo Project
- Competent and committed planners and owners. Planning team has well-understanding of ZEB and its solutions
- Funding commitment already exists
- Energy control and optimization is possible during operation due to competent ownership and facility management
- The planning team has very good knowledge about energy and emission calculation as well as life cycle management
- Very good location and accessibility. In addition, elaborate architecture and thus, good visibility.

Possible inputs for improvement of Swiss experts

- As a single building, the project can be optimized well. However, the time for adjustments is very short. The single building itself is not diverse, so we suggest to think about an district/building compound solution with the whole campus.
- Embodied energy must be considered here. An area solution with energy interconnection with the five other buildings would make sense,
- The façade material needs to be replanned, because the reflected sunlight on the planned metal surface can cause the “hot surrounding”
- PV on roof and façade need to be well planned
- Suggestion to integrated planning and energy-saving solution on roof and façade
- Material concept and circular construction could be supported by Swiss team

1.3. Working process

Sino-Swiss team

The Sino-Swiss expert team is composed of Swiss and Chinese specialists. The Chinese DP team first proposed design prototypes and zero-carbon design strategies. After reviewing the design features of the project, the Sino-Swiss expert team gave tailored feedback to the design team on the design prototype and strategical concept, which the design team will integrate as they adapt the project. The Swiss team also arranged webinars to exchange on specific zero-carbon topics based on the questions from the DP team. The ideas contributed by the Swiss experts are based on their international experience from Switzerland, Europe, and other similar climate zones around the world.

The goal of Sino-Swiss cooperation

The goal of Sino-Swiss cooperation is to jointly monitor and improve the quality of the demonstration project and support the project to meet the ZEB-standards. The cooperation is mutually beneficial – the Swiss team brings experience and expertise to China, while the Chinese colleagues can share their experiences for the Swiss to learn from. Jointly the Swiss and Chinese teams discover what the best solutions are to develop a successful zero emission building.

Working process

Webinars, online workshops, RTIPs, Charrettes, WeChat discussions and site visits were held to turn ideas into constructive proposals. The transparent exchange is very helpful for determining the project’s feasibility.

Demo project duration

May. 2021 - Sept. 2024



2. PROJECT INITIAL STATE

2.1. Project organization

In March 2022, the “Wuxi Shangxian Lake Low-Carbon Digital Industrial Park” was selected as one of the 2nd batch Demonstration Projects of Sino-Swiss ZEB Project. This project is a ministerial-level international cooperation project initiated by the Chinese Ministry of Housing and Urban-Rural Development and the Swiss Agency for Development and Cooperation. The project commenced in Jun. 2022 and is planned to be completed with its construction in Dec.2024.

Investor

Wuxi Taihu New City Urban Development Co.

Lead planning team

China Academy of Building and Research (CABR)

Sino-Swiss ZEB international joint consulting team

Intep, Skat, CABR, Low-tech, UAD, HSLU, EMPA, etc

2.2. Project overview

Location

Wuxi, Jiangsu, China (Hot Summer Cold Winter; Solar Resource Area IV)

Area

- Total planned land area: 96' 657 m²
- Total construction area: 210' 980 m²

Function:

- Mix function office, conference, exhibition, education
- The ZEB Demo Project is the Conference Building (Building 1#):
- Building Area: 210' 980 m²
- Building Height:
3 floors above ground, 1 floor underground.
- Building Function: Conference

Investment costs

2' 170' 622' 600 RMB total

Architectural concept highlights

(see plans in attachment)

- New construction
- Mix functions with office, conference, exhibition, education

Energy concept

(see schema in attachment)

- Energy Label:
 - 1# 10094 m² - Zero Carbon Building
 - 2-6# 92655 m² - Nearly Zero Energy Building
 - 7-10# 8999m² - Low-Energy-Consumption Building

