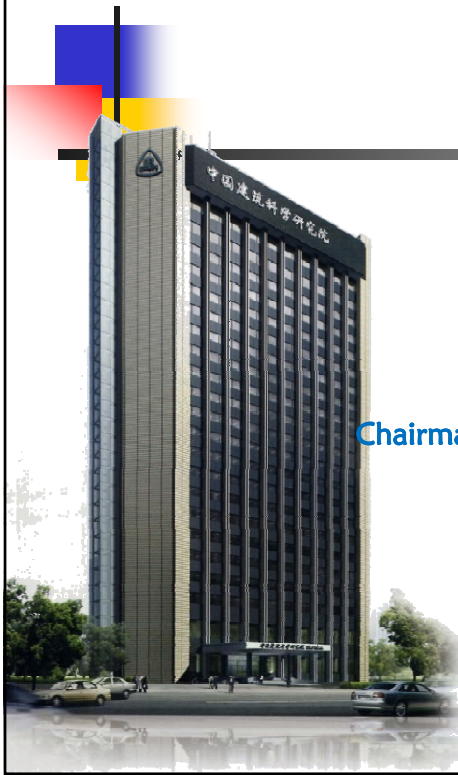


China Building Energy Efficiency Policies and Codes & Standards System



XU WEI

Director of Institute of Building Environment and Energy Efficiency.

China Academy of Building Research (CABR-IBEE)

Chairman. China Committee of Heating Ventilation and Air Conditioning (CCHVAC)



中國建築科學研究院
China Academy of Building Research

Contents

- ☞ **Brief of CABR-IBEE and CCHVAC**
- ☞ **China economic & energy situation**
- ☞ **Component of building Energy Efficiency Codes & Standards System**
 - ➔ **Design stage**
 - ➔ **Construction stage**
 - ➔ **Operation stage (in using)**
 - ➔ **Test & evaluation stage**
- ☞ **Conclusion**



Brief introduction of CABR

- **CABR was founded in 1953, used to be the largest R&D institute affiliated to Ministry of Construction (now called MOHURD, Ministry of Housing and Urban-Rural Development) .**
- **Since 1 October 2000, turned into a technology-based enterprise.**
- **2179 research project completed, 91 national awards, 400 provincial/ministerial awards, 163 national patents, 453 standards and codes.**
- **More than 4000 researchers and engineers**



Brief introduction of CABR

R & D field

- **HVAC**
- **Building Physics**
- **Building Machinery**
- **Foundation Engineering**
- **Building Structures**
- **Computer Center**
- **Building Fire Prevention**
- **Building Materials**
- **Earthquake Engineering**



Institute of Building
Environment and Energy
Efficiency



Brief introduction of CABR-IBEE

Institute of Building Environment and Energy Efficiency (referred to as "IBEE"), as an institute of China Academy of Building Research, was founded based on the integration of Institute of Air-conditioning and Institute of Building Physics in August 2006.

IBEE have 300 R & D researchers focus on the R&D of building environment, building energy system, building energy efficiency, green building and intelligent building, addressing on the key technical problems of HVAC system, building acoustics and lighting, thermal field.



Brief introduction of CABR-IBEE

R & D field

Building certification,

Green building,

Energy management contract

Building acoustics

Building lighting

Building thermal environment

Fenestration

Central heating and heat metering

HVAC equipment development and integration

.....

16 main fields.



Brief introduction of CCHAVC

- China Committee of Heating, Ventilation and Air-conditioning (CCHVAC) was founded in 1978.
- Its predecessor was China Building Equipment Committee (since 1962).
- In 1978, CCHVAC held the first national HVAC&R conference.



