

Model of Success?

Implementing Building Energy Efficiency Codes in China

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Energy Sector Management Assistance Program (ESMAP)

The World Bank

International Workshop

Mainstreaming Building Energy Efficiency Codes in Developing Countries

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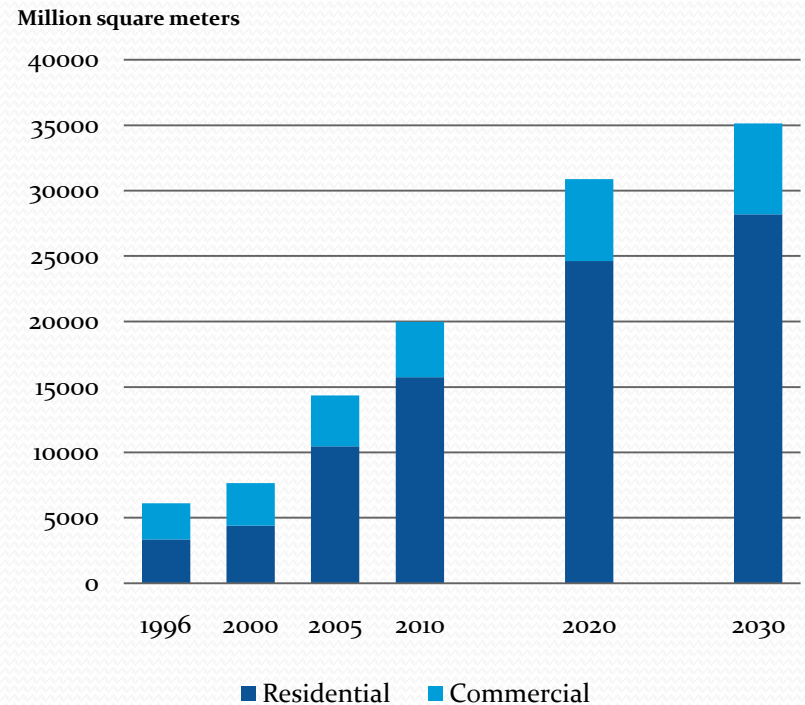
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Washington, DC

Built to Last: Locking-in Energy Waste or Energy Efficiency?

- 60% of the residential and commercial building stock in Chinese cities as of 2006 had been built since 1996
- 60% of the residential and commercial building stock in Chinese cities by 2030 will have been built since 2006
- All residential and commercial buildings in Chinese cities are subject to mandatory BEECs as of 2005

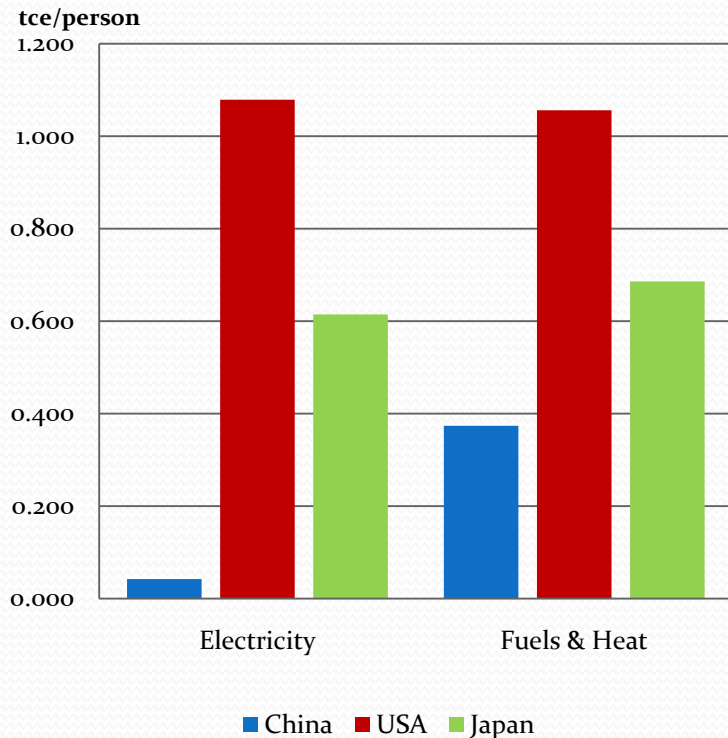
Construction Floor Areas of Residential and Commercial Buildings in Chinese Cities, Actual and Projected