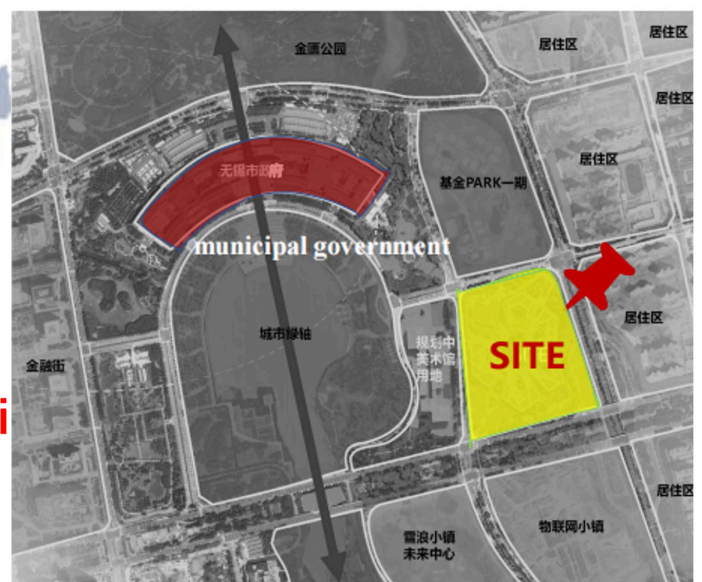


Figure 2 Demo Project located near municipal government, Source: Project Presentation 14.03.2023 ©CABR

- Space heating and room cooling with ground-source heat pump system (1#, 2#, 7-10# Building) and Multi-split air conditioning (air-source heat pump) system (3-6# Building)
 - Hot water: ground heat source pump system (2-6# hot water for canteen, no need of hot water for other buildings)
- Other sustainability concepts**
- Low carbon digital park integrated technology system
 - Low carbon planning (Improve the micro-climate of the park, Planning of low carbon office circle)
 - Low carbon transport (Intelligent transportation, slow-moving system)
 - Low carbon building (Reduce operation and production energy consumption)
 - Low carbon energy (Multi-energy complementary Energy management)
 - Low carbon Materials (Carbon fixation materials, Circulation reuse)
 - Carbon sinks (Multiple greening Biodiversity)
 - Low carbon Lifestyle (Low-carbon lifestyle Low carbon intelligent operation and maintenance system)



Figure 3: Rendering in early planning phase. Source: Project Presentation 14.03.2023 © AAI Int'l Architect Office

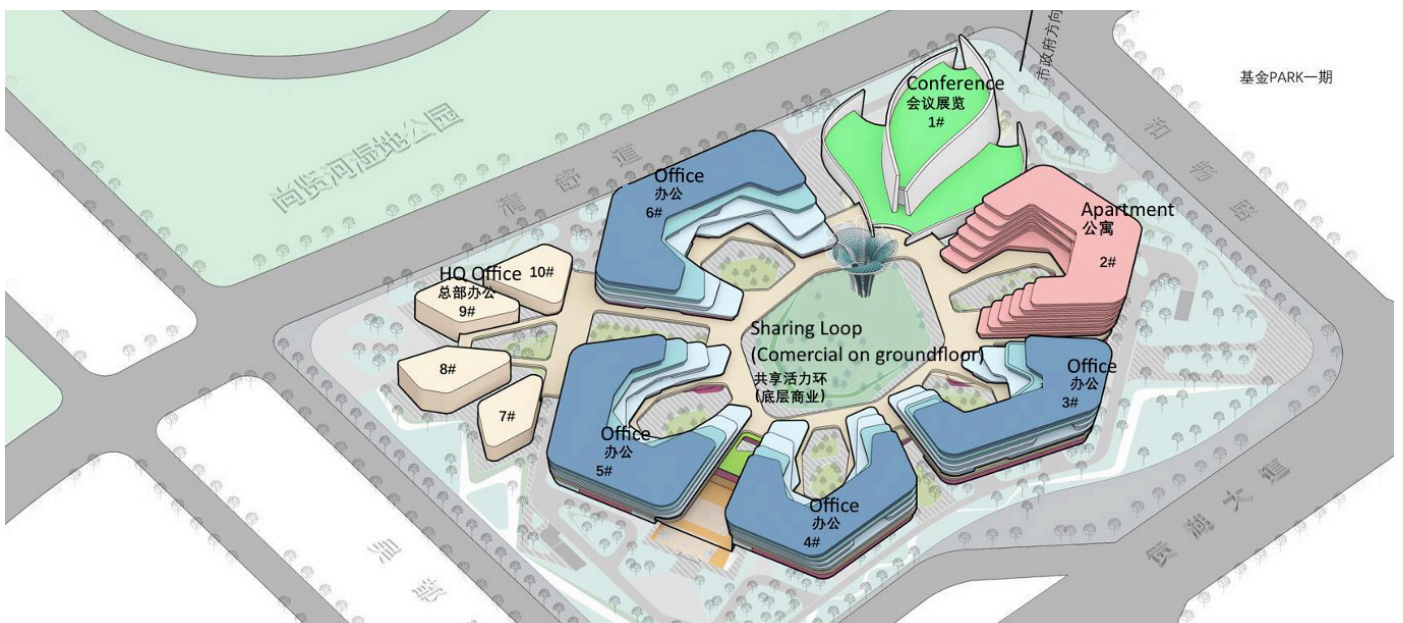


Figure 4: Building Functions. Source: Project Presentation 14.03.2023 © AAI Int'l Architect Office