Brief introduction of CCHAVC

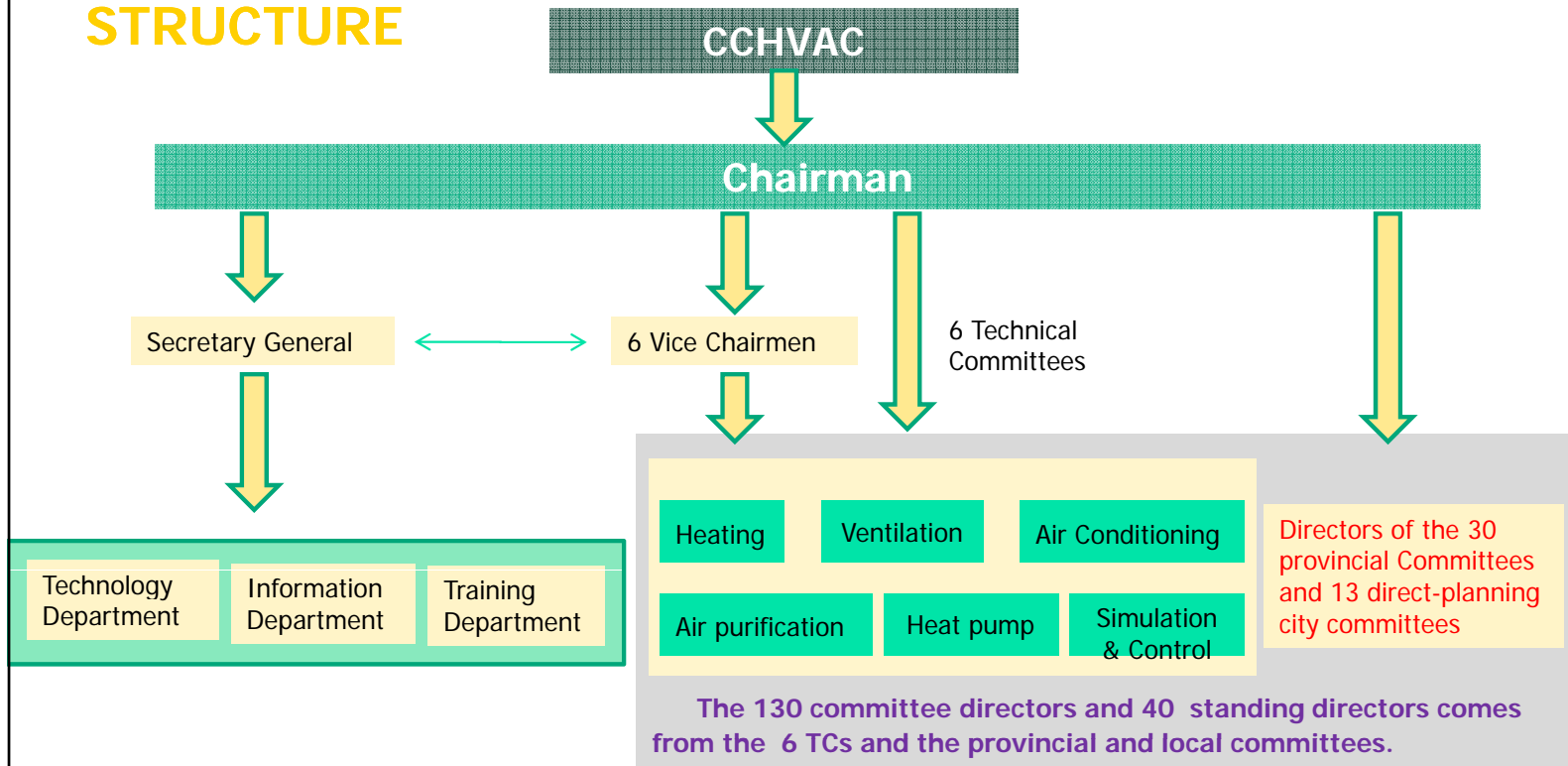
STRUCTURE

- The Committee is composed of nationwide specialists and scholars from research institutes, design & consulting firms, universities and professionals in the field of HVAC&R engineering, manufacturing, operation and management.
- It is the national organization in the field of HVAC in China with the most authoritative experts, scholars and technicians.
- The Committee have 130 committee directors and 40 standing directors which all over the nationwide, including most of the directors of the local committees. The committee can influence 50,000 engineers and technicians in the HVAC field.



Brief introduction of CCHAVC

STRUCTURE



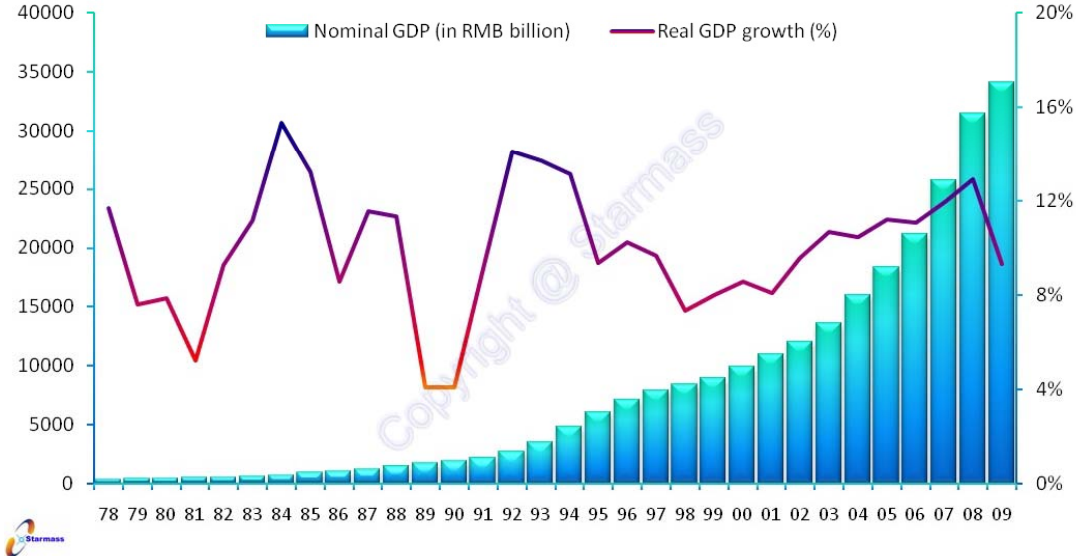
Contents

- ☞ Brief of CABR-IBEE and CCHVAC
- ☞ **China economic & energy situation**
- ☞ Component of building Energy Efficiency Codes & Standards System
 - ➔ Design stage
 - ➔ Construction stage
 - ➔ Operation stage (in using)
 - ➔ Test & evaluation stage
- ☞ Conclusion