National Bureau of Statistics of China, <http://www.stats.gov.cn>
Lang Siwei, et al, 2008, Building Sector Assessment Report to Energy Foundation China Sustainable Energy Program

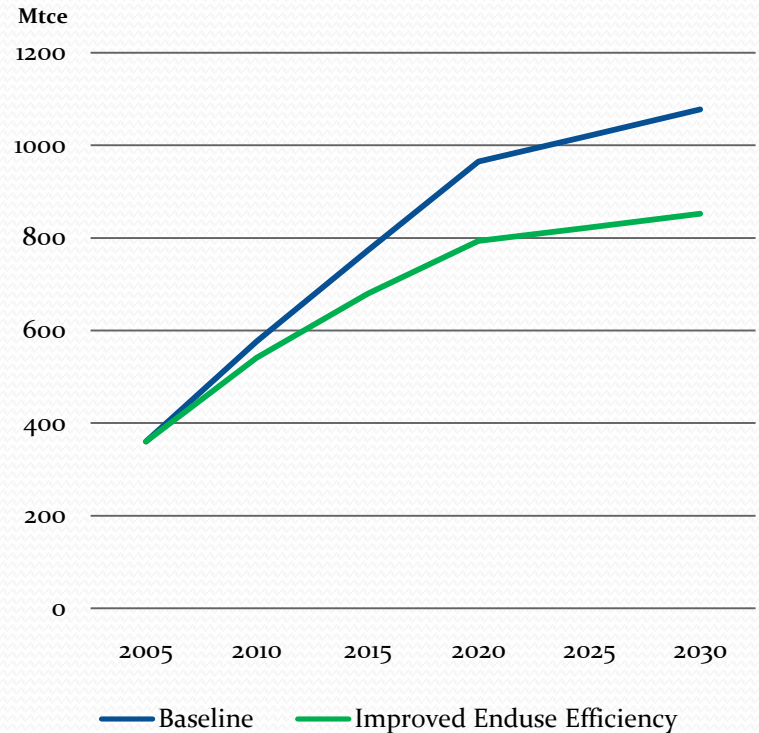
Room to Grow: Energy Use in Buildings Will Rise Sharply

Per Capita Energy Use in Residential and Commercial Buildings, China, USA, and Japan, 2006



IEA Energy Statistics, 2006
Electricity is converted to coal equivalent using heating value 1kWh = 3.6 MJ

Scenarios of Energy Demand in Residential and Commercial Buildings in Chinese Cities, 2005-2030



Lang Siwei, et al, 2008, Building Sector Assessment Report to Energy Foundation China Sustainable Energy Program
Electricity is converted to coal equivalent using then current thermal generation efficiency.

Bricks and Mortar: Key Characteristics of Chinese Buildings

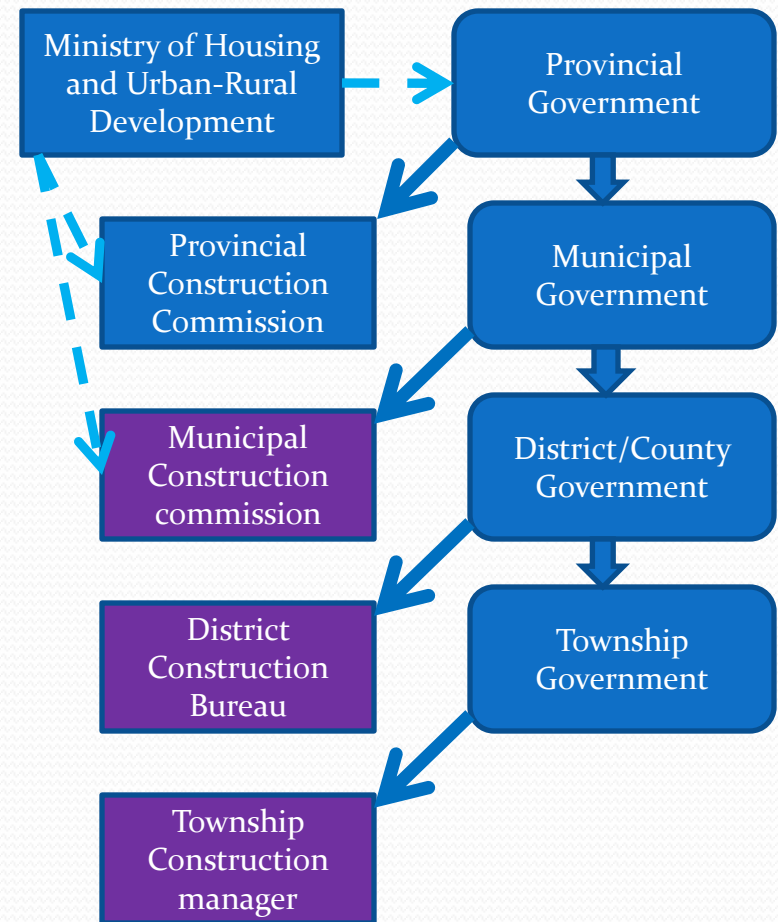
- Residential buildings in Chinese cities are multi-stories or high-rises of predominantly heavy-mass structures with solid brick or concrete walls
- Commercial buildings also are predominantly heavy-mass structures and are increasingly equipped with central HVAC systems
- Glazing areas in both residential and commercial buildings have increased dramatically