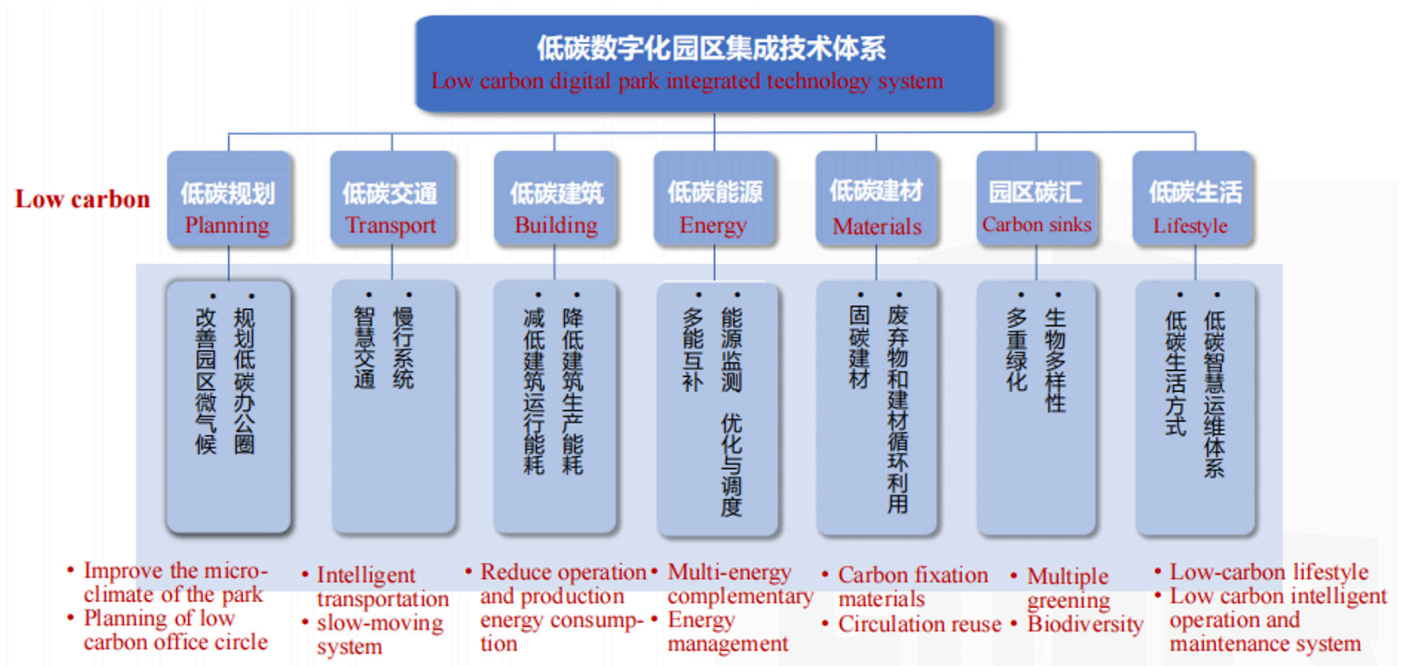


Figure 5: Integrated Low Carbon Technology System. Source: Project Presentation 15.03.2024 ©CABR

3. SWISS EVALUATION AND INPUTS

3.1. About the Demo Project Design Team

Architecture design:

AAI Int'l Architect Office

Landscape planning:

Shenzhen L&A Design

Construction plan:

Wuxi Urban Design Institute Co., Ltd.

ZEB advisory:

China Academy of Building Research

3.2. First inputs and suggestions

- Comprehensive energy monitoring and optimization software is being developed with focus on energy and emission reduction.
- In completion to the landscape design, including central courtyard and parks along building site, additional thought should be put into the watering system.
- Further consideration of rainwater management and reuse, sponge city concept.
- Airflow analysis of the central sunken park.
- The thorough analysis of mobility in between the district itself and connecting the district to its surrounding can add a lot to energy saving and the overall wellbeing.
- Facility Management during planning and construction could be adopted.
- Suggested high performance window products from the above-mentioned RTIS will be used.
- The project impresses with a holistic approach to sustainability, which makes statements about mobility and sustainable lifestyle.
- While the architectural design creates an unfortunately large surface area of the building envelope, it offers large terrace and roof areas that are well suited for greenery and PV.

