

Zero Emissions Building China

Sino-Swiss Cooperation on Zero Emissions Building

ENGLISH VERSION
NOVEMBER 2025



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development
and Cooperation SDC



中华人民共和国
住房和城乡建设部

IBEE 环能科技

intep

SKAT Partners for Impact



“ The Sino-Swiss Zero-Emission Building Project has seized the opportunities presented by the “dual carbon” goals and has garnered widespread attention from universities, enterprises, research institutions, and other stakeholders both in China and abroad ”

Greeting from Mr Li Zhe

Deputy Director General

Department of Planning, Finance, and Foreign Affairs

Ministry of Housing and Urban-Rural Development



Against the backdrop of continuously deepening global climate governance and the comprehensive advancement of China's “dual carbon” strategy, the green and low-carbon development of the building sector is at a critical stage of transformation and upgrading. The Sino-Swiss Zero-Emission Building Project Achievement Report systematically summarizes the practical experience of Chinese and Swiss experts over the past five years in areas such as standard development, technological innovation, demonstration projects, and education and training, providing valuable references for the development of replicable and scalable zero-carbon buildings in China.

In recent years, the Ministry of Housing and Urban-Rural Development has thoroughly implemented the decisions and plans of the Central Committee of the Communist Party of China and the State Council, accelerating the transformation of urban and rural development methods. As a result, the level of green and low-carbon development in urban and rural areas, as well as the quality of human settlements, has continuously improved, driving the green and low-carbon transition in urban and rural development. The Sino-Swiss Zero-Emission Building Project has seized the opportunities presented by the “dual carbon” goals and has garnered widespread attention from universities, enterprises, research institutions, and other stakeholders both in China and abroad. Looking ahead, we anticipate building on the existing achievements to further deepen and expand cooperation, consolidating and enhancing the partnership between the two countries in the field of sustainable development. We believe that the advanced experiences, technical standards, and demonstration models developed through the project can be applied and promoted in more countries and regions, making greater contributions to the global response to climate change challenges.

Thank you all!



“ Together, we have not only given life to zero-emission buildings, but also laid the foundations for a climate-neutral, sustainable, and resilient future ”

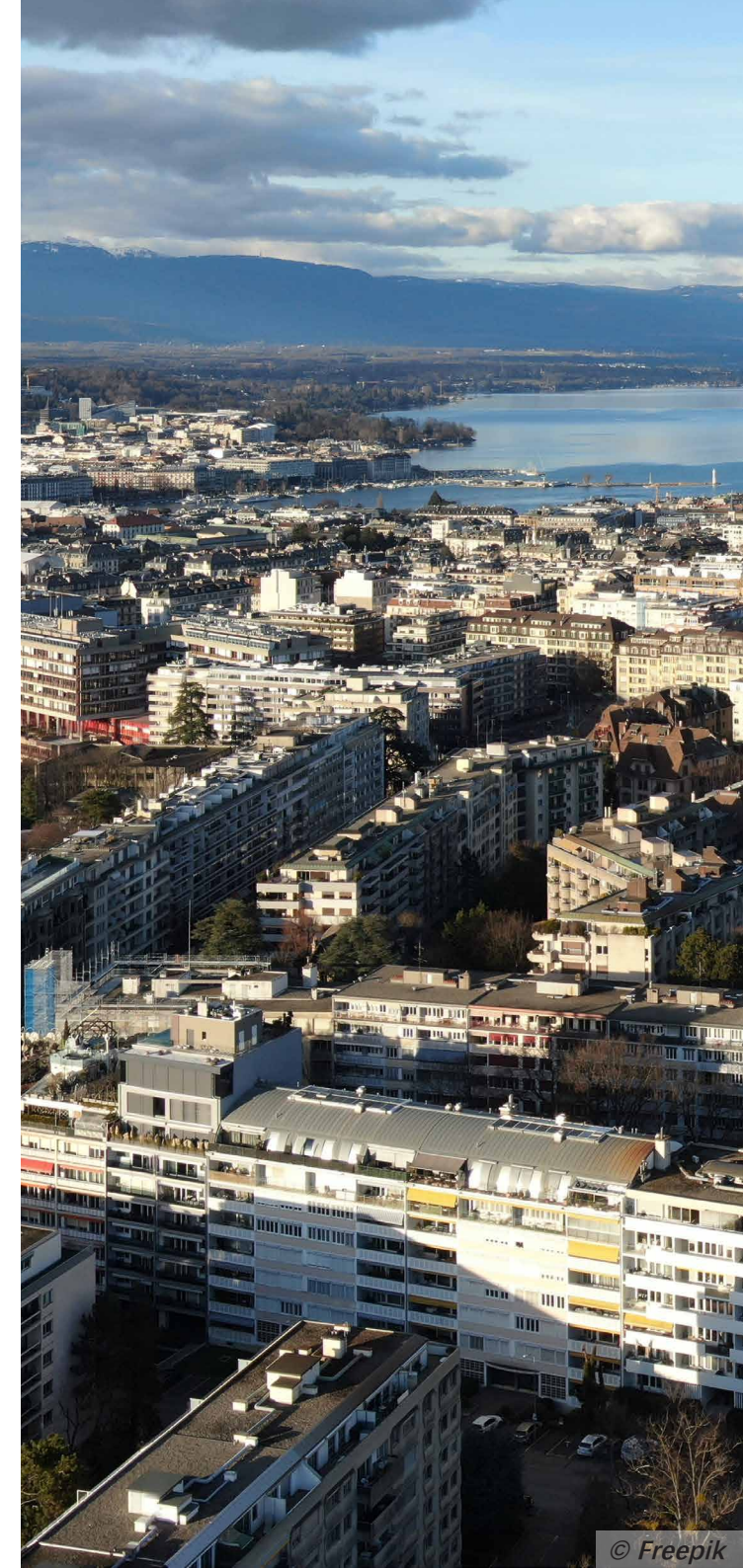
Greeting from Barbara Profeta
Head of the Swiss Agency for Development and Cooperation
Beijing Office

It is with great pride and appreciation that I present this final report of the Sino-Swiss Zero Emission Building (ZEB) Project, marking the conclusion of a successful five-year journey of cooperation, innovation, and shared commitment to addressing a global challenge.

Launched in 2021 under the framework of the Memorandum of Understanding on Development Cooperation in the Field of Energy Efficiency in Buildings, signed between the Swiss Federal Department of Foreign Affairs and the Ministry of Housing and Urban-Rural Development of China (MOHURD), this project represents a milestone in the longstanding partnership between Switzerland and China in the area of carbon emission reduction in the building sector. It also underscores the very good diplomatic relationships existing between our two countries, whose 75th anniversary is precisely celebrated in 2025.

Over the past five years, the ZEB Project has achieved several tangible results, such as the formulation of China's National Zero Carbon Building Standards, and the involvement of Chinese prominent investors in the realization of ten demonstration buildings across different climate zones, ranging from Shenzhen to Harbin and from Shanghai to Hanzhong. The combination of a (non-binding) normative framework, addressing both new and existing, as well as urban and rural architectures, and practical showcasing of the potential of quality zero carbon emission investments is set to guide China's building sector toward a significant contribution to global carbon footprint reduction, and to inspire other countries along the way. Beyond technical results, the project's strong emphasis on capacity building and knowledge exchange has granted access to training and learning opportunities to more than 5,000 professionals, government officials, and students, thereby strengthening the human and institutional foundations for future Sino-Swiss cooperation.

On behalf of SDC, I extend my heartfelt gratitude to all our partners - MOHURD, the China Academy of Building Research, Intep, SKAT, and the Swiss Green Building Association - as well as to the many experts, architects, researchers, and students who have contributed their dedication and creativity to this initiative. Together, we have not only given life to zero-emission buildings, but also laid the foundations for a climate-neutral, sustainable, and resilient future.



This report has been produced within the framework of the 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.

Authors

Dr André Ullal, SKAT Consulting

Dr Feng Lu-Pagenkopf, Intep Integrated Planning

Roland Stulz, Intep Integrated Planning

Fabienne Hugi, SKAT Consulting

Jilong Zhu, Intep Integrated Planning

Contributors

Dr Shicong Zhang, China Academy of Building Research

Dr Xinyan Yang, China Academy of Building Research

Yin Li Architectural Design and Sustainable Consulting

Design and layout

SKAT Consulting

Cite as

Ullal, A., Lu-Pagenkopf, F., Stulz, R., Hugi, F., Zhu, J. (2024). Sino-Swiss Zero Emissions Building Project Consolidation Report. Intep-Skat: Zurich

Cover image licensed from Getty Images

CONTENTS

1

INTRODUCTION

1

Building sector emissions
Sino-Swiss cooperation on
zero-emissions building

2

STANDARDS

5

Switzerland's path to
reducing building sector
emissions

China's path to reducing
building sector emissions

Urban-scale evaluation of
current standards

National-scale evaluation of
current standards

ZEB Certification

ZEB Incentives

Interview with Dr ZHANG
Shicong, China Academy of
Building Research

3

SOLUTIONS

13

Energy efficiency

Renewable energy

Circular construction &
design for disassembly

Low-carbon building
materials

Districts

Networks

4

DEMONSTRATION

21

Gongchen Community
Centre, Beijing

Shanghai Jiading Future City

Training Building of Long
Shan Shu Yuan, Shaoxing

Shenzhen Nanshan Energy
Ecological Park Zero Carbon
World

Wuxi Shangxian Lake Low-
Carbon Digital Industrial
Park

Liuba County Chinese Bee
Museum

Taixing Development Zone
Waterworks

Office Building Complex in
Harbin

Interview with Mr LU
Jianping, Wuxi Taihu
New City Construction
Engineering Group

5

EDUCATION

39

University lectures and
seminars

Interview with Prof. HE
Yong, Zhejiang University

ZEB Talks

Mayor Training



1 INTRODUCTION

The building sector accounts for roughly one-third of global greenhouse gas (GHG) emissions, including those from material production and energy use during building operation. Reducing these emissions is essential to mitigating global warming and meeting the Paris Agreement targets.

Switzerland and China have set ambitious goals for building sector emissions. Switzerland's Climate and Innovation Act (2023) targets an 82% reduction by 2040 and full decarbonization by 2050 (relative to 1990). China's Action Plan for Carbon Dioxide Peaking in the Construction Sector (2022) and Action Plan for Accelerating Energy Conservation and Carbon Reduction in the Building Sector (2024) aim to improve energy efficiency and integrate renewables, supporting national goals to peak emissions by 2030 and reach net-zero by 2060. Given the scale of China's construction sector, progress there is vital for global climate efforts.

The Zero Emissions Building (ZEB) China Project brings together Swiss and Chinese expertise to advance building sector decarbonization. Supported by the Swiss Agency for Development Cooperation and China's Ministry of Housing and Urban-Rural Development, the project promotes development of national and provincial ZEB standards and demonstrates their application in building projects across China. It also fosters knowledge exchange among officials, professionals, and students on reducing building-related emissions.

This report introduces the ZEB China Project and its contributions to emissions reduction in the building sector. It complements the website <http://zeb-china.org>, which showcases Swiss and Chinese collaboration and expertise in addressing the challenge of building sector decarbonization.



1.1 Building sector emissions

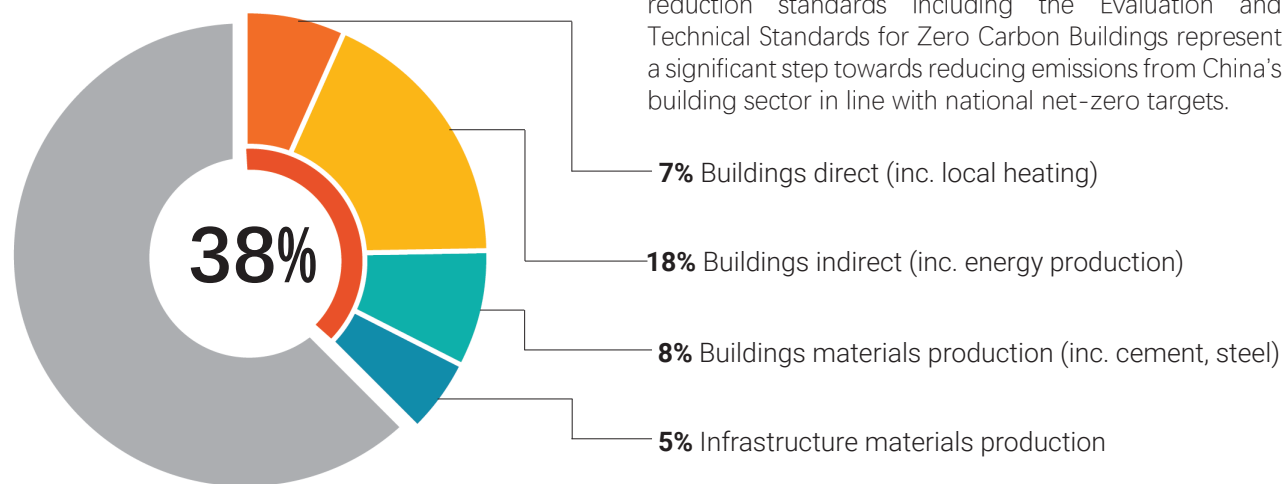
The buildings and construction sector remains a major contributor to global greenhouse gas emissions, accounting for 34% of energy-related CO₂ emissions and over 32% of energy demand in 2023. Despite growing awareness and some progress - such as increased adoption of renewable energy and green building certifications - the sector is not on track to meet net zero targets. Emissions have risen 5% since 2015, far from the 28% reduction needed by 2030. Embodied carbon from materials like steel and cement remains a key challenge, underscoring the urgent need for stronger policies, investment, and global coordination.