The Chinese Construction Sector: Hyper Growth but Organized

- Ministry of Housing and Urban-Rural Development, Ministry of Land and Resources, and their counterparts at provincial and lower level governments
- Urban construction is well organized and planned with minimum room for old fashioned organic growth or informal settlements
- The commercialization of housing development in the 1990s ushered in more transparent and structured construction practices
- The maturing construction management system now provides a good basis for BEEC compliance enforcement

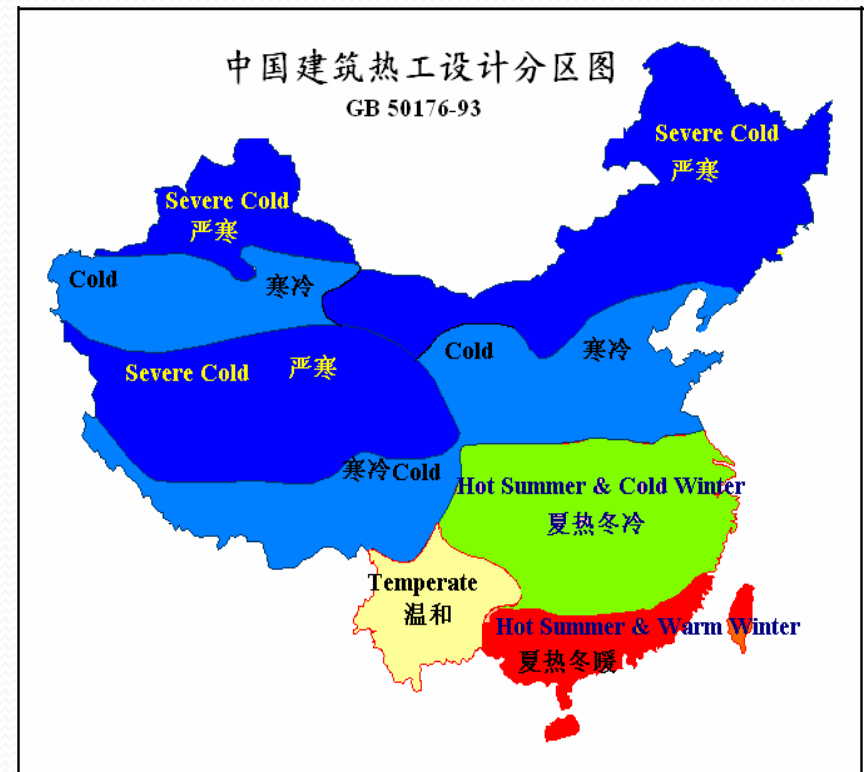
Government Oversight of the Construction Sector