3.3. Reaction of DP team and concept improvement

- Carbon sink and park greening had been fully considered in the design.
- The further consideration of rainwater management and reuse, sponge city concept is already accepted in the design.

3.4. Further swiss inputs and suggestion

- Recommendations on the choice and lifecycle management of the building materials used. The use of recycled material in the landscaping deserves a warm welcome.
- Ground source is recommended and could be optimized in efficiency applied as an energy network.
- U-Value for glazing should be optimized.
- The low carbon building material concept and PV & greenery
- The low carbon lifestyle incl. mobility.

3.5. Further improvement and knowledge received

Landscape Design: The Wuxi team will provide subsequent landscape design drawings. Regarding the selection of vegetation, the emphasis is primarily on using local plants, considering both the height variation of the vegetation and biodiversity. Additionally, there are plans to incorporate design elements such as rain gardens and sponge cities to achieve a balance between overall design aesthetics and functionality.

3.6. Calculations

Final calculations

- Reference Building: 32.67 kWh/m²a
- Design Building: 21.58 kWh/m²a
- Total energy demand: 217' 850 kWh/a
- Yield of PV system: 26.52 kWh/m²a
or 267' 700 kWh/a (excl. PV of neighboring building or landscape architecture)
- Carbon intensity indicator: 0.00 kg CO₂ eq/m²a

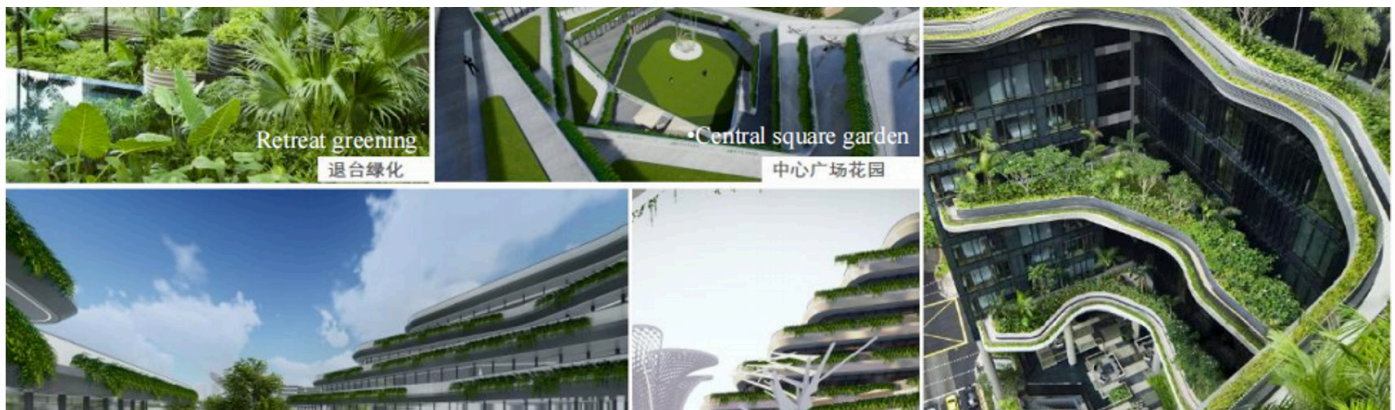


Figure 6: Micro-Climate Design. Source: Project Presentation 14.07.2023 ©CABR



Figure 7: Sponge City Landscape Design. Source: Project Presentation 14.07.2023 ©CABR



Figure 8: Rendering after optimization. Source: Project Presentation 04.2024 © AAI Int'l Architect Office