The challenge of building sector emissions is especially acute in rapidly urbanizing nations such as China. In 2022, carbon emissions from China's building sector reached 513 million tonnes of CO₂, representing 48.3% of the country's energy-related emissions. In the same year, emissions from building operations rose by 2.7%, or 60

million tonnes, compared to 2021, reflecting an average annual growth rate of 3.0% over the past five years. China has committed to peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. However, with continued expansion in new construction and rising living standards, unchecked energy consumption in the building sector could pose a major barrier to reaching these climate goals.

Looking ahead, China's construction sector is expected to remain active through 2060, driven by ongoing urbanization, infrastructure upgrades, and population shifts. Although the pace of new construction may slow, the total building stock will continue to grow, increasing the demand for energy and materials. Without intervention, this could lead to a continued rise in emissions.

China has committed to achieving carbon neutrality by 2060, and the building sector is central to this goal. The promulgation of building energy efficiency and emissions reduction standards including the Evaluation and Technical Standards for Zero Carbon Buildings represent a significant step towards reducing emissions from China's building sector in line with national net-zero targets.



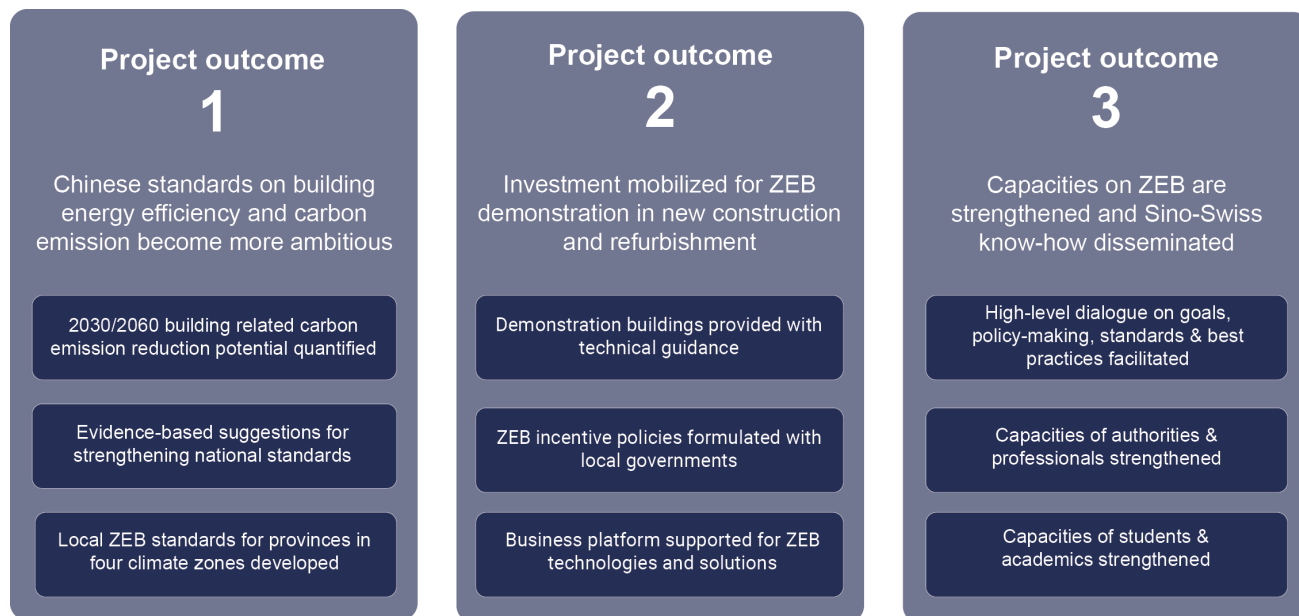
Global building sector proportion of total CO₂e emissions. Based on data from United Nations Environment Programme (2025). Global Status Report for Buildings and Construction 2024/2025 (p.14). Paris. <https://wedocs.unep.org/20.500.11822/47214>

1.2 Sino-Swiss Cooperation on Zero Emissions Building

The ZEB-China project is a collaborative initiative between China and Switzerland aimed at reducing emissions in China's building sector. Launched under a Memorandum of Understanding signed on 24 November 2020 by the Ministry of Housing and Urban-Rural Development of China and the Swiss Federal Department of Foreign Affairs, the project promotes international cooperation in building energy efficiency. Funded by the Swiss Agency for Development and Cooperation (SDC), ZEB-China supports China in developing zero carbon building standards and long-term decarbonization strategies. Switzerland contributes technical expertise, showcases zero emission demonstration buildings across four climate zones, and conducts capacity-building activities.

The project is underpinned by the objective of reducing greenhouse gas emissions and enabling the carbon neutral development of the building sector in China through achievement of three project outcomes:

- 1) Chinese standards on building energy efficiency and carbon emission become more ambitious;
- 2) Mobilisation of investments in ZEB-compliant new construction and building retrofit projects
- 3) Strengthening of capacities on building emissions reduction through dissemination of Sino-Swiss know-how





Shanghai © Freepik



Geneva © Freepik



2 STANDARDS

Zero Emissions Building (ZEB) standards define the performance and technical criteria required for buildings or districts to be recognized as zero-emission. These standards are part of broader regulatory frameworks aimed at reducing both operational and embodied CO₂ emissions. They are context-specific, reflecting national, provincial, and local priorities as well as environmental and regulatory conditions.

China has rapidly advanced its building energy and emissions standards in recent years. Key developments include national standards for carbon emission calculation (GB/T 51366-2019), energy efficiency and renewable energy integration (GB 55015-2021), and a draft technical standard for zero carbon buildings released for public consultation in 2024. These efforts align with China's ambitious carbon neutrality targets.

Switzerland, by contrast, has a long-standing tradition of regulating building energy performance through federal, cantonal, and municipal instruments, supported by standards from the Swiss Society of Engineers and Architects (SIA). Swiss frameworks emphasize energy efficiency and sustainability, with standards like Minergie serving as benchmarks.

To support China's standard development, the project team conducted a comparative analysis of Chinese and Swiss standards, offering recommendations to optimize China's national ZEB criteria.



2.1 China's path to reducing building sector emissions

China's regulatory journey toward building energy efficiency and zero emissions buildings (ZEB) has evolved in response to rapid urbanization and rising energy demand. In the 1980s and 1990s, early efforts focused on improving thermal comfort and basic energy conservation, with regional standards addressing insulation and heating. These laid the foundation for more comprehensive national regulations.

In the 2000s, China formalized its approach through national building codes and standards, coordinated by the Ministry of Housing and Urban-Rural Development (MOHURD). These introduced mandatory requirements for thermal performance and energy systems in new buildings. The focus gradually expanded to include broader sustainability goals, supported by institutions like the China Academy of Building Research.

The 2010s marked a shift toward integrating energy efficiency into climate policy. China launched green building pilot programs and began addressing embodied emissions and renewable energy integration. Key milestones included the GB/T 51366-2019 standard for carbon emission calculation and GB 55015-2021 for energy efficiency and renewables.

Following its 2060 carbon neutrality pledge, China accelerated ZEB development. In 2024, a draft national technical standard for zero carbon buildings was released, reflecting international best practices and domestic innovation. Collaborative efforts, such as the Sino-Swiss ZEB project, supported refinement of these standards through comparative analysis and engagement with provincial authorities.

China's regulatory evolution reflects a transition from basic energy-saving measures to a comprehensive framework targeting lifecycle emissions, renewable integration, and regional adaptation. With ZEB standards now central to climate goals, China is positioning its building sector as a contributor to climate action.

*Action Plan for Carbon Dioxide Peaking
in the Construction Sector, 2022*

*Work Plan for Accelerating Energy Conservation and Carbon
Reduction in the Construction Sector, 2024*

*GB 50189-2015
Design standard for energy efficiency of public buildings*

*GB/T 51350-2019
Technical standard for nearly zero energy buildings*

*GB/T 51366-2019
Standard for building carbon emission calculation*

*GB 55015-2021
Design standard for energy efficiency & renewable energy in buildings*

*T/CABEE 080-2024
Testing and evaluation standard for zero carbon buildings*

*GB/T xxxxx-202x
Technical standard for zero carbon buildings*

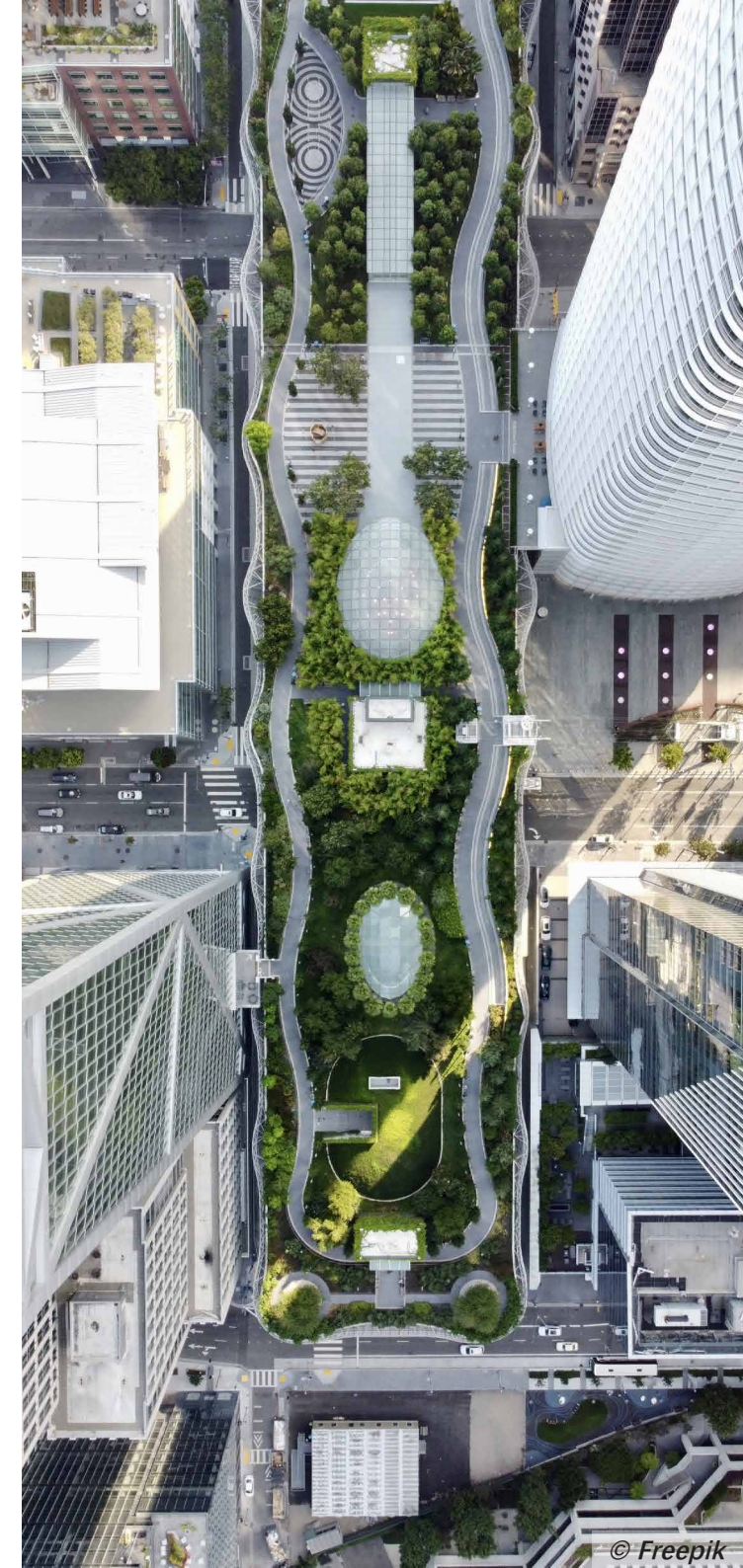
*JGJ 26-2010
Design standard for energy efficiency of residential
buildings in severe cold and cold zones*

*JGJ 75-2012
Design standard for energy efficiency of residential
buildings in hot summer and warm winter zone*

*JGJ 134-2010
Design standard for energy efficiency of residential
buildings in hot summer and cold winter zone*



*Policy Report
Zero Emissions Building Standards - A
comparative analysis of China & Switzerland
Low Tech Labs*



2.2 Switzerland's path to reducing building sector emissions

Switzerland's path toward zero emissions buildings (ZEB) is rooted in over five decades of progressive technical regulation, policy innovation, and stakeholder collaboration. The journey began in the 1960s with efforts to address indoor comfort and structural issues caused by poor thermal performance. The 1970s oil crisis catalyzed the development of energy efficiency standards, leading to the first national technical regulations issued by the Swiss Society of Engineers and Architects (SIA).

By the 1990s, Switzerland had introduced harmonized model regulations (MuKEN) to unify cantonal standards and launched national programs like "Energie 2000" (now EnergieSchweiz) to promote energy efficiency and renewable energy. The 2000s saw a shift toward life-cycle thinking, with regulations addressing not only operational energy but also embodied emissions and renewable integration. Labels like MINERGIE and GEAk became benchmarks for high-performance buildings.

In 2019, Switzerland adopted a national target of net-zero greenhouse gas emissions by 2050. This led to stricter building codes, including bans on fossil fuel heating systems in many cantons and requirements for nearly zero-energy performance in new buildings. The focus has shifted from improving new construction to decarbonizing the existing building stock, which accounts for the majority of emissions.