The Challenge of Being Big with Large Space Conditioning Needs

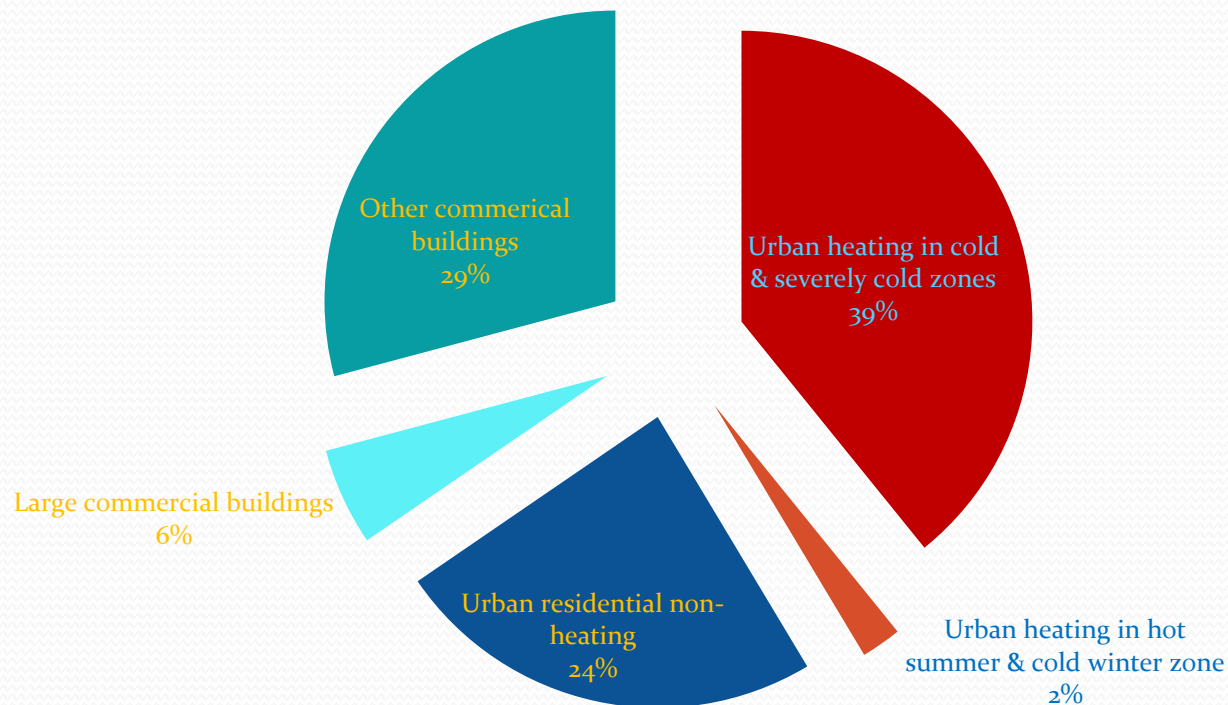
- 550 million people in cold and severely cold climate zones, 43% of urban residential and commercial buildings
- 500 million people in hot summer and cold winter zone, 42% of urban residential and commercial buildings
- 160 million in hot summer and warm winter zone, 12% of urban residential and commercial buildings
- Differentiated BEECs to address varied design needs of different climate conditions

Climate Zoning for Building Thermal Designs In China



Space Heating Is the Single Largest Energy Use in Chinese Buildings

Energy Use in Urban Residential and Commercial Buildings, 2004
Estimated total consumption: 325 million tce



Tsinghua University Research Center for Energy efficiency in Buildings, China Building Energy Efficiency Annual Report 2008
(electricity converted to tce using then current year thermal generation efficiency)

A Brief History of BEECs in China

Time Line:

- ❖ **1986:** Trial BEEC for centrally heated new residential buildings in cold climate regions
- ❖ **1995:** National BEEC for new residential buildings in cold climate regions
- ❖ **2001:** National BEEC for new residential buildings in hot summer and cold winter regions
- ❖ **2003:** National BEEC for new residential buildings in hot summer and warm winter regions
- ❖ **2005:** National BEEC for new commercial buildings in all climate regions
- ❖ **2007:** National Code for Acceptance of Energy Efficient Building Construction
- ❖ **2010:** Revised National BEEC for new residential buildings in cold climate regions

Nature of Efforts:

- ❖ Part of a central government energy conservation strategy from the start
- ❖ Focused on high impact buildings first
- ❖ Set clear and realistic energy efficiency targets
- ❖ Kept requirements simple and prescriptive

Key Characteristics of Chinese Building Energy Efficiency Codes

- ❖ National model codes which need provincial-level adoption
- ❖ Mandatory but contain voluntary elements
- ❖ Emphasize requirements for building envelope thermal performance, although
 - ✓ Residential code for cold climate regions also cover central heating system energy efficiency
 - ✓ Commercial building code also address HVAC system efficiency
 - ✓ Separate national standards for lighting , room air conditioners, and commercial HVAC equipment are referred to by BEECs
- ❖ Largely prescriptive but with flexibility in
 - ✓ Allowing trade-off between envelope components in residential codes
 - ✓ Allowing energy budget option for commercial buildings