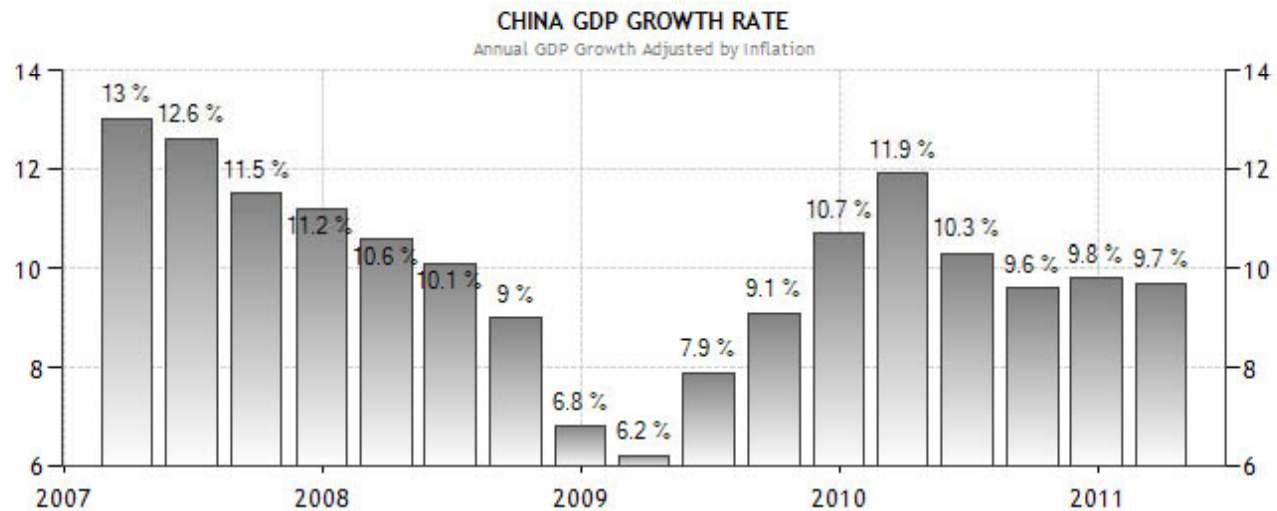
General economic situation China

China GDP trends from 1978 - 2009



Data from National Bureau of Statistic of China

General economic situation China



source: TradingEconomics.com; National Bureau of Statistics

GDP

Even in the financial crisis, it continue to grow more than 6%. From this picture we can tell that the financial crisis didn't have a very negative impact to China's economy. China's gross domestic product jumped 9.7 percent on year in the first quarter of 2011, based on the report form the National Bureau of Statistics.



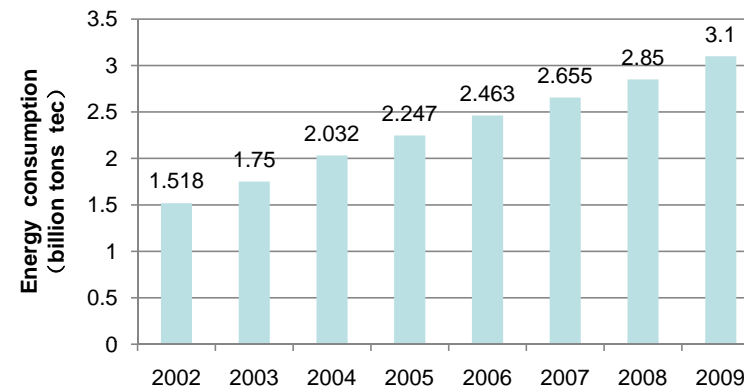
中國建築科學研究院
China Academy of Building Research

12

Characteristics of energy consumption in China

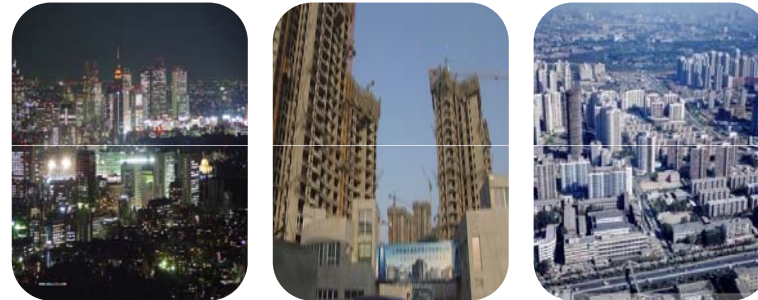
- Huge energy consumption with high growth rate.
- Low carbon energy grows fast in recent years while small in proportion.
- The total energy consumption more than doubled from 2002 to 2009.
- China's building energy consumption grows with a high speed, which increased by almost 2 times from 2003 to 2009.

Energy consumption in China



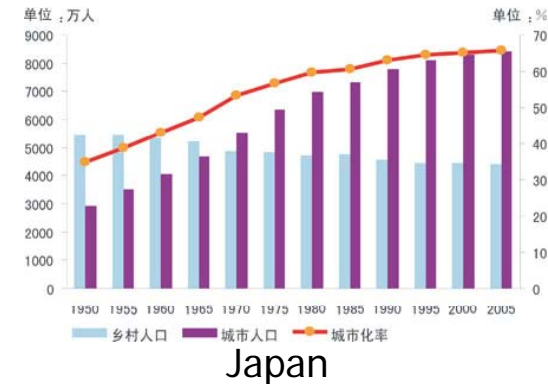
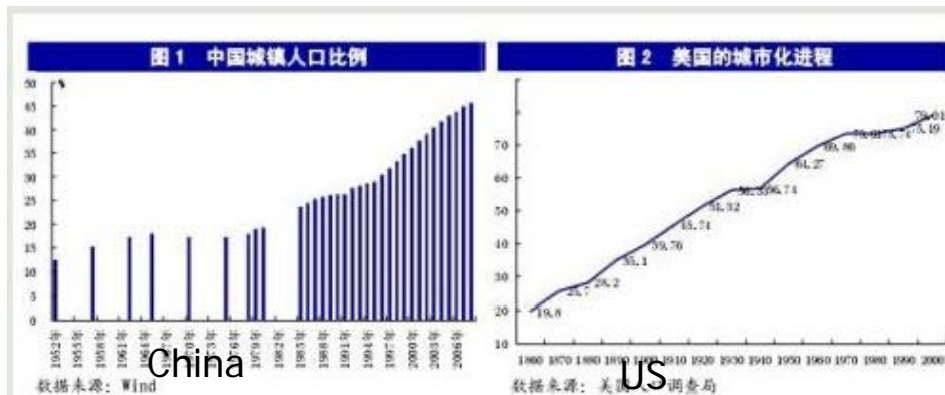
China's urbanization development and forecast

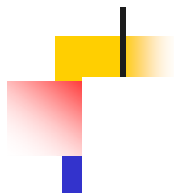
- China's urbanization rate is 46% in 2009.
- Until 2020, about 200 millions people will move into city to ,the urbanization rate will reach 58.7%.
- Nearly 20 billion m² floor area will be constructed before 2020.
- Before 2050, the urbanization rate will reach to 70%.