Switzerland's approach emphasizes a mix of legal mandates, financial incentives, voluntary certification schemes, and continuous stakeholder engagement. The next generation of technical regulations is expected to adopt a life-cycle approach, regulating emissions across construction, operation, and decommissioning phases. Key strategies include promoting district-level energy solutions, simplifying compliance through prescriptive "sample solutions," and prioritizing rapid decarbonization of heating systems.

Key takeaways from Swiss experience of technical regulation for energy and emissions in the building sector

- Only a target-defined policy framework with a clear and long-term reduction path with gradual ratcheting up of TERs gives the necessary predictability for investors, planners, and technology providers
- Successful policy implementation for ZEB needs a diverse ecosystem of measures with three main pillars
- Effective TER must be simple and easy to apply and must be supported by practical guidelines
- Monitoring and field evaluation of real-life performance is a key element to successful implementation
- Flexibility in the enforcement organization helps to achieve effective implementation
- Effective norms and regulations for ZEB need to refer to primary energy demand and life-cycle emissions
- Robust technology that is applied and optimized on a district scale is needed to increase market reach of ZEB effectively
- The fast decarbonization of the energy sources of heating systems is becoming a priority for achieving carbon emission goals on time
- A net-zero emission building stock can only be achieved with a high renovation rate and an optimized share of replacement buildings

1

1960-1973
Ensuring a comfortable indoor climate and preventing structural damage

2

1973-1989
Piloting and anchoring technical regulation for building efficiency

3

1990-1993
Harmonizing national and cantonal technical regulation

4

1994-2014
Ratcheting up of technical regulation and focus shift to renewable energy

5

2015-2021
Net-zero emission readiness of technical regulation

Phases of development of regulation of building energy and emissions in Switzerland



Technical Report
The Swiss Decarbonisation Roadmap for 2050 & Related Policies for the Building Sector
EMPA
INFRAS



Technical Report
Swiss Experience on Technical Regulation for Energy & Emissions in the Building Sector
INFRAS

2.3 Urban-scale evaluation of current standards

China's transition to zero-emission buildings is vital to its national carbon reduction goals. A study by the Zurich University of Applied Sciences (ZHAW) Institute for Building Technology and Process assesses the impact of new zero-carbon building standards across four climate zones - Shenzhen, Harbin, Beijing, and Shanghai - using a GIS-based method to simulate energy demand and emissions in residential buildings. Each building is categorized into an archetype (e.g., terraced house, low-rise, high-rise) and assigned envelope configurations and operational schedules to model baseline energy use.

Results show significant variation in emissions by climate, building age, and type. Older buildings and terraced houses in heating-dominated regions like Harbin and Beijing have the highest emissions, reaching up to 79.4 kg CO₂eq/m²/year. Cooling-dominated Shenzhen shows lower emissions, while Shanghai presents intermediate values.

Retrofit strategies tailored to each region reveal that envelope upgrades are most effective in colder climates, while HVAC and photovoltaic (PV) improvements benefit all zones. Electrification via heat pumps and PV integration can achieve net-negative emissions in low-rise buildings with sufficient solar access.

To scale the analysis, representative urban superblocks were identified using k-means clustering based on characteristics like U-value, shape, and density. This enabled estimation of total annual emission reductions: 68,100 tons CO₂eq in Beijing, 73,606 in Harbin, 73,296 in Shanghai, and 118,390 in Shenzhen.

The superblock-level approach improves accuracy by accounting for urban form and shading effects, helping identify priority retrofit zones. The study offers valuable insights for policymakers and urban planners, demonstrating the potential of zero-carbon standards to support China's climate goals.

Key takeaways

- The study provides actionable insights for Chinese policymakers, planners, and designers to support low-carbon development & climate goals.
- The methodology offers a replicable framework to assess urban-scale impacts of zero-carbon building standards, aiding strategic planning and decarbonization.
- Residential building energy performance in China varies by climate, age, and type—older buildings and terraced houses show higher energy demand, especially in colder regions.
- Retrofit strategies must be climate-specific: envelope upgrades work best in heating-dominated areas, while HVAC and PV improvements are effective across climates; combined measures suit balanced zones.
- Decarbonizing the electricity grid is critical. A 25% reduction in grid emissions enables all superblocks to meet nearly zero-carbon thresholds under Scenario 3.
- Superblock-level analysis improves accuracy by accounting for shading and enhances the scalability of retrofit strategies.
- The framework's effectiveness depends on high-quality data—key parameters like building height, age, footprint, and superblock traits are essential.



Research Report
**Impact Simulation of the Chinese
ZEB Standard**
ZHAW Institute of Building Technology & Process

2.4 National-scale evaluation of current standards

A study by the School of Management Science and Real Estate at Chongqing University assesses the potential impact of implementing new ZEB standards across China's building sector. With buildings accounting for nearly half of China's energy-related CO₂ emissions, the study emphasizes the urgency of adopting ZEB policies to meet the country's 2030 carbon peak and 2060 neutrality goals.

Using a top-down modeling approach, the study simulates building area growth, energy consumption, and carbon emissions under multiple scenarios. It incorporates variables such as new construction scale, retrofit intensity, and ZEB penetration rates across urban residential, rural residential, and public buildings. The model spans 31 provinces and forecasts trends from 2021 to 2050.

Results show that high ZEB penetration combined with aggressive retrofitting and controlled new construction can significantly reduce emissions. In the most ambitious scenario (SC 2-2-2), carbon emissions drop to 530 million tonnes by 2050, compared to over 770 million tonnes in baseline scenarios. Early implementation of ZEB standards (by 2025) yields greater cumulative reductions than delayed adoption.

The study concludes that ZEB standards are essential for decarbonizing China's building sector. It provides policymakers with quantitative insights to guide strategic planning, emphasizing the importance of timely action, regional customization, and technological innovation to maximize carbon reduction benefits.



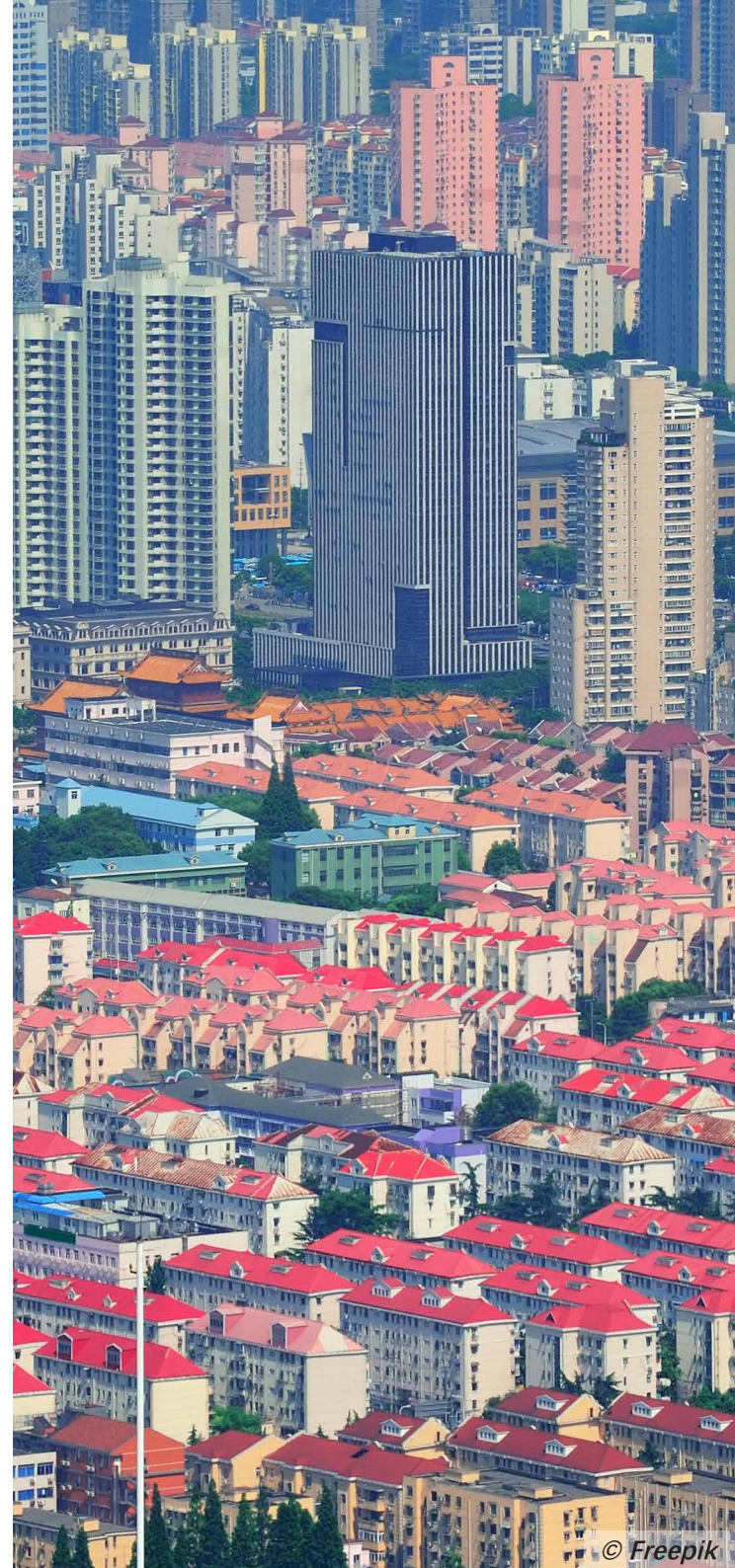
Research Report

Top-down modelling of emissions impacts of national ZEB standard implementation

School of Management Science and Real Estate at Chongqing University

Key takeaways

- **ZEB Standards Can Significantly Reduce Carbon Emissions.** High ZEB penetration combined with aggressive retrofitting and controlled new construction can reduce building sector emissions by up to 70% by 2050, compared to the baseline scenario.
- **Early Implementation Is Critical.** Promoting ZEB standards starting in 2025 leads to substantially greater decarbonization than delaying until 2035. Early action accelerates cumulative emission reductions & helps meet national climate targets.
- **Retrofit Policies Are Essential.** Retrofitting existing buildings plays a major role in emission reduction. A high retrofit rate (0.2%) nearly doubles the retrofitted area compared to a low rate, amplifying the impact of ZEB standards.
- **Urbanization and Building Demand Must Be Managed.** Even with ZEBs, energy demand continues to grow due to urbanization. Managing the scale of new construction is necessary to avoid offsetting gains from energy efficiency improvements.
- **Scenario Modeling Supports Strategic Planning.** The study's multi-scenario model provides a robust framework for policy evaluation, showing how combinations of construction scale, retrofit intensity, and ZEB adoption affect emissions trajectories.
- **ZEBs Are a Viable Path to Carbon Neutrality.** Under optimal conditions, the building sector can achieve carbon neutrality in operations by 2050, aligning with China's national climate goals and international commitments.



2.5 ZEB Certification

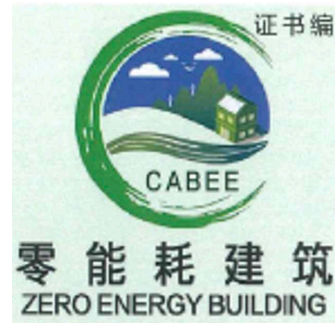
Various forms of certification are available to assess and validate compliance of a building with ZEB standards. China's Zero Carbon Building certification is part of a broader national effort to meet carbon neutrality goals. The certification is based on the Technical Standard for Zero Carbon Buildings (2024 draft under public consultation) and covers the entire building lifecycle - from design to operation and evaluation. China's Zero Energy Building certification is governed by the Technical Standard for Nearly Zero Energy Buildings (GB/T 51359-2019).

Minergie is a Swiss building certification standard focused on energy efficiency, comfort, and sustainability for both new and renovated buildings. It is one of the most widely adopted construction standards in Switzerland and has also been implemented internationally. The Shenzhen Nanshan Energy Ecological Park Zero Carbon World received Minergie-A certification – the highest level of pre-certification – highlighting the increasing alignment between Chinese and Swiss standards in ZEB certification. At urban scale, the Swiss 2000W Areal is available for certification of Zero Emissions Districts (ZED).

The certification process typically involves comprehensive assessments based on criteria such as energy efficiency, renewable energy usage, carbon emissions, and environmental impact. These certifications not only demonstrate a building's sustainability but also enhance its marketability and attractiveness to investors, while ensuring the project contributes to broader environmental and climate goals.



零 碳 建 筑
ZERO CARBON BUILDING



MINERGIE®
Besser bauen. Besser leben.



Technical Report
Zero Emissions Districts and the
2000-Watt Certificate
Intep Integrated Planning



Technical Report
Zero Emissions Districts Sustainability
Criteria
University Applied Sciences of Northwestern
Switzerland (FHNW)





2.6 ZEB Incentives

Incentives play a crucial role in encouraging the adoption of Zero Emissions Buildings (ZEB) by making sustainable building practices financially attractive. These incentives can include fiscal benefits such as tax rebates, subsidies, and other financial mechanisms that reduce the upfront costs of ZEB projects, helping to accelerate their implementation.

The project team conducted research on the Overview of Fiscal Incentives for Green Building in both Switzerland and China, offering valuable insights into how fiscal policies can support the development of sustainable buildings. Based on Swiss experience, the team provided recommendations to local authorities in China on how to adapt and implement similar incentive structures. These suggestions aim to align local fiscal policies with international best practices, fostering a more supportive environment for green building initiatives.