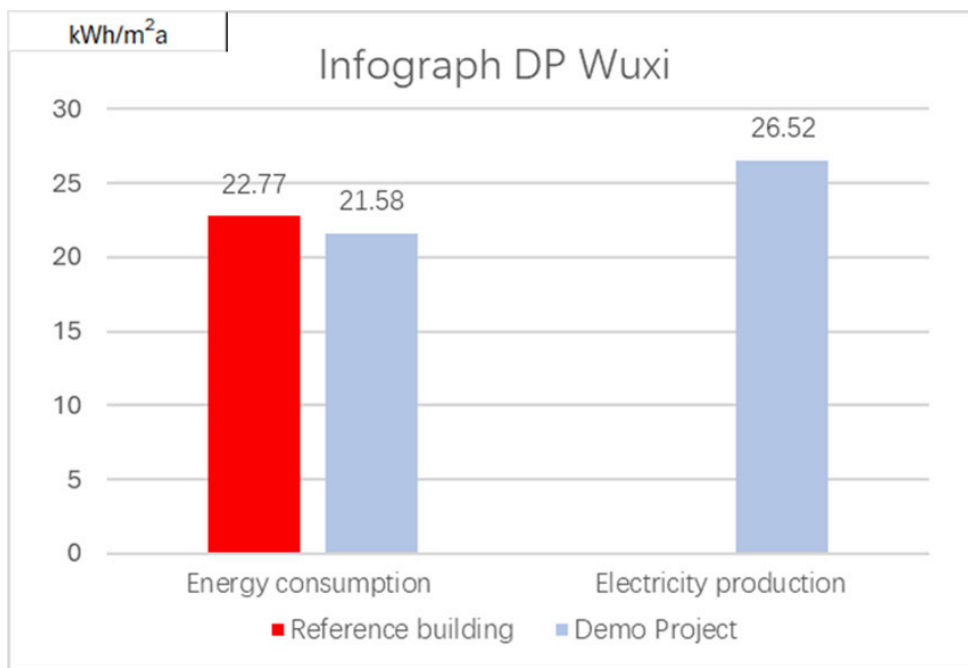


Figure 9: Infograph Energy Calculation DP Wuxi. Source: Sino Swiss ZEB Project

4. OUTCOME/REACHES

4.1. Confirmation of ZEB demo project

Confirm, that the project has big potential to be qualified as “Zero Carbon Building” required in ZEB Standards, especially in the operational phase.

Confirm, that the project considered the carbon emission throughout the whole life cycle and did its best to reduce the embodied emission as much as possible.

4.2. Testimonials from Demo Project Team

Project Architect: Zhang Miao

Wuxi Taihu New City Urban Development Co., Ltd.

In response to the dual carbon policy, we are promoting actions to reduce costs, consumption, and carbon emissions. Focusing on the natural conditions suitable for areas with hot summers and cold winters, we comprehensively apply multiple green energy-saving technologies in aspects such as buildings, equipment and facilities, and energy utilization. With the joint efforts of Chinese and Swiss zero-carbon expert teams, we aim to create replicable and promotable zero-energy conference buildings and low-carbon industrial office park demonstration projects throughout their entire life cycle.

Energy Consultant: Zhang Chengjie

Wuxi Taihu New City Urban Development Co., Ltd.

We choose efficient and energy-saving systems suitable for the project’s characteristics, install high-efficiency cooling and heating equipment, fully recover and utilize surplus cooling and heat, and comprehensively utilize renewable energy. By employing various energy storage methods, we achieve energy load shifting and peak shaving for the project, thereby truly reducing building energy consumption and achieving energy savings and carbon reduction.

Investor: Wuxi Taihu New City Urban Development Co., Ltd.

Facing new changes, new patterns, and new development situations, we are guided by the philosophy of establishing before breaking, piloting first, and leading by example. We firmly shoulder social responsibilities and corporate duties, plan future development directions, and actively collaborate with outstanding domestic and international teams to develop new productive forces. On this new track, we inject new momentum, gradually forming a diversified and complementary green low-carbon industrialization, low-carbon building clustering, intelligent and flexible energy supply and consumption, lifecycle energy storage, comprehensive and transparent energy management, and a comprehensive green low-carbon strategy.



5. LESSONS LEARNED

5.1. Management and organization

The short design phase in China is very challenging for the Swiss expert team. Effective and continuous communication with the DP team is crucial for the development of the project. The Swiss team was required to respond promptly to the DP team's enquiries and provide quick inputs to ensure swift integration of ideas into the project within the limited timeframe.

Concrete factors and numbers are more persuasive than words or theory. For instance, through the utilization of a calculation tool developed by a Swiss expert, the Swiss team communicated with the DP team in a very constructive way. The project effort is a common achievement of Sino-Swiss joint team.

5.2. Technical solutions

China is primarily committed to zero-carbon initiatives by reducing the energy consumption of buildings (such as through external insulation systems and glass curtain walls), improving the efficiency of electromechanical equipment, and increasing the utilization of renewable energy (such as photovol-

taics and geothermal heat pumps). Currently, China focuses more on the operational phase in zero-carbon building initiatives, while aspects like embodied carbon and the reuse of building materials still require further attention.

