



中国建筑科学研究院
China Academy of Building Research
建筑环境与节能研究院
Institute of Building Environment and Energy Efficiency

China's Building Energy Efficiency Policy and Passive Building Development

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China Academy of Building Research

China Passive Building Alliance



中国被动式超低能耗建筑联盟
CHINA PASSIVE BUILDING ALLIANCE



OUTLINE

- 1 Building Energy Efficiency in China
- 2 Guideline of Ultra-low Energy Building
- 3 Cutting-edge Research
- 4 Summary



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Efficiency



Most People are familiar with Shanghai, the largest city in China. Now. With lots of skyscrapers

SHANGHAI. CHINA.



This is what SHANGHAI looks like 20 years ago.

Each year there are 1.5 billion m² new construction in China.



During the next two decades, over **80 billion m²** (900 billion ft²)
of new and rebuilt buildings
will be constructed in urban areas worldwide.

Building Energy Efficiency in China



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LAWs

Energy Conservation Law of the People's Public of China (2016 Revision)

http://www.zhb.gov.cn/gzfw_13107/zcfg/fg/xzfg/201610/t20161008_365106.shtml

Renewable Energy Law of the People's Public of China

http://www.gov.cn/fwxx/bw/gjdljgwyh/content_2263069.htm

REGULATION

Regulations on energy conservation for civil buildings

http://www.gov.cn/flfg/2008-08/07/content_1067062.htm

CODEs and STANDARDS



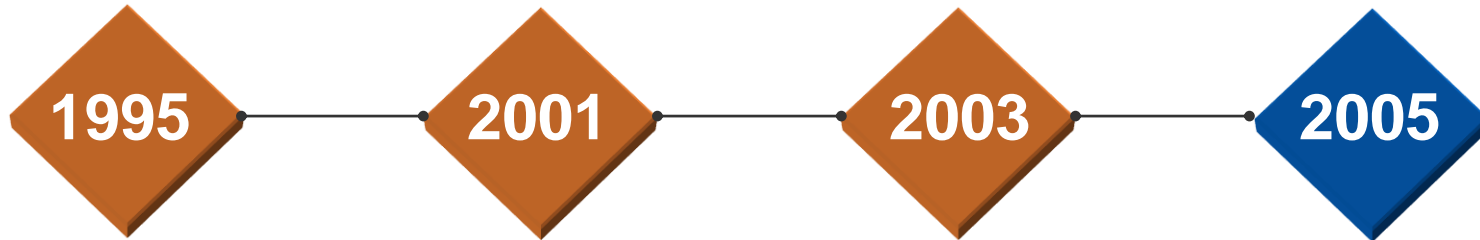
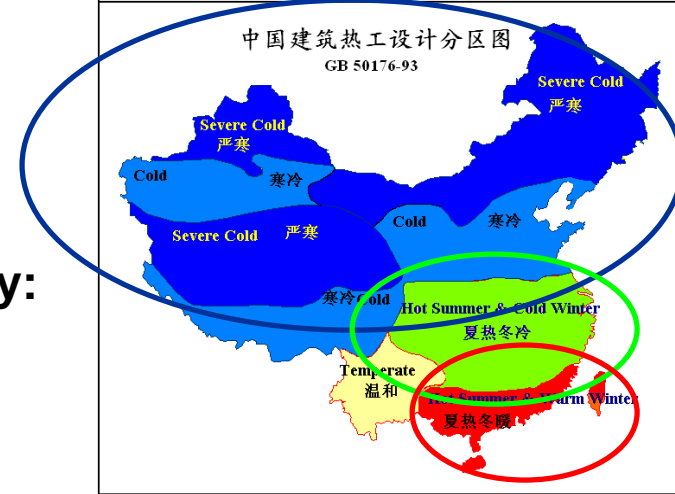
Mandatory

Voluntary

Building Energy Efficiency in China

Building Energy Efficiency Standard develop history:

North -> Central -> South, Residential -> Public



- JGJ 26-86: Design standard for Civil Buildings
- JGJ 26-1995: Design standard for Civil Buildings (Heating part for Residential Buildings)
- JGJ 26-2010: Design standard for energy efficiency of residential buildings in severe cold and cold zones

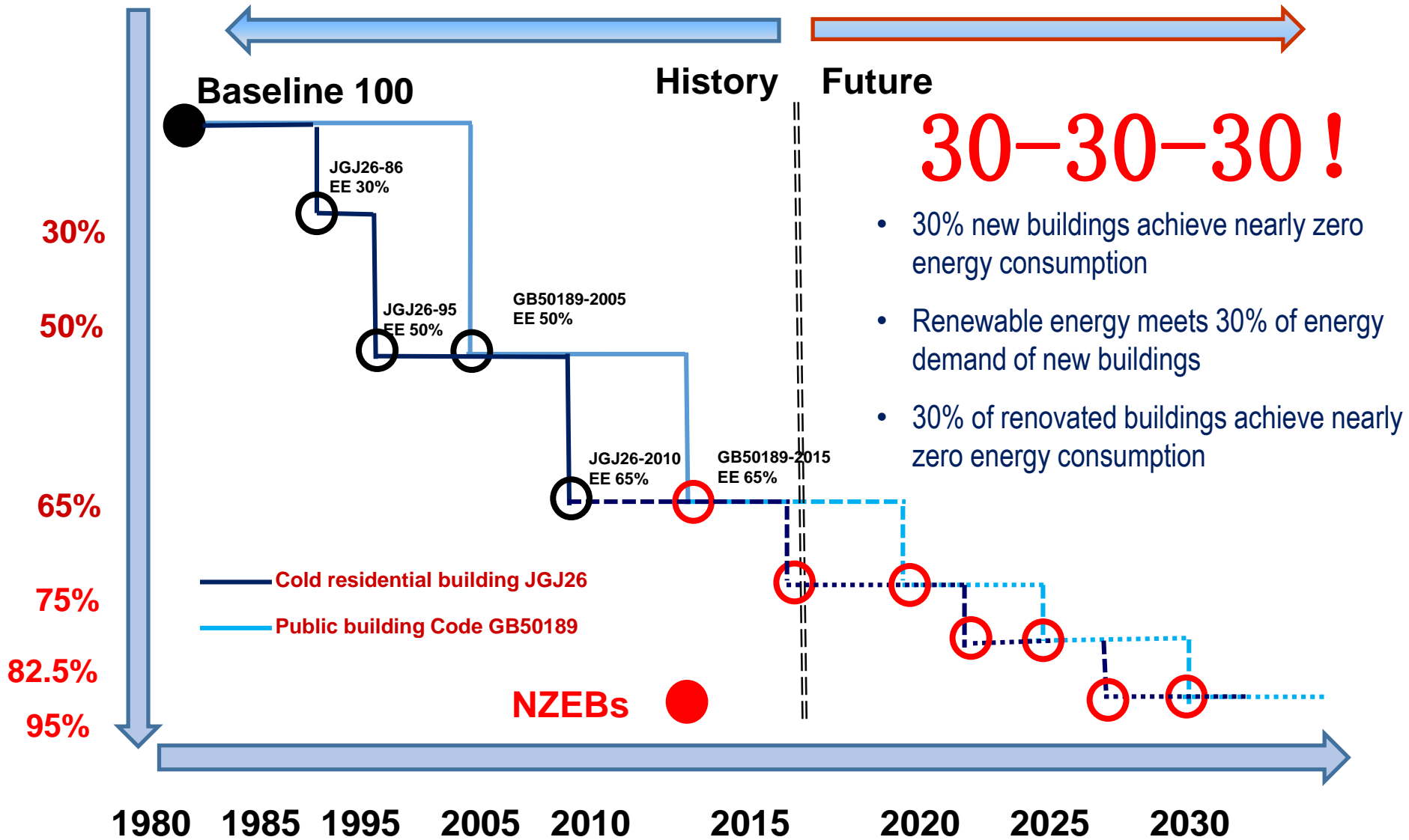
- JGJ 134-2001: Design standard for energy efficiency of residential buildings in hot summer and cold winter zone
- JGJ 134 -2010 Revision