Swiss fiscal incentives typically focus on rewarding energy-efficient design, the integration of renewable energy sources, and the reduction of carbon emissions. In China, incentives are increasingly geared toward encouraging zero-energy and low-carbon buildings. By leveraging fiscal incentives, both countries can create more favorable conditions for the growth of the ZEB market, ensuring that sustainability goals are met while promoting innovation in green building practices.

The integration of these incentives supports the broader goal of accelerating the transition to sustainable, zero-emissions buildings by making such projects more financially viable and attractive for developers and property owners.

Beijing city	CNY 600-1,000 /m ² up to CNY 30 million
Qingdao city	CNY 200 /m ² up to CNY 3 million
Henan province	CNY 200 /m ² up to CNY 3 million
Zhengzhou city	CNY 300-500 /m ² up to CNY 15 million
Jiaozuo city	CNY 1,000 /m ² up to CNY 20 million
Hebei province	CNY 100 /m ² up to CNY 3 million
Shijiazhuang city	CNY 100-300 /m ² up to CNY 5 million
Chengde city	CNY 100 /m ² up to CNY 3 million
Baoding city	CNY 100 /m ² up to CNY 3 million
Urumqi city	CNY 10 /m ² up to CNY 1 million

Provincial and municipal financial incentives for ZEB investment.



Policy Report
Overview of Fiscal Incentives for Green Building in China
Zhejiang University School of Public Affairs



Policy Report
Overview of Fiscal Incentives for Green Building in Switzerland
Infras



“ ZEB also means future buildings with a better life quality and economically more efficient. It’s a human centred approach, thus ZEB is more than zero emissions “

2.7 Interview with Dr Zhang Shicong

Deputy Director of the Enterprise Development Department
China Academy of Building Research

Recent years have seen increased efforts to improve building energy efficiency and reduce GHG emissions from the building sector in China. What is motivating this effort?

China’s economic development and rapid urbanization in the past 40 years resulted in a construction boom, over-exploitation of energy resources, and a major contributor to smog and climate change. As the largest building sector in the world, China is responsible for some of the highest building emissions globally and accounts for 1/3 of China’s energy demand. Addressing these challenges, reducing the energy consumption of building has become a top priority for the Chinese government.

What are some of the challenges facing these efforts?

China is the third largest country in the world by landmass, with one of the most diverse climates. It also has one of the largest number of buildings and thus the largest amount of building emissions; in 2023 China’s CO₂ emissions increased, accounting for 22% of the country’s total emissions. But imagine if we could reduce building emissions to zero.

Aside from environmental benefits, what other benefits do you see from recent changes in Chinese building energy efficiency and carbon emissions standards?

Zero Emission Building is an approach that produces no net carbon emissions throughout the entire building life cycle of a building, a building cluster or a district. This means that the building’s design, construction, operation, and renovation or demolition should result in zero greenhouse gas emissions. To achieve this, ZEB must be energy-efficient, rely on renewable energy sources, and integrate technologies that minimize energy consumption and emissions at every stage. ZEB also means future buildings with a better life quality and economically more efficient. It’s a human centred approach, thus ZEB is more than zero emissions.



3 SOLUTIONS

The range and effectiveness of solutions for reducing building-related emissions is evolving rapidly with increasing recognition of the central role of the building sector in national and global emissions targets. Building emissions reduction solutions may generally be grouped into those targeting operational emissions associated primarily with energy consumption and embodied emissions primarily associated with building materials production and supply chains.

Solutions for reducing operational emissions focus on improving building energy efficiency and increasing on-site renewable energy production. Solutions for reducing embodied emissions focus on materials that are less emissions intensive, including low carbon materials, recycled materials and reused materials associated with circular construction. Beyond the building scale, district scale solutions seek to harness synergies between buildings, for example through energy and heating networks.

Application of these solutions is mediated by prevailing conditions affecting building construction and use, including economic and industrial conditions. The ZEB China project combined Swiss and Chinese expertise to review conditions and adapt solutions to promote reductions in emissions from China's building sector.

3.1 Energy efficiency

Energy efficiency in buildings involves reducing energy consumption while maintaining comfort and functionality. This can be achieved through improved insulation, high-performance windows, energy-efficient lighting, and advanced HVAC systems. Enhancing energy efficiency lowers operational emissions and contributes to ZEB objectives by minimizing the need for energy production. Moreover, energy-efficient buildings often result in cost savings over time, making them economically viable and environmentally responsible choices in sustainable design.

Building control systems manage a building's internal environment to optimize energy use and occupant comfort. These systems monitor and adjust heating, ventilation, air conditioning (HVAC), lighting, and other factors in real-time, ensuring efficient energy consumption. By leveraging smart technologies and data analytics, building control systems can drastically reduce energy waste and operational emissions. Advanced systems also enable predictive maintenance and demand-response capabilities, further enhancing sustainability and resilience in building operations.

Passive systems leverage natural environmental elements to regulate indoor conditions, reducing reliance on mechanical systems. Techniques such as passive solar heating, natural ventilation, and the use of thermal mass help maintain comfortable temperatures without excessive energy use. By designing buildings to harness these natural processes, passive systems contribute to substantial energy savings and lower operational emissions. This approach aligns with sustainable architecture principles, emphasizing harmony between the built environment and nature.



Heat network infrastructure at Frielager, Zurich



Technical Report
Building Automation and Smart Control
Willers



Technical Report
Zero-Emissions Building Design with Greenery and Photovoltaics
Lucerne University of Applied Sciences and Arts (HSLU)



Technical Report
Integrated Multi-Energy System Planning - The E-Hub Approach
Intep Integrated Planning
Symphony



ZEB Talk
High Performance Energy Recovery
Konvekta



Technical Report
Energy Networks - Shaping Low-Carbon Energy System
Anex
Intep Integrated Planning



ZEB Talk
Energy Hub - How Decentralised Energy Systems Accelerate Decarbonisation
EMPA

3.2 Renewable energy

Renewable energy sources include solar, wind, and geothermal production that provide clean alternatives to fossil fuels. For buildings solar energy harnessed through photovoltaic systems is a readily accessible source of renewable energy, with building-integrated photovoltaic (BIPV) systems increasingly incorporated in new buildings and renovation projects. The rapid uptake of BIPV systems in many countries has been facilitated by rapid improvements in related technologies. Efficiencies of photovoltaic systems has improved in parallel with cost reductions, while design options for integration of PV panels within building envelopes have expanded.

Integration of BIPV systems with electricity grids remains an important consideration and potential limitation, reducing requirements for battery systems that increase costs and reduce system efficiency.

China is well-placed to lead expansion of BIPV as the largest producer of photovoltaic systems. National policies and ZEB standards support integration of PV systems within new building and renovation projects in order to reduce reliance of emissions-intensive energy production. When combined with energy-efficient design and passive systems, renewable energy through BIPV can enable buildings to achieve net-zero energy consumption. Additionally, renewable energy integration supports grid resilience and can contribute to broader community sustainability efforts.



ZEB Talk
PV Battery Storage
Willers



Workshop Presentation
Green Photovoltaics - The Potential of the Building Envelope
Lucerne University of Applied Sciences and Arts (HSLU)



3.3 Circular construction and design for disassembly

Circular construction is a regenerative approach to building design and construction that aims to minimize waste, reduce environmental impact, and extend the lifecycle of materials. It challenges the conventional linear model of “take-make-dispose” by promoting strategies such as reuse, repair, remanufacturing, and recycling.

The ZHAW report emphasizes that circular construction is not just about material recovery but about rethinking the entire design process. It prioritizes preservation of existing structures, reuse of components with minimal processing, and recycling only when necessary. Among these, reuse is the most impactful, offering up to 90% savings in embodied energy compared to new materials.

Key principles include:

- Use of local, natural, and low-impact materials;
- Modular and reversible construction systems;
- System separation, allowing independent maintenance and upgrades of building layers.
- Design for Disassembly (DfD) to enable future reuse;

Projects like the K.118 building in Winterthur demonstrate that circular construction is both feasible and economically competitive. In such projects, the design process is reversed – driven by the availability of reclaimed materials rather than predefined forms – requiring flexibility, creativity, and deep material knowledge.

Ultimately, circular construction redefines architecture as a dynamic, adaptable system. It supports a built environment where buildings are not end-products but material banks – designed to evolve, be dismantled, and reassembled – contributing to a more sustainable, low-carbon future.



Technical Report
Circular Construction - Swiss Experiences
ZHAW Institute for Constructive Design
ZHAW Institute for Building Process



Technical Report
Zero Emissions Building Design with Low Carbon Building Materials
Lucerne University of Applied Sciences and Arts (HSLU)



Technical Report
Strategy Optimisation for Improving Demolition Material Reusability
SUP Atelier
Tsinghua University



Technical Report
Circular Construction Analysis of the Heilongjiang Cold Land Building Science Research Institute
Zirkular



Presentation
Circular Building - Best Practises in Switzerland
Baubüro In-situ



3.4 Low-carbon building materials

Low carbon building materials are essential for reducing the environmental footprint of the construction sector, which contributes over 25% of Switzerland's CO₂ emissions. These materials are defined by their low embodied carbon emissions generated during extraction, manufacturing, transport, and installation.

The report emphasizes that as operational emissions decrease through energy efficiency, embodied emissions become increasingly significant. A Life Cycle Assessment (LCA) is crucial to evaluate the full environmental impact of materials. Tools like the Swiss KBOB database and SIA 2032 guidelines help quantify emissions and guide sustainable material choices.

Key strategies include:

- Using renewable, natural materials like wood, straw, and clay
- Avoiding high-impact materials such as cement and synthetic insulation
- Designing for reuse and disassembly to extend material lifespans
- Sourcing locally to reduce transport-related emissions

Case studies, such as the timber-hybrid buildings in Rotkreuz and the K118 project in Winterthur, show that low carbon materials can be both practical and architecturally expressive. Reusing components like steel beams, windows, and façade panels can reduce emissions by up to 98%.

Ultimately, adopting low carbon materials requires a shift in mindset - from linear consumption to circular thinking - where buildings are designed as material banks, supporting a sustainable, climate-resilient future.



ZEB Talk
ZEB Design with Low Carbon Building Materials
Lucerne University of Applied Sciences and Arts



Workshop Presentation
Timber Construction in Switzerland - A Successful Revolution
ETH Zurich Institute of Structural Engineering



ZEB Talk
Decarbonising the Cement Sector and LC3
Ecole Polytechnique Fédérale de Lausanne
Laboratory of Construction Materials



ZEB Talk
KBOB - Lifecycle Assessment in the Construction Sector
Intep Integrated Planning



Technical Report
Lifecycle Carbon Emissions Calculation in China
Xi'an University of Architecture and Technology

3.5 Districts

Zero Emissions Districts (ZEDs) represent a transformative approach to urban development, integrating energy, mobility, construction, and community planning to drastically reduce greenhouse gas emissions. Rather than focusing solely on individual buildings, ZEDs adopt a systemic, district-level strategy that maximizes synergies across sectors and scales. The ZED concept emphasizes:

- Energy-efficient buildings powered by locally generated renewable energy;
- Low-carbon construction using bio-based, reused, and recyclable materials;
- Sustainable mobility, prioritizing public transport, cycling, walking, and shared mobility;
- Efficient water and waste management, promoting circular resource use;
- Green spaces and biodiversity, enhancing climate resilience and well-being;
- Social diversity and shared amenities, fostering inclusive, vibrant communities.

The report compares Swiss district labels (Minergie, SNBS, 2000-Watt District) with China's ZED standard, identifying nine shared sustainability criteria. These include operational and embodied carbon reduction, mobility, outdoor quality, planning processes, and stakeholder participation.

Case studies from China (e.g., Jiading Future City, Wuxi Fund Park II) and Switzerland (e.g., Kalkbreite, Lokstadt) illustrate how ZED principles are applied in diverse contexts. Surveys show strong stakeholder support for renewable energy, social integration, and climate adaptation, while highlighting opportunities to improve water monitoring and mobility strategies.

ZEDs offer a scalable, holistic model for climate action – turning districts into engines of sustainability, resilience, and community well-being.