5.3. Communication and Cooperation

The following formats and means of communication were actively used in the project procedure:

Charrettes incl. technical response by the Swiss team

- Kick-off charrette
- Update charrette
- Offline workshop and onsite visit
- Kick-off meeting on building automation and smart control

Joint charrettes with all three DPs from first batch

- ZEB Duty Book
- Circular construction
- Fire safety of timber structures
- Facility management and ZEB operation



Figure 10: The Sino-Swiss experts team are visiting Wuxi demo project site. 24.10.2023

- Zero Emission District
- Computational fluid dynamics (CFD) Simulation
- Green PV
- Swiss technologies and products

Rapid technical input sheets (RITS) about:

- BIPV solutions incl. façade PV and photovoltaic tiles, local product manufacturer recommendations
- KBOB – Swiss Coordination Conference of Building and Property Bodies of Public Sector Developers
- Low carbon cement LC3
- High performance windows and doors
- Facility management
- Shading systems and products
- Greenery and PV

Q&A sheet and further thematic inputs on:

- ISO norm and SIA2040
- U-value / visible light transmission (VLT)
- Heat recovery / air handling unit / AC
- Earth tubes for ventilation system

Further performances:

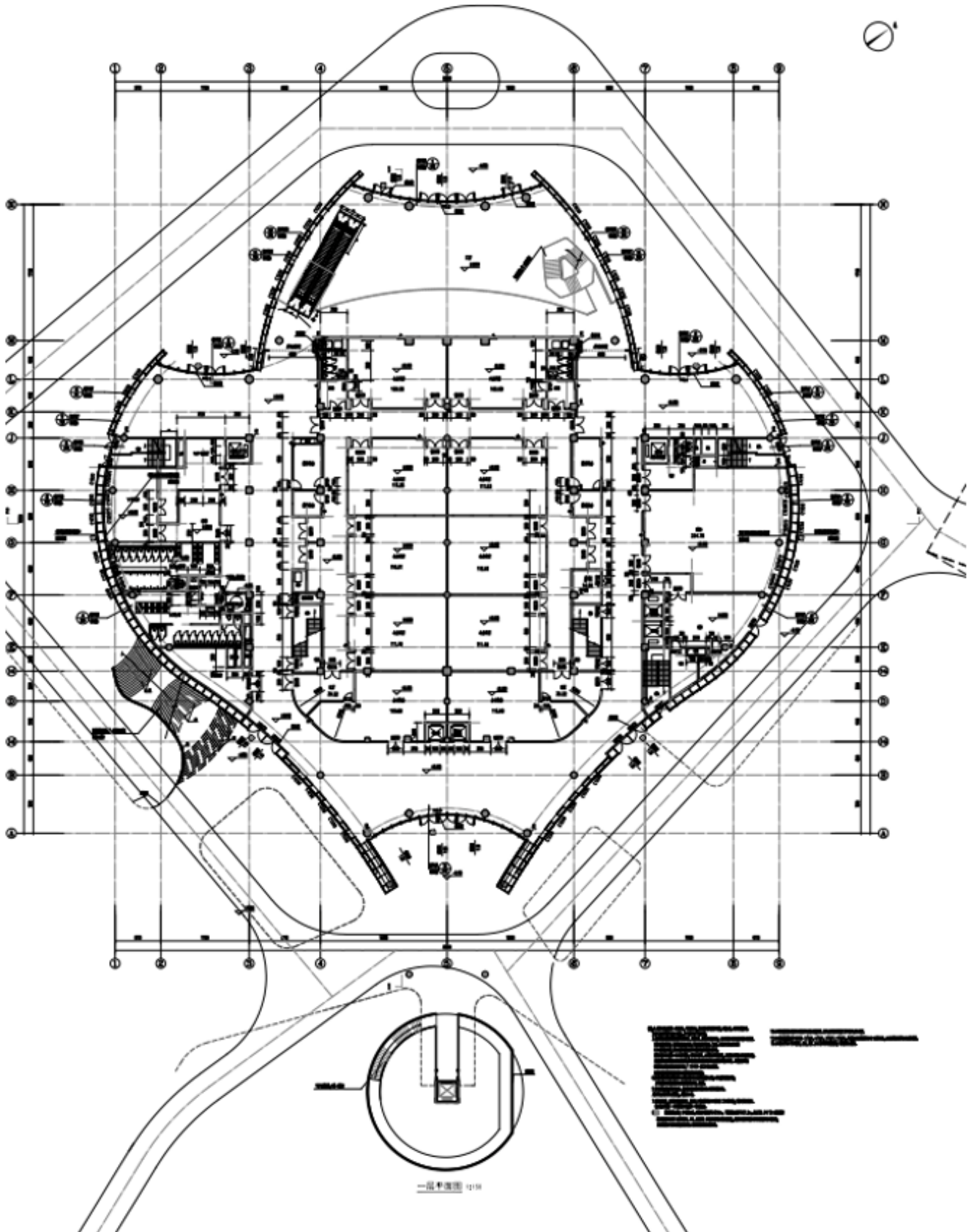
- ZEB Duty Book developed, shared and presented
- Regular exchanges and discussions per WeChat, telephone and email
- Site visit and technical exchange on construction site
- Public and internal ZEB Talks on various ZEB topics
- Booklet regarding ZEB policies, regulations, standards, concepts and techniques
- Exchanges and discussion on events like National NEZB Conferences and the Sino-Swiss Industry University Research Collaboration Forum on Zero Emission