- JGJ75-2003: Design standard for energy efficiency of residential buildings in hot summer and warm winter zone
- JGJ75-2012 Revision

- GB 50189-2005: Design standard for energy efficiency of public buildings
- GB50189-2015 Revision

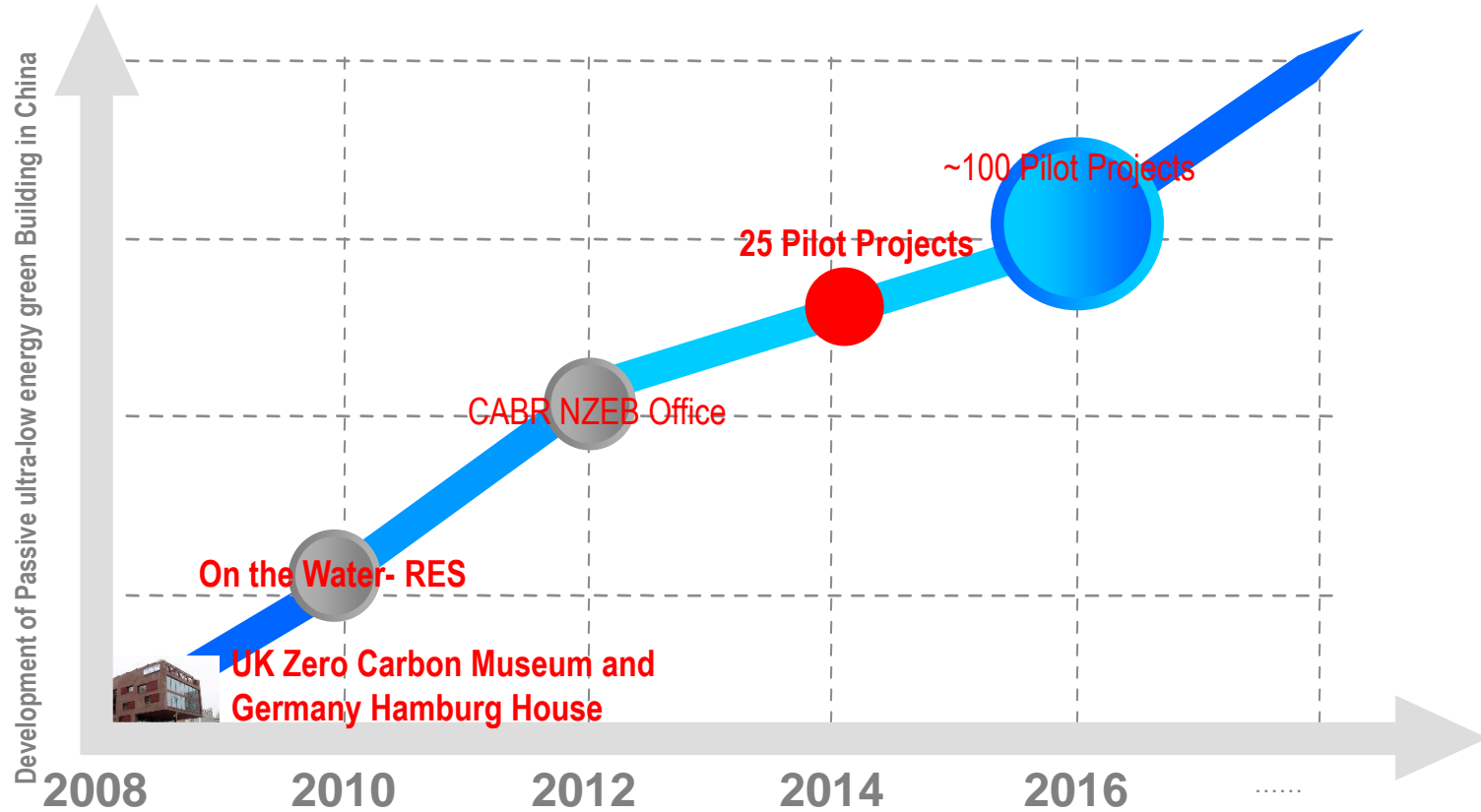


Building Energy Efficiency in China





Development of Ultra-low energy building in China



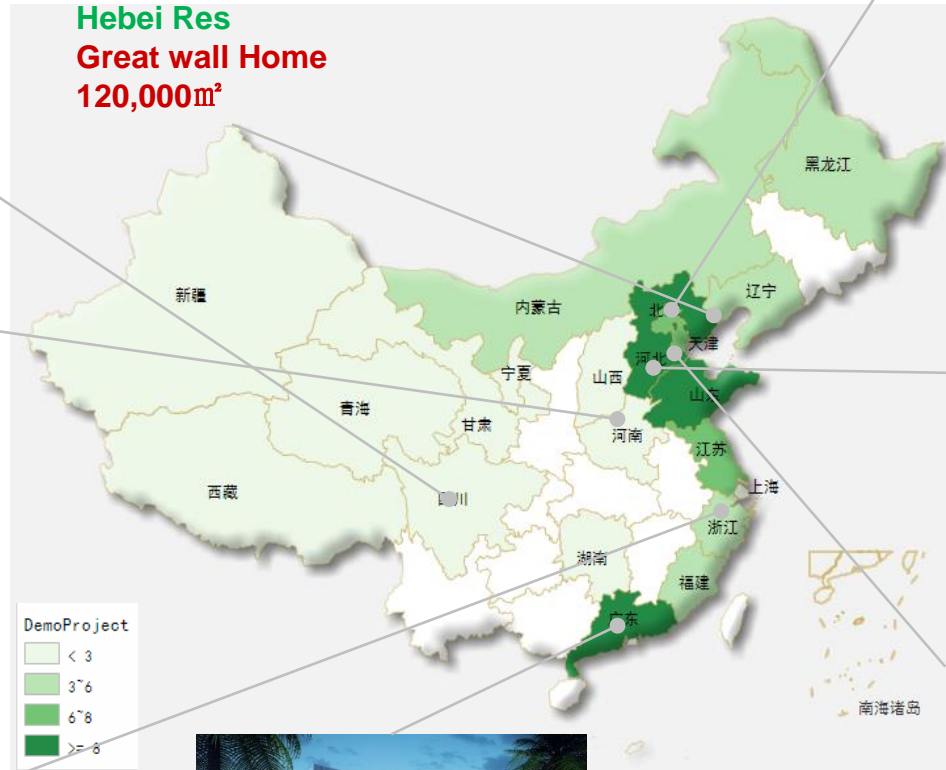
Development of Ultra-low energy building in China

Ultra-low energy / Passive Building / NZEB Pilot Projects

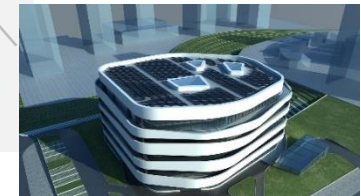


Beijing Office
CABR NZEB 4,200m²

Sichuan Office
Huagou Pilot
13,078m²



Tianjin Res
10,000m²



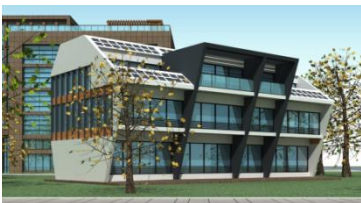
Shandong Office
Qingdao Ecological Park
10,000m²



Zhuhai office
Gree ZEB center



Henan School
Hebi Passive School



Zhejiang Office
Menred NZEB center



Central Government- Policy and Standards

China State Council

- *Opinions on Further Strengthening the Administration of Urban Planning and Construction*
- “develop green, energy-effective buildings, such as passive houses”

NDRC & MoHURD

- *Action Plan for Urban Adaptation to Climate Change*
- “promote passive ultra-low energy green buildings by using high-performance components of the thermal envelope to improve building tightness and indoor environment”