Technical Report
Zero Emissions Districts - Swiss Experiences
University Applied Sciences of Northwestern
Switzerland (FHNW)



Technical Report
**Zero Emissions Districts and the
2000-Watt Certificate**
Intep Integrated Planning



Technical Report
**Zero Emissions Districts - Sustainability
Criteria**
University Applied Sciences of Northwestern
Switzerland (FHNW)



ZEB Talk
Zero Emissions Districts
Intep Integrated Planning
Centre for Science & Technology Development (CSTID)

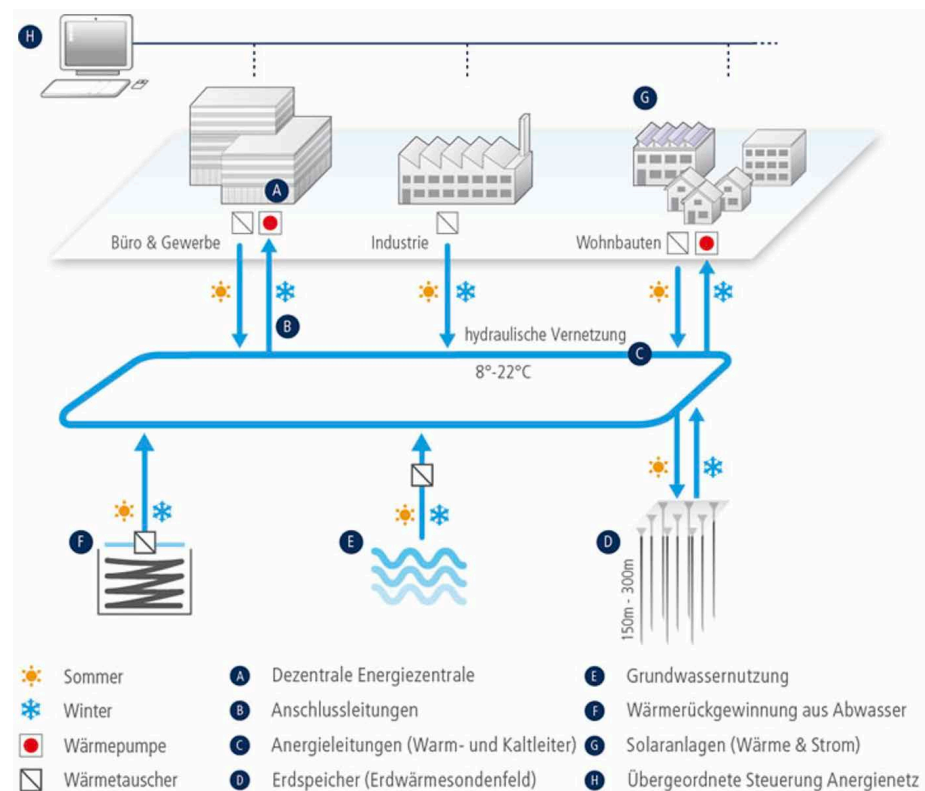
3.6 Networks

Network-based energy solutions are emerging as powerful tools for reducing emissions in the building sector. Two complementary approaches - energy networks and multi-energy system optimization (E-Hub) - show how integrated, decentralized systems can cut greenhouse gas emissions while improving efficiency and resilience.

Energy networks operate at low temperatures (8–26°C), distributing thermal energy for heating and cooling. They use water as a medium and rely on decentralized heat pumps to adjust temperatures. These networks harness local low-grade energy sources such as groundwater, lake water, and waste heat from data centres or industry. Their dual functionality enables simultaneous heating and cooling, and their decentralized design reduces transmission losses. Seasonal geothermal storage boosts efficiency by saving excess summer heat for winter. Swiss projects, including Friesenberg and Freilager in Zurich, report up to 90% emission reductions and 65% lower primary energy demand.

The E-Hub approach, developed by Sympheny, uses digital twin modelling and mathematical optimization to design multi-energy systems. In demonstration projects in Wuxi and Dalian, it identified cost-effective pathways to meet low-carbon and near-zero standards. Key strategies included integrating façade photovoltaics, thermal storage, and internal thermal networks. Life-cycle cost analysis and system-wide optimization help planners balance emissions reduction with economic feasibility.

Together, these network solutions offer scalable, flexible strategies for decarbonizing buildings. By leveraging synergies between energy sources, storage, and end uses, and by integrating renewables and waste heat, they provide a blueprint for climate-resilient urban energy systems. Their success depends on early planning, collaboration, and supportive policies that prioritize long-term sustainability.



Schematic energy network with heat and cold exchange between geothermal probe fields and buildings, groundwater, or waste heat as energy source. Source: Energienetz-gsg



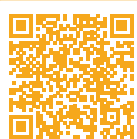
Technical Report
Energy Networks - Shaping Low-Carbon Energy System

Anex
Intep Integrated Planning



Technical Report
Integrated Multi-Energy System Planning - The E-Hub Approach

Intep Integrated Planning
Sympheny



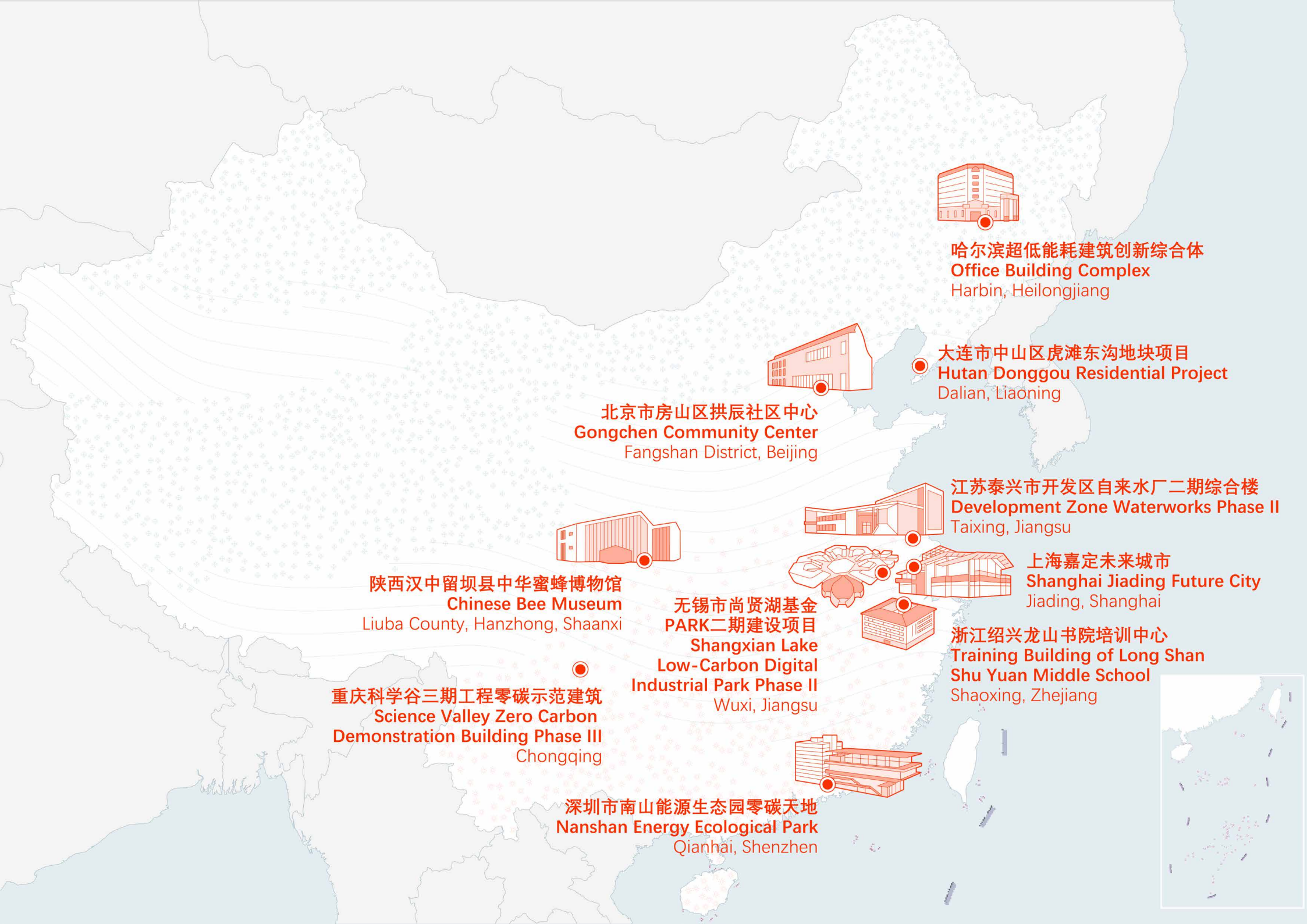
ZEB Talk
In-depth Course on Thermal Area Networking

Anex



ZEB Talk
Energy Hub - How Decentralised Energy Systems Accelerate Decarbonisation

EMPA



哈尔滨超低能耗建筑创新综合体
Office Building Complex
Harbin, Heilongjiang



大连市中山区虎滩东沟地块项目
Hutan Donggou Residential Project
Dalian, Liaoning

北京市房山区拱辰社区中心
Gongchen Community Center
Fangshan District, Beijing



陕西汉中留坝县中华蜜蜂博物馆
Chinese Bee Museum
Liuba County, Hanzhong, Shaanxi



江苏泰兴市开发区自来水厂二期综合楼
Development Zone Waterworks Phase II
Taixing, Jiangsu



上海嘉定未来城市
Shanghai Jiading Future City
Jiading, Shanghai



浙江绍兴龙山书院培训中心
Training Building of Long Shan
Shu Yuan Middle School
Shaoxing, Zhejiang

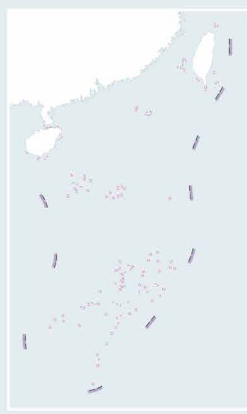


重庆科学谷三期工程零碳示范建筑
Science Valley Zero Carbon
Demonstration Building Phase III
Chongqing

无锡市尚贤湖基金
PARK二期建设项目
Shangxian Lake
Low-Carbon Digital
Industrial Park Phase II
Wuxi, Jiangsu



深圳市南山能源生态园零碳天地
Nanshan Energy Ecological Park
Qianhai, Shenzhen





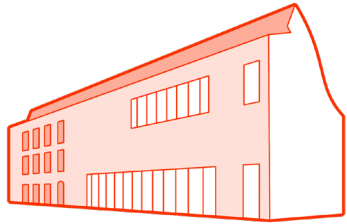
4 DEMONSTRATION

Practical demonstration of ZEB solutions in building projects is important for promoting ZEB as a feasible pathway to building sector emissions reduction. Reducing building-related emissions requires changes in the ways that we construct and use buildings. Compliance with new ZEB standards involves new investment decisions, new building requirements, new designs, and new ways of inhabit-ing and using buildings. Change always involves uncertainty and risk, and this uncertainty and risk are particularly significant in the building sector where decisions have large and durable financial conse-quences.

Practical demonstration of ZEB in building projects reduces this uncertainty and risk. Demonstration projects show to other investors, regulators, planners, architects, engineers, and building users that compliance with ZEB standards adds value, that it is economical, technically feasible, and leads to successful buildings that also contribute positively to our current environmental challenge. In addition, demonstration projects are also important because they provide feedback for further development of ZEB standards and guidelines.

The ZEB China project supported eight demonstration construction projects and two projects that did not proceed beyond the design phase. These demonstration projects spanned four climate zones and included a range of building types, including residential, commercial, institutional and educational buildings, as well as new construction and a renovation project. This diversity of projects represents a wide cross section of the Chinese building sector.

4.1 Gongchen Community Centre, Fangshan District, Beijing



Gongchen Community Center Fangshan District, Beijing

Multifunction community center, 1200 m²

- BIPV and rooftop PV
- Reused local materials
- High performance envelope
- Flexible space planning
- Energy-efficient air heat pump and heat recovery systems

Cold climate zone

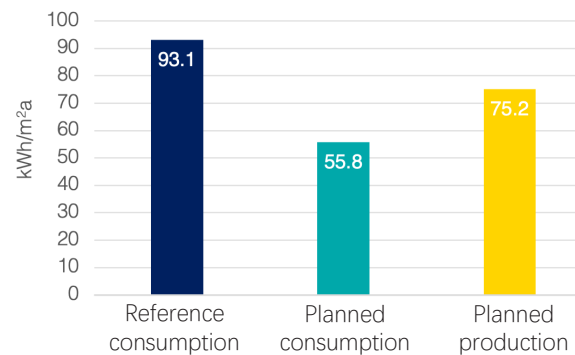
The Gongchen Community Centre in Beijing showcases zero emissions building principles through an integrated approach to sustainability. It features building-integrated photovoltaics (BIPV) and rooftop solar panels that generate more energy than the building consumes. The design prioritizes natural ventilation, daylighting, and heat recovery, reducing reliance on mechanical systems. Recycled materials, including wood and pipes from nearby construction waste, minimize embodied carbon. Smart controls and energy-efficient HVAC systems further optimize performance. The calculations by the building design team suggest the building achieves a carbon intensity of 0 kg/m² annually. Its flexible layout and public exhibition space promote awareness, making it a replicable model for low-carbon urban development.