The Road to Compliance: Implementing BEEC-1995

National pilots and demonstrations

- Ensure technical and financial feasibilities and balance regional differences
- Some 30 million m² apartments were built from 1986 to 1995
- 50% energy savings deemed possible with no more than 10% incremental cost
- Orchestrated effort to develop compliance technologies

Provincial-level adoption of national BEEC

- A typical political process for local consensus building
- A compliance capacity development process with help from the ministry
- Provincial BEECs usually include construction drawings of compliant designs

City-level enforcement

- Start in cities with strong technical capacity and high political pressure
- Train the construction industry and implant standardized procedures in the construction cycle
- Government (mayor) commitment determines the pace of compliance uptake

BEEC Enforcement in Tianjin: Stakeholders and Responsibilities

Municipal Oversight Agencies

TJDRC, TJPB, and TJCC
Approval of Project Feasibility
Studies

TJUPB and TJCC
Approval of Site Plans, Detailed
Designs, Drawings, and Permits

TJCC
Tendering and Contracting
Due Diligence

TJCC
Construction Quality Inspection

TJCC
Construction Quality Evaluation

Housing Construction Cycle Developer

Project Registration

Project Design
and Construction Permit

Project Tendering
and Contracting

Project Construction

Project Completion
Acceptance

Third Parties Involved

Technical/engineering firms or
institutes

Architecture and engineering
design firms or institutes
Drawings review entity

Tendering company

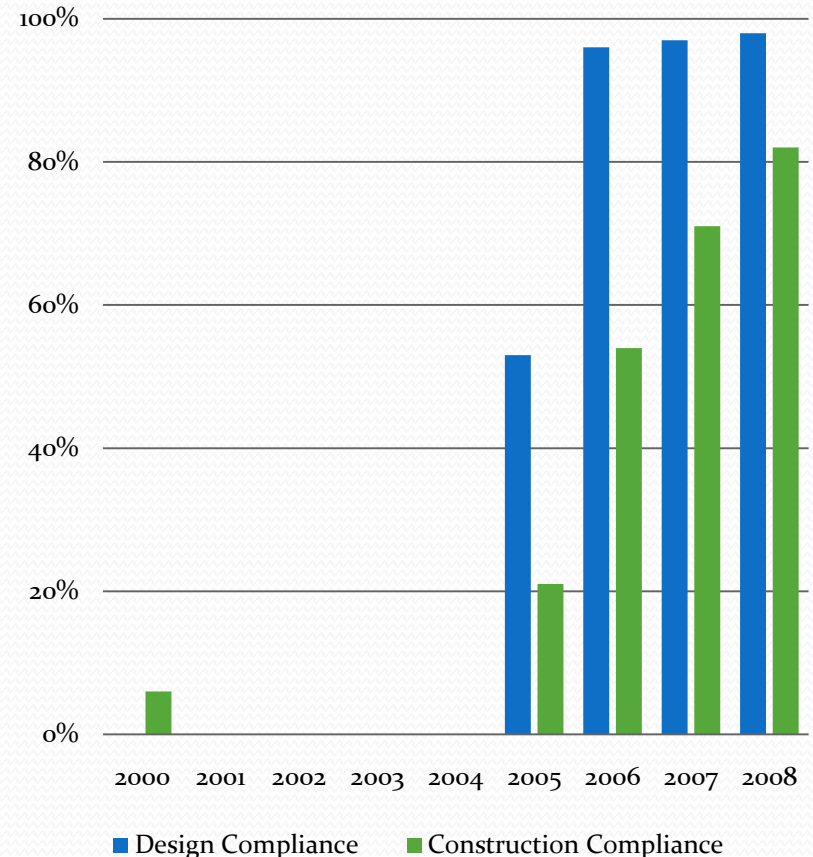
Construction contractors
Construction supervision entity
Testing and certification entities

Project design entities
Construction contractors
Construction supervision entity
Acceptance inspection entities