MoHURD

- *13th Five-Year Plan of Building Energy and Green Building Development*
- “develop ultra-low energy neighbourhoods; nearly zero-energy building pilot projects; and by 2020, construct ultra-low energy and nearly zero energy buildings totalling more than 10 million square meters.”
- National Guideline for residential buildings - published in 2015
- National Standard – on going, planned to be finished in 2018

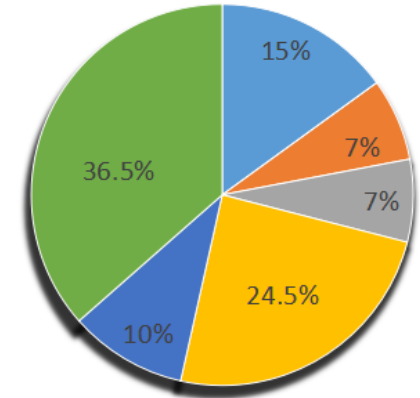


Local Government- Policy and Standards

| Province/ Municipality | Local Technical Standard | City | Local Fiscal Reward | |
|---------------------------|---------------------------------------|--------------|---------------------|---|
| | | | Period | Amount (RMB) |
| Beijing | On-going, ready by the end of 2017 | / | 2016-2019 | 1000/m ² |
| Hebei | Effective on May 1st, 2015 | Shijiazhuang | 2017-2020 | 300-100/m ² |
| Shandong | Effective on December 1st, 2016 | Tsingtao | 2016-2019 | 200/m ² (City Gov) Partial Incremental Cost (Province Gov) |



- ❑ China Passive Building Alliance was established in 2014, Beijing
- ❑ Led by the China Academy of Building Research
- ❑ Built by more than 60 enterprises and institutions.