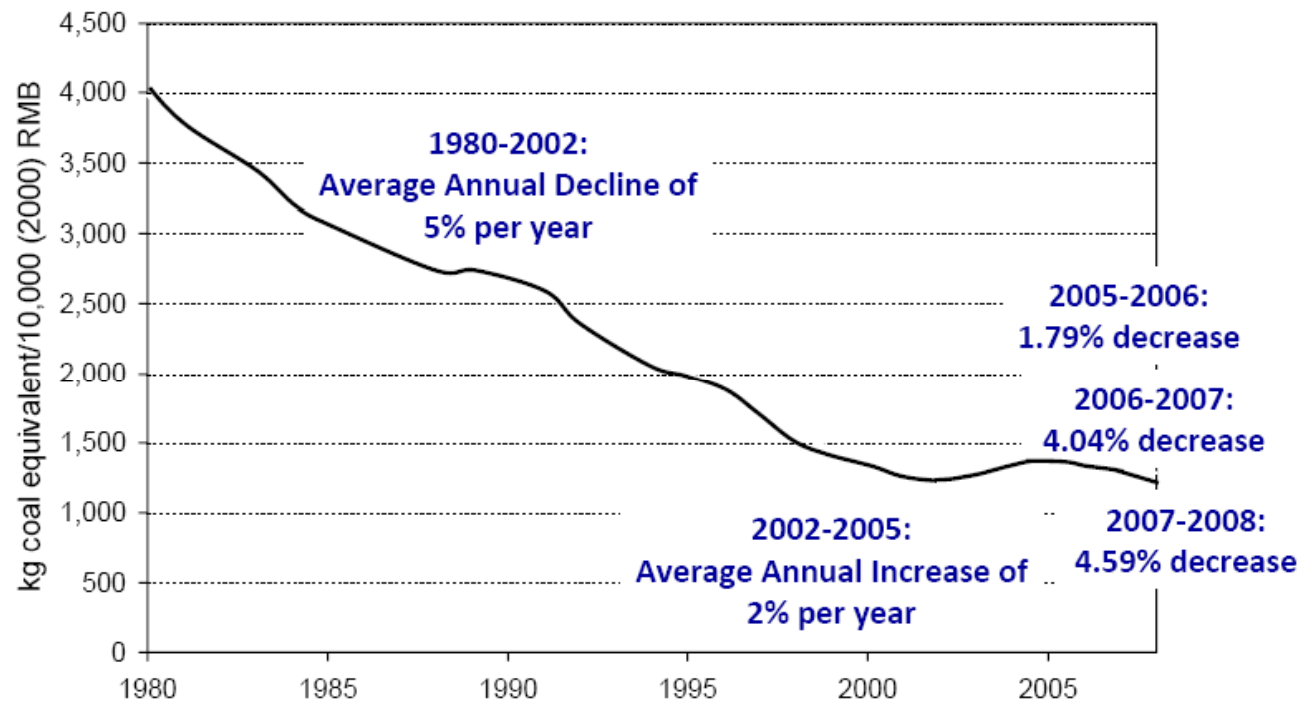
Factors influence the BEE & HVAC market growth in China

- Drivers in urbanization
- Population and GDP growth . (1.4-1.5 billion at the peak in 2020-2030.)
- Living condition improvement
- Climate Change and Greenhouse Gas Emission.





Energy Use in China: Recent Trends



Key Energy-Efficiency Policies and Programs

Energy Policies	Date Effective
Fuel Consumption Limits For Passenger Cars	2004
Medium and Long-Term Plan for Energy Conservation	2005
Renewable Energy Law	2005
Government Procurement Program	2005
National Energy Efficient Design Standard for Public Buildings	2005
Eleventh Five-Year Plan	2006
The State Council Decision on Strengthening Energy Conservation	2006
Revised Consumption Tax for Larger, Energy-Inefficient Vehicles	2006
Reduced Export Tax Rebates for Many Low-Value-Added But High Energy-Consuming Products	2006
Top-1000 Energy-Consuming Enterprise Program	2006
"Green Purchasing" Program	2006
Revision of Energy Conservation Law	2007
Allocation of Funding on Energy Efficiency and Pollution Abatement	2007
China Energy Technology Policy Outline 2006	2007
Government Procurement Program	2007
National Phase III Vehicle Emission Standards	2007
Interim Administrative Method for Incentive Funds for Heating and Metering and Energy Efficiency Retrofit for Existing Residential Buildings in China's Northern Heating Area	2007
Law on Corporate Income Tax (preferential tax treatment for investment in energy-saving and environmentally-friendly projects and equipment)	2008
Allocation of Funding on Energy Efficiency and Pollution Abatement	2008
Appliance Standards and Labeling	Various Years

Contents

- ☞ Brief of CABR-IBEE and CCHVAC
- ☞ China economic & energy situation
- ☞ **Component of building Energy Efficiency**