" The Demo Project at Gongchen Community Centre in Beijing showcases a cutting-edge approach to sustainable building design by embedding photovoltaic materials directly into the building's fa-cade. This building-integrated photovoltaic system turns the exterior walls into energy-generating surfaces, harnessing sunlight to produce electricity for the building's operations. The PV modules are seamlessly integrated into the facade, maintaining the building's aesthetic appeal while providing a reliable source of renewable energy "

Energy Performance

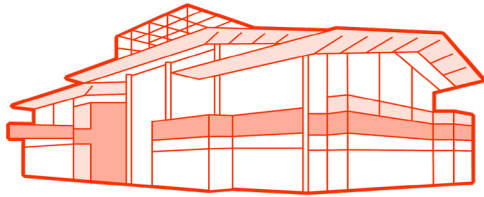


Demonstration Project
Gongchen Community Center
 Fangshan District, Beijing
 C-Land Real Estate
 SUP Atelier



Workshop Presentation
Green Photovoltaics - The Potential of the Building Envelope
 Lucerne University of Applied Sciences and Arts (HSLU)

4.2 Market Hall at Shanghai Jiading Future City



Shanghai Jiading Future City Jiading, Shanghai

Market hall, 5760 m²

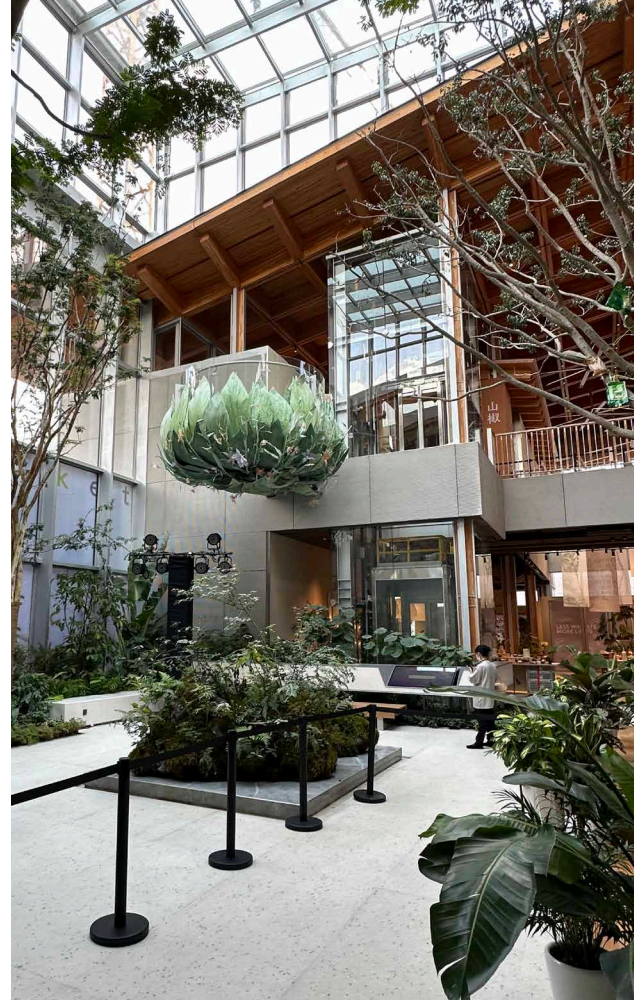
Exhibition hall 2942 m²

- Steel-timber hybrid structure
- Rooftop PV
- External shading system
- Efficient ventilation
- Atrium skylight
- Sustainable waste disposal concept

Hot summer cold winter climate zone

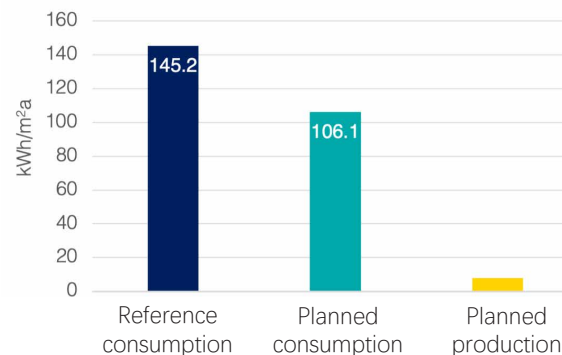
The market hall at Jiading Future City demonstrates zero emissions building through a comprehensive low-carbon design. It features rooftop photovoltaic panels, a double-layer ventilated roof, and high-performance insulation and windows. Natural ventilation is enhanced by funnel caps and HVLS fans, while shading systems reduce heat gain. The building uses electricity-only cooking to lower emissions and incorporates recycled materials and design-for-disassembly principles. Organic waste is composted onsite. Despite a steel structure, wood is prominently used to reduce embodied carbon. The hall achieved a 27% reduction in energy consumption compared to reference buildings, with a carbon intensity of 72.69 kg/m² annually, showcasing replicable urban sustainability.



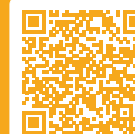


"In the Shanghai Jiading future city project, we have assessed the complete building lifecycle and have applied circular construction principles to achieve zero carbon standard. One of these principles is the reuse of construction materials. For example, we sourced concrete aggregates from construction waste and used recycled steel rebars. We also implemented the "Design for Disassembly" approach, which allows key building connection points to be easily disassembled and recycled. For the Shanghai market hall, specialized connecting nodes are being developed to make future disassembly straight-forward"

Energy Performance



Demonstration Project
Market Hall & Exhibition Hall
 Shanghai Jiading Future City
 Shanghai Jiading Future Property Co. Ltd
 Huajian Group East China Arch. Design & Research

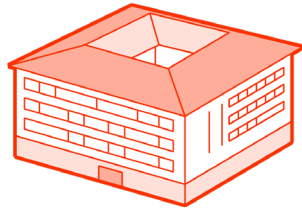


Workshop Presentation
Timber Construction in Switzerland - A Successful Revolution
 ETH Zurich Institute of Structural Engineering



Technical Report
Circular Construction - Swiss Experiences
 ZHAW Institute for Constructive Design
 ZHAW Institute for Building Process

4.3 Training Building of Long Shan Shu Yuan in Shaoxing



Training Building of Long Shan Shu Yuan Middle School Shaoxing, Zhejiang

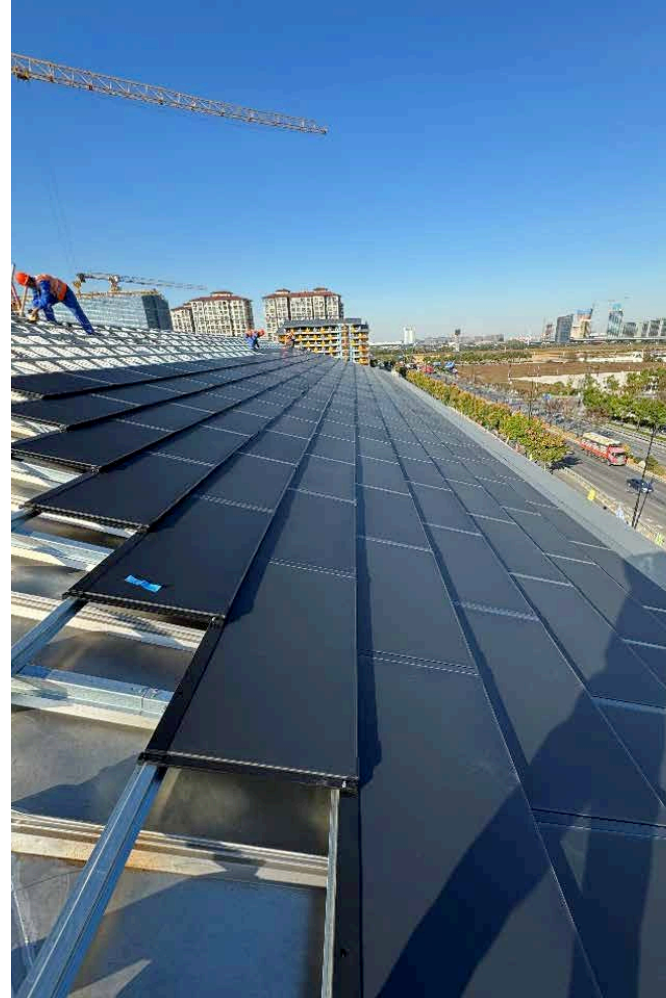
Training center/school, 5697 m²

- Recycled concrete
- Energy-efficient building envelope
- Smart energy control in classrooms (occupancy-based)
- PV integrated into landscape

Hot summer cold winter climate zone

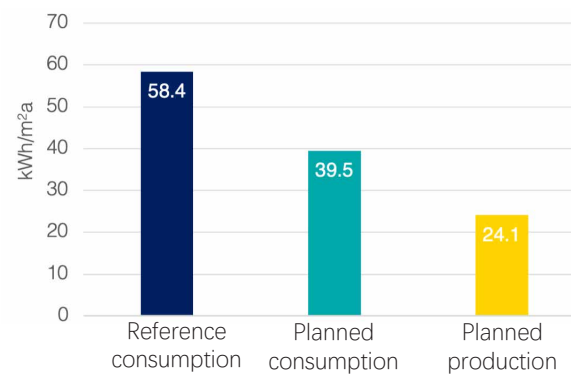
The Training Building of Long Shan Shu Yuan in Shaoxing exemplifies zero emissions building through its energy-efficient design and renewable energy integration. It uses air-source VRF systems for heating and cooling, mechanical ventilation with heat recovery, and LED lighting with smart controls. A rooftop BIPV system contributes significantly to energy generation. The building achieved a 32% reduction in energy consumption compared to reference buildings, with a carbon intensity of just 7.72 kg/m² annually. Its compact form and classical design enhance thermal performance, while its location and transport access support sustainable mobility. The project serves as a replicable model for zero-carbon educational buildings.





" The training building at Long Shan Shu Yuan Middle School is designed with energy-saving features. Among other ZEB measures, the building employed smart building automation to control the indoor environment making the Shaoxing training building a Zero Emission Building. With Swiss expertise, the building's control systems are fully interconnected. The building automation system monitors the indoor air quality, and adjusts airflow as needed. Shading and cooling are linked, activating cooling automatically when shading is in use. Additionally, lighting is equipped with motion sensors in class-rooms and corridors, ensuring lights are on only when necessary "

Energy Performance

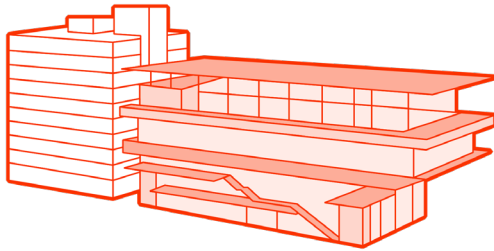


Demonstration Project
Training Building, Long Shan Shu Yuan, Shaoxing
 Shaoxing Future Community Development & Construction Co.
 China Academy of Building Research Ltd.



Technical Report
Building Automation and Smart Control
 Willers

4.4 Shenzhen Nanshan Energy Ecological Park Zero Carbon World



Nanshan Energy Ecological Park Qianhai, Shenzhen

**Mixed-use sport center
and recreation facility, 8162 m²**

- Waste heat from incineration plant for space cooling and hot water
- Rooftop PV and BIPV
- Façade solar shading
- Minergie-A pre-certification

Hot summer warm winter climate zone

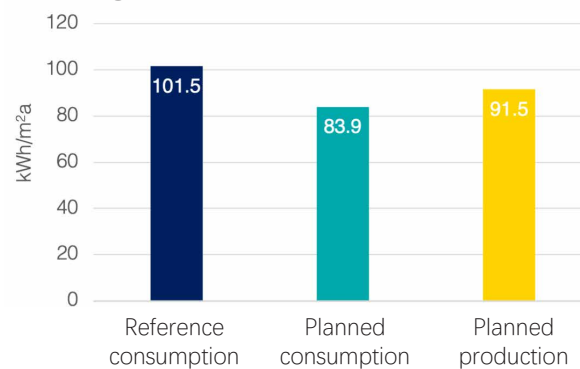
The Shenzhen Nanshan Energy Ecological Park Zero Carbon World demonstrates zero emissions building through innovative energy and architectural strategies. It utilizes waste heat from a nearby incineration plant for cooling, dehumidification, and pool heating, supported by absorption chillers. A rooftop BIPV system and CdTe curtain walls generate renewable energy, achieving a net-zero carbon intensity. The building integrates passive cooling, water curtain façades, and extensive greenery to reduce heat gain. Public spaces like the rooftop park promote awareness of zero-carbon living. With optimized energy use and a projected net-zero carbon intensity, the project serves as a replicable model for sustainable urban development.





“ The Shenzhen Nanshan Energy Ecological Park serves as a sport centre and recreation facility with an 8-lane swimming pool. The building’s energy concept harnesses waste heat steam from a nearby waste incineration power plant. This waste heat is captured and transferred through a heat exchange system, which is then used to efficiently heat the swimming pool, reducing the need for traditional energy sources “

Energy Performance



Demonstration Project
Shenzhen Nanshan Energy Ecological Park
Zero Carbon World
 Shenzhen Energy and Environmental Protection Group
 Jianxue Architecture and Engineering Design Institute

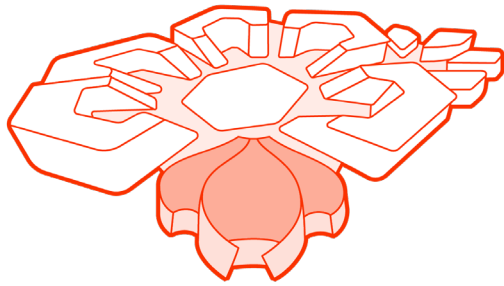


ZEB Talk
In-depth Course on Thermal Area
Networking
 Anex



ZEB Talk
PV Battery Storage
 Willers

4.5 Shangxian Lake Low-Carbon Digital Industrial Park Phase II



Shangxian Lake Low-Carbon Digital Industrial Park Phase II Wuxi, Jiangsu

Exhibition hall, 10 094 m²

- Geothermal energy for heating/cooling
- Rainwater management
- Enhanced local biodiversity

Hot summer cold winter climate zone

The Wuxi Shangxian Lake Low-Carbon Digital Industrial Park Phase II is a compelling example of a zero emissions building. It integrates ground-source heat pumps, photovoltaics, and intelligent energy systems. The design prioritizes lifecycle carbon reduction, sustainable materials, and biodiversity, with features like sponge city landscaping and rainwater reuse. Its energy demand is significantly lower than conventional buildings, and its architecture supports green roofs and terraces. With a holistic approach to mobility, energy, and lifestyle, the project demonstrates scalable, replicable strategies for climate-resilient urban development in hot summer–cold winter regions.