Establish Standards

Organize the compiling of China Passive Ultra-low Energy Building Standard

Technology Promoting

Promote the technology of Passive Ultra-low Energy Building

Platform for Exchanging

Facilitate the communications between research institutions and enterprises of Passive Ultra-low Energy Building industry in China and abroad

- Science research organization
- University
- Real estate developer
- Building material manufacturer
- Equipment manufacturer
- Others



Certified passive buildings in 2016 by CPBA

第一批被动式超低能耗评价标识项目



“幸福堡”商业综合楼



天津象博庭院



中国建筑科学研究院近零能耗示范建筑



翠成经济适用房4期



南京绿色灯塔



奥润顺达专家公寓



河北省建筑科技研发中心



承德中天建设工程检测试验有限公司物资储备库



沈阳建筑大学中德节能示范中心



秦皇岛任水一方被动式超低能耗绿色建筑



淄博临淄区莲台养生养老院



青岛中德生态园被动房技术体验中心



翎翔上郡39号楼



镇江联合国CIFAL培训基地展示中心



天津生态城南片区15号地块公寓二期2B项目



威海市委党校新建项目综合教学楼项目



吉林建筑大学城建学院超低能耗建筑



西藏城发节能建材股份有限公司（生产基地）建设项目办公楼



山东城市建设职业学院实验实训中心



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Ultra-low energy building in China: National Guideline for Residential Buildings

• Principles

• Incremental costs under control

- Significant for the long-term development of the passive ultra-low energy building
- Encourages to use local or domestic products so that the incremental costs will be affordable
- The related building components industry could be promoted at the same time

• Whole process control of master plan, design, construction, evaluation and operation

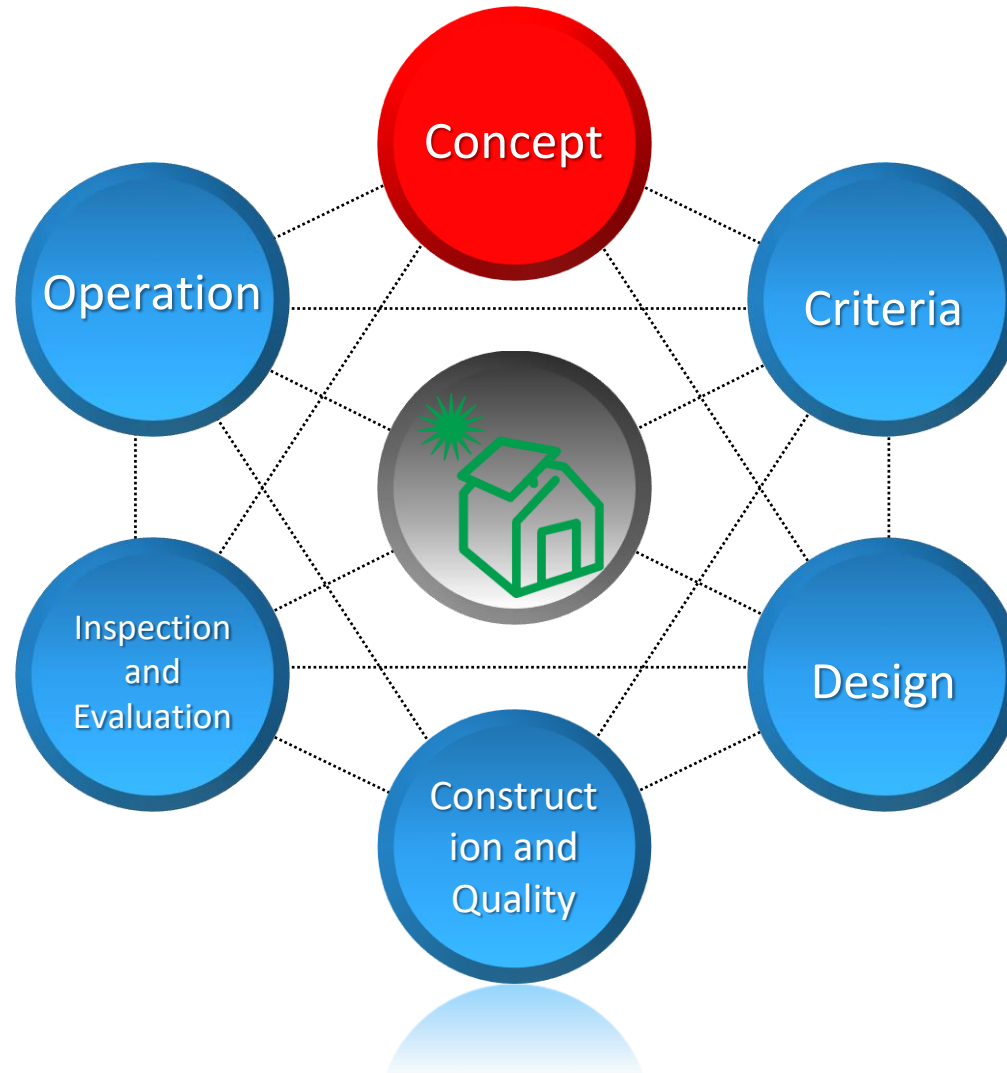


• Link up the current building energy technical code and standard of China

- Only focus on the special items and technical measures of ultra-low energy buildings