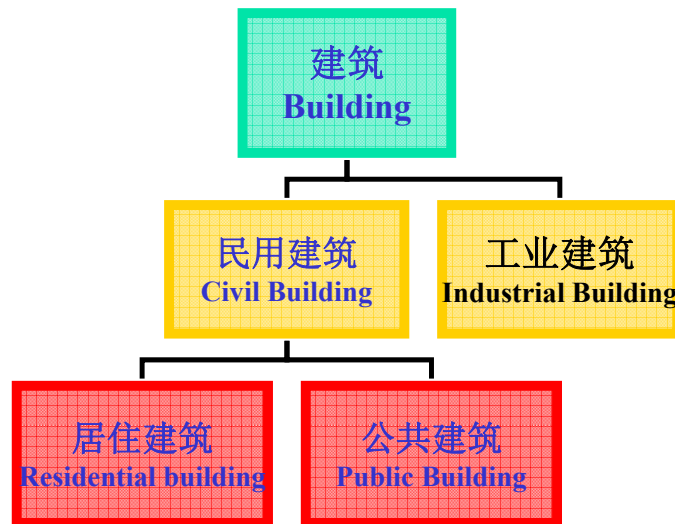
Codes & Standards System

- ➔ Design stage
- ➔ Construction stage
- ➔ Operation stage (in using)
- ➔ Test & evaluation stage

- ☞ Conclusion



Building Classification



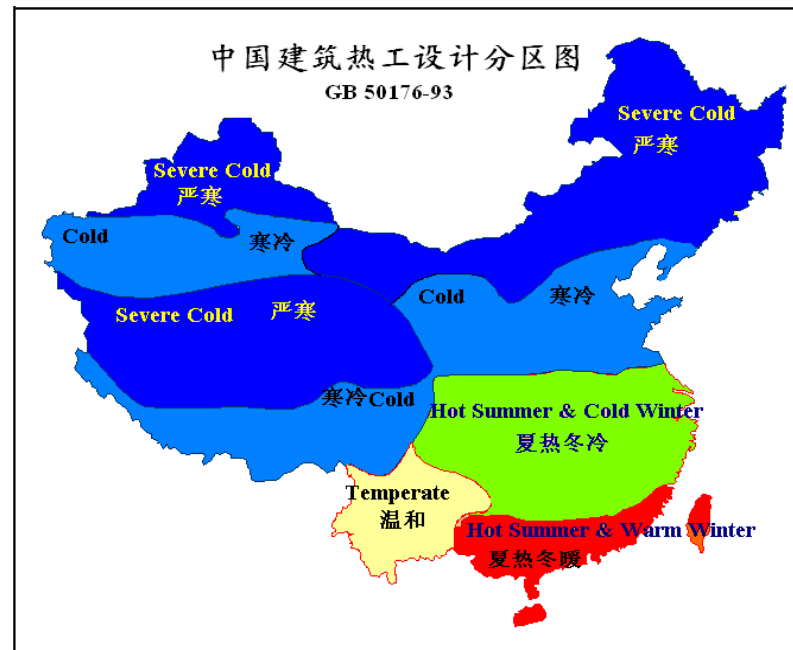
- Building includes Civil Building and Industrial Building
- Civil Building includes Residential Building and Public Building

- **Residential Building:**
 - House, apartment, dormitory, the residential part in mixing building, nursery, kindergarten, etc.
- **Public Building:**
 - Office Building
 - Shopping, Finance Building
 - Hotel and place of entertainment
 - Buildings for education, science, culture, Gymnasium and public health services
 - Buildings for communication, post and broadcasting
 - Buildings for transportation (Airport, Train station, etc.)



Consideration of building Energy Efficiency Codes & Standards

- MOUHRD had started to organize the building energy efficiency work since 1980's
- Principle of considering the region & type of building
 - North -> Central -> South
 - Residential -> Public
 - New Construction -> Retrofit





Consideration of building Energy Efficiency Codes & Standards (cont.)

■ Type of the Codes & Standards

- **Design** (e.g. Design standards for energy efficiency of residential / public building)
- **Construction** (e.g. Code for acceptance of energy efficient building construction, Technical specification for energy conservation renovation of existing residential/ public building)
- **Operation** (e.g. Standard for energy consumption survey of civil buildings)
- **Test and Evaluation** (e.g. standard for energy efficiency test of residential / public buildings, Evaluation standard for green building)

■ Principle of Implement

- **Mandatory: Standards for Design & Construction**
- **Voluntary: Standards for Operation, Test & Evaluation**





Design Stage



Design Standards for Building Energy Efficiency

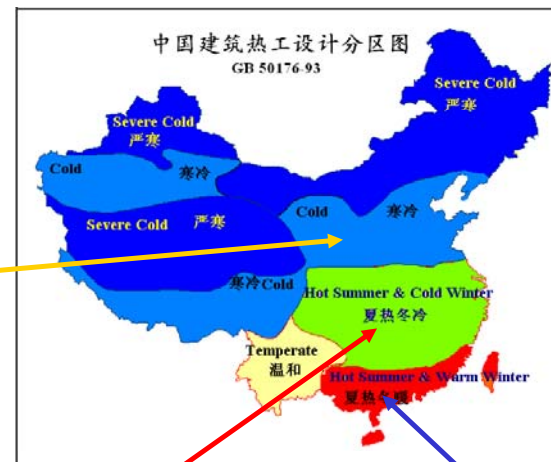
UDC
中华人民共和国行业标准
JGJ
P
JGJ 26 - 2010
备案号 J 997 - 2010

严寒和寒冷地区居住建筑节能设计标准
Design standard for energy efficiency of residential buildings in severe cold and cold zones