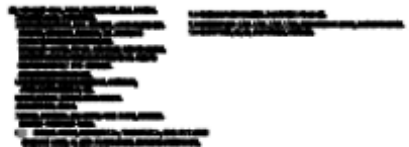


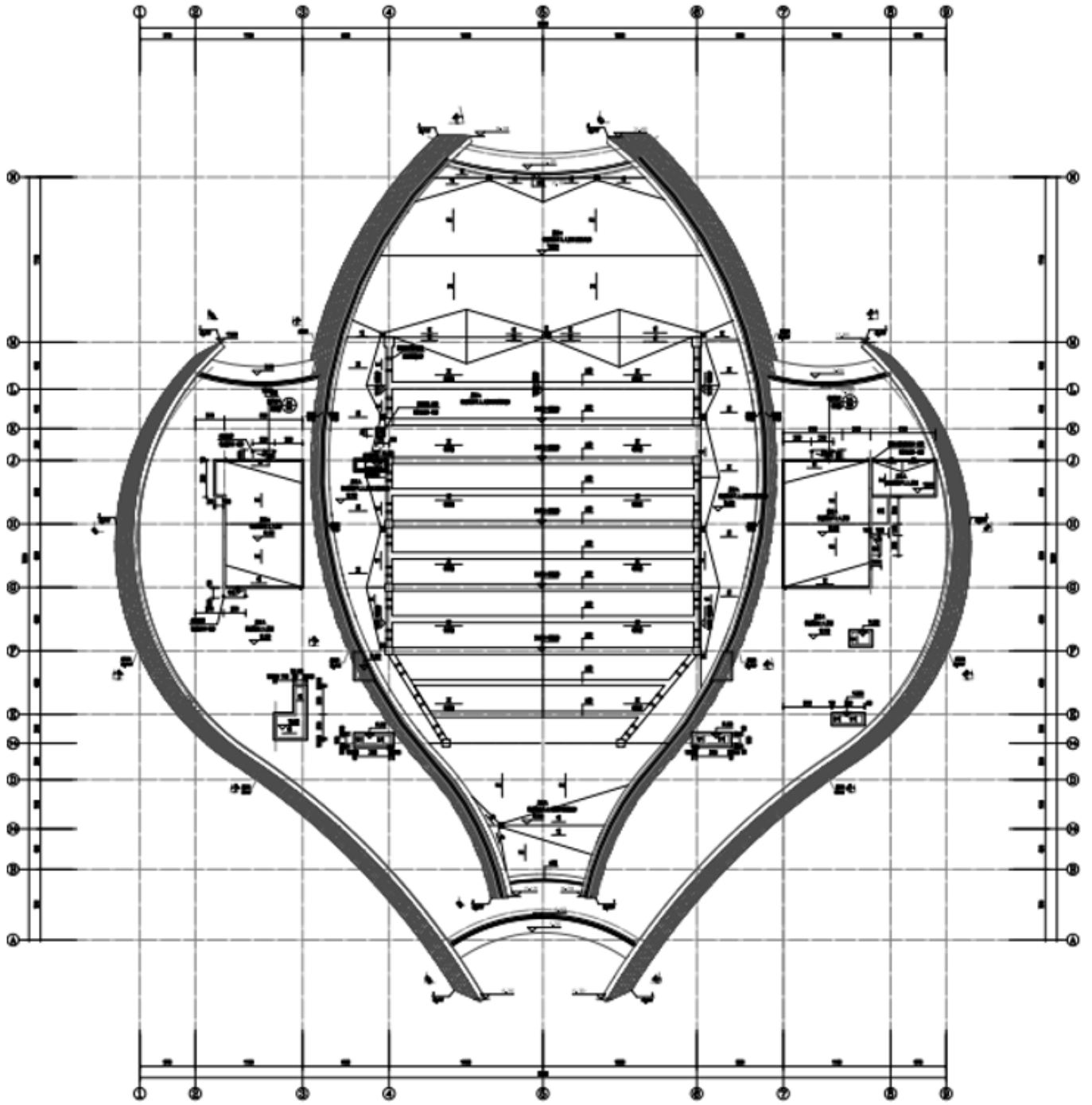
Figure 11: construction site, summer 2024. Source : Wuxi Urban Design Institute Co., Ltd.