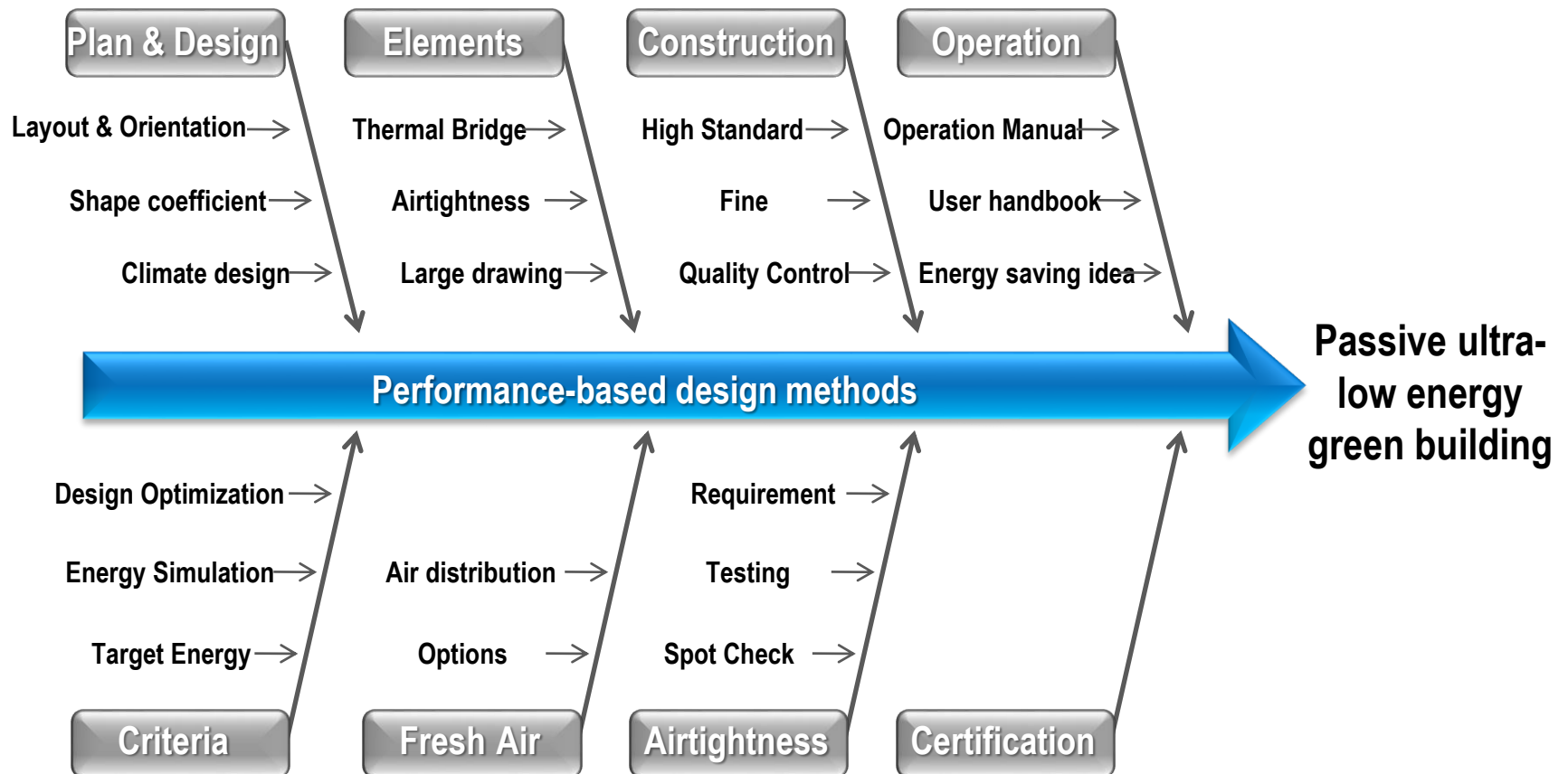
Ultra-low energy building in China: National Guideline for Residential Buildings





Ultra-low energy building in China: National Guideline for Residential Buildings

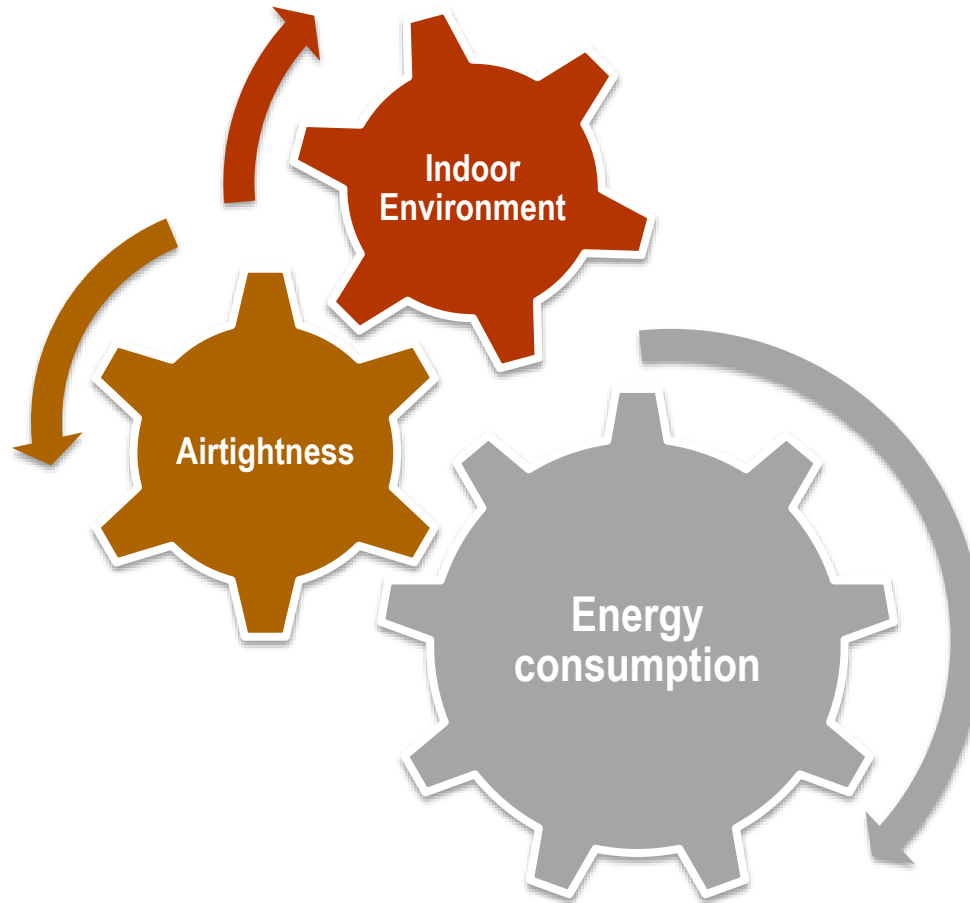
1 General principles





Ultra-low energy building in China: National Guideline for Residential Buildings

2 Technical Criteria





Ultra-low energy building in China: National Guideline for Residential Buildings

2 Technical Criteria

| Climate Zone | | Severe Cold | Cold | Hot Summer, Cold Winter | Hot Summer, Warm Winter | Temperate |
|-----------------|--|---|------|-------------------------|-------------------------|-----------|
| Energy Criteria | Accumulative Annual Heating [kWh/(m ² a)] | ≤18 | ≤15 | ≤5 | | |
| | Accumulative Annual Cooling [kWh/(m ² a)] | ≤ 3.5 + 2.0 WDH ₂₀ + 2.2 DDH ₂₈ | | | | |
| | Accumulative Heating, Cooling and Lighting Energy | ≤ 60 kWh/(m ² a) (= 7.4 kgce/(m ² a)) | | | | |
| Airtightness | n ₅₀ [h ⁻¹] | ≤ 0.6 | | | | |

The energy criteria are referenced to the total floor area [m²], which include the floor areas of living room, dining room, kitchen, restroom, hall, hallway, storage room and closet.