**Implementing on
Aug.1st, 2010**

2010 - 03 - 18 发布 2010 - 08 - 01 实施

中华人民共和国住房和城乡建设部 发布



UDC
中华人民共和国国家标准
GB
P
GB 50189 - 2005

公共建筑节能设计标准
Design standard for energy efficiency of public buildings

**Implementing on Jul
1st, 2005**

2005 - 04 - 04 发布 2005 - 07 - 01 实施

中华人民共和国建设部
中华人民共和国国家质量监督检验检疫总局 联合发布

UDC
中华人民共和国行业标准
JGJ
P
JGJ 134 - 2010
备案号 J 995 - 2010

夏热冬冷地区居住建筑节能设计标准
Design standard for energy efficiency of residential buildings in hot summer and cold winter zone

**Implementing on
Aug.1st, 2010**

2010 - 03 - 18 发布 2010 - 08 - 01 实施

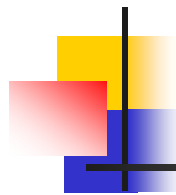
中华人民共和国住房和城乡建设部 发布

中华人民共和国行业标准
JGJ
P
JGJ 75 - 2003
J 275 - 2003

夏热冬暖地区居住建筑节能设计标准
Design standard for energy efficiency of residential buildings in hot summer and warm winter zone

**Implementing on
Oct.1st, 2003**

2003 北京



Design Standards: Goal and Path

- **Goal of Building Energy Efficiency**
 - **Guarantee the comfort & health indoors, to reduce:**
 - Energy Conservation of HVAC (Residential Building)
 - Energy Conservation of HVAC & lighting (Public Building)
 - **Take the energy conservation of HVAC & lighting of the buildings constructed in the early 1980's as the baseline, buildings constructed under the energy efficiency standards:**
 - Energy conservation of HVAC 65% off (residential in severe cold and cold zone)
 - Energy conservation of HVAC & lighting 50% off (Public Building)
- **How?**
 - Improve the insulation, tightness
 - Improve the efficiency of HVAC & lighting system
 - Optimize the operation strategy
 - Renewable energy application





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

- **1 General Provisions**
 - **2 Terms and Symbols**
 - 2.1 Terms
 - 2.2 Symbols
 - **3 Climate Sub-zone and Calculation Parameter of Indoor Thermal Environment**
 - **4 Building and Envelop Thermal Design**
 - 4.1 General Requirement
 - 4.2 Building Envelop Thermal Design
 - 4.3 Building Envelop Thermal Performance Trade-off
 - **5 Energy Efficiency Design on HVAC System**
 - 5.1 General Requirement
 - 5.2 Heat Source, Heating Plant and Heat Supply Network
 - 5.3 Heating System
 - 5.4 Ventilation and Air-conditioning System
- Appendix A Climate Zone Criteria, Weather Data, Heat Loss Index Requirements of Building for Cities
 - Appendix B Methodology for Mean Heat Transfer Coefficient and Linear Heat Transfer Coefficient of Thermal Bridge
 - Appendix C Calculation of Heat Transfer Coefficient of Ground of Building
 - Appendix D Simplification on Building Shading Coefficient
 - Appendix E Correction Factor of Building Envelop (ϵ) and Temperature Difference Correction Factor of Enclosing Balcony (ζ)
 - Appendix F Building Area and Volume
 - Appendix G Minimum Thickness of Heating Pipe's Insulation Layer (δ_{\min})