BEEC Compliance in China: Much Achieved and Much to Accomplish

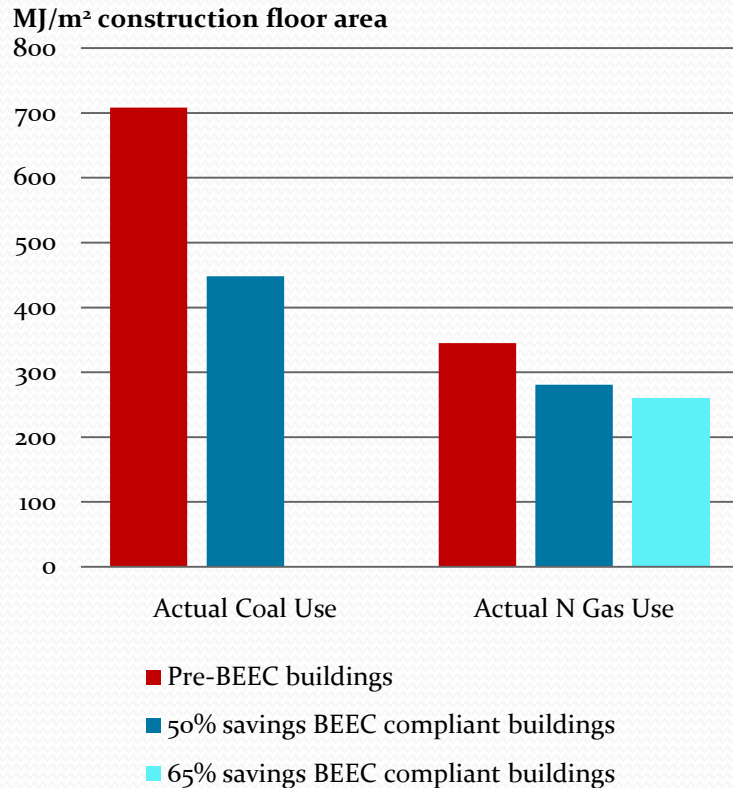
- ❖ In large urban centers BEEC compliance is generally integrated into normal construction cycle
- ❖ Good quality materials and components are widely available
- ❖ Consumers are more informed and begin to care about the amenity brought by BEEC compliance
- ❖ Political pressure of the 11th Five-Year Plan
- ❖ Compliance level in about one third of the urban construction market (the largest 30 or so cities) is at about 80%
- ❖ Compliance level in the rest of the urban construction market is believed to be significantly lower

Results of National BEEC Compliance Inspections in Large Chinese Cities

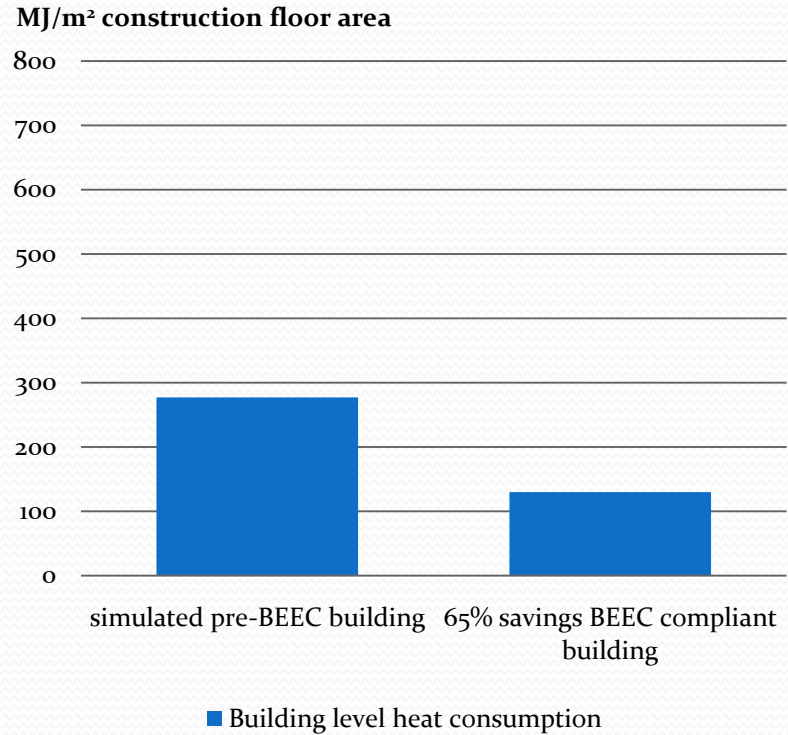


BEECs Save Energy but Technology Is Only Part of the Answer

Survey