WDH₂₀: Wet-bulb degree hours 20 [kKh] – Accumulative value of the difference between the outdoor wet-bulb temperature and 20 ° C when the outdoor temperature is higher than 20 ° C.

DDH₂₈: Dry-bulb degree hours 28 [kKh] – Accumulative value of the difference between the outdoor dry bulb temperature and 28 ° C when the outdoor temperature is higher than 28 ° C.

n₅₀ is the air changes per hour [h⁻¹] at 50 Pa pressure difference.



Ultra-low energy building in China: National Guideline for Residential Buildings

2 Technical Criteria

| Indoor Environmental Parameter | Winter | Summer |
|--|----------------------|--------------------|
| Temperature [° C] | ≥ 20 | ≤ 26 |
| Relative Humidity [%] | ≥ 30 ^{a)} | ≤ 60 |
| Fresh Air [m ³ /h·per person] | ≥ 30 ^{b)} | |
| Noise [dB(A)] | Day ≤ 40; night ≤ 30 | |
| Unguaranteed temperature rate [%] | ≤ 10 ^{c)} | ≤ 10 ^{d)} |

a) The energy consumption calculation does not consider the relative humidity in winter.

b) Per capita floor space taken as 32 m² per person.

c) When there are no heating facilities, the percentage of hours with indoor temperature below 20 ° C per year.

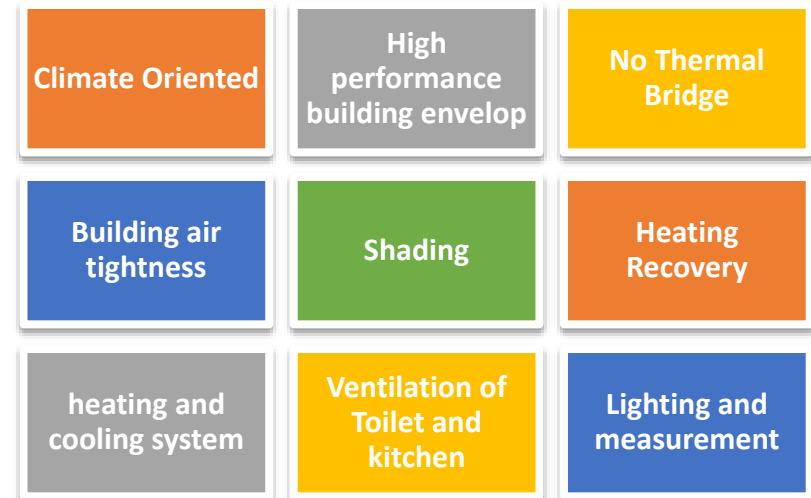
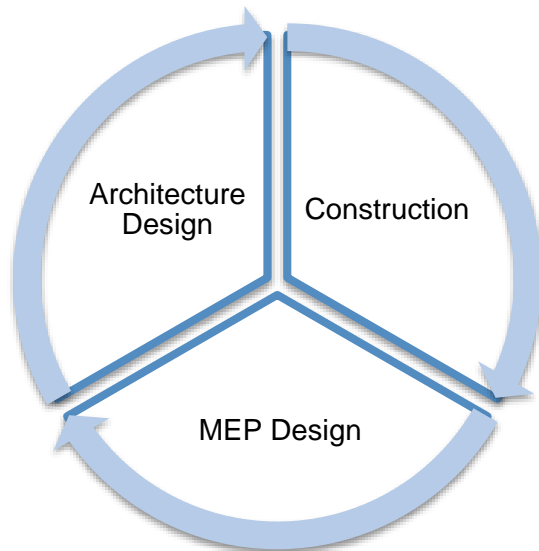
d) When there is no air conditioning, the percentage of hours with indoor temperature higher than 28 ° C per year.



Ultra-low energy building in China: National Guideline for Residential Buildings

3 Design

Collaborative design:



Full text of the National Guideline:
<http://www.mohurd.gov.cn/wjfb/201511/W020151113040354.pdf>



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Objectives

Quantitative definition of NZEB of China | Provide **technical path** of all climate zones
Require not measurement but energy result | Promote the performance of building products

Fundamental Research

1. Dynamic heat and moisture transfer
2. Theory and modeling of fresh air demand and coupling with air quality
3. Definition of China NZEB
4. Multi-objective and multi parameter optimization
5. Climatic adapted technical criteria for multi climate zones China

Key Technologies and Product

1. High performance integrated heat insulation wall
2. Multifunction door and window
3. User demand oriented accuracy control
4. R&D integrated high performance heat recovery and dehumidification devices
5. Combined system of renewable energy and energy storage

Evaluation of Design and Construction

1. Design methodology and tool of energy oriented multi parameter optimization
2. Construction technology and standardization of thermal bridge-free, high air tightness and fabricated construction
3. NZEB building overall performance test and evaluation method

Integration and Demonstration

1. Incremental cost analysis
2. jishuImplementation effect evaluation
3. Research on international NZEB technical criteria and key technology.