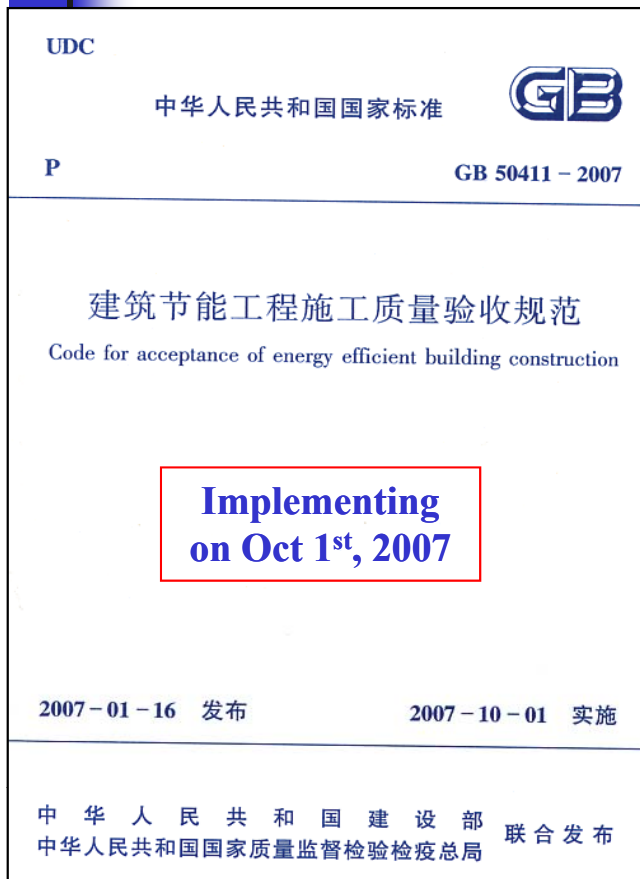




Construction Stage



Code for acceptance of energy efficient building construction GB 50411-2007



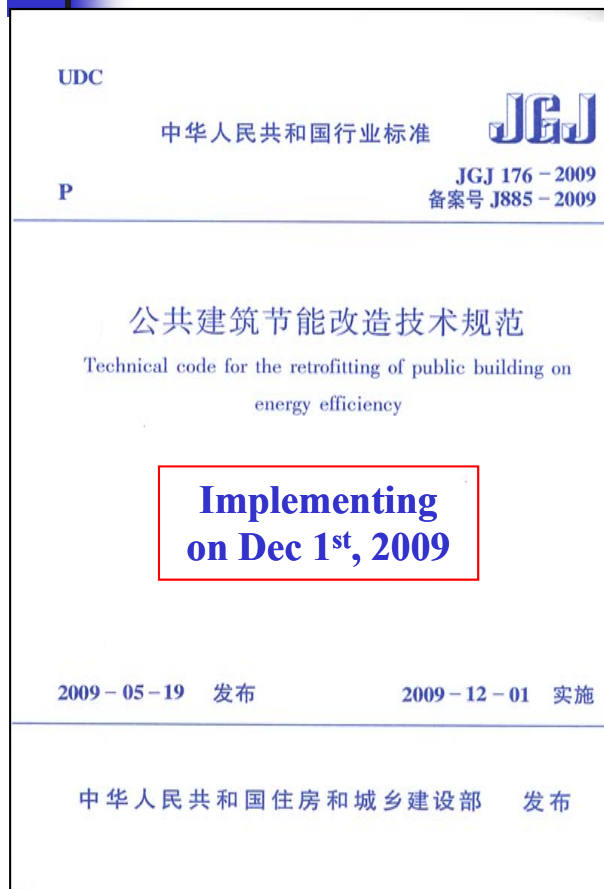
■ Contents:

- **Wall** Energy Efficiency Construction
- **Curtain Wall** Energy Efficiency Construction
- **Door and Window** Energy Efficiency Construction
- **Roof** Energy Efficiency Construction
- **Floor** Energy Efficiency Construction
- **Heating** Energy Efficiency Construction
- **Ventilation and Air-Conditioning** Energy Efficiency Construction
- **Heating & Cooling Source and Network** Energy Efficiency Construction
- **Power Distribution and Lighting** Energy Efficiency Construction
- **Monitor and Control** Energy Efficiency Construction
- **Building Energy Efficiency Construction Field Inspection**
- **Building Energy Efficiency Construction Acceptance of Divisional Work**



Technical code for the retrofitting of public building on energy efficiency

JGJ 176 – 2009



- 1 General Provisions
- 2 Terms
- 3 Energy System Diagnose
- 4 Benchmark on Retrofitting of Energy Efficiency
- 5 Retrofitting on Thermal Performance of External Envelope
- 6 Retrofitting on HVAC and Domestic Hot Supply Systems
- 7 Retrofitting on Power Supply and Distribution Systems and Lighting
- 8 Retrofitting on Monitoring and Control Systems
- 9 Renewable Energy System
- 10 Measurements and Verification on Energy Savings
- Appendix A: The Performance of Heating and Cooling Equipment

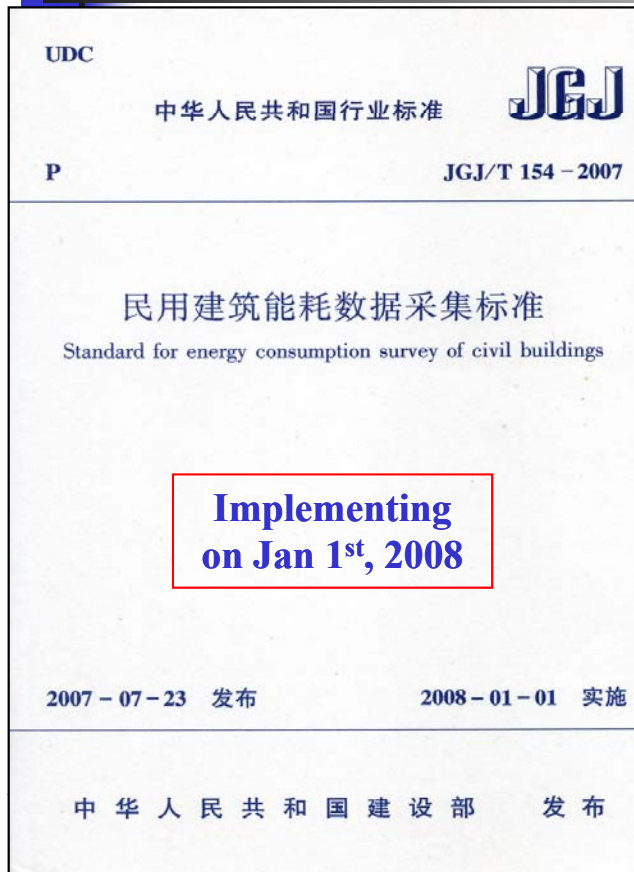




Operation (Using) Stage

Standard for Energy Consumption Survey of Civil Buildings

JGJ/T 154-2007



- 1 General Provisions
- 2 Terms
- 3 Object and Index of Energy Consumption Survey
- 4 Sample Size and the Method for determining the sample in Energy Consumption Survey
- 5 Method of Energy Consumption Survey in Sample Building
- 6 Method of Data Report Generation and Submitted
- 7 Data Posted
- Appendix A Information Sheet of Urban Civil Buildings
- Appendix B Survey Data Sheet of Sample Buildings
- Appendix C Data Processing Method of Building Energy Consumption Survey
- Appendix D Data Report Sheet for Urban Civil Buildings
- Appendix E Data Posted Sheet for Urban Civil Buildings