Annex 1.Plans







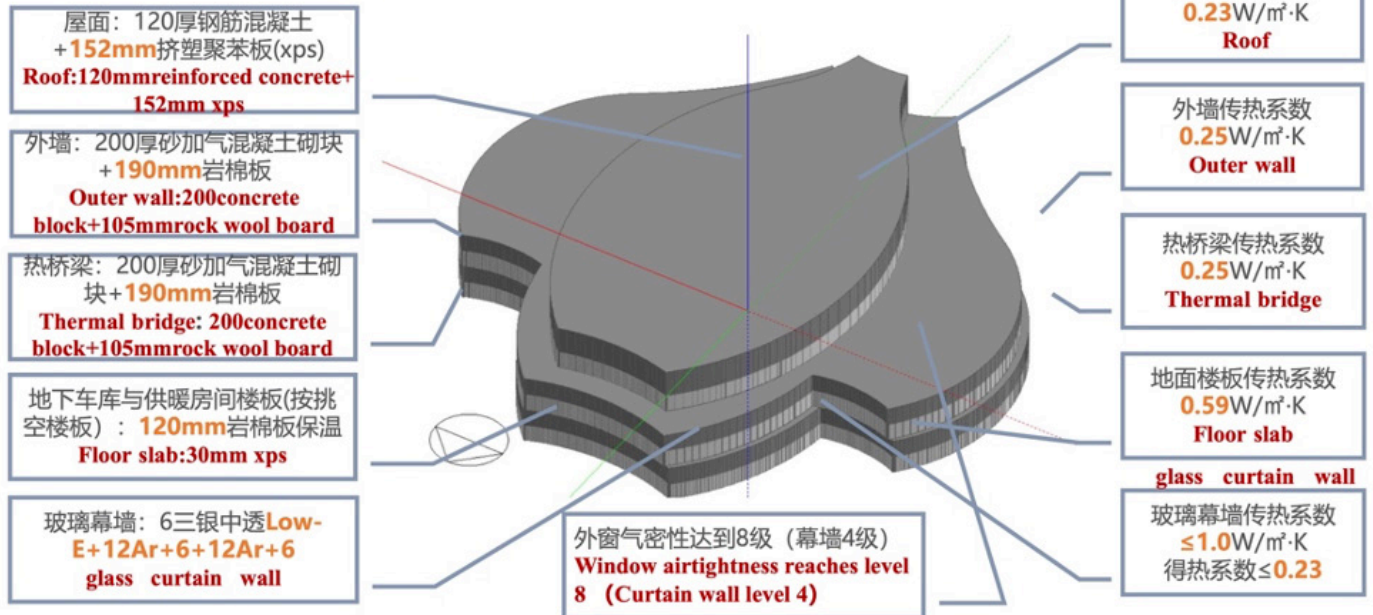
顶层平面图 1:100

Annex 2. Energy concept



建筑低碳技术 Low technology

被动式/围护结构优化 (1#的做法)

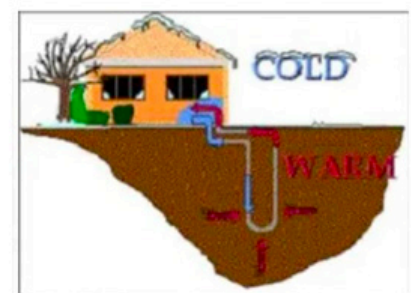
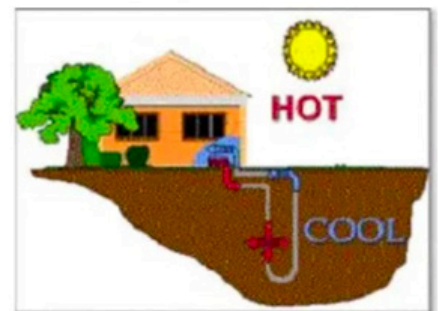


Schema of building envelope



地埋管系统 Buried pipe system

Schema of geo-sourced heat pump system





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