Nearly Zero Energy Building Technical System Investigation

Fundamental Research

Topic 1 Basic theoretical research

Criteria System

Topic 2 Definition and Technical Criteria

Technical research and product R&D

Topic 3 **Passive** technical research and product R&D

Topic 4 **Active** technical research and product R&D

Topic 5 Coupling study of **renewable energy** and energy storage

Design, construction and evaluation methods

Topic 6 **Design methodology** research and tool development

Topic 7 **Construction standardization** process and quality control

Topic 8 Performance testing and **Evaluation** Technology

Integration and Demonstration

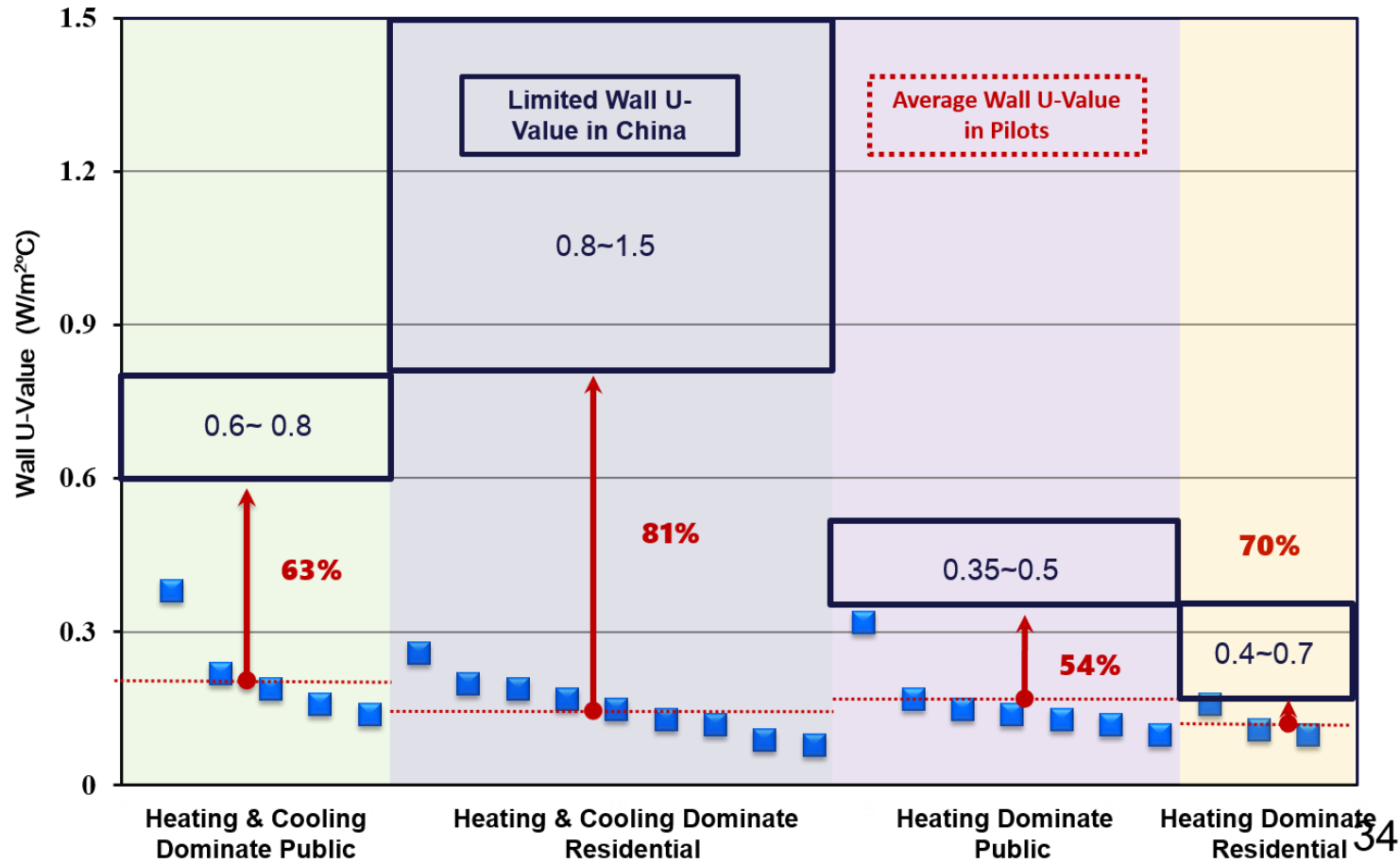
Topic 9 Technology integration and demonstration project of **residential buildings**

Topic 10 Technology integration and demonstration project of **public buildings**

NZEB Pilot projects study



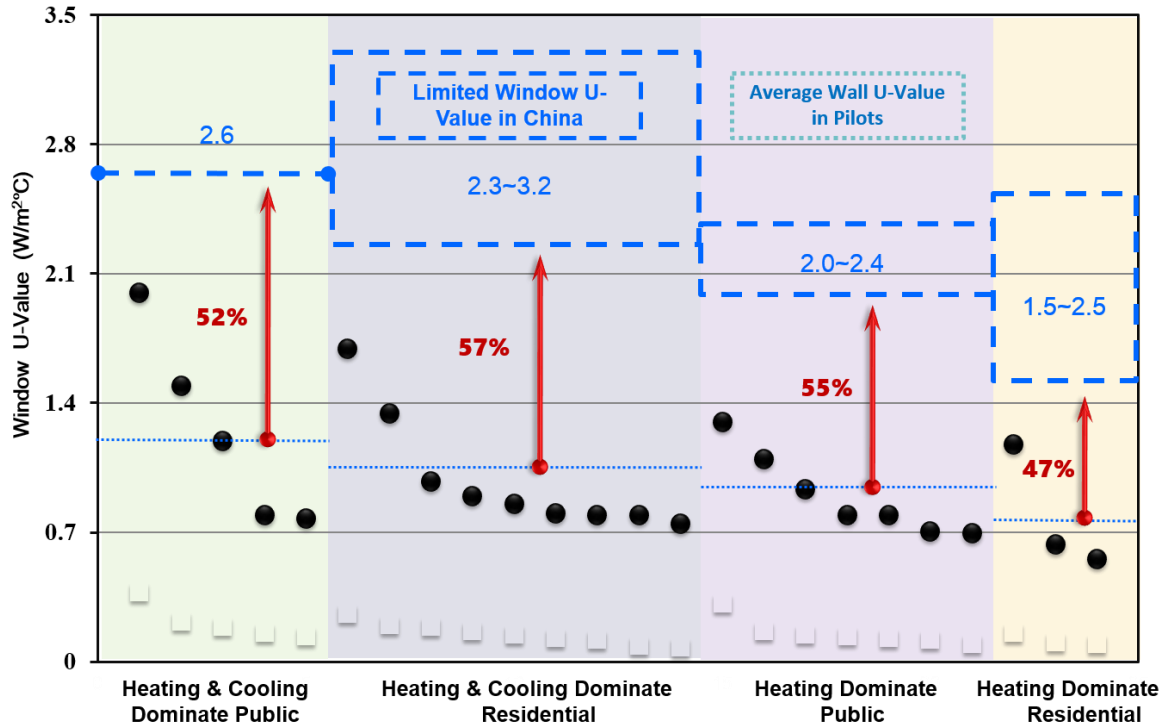
Comparison of Wall U-value between standards and best practices



NZEB Pilot projects study



Comparison of Window U-value between standards and best practices



The gap between the best practices and the building codes now is the future revision trend of China building codes.



Summary

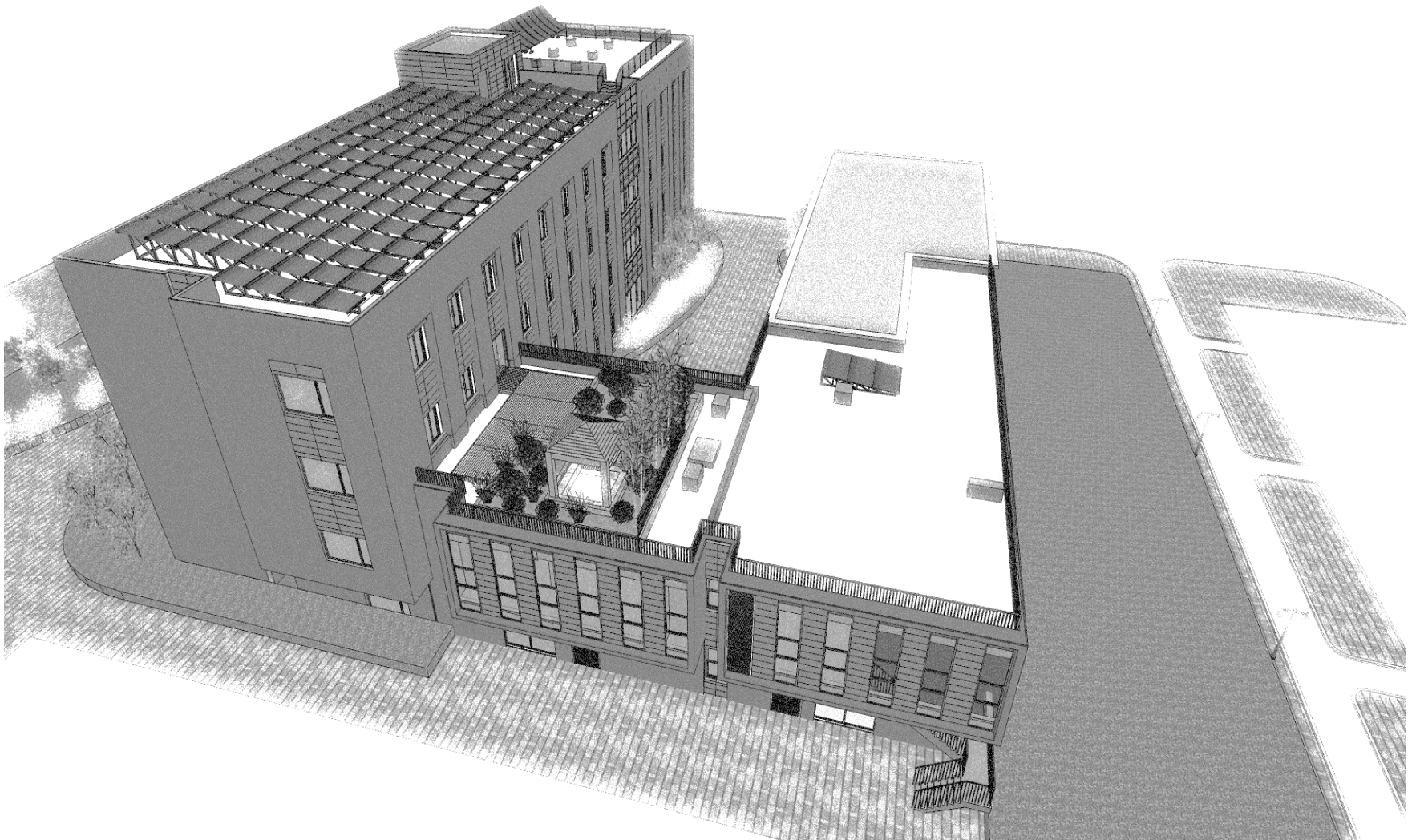
● Move forward...

- Researchers, central and local governments, property developers, manufactures...
- Beijing certified the first batch of ultra-low pilot buildings last week, with ¥1000/m² subsidy.
- The 13th Five-Year the National Research Project “**NZEB Technical System Investigation**” started up last Tuesday, with 5.2 million USD national funding, led by China Academy of Building Research, 2017-2020
- The National Technical Standards for Nearly Zero-Energy Buildings were launched in 2016, will be published in 2018.



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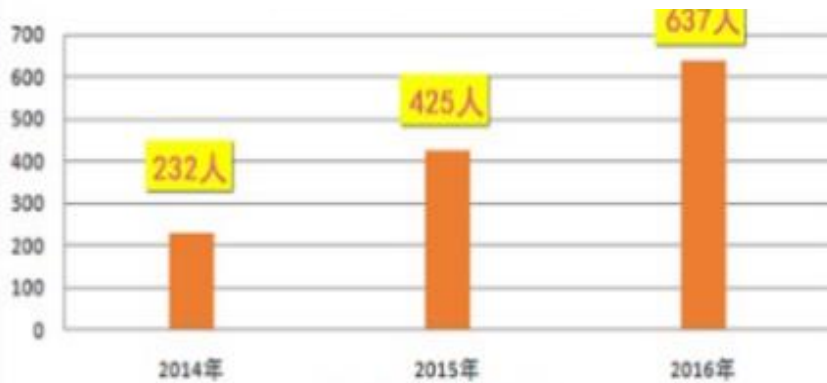
Thank You for listening!





China National Nearly Zero Energy Building Conference

Number of participants in previous Congresses



3rd national NZEB conference
637 participants



中国建筑节能协会
CHINA ASSOCIATION OF BUILDING ENERGY EFFICIENCY



中国建筑科学研究院
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CHINA PASSIVE BUILDING ALLIANCE

2017年第四届 全国被动式超低能耗建筑大会

The 2017 China Nearly Zero Energy Building Conference

See you in November!

2017年11月22日-23日

November 22ND -23RD 2017

河北·高碑店

Hebei · Gaobeidian