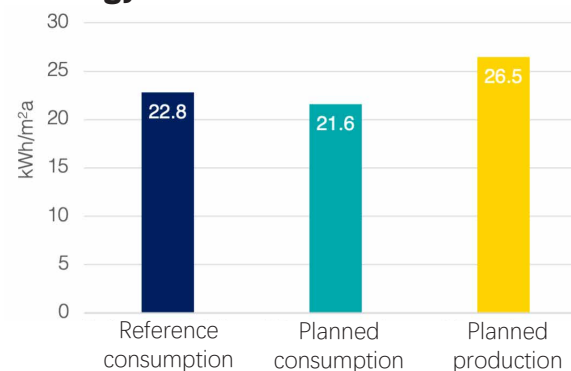




“ In Wuxi’s Shangxian Lake low-carbon Digital Park, the project is taking the leap from ZEB buildings to entire districts. The park includes nine buildings around a central pond, using geothermal energy for efficient temperature control and reducing reliance on external power sources.

The geothermal system works by transferring heat between the ground and the buildings. In colder months, a ground-source heat pump extracts heat from the earth to provide space heating, while in warmer months, it transfers heat from the buildings back into the ground to keep interiors cool. This system also provides hot water for the canteen ”

Energy Performance

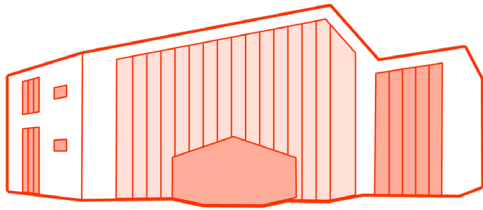


Demonstration Project
Shangxian Lake Low-Carbon Digital Industrial Park Phase II
 Wuxi Taihu New City Urban Development Co.
 China Academy of Building and Research (CABR)



ZEB Talk
Biodiversity in the Built Environment - A Swiss Perspective
 Intep Integrated Planning

4.6 Liuba County Chinese Bee Museum



Chinese Bee Museum Liuba County, Hanzhong, Shaanxi

Exhibition and shop, 1530 m²

- Recyclable, reusable materials
- BIPV and rooftop PV
- Lifecycle zero emission

Hot summer cold winter climate zone

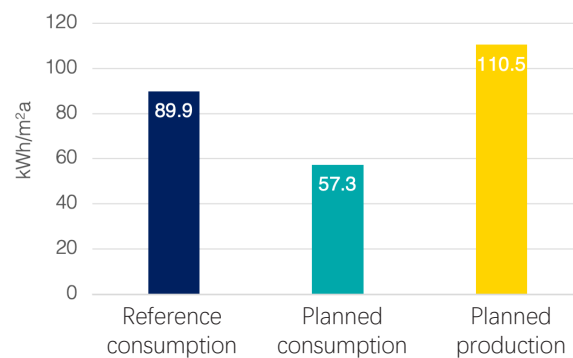
The Liuba County Chinese Bee Museum showcases an exemplary zero emissions building in a rural setting. Designed with a honeycomb structure, it integrates passive ventilation, high-performance insulation, and renewable energy systems including rooftop, façade, and parking-lot photovoltaics. Its design emphasizes circular construction, biodiversity, and educational engagement, with sponge park landscaping and ecological features. By combining cultural identity, low-carbon materials, and flexible spatial use, the museum demonstrates how small-scale public buildings can achieve full lifecycle carbon neutrality and contribute to sustainable rural revitalization.





“ The Shaanxi Tourism Centre, Bee Research and Rural Revitalization project aims to monitor carbon emission, to have a comprehensive view of the emissions during the building life cycle. To support this goal, a lifecycle analysis is underway to assess the environmental impact associated with the stages of a building, from procurement, to construction, operation and disposal or reuse ”

Energy Performance



Demonstration Project
Liuba County Chinese Bee Museum
Shaanxi
 Liuba Yunmu Rural Tourism Development Co. Ltd
 Xi'an University of Architecture and Technology



Workshop Presentation
Green Photovoltaics - The Potential of the Building Envelope
 Lucerne University of Applied Sciences and Arts (HSLU)

4.7 Taixing Development Zone Waterworks Phase II



Development Zone Waterworks Phase II Taixing, Jiangsu

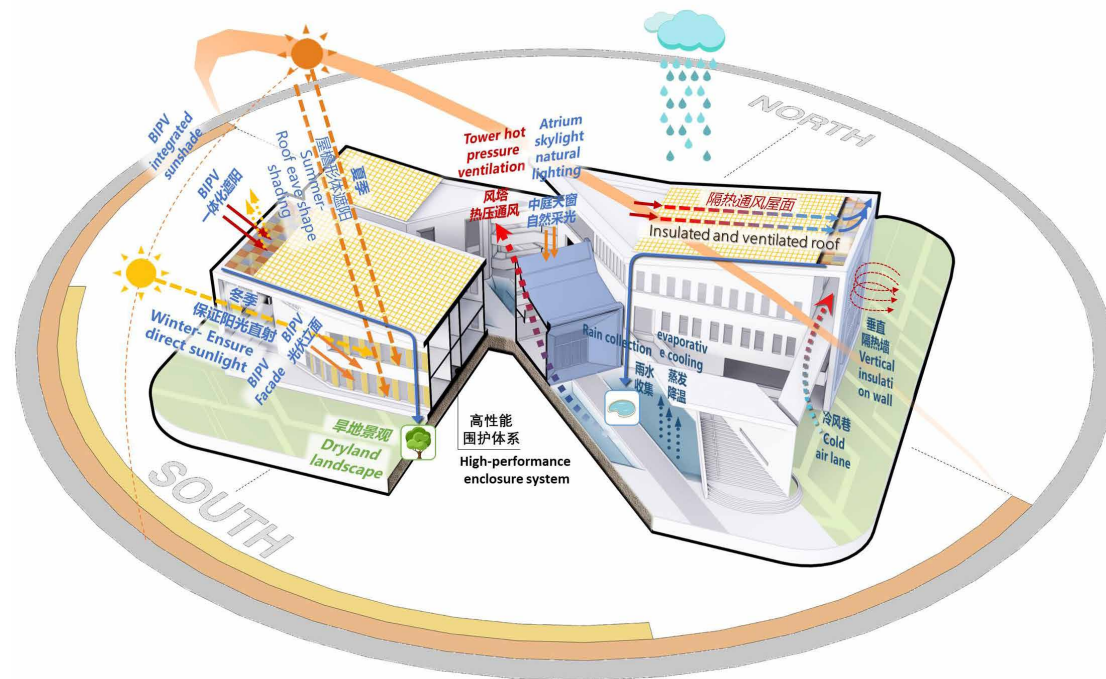
Mixed-use building, 2687 m²

- High-performance envelope
- Intelligent shading control and natural ventilation
- Rainwater recycling
- BIPV

Hot summer cold winter climate zone

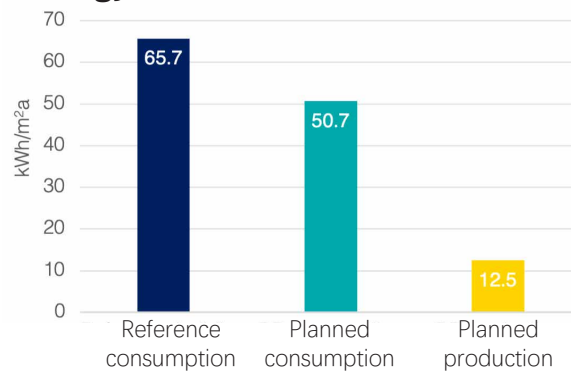
The Taixing Development Zone Waterworks Phase II exemplifies zero emissions building design tailored for hot summer–cold winter climates. Integrating passive cooling, natural ventilation, and advanced insulation, the complex uses building-integrated photovoltaics, heat recovery systems, and intelligent controls to achieve high energy efficiency. Its innovative use of adjacent water infrastructure as a thermal source enhances sustainability. With projected PV output exceeding energy demand, the project demonstrates lifecycle carbon reduction through prefabricated construction, recycled materials, and rainwater reuse. Combining regional architectural principles with modern green technologies, it sets a replicable model for low-carbon urban infrastructure.





"In the Taixing Development Zone Waterworks Demo Project, we designed a highly efficient building that functions like a wind tunnel, enabling natural ventilation and cooling. During the transition seasons, the skylight in the wind tower opens to release warm air, while cool, fresh air enters through the ground floor"

Energy Performance

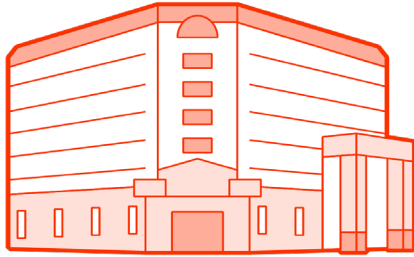


Demonstration Project
Taixing Development Zone Waterworks Phase II
 China Construction Eco-Environmental Group Co. Ltd
 Tianjing Tenio Architecture and Engineering Co. Ltd



Presentation
Natural Ventilation Potential and Use of Computational Fluid Dynamics in Residential Buildings
 Pravah

4.8 Office Building Complex in Harbin



Office Building Complex Harbin, Heilongjiang

Office building and exhibition hall, 8610 m²

- Internal insulation on street façade, external insulation on courtyard side
- Air heat pump / chiller
- Heat recovery ventilation
- High-performance windows
- Rooftop PV

Severe cold climate zone

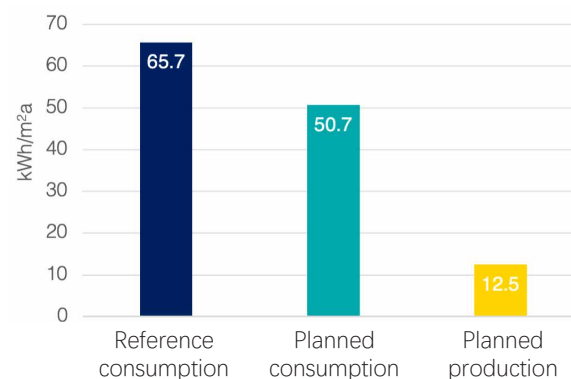
The Office Building Complex in Harbin showcases an exemplary zero emissions renovation in China's extremely cold climate zone. Retrofitted from a 1990s structure, the project preserves its historic façade while integrating ultra-low energy technologies. It features internal and external insulation, triple-glazed windows, air-source heat pumps, and compound ventilation systems. With a carbon intensity of 16.3 kg CO₂/m²a and optimized energy demand, it demonstrates lifecycle carbon reduction and adaptive reuse. The renovation balances heritage conservation with modern sustainability, offering a replicable model for retrofitting cold-region buildings and advancing low-carbon urban transformation through intelligent design and efficient building systems.





“ To address Harbin’s cold climate, the project incorporated several key energy-efficient measures. These included exterior and interior wall insulation, high-efficiency insulation material, and energy-saving triple-glazed windows, which significantly reduce heat loss. The combination of these high-performance insulation techniques and efficient clean energy systems ensures a comfortable indoor environment by maintaining consistent temperatures while minimizing energy use, leading to cost-effective operation ”

Energy Performance



Demonstration Project
Office Building Complex in Harbin
 Heilongjiang Province Academy of Cold Area
 Building Research



Technical Report
**Circular Construction Analysis of the
 Heilongjiang Cold Land Building Science
 Research Institute**
 Zirkular



“ Implementing zero-carbon building strategies has significantly enhanced the project’s performance quality and public visibility “

4.9 Interview with Mr Lu Jianping

Wuxi Taihu New City Construction Engineering Group

Why did you decide to align the Shangxian Lake Low-Carbon Digital Industrial Park Phase II with zero-emissions standards?

Dual-carbon goals of carbon peaking and carbon neutrality are not only a corporate social responsibility but also a development opportunity. As an urban investment and construction platform, the company recognizes that green, low-carbon, and zero-carbon buildings are the inevitable path for the construction industry. Choosing this project as a pilot for zero-carbon building standards is the first step in promoting the company’s green and low-carbon transformation.

What new challenges did the zero-emissions standards present for your design team?

We need deeper, full-life-cycle collaboration. This requires rigorous research and deployment of the latest green, low-carbon, and energy-efficiency approaches - introduced from the outset - to build consensus among stakeholders, embed those measures in design and planning, and ensure they are delivered on site.

Did compliance with zero-emissions standards involve greater costs for your project?

Yes, it has increased construction costs, mainly in the early stages, particularly for envelope materials and high-performance equipment. However, we believe that from a full life-cycle perspective, the long-term economic benefits and social value of the building fully justify the initial exploration and investment.

What do you see as the main benefits of ZEB for your project?

Implementing zero-carbon building strategies has significantly enhanced the project’s performance quality and public visibility. We believe that in future operations, its economic, low-carbon, and health-oriented features will also provide users with a better overall experience.



5 EDUCATION

ZEB involves new ways of building in a rapidly evolving field of new approaches and solutions. New knowledge is required across all stakeholders in the building sector to promote the messages of ZEB, to increase skills and to expand the scope of ZEB-compliant buildings.

The building sector engages a diverse array of stakeholders including investors, government officials, architects, engineers and planners, as well as students who will be building sector stakeholders of the future.

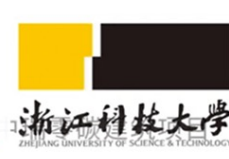
The ZEB China project brought together Swiss and Chinese expertise to deliver training and to develop knowledge and educational resources for the full range of stakeholders engaged in China's building sector. A range of formats and media including online and in-person training targeted officials, investors, professionals and students to increase knowledge and communicate the importance and feasibility of ZEB to reduce building sector emissions.

5.1 University lectures and seminars

Architectural curricula in Swiss and Chinese universities are changing in response to new demands upon building professionals and new knowledge that these demands entail. Changes in architectural teaching include new courses and changes to existing courses to integrate sustainability, emissions mitigation, and the new approaches and solutions that these challenges present.

The ZEB China project brought together Swiss and Chinese experts to develop courses and deliver lectures on various aspects of ZEB in Chinese universities. Lectures were delivered in 13 Chinese universities and reaching around 600 students who will be the future professionals leading the ZEB challenge.

Subjects addressed in university lectures included ZEB targets and goals, circular construction, embodied emissions calculation, ZEB in architectural design, lightweight construction for material efficiency, and many other topics. These topics were addressed in the context of both architectural theory classes, research seminars, and design workshops.



中国零碳建筑合作示范项目 国际绿色建筑联盟（IGBC）中国项目
Lecture 1:
What Is ZEB and Its Goal

主讲人: Prof. Adrian Altenburger
中国零碳建筑合作示范项目国际绿色建筑联盟（IGBC）中国项目
卢塞恩应用科学与艺术大学 建筑技术系 系主任
HSLU - School of Building Technology Department
HSLU 建筑技术系教授 联合创始人
ETH Zurich 建筑一体化建筑系统 系主任 顾问委员会成员
ETH Zurich - ARC Integrated Building Systems
Advisory Board Member

2024/09/25 (Wed.)
8:15 - 9:50 (Swiss Time)
16:15 - 17:50 (Beijing Time)
14:15 - 15:50 (Beijing Time)
Topic: 367-637-738 (445) (Cantonese)
腾讯会议: 986-186-638
主持人: 李寅、樊一帆

中国零碳建筑合作示范项目 国际绿色建筑联盟（IGBC）中国项目
Lecture 2:
Circular Construction
- Swiss Experience / Reuse Game

主讲人: Prof. Andri Gerber
中国零碳建筑合作示范项目国际绿色建筑联盟（IGBC）中国项目
卢塞恩应用科学与艺术大学 建筑技术系 系主任
HSLU - School of Building Technology Department
HSLU 建筑技术系教授 联合创始人
ETH Zurich 建筑一体化建筑系统 系主任 顾问委员会成员
ETH Zurich - ARC Integrated Building Systems
Advisory Board Member

2024/10/15 (Tue.)
16:15 - 17:50 (Beijing Time)
10:15 - 11:50 (Swiss Time)
Topic: 367-637-738 (445) (Cantonese)
腾讯会议: 986-186-638
主持人: 李寅、樊一帆、陈建峰

LECTURE 3:
Construction and Architecture

主讲人: 李寅
中国零碳建筑合作示范项目国际绿色建筑联盟（IGBC）中国项目
浙江工业大学建筑设计研究院 国际设计中心 主任建筑师
浙江省住房和城乡建设厅 建筑节能与绿色建筑处 处长
苏黎世联邦理工大学 ETH Zurich 建筑学 硕士
浙江工业大学 博士

2023/03/27 (Wed.)
17:00 (Beijing Time)
腾讯会议: 117-056-638
主持人: 周建东 浙江工业大学教授

课程主题: 构造设计与建筑表达

LECTURE 4:
Calculation Carbon Emission

主讲人: 吴佳楠
中国零碳建筑合作示范项目国际绿色建筑联盟（IGBC）中国项目
浙江工业大学建筑设计研究院 国际设计中心 主任建筑师
浙江省住房和城乡建设厅 建筑节能与绿色建筑处 处长
苏黎世联邦理工大学 ETH Zurich 建筑学 硕士
浙江工业大学 博士

2024/04/16 (Thu.)
16:30 (Beijing Time)
腾讯会议: 508-068-535
主持人: 吴建东 浙江工业大学教授

课程主题: 建筑碳排放控制与计算

"...from a life-cycle perspective, energy efficiency and carbon emissions must be taken into account during the design process "

5.2 Interview with Professor He Yong

Institute of Architectural Design and Theory at Zhejiang University

Why are energy efficiency and carbon emissions important issues for architectural design?

Because sustainable development is a shared goal for the future of humankind, architects - as the creators of a project's blueprint - have a decisive influence on the subsequent construction methods and operational models. Therefore, from a life-cycle perspective, energy efficiency and carbon emissions must be taken into account during the design process. This is the most effective way to achieve energy conservation and emission reduction at the source.

Do students have a strong interest in sustainability and environmental impacts of buildings and construction?

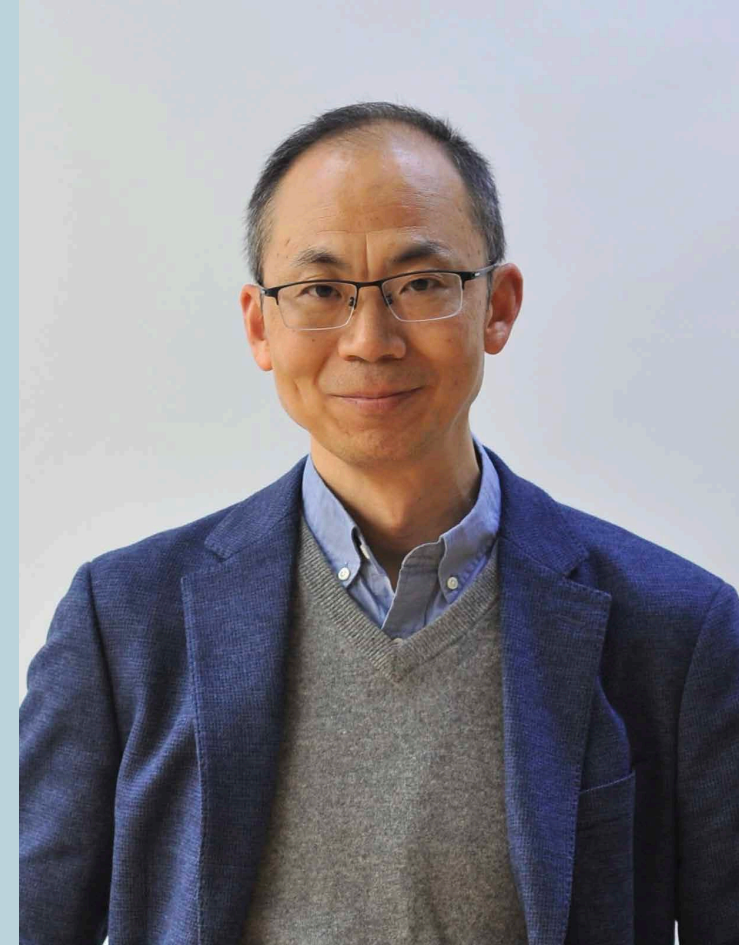
To be honest, students are generally not very interested in the sustainability and environmental impact aspects of architecture and construction. Compared with the more artistic and creative aspects of spatial design, this area can seem rather tedious, as it involves collecting, testing, analysing, calculating, and simulating data related to materials, environment, and energy. Moreover, this type of work requires a strong and diverse knowledge base, covering multiple disciplines such as materials science, energy systems, environmental studies, and project management, as well as familiarity with relevant policies, standards, and regulations. Therefore, it is indeed a complex field - and a significant challenge for both teachers and students.

How are issues of sustainability and environmental impacts addressed in architectural education in China?

First of all, our curriculum includes many courses and studio projects focused on green buildings, energy and environment, and sustainable cities. In addition, there are various workshops on these topics, especially joint workshops with overseas universities, which usually involve in-depth exploration through specific project designs. We also encourage students to participate in competitions related to these themes, helping them stay informed about the latest developments and trends in the industry and the discipline.

Looking to the future, what changes do you see in the ways that sustainable design is addressed in architectural teaching and practice?

With the rapid advancement of new technologies, especially artificial intelligence, I believe that future education will offer more efficient and convenient methods to simulate and calculate a building's full life-cycle energy consumption and carbon emissions. This will allow the design of spatial forms and the optimization of resource and energy use to proceed simultaneously. Such integration will further streamline our design processes and help reshape how we experience and assess the beauty of building performance.



5.3 ZEB Talks

ZEB Talks provided an effective forum for engaging a wide audience of Chinese officials, professionals and academics in ZEB topics. Each monthly online ZEB Talk brought together a Swiss and a Chinese expert to present on a specific topic, combining knowledge and communicating to wide audience. Recorded and translated ZEB Talks are publicised and remain available online for ongoing consultation and communication.

The range of topics addressed in ZEB Talks reflects the scope of Swiss and Chinese expertise in building emissions reduction. Topics included the range of new and emerging solutions for reducing operational and embodied emissions, including topics relating to energy efficiency, low carbon materials, circular construction, network solutions, emissions calculation, and many more.

The audiences brought together for ZEB Talks highlights interest in ZEB across building sector stakeholders and recognition that new ZEB challenges require new knowledge and solutions.

ZEB TALK

建筑设计实践中的循环建造

ZEB TALKS 是由“中瑞零碳建筑项目”瑞士联合团队 Intep/Skat 与中方牵头实施单位中国建筑科学研究院 (CABR) 共同发起的零碳建筑主题系列研讨会。

在 2025 年 7 月的研讨会中，我们将重点关注循环建造在建筑设计实践中的应用。清华大学宋晔皓教授将以北京的零碳建筑示范项目及其他相关项目为例，深入讲解建筑再利用和循环建造的原则及思路，并介绍在中国推进循环建造所面临的挑战、相应的政策及监管框架等。来自瑞士的 Barbara Buser 女士将分享瑞士的优秀实践，展示她如何通过再利用现有建筑构件和材料实现循环建筑的理念。杨芯岩博士将担任本次 ZEB Talk 的主持人。

议程

中国时间	瑞士时间
15:00-15:05	(09:00-09:05)
15:05-15:45	(09:05-09:45)
15:45-16:15	(09:45-10:15)
16:15-16:35	(10:15-10:35)
16:35-16:40	(10:35-10:40)

杨芯岩博士致欢迎辞和开场介绍
宋晔皓教授报告
Barbara Buser 女士报告
讨论问答
杨芯岩博士总结发言

演讲和讨论将以英文或中文进行，并配有同声翻译。

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

2025年7月23日 (周三) – 中国时间15:00
瑞士时间 09:00

演讲嘉宾

Barbara Buser 女士是瑞士的建筑师、城市规划师及循环建筑领域的领军人物。她是 Baubüro in situ、城市发展公司 Denkstatt Sàrl 以及循环技术企业 Zirkular 的创始人。她专注于低碳改造、擅长通过适应性再利用、最小化拆除以及最大化材料回收来实现循环建筑。

演讲嘉宾

宋晔皓教授是清华大学建筑学院的长聘教授，研究领域涵盖建筑设计理论与方法、可持续建筑设计的创新与综合策略、建筑施工系统优化，以及乡土建筑的现代化实践等。

资深主持

杨芯岩博士拥有与建筑设备相关的机械工程博士学位，是中国建筑科学研究院 (CABR) 零碳建筑 (ZEB) 领域的专家和核心研究员。

Zoom 会议链接:
<https://us06web.zoom.us/j/88946258062?pwd=L4UjQmNYZ4FzODNlPjVlZDh4ODk5LkBD.1>
Meeting code: 889 4625 8062
Passcode: 334455

01 How Switzerland meets ZEB Targets for 2050	Infras
02 Integrated Planning for ZEB Projects	HSLU CABR
03 Zero Emissions Districts	Intep CSTID
04 Demonstrators NEST and MOVE	EMPA
05 ZEB Design with Low Carbon Building Materials	HSLU
06 Energy Hub - Decentralised Energy Systems	EMPA
07 LC3 - Reducing Emissions of Cement Materials	EPFL
08 Minergie - The Swiss Green Building Standard	Minergie
09 KBOB - LCA Data in the Construction Sector	Intep
10 ZEB Concept and Review	SKAT
11 Elevators for New Buildings	Schindler
12 Photovoltaic Battery Storage	Willers
13 Anergienetz	Anex
14 Fair and Transparent Architecture Competitions	HSLU CUHK
15 High Performance Energy Recovery	Konvekta
16 Zero Emissions Districts and Communities	FNHW Shanghai DP
17 Energy System Optimisation	Symphony Dalian DP
18 Impact Simulation of Chinese ZEB Standard	ZHAW CQU
19 Biodiversity	Intep Shaanxi DP
20 Circular Construction in Architectural Practice	SUP Atelier Baubüro insitu
21 ZEB Monitoring During Operations	Anex

5.4 Mayor Training

Government officials play a central role in promoting, incentivising and regulating emissions reduction and ZEB. This includes officials without specific professional engineering or architectural training. To address the specific roles that officials play in promoting ZEB, the ZEB China project developed a training series adapted to the needs and characteristics on stakeholders that are not building professionals.

A course comprising five modules addresses municipal and provincial government officials tasked with promoting ZEB and regulating the building sector. Topics addressed in these modules included Swiss experiences of building sector emissions regulation, various legal instruments available for regulating emissions, planning instruments and tools to support ZEB project development and management, and different strategies used to promote and demonstrate ZEB solutions.

The format of modules and lectures has been developed in response to specific needs of mayors and other senior municipal officials. The training modules remain available on zeb-china.org for ongoing dissemination and training.



Mayor Training
Swiss Decarbonisation Roadmap
Intep Integrated Planning
SKAT Consulting



Mayor Training
Swiss Landscape of Technical Regulations
Intep Integrated Planning



Mayor Training
NEST and MOVE Demonstrators
EMPA



Mayor Training
Swiss Legal Economic and Information Instruments
Intep Integrated Planning
SKAT Consulting



Mayor Training
3 Steps Towards ZEB
Intep
HSLU