中國建築科學研究院
China Academy of Building Research

30

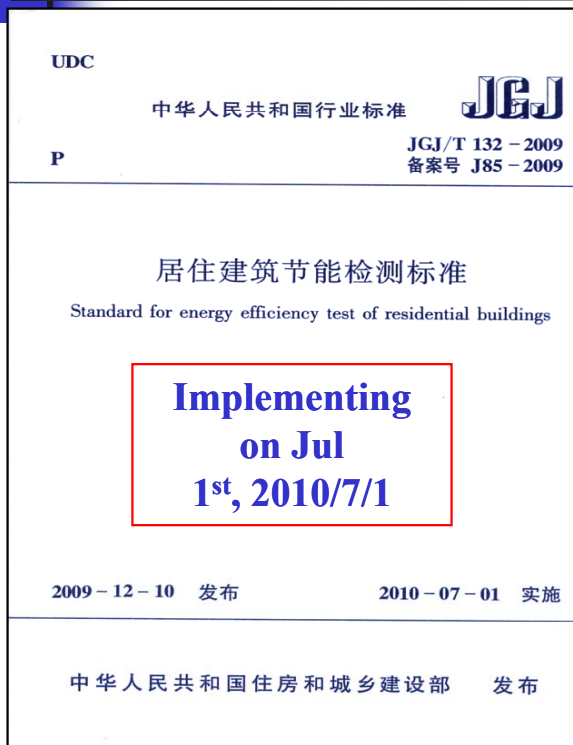


Test & Evaluation Stage



Standards for energy efficiency test of residential buildings

JGJ/T 132-2009



检测项目章节，均规定“检测方法”和“合格指标与判定方法”

- General Provisions
- Terms and Symbols
- Basic Requirements
- Average Room Air Temperature
- Thermal Irregularities in External Envelops
- Inside Surface Temperature of Thermal Bridge for Exterior Building Envelops
- Overall Heat transfer Coefficient of Building Envelops
- Air tightness of Exterior Windows
- Insulation Performance of Exterior Building Envelops
- Outside Shading Fixtures of Exterior Windows
- Hydraulic Equilibrium of Outdoor Network
- Replenishment rate
- Heat Loss Ratio of Outdoor Network
- Boiler Operation Efficiency
- Ratio of Electricity Consumption to Transferred Heat Quantity
- Appendix A~G



中國建築科學研究院
China Academy of Building Research

Standards for energy efficiency test of public buildings

JGJ/T 177-2009



- General Provisions
- Terms
- Basic Requirements
- Average Indoor Air Temperature and Relative Humidity Test
- Non-transparent Envelope Thermal Performance Test
- Transparent Envelope Thermal Performance Test
- Building Envelope Thermal Performance Test
- Heating and Air-conditioning Water System Performance Test
- Air-conditioning Air System Performance Test
- Heating and Air-conditioning System Year Energy Consumption & Energy Efficiency Ratio of Cooling Source System Testing
- Power Supply and Distribution System Test
- Lighting System Test
- Monitoring and Control System Test

Appendix A-E



中國建築科學研究院
China Academy of Building Research

Evaluation standard for green building

GB/T 50378-2006

UDC
中华人民共和国国家标准
P
GB/T 50378-2006

绿色建筑评价标准
Evaluation standard for green building

**Implementing
on Jun 1st, 2006**

2006-03-07 发布 2006-06-01 实施

中华人民共和国建设部 联合发布
中华人民共和国国家质量监督检验检疫总局



Credits requirements of green building classification (residential)

Class	Credits (40)						Bonus Credits (9)
	Site and outdoor environment (6)	Energy (6)	Water (6)	Material (7)	Indoor Environment (6)	Operation Management (7)	
★	4	2	3	3	2	4	-
★★	5	3	4	4	3	5	3
★★★	6	4	5	5	4	6	5

Credits requirements of green building classification (public)

等级	一般项数 (共 43 项)						优选项数 (14 项)
	节地与室外环境 (6 项)	节能与能源利用 (10 项)	节水与水资源利用 (6 项)	节材与材料资源利用 (8 项)	室内环境质量 (6 项)	运营管理 (7 项)	
★	3	4	3	5	3	4	-
★★	4	6	4	6	4	5	6
★★★	5	8	5	7	5	6	10



中国建筑科学研究院
China Academy of Building Research



The goal of building energy efficiency in the next five years

- The building sector will take a responsibility of 4.4% energy reduction in the whole economy.
- The new building will be enforced to use the higher level of the standards. 30% more stringent than now.
- The energy efficiency retrofitting (refurbishment) will be 0.25 billion square meters in China .
- The renewable energy utilization in buildings will be doubled than now.



Contents

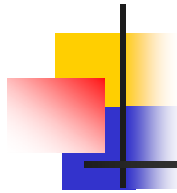
- ☞ Brief of CABR-IBEE and CCHVAC
- ☞ China economic situation
- ☞ Component of building Energy Efficiency

Codes & Standards System

- ➔ Design stage
- ➔ Construction stage
- ➔ Operation stage (in using)
- ➔ Test & evaluation stage

☞ **Conclusion**





CONCLUSION

- With the problem of the climate change, China government published a series of policies and subsidies to building energy efficiency.
- China's building energy efficiency standards and codes system is completed but still needs to be upgraded to catch up with the developed countries. That is the greatest opportunity for related advanced technologies already existed in EU.
- The building energy will increase due to the increase of the urbanization rate and improvement of people's living standard. Huge market exists in the new building area and existing building retrofit area.
- CABR-IBEE and CCHVAC would like to take more and more responsibility in China-EU building energy efficiency and HVAC related collaboration in the future.





Thanks!

Comments & Questions

Contact: xuwei19@126.com



中國建築科學研究院
China Academy of Building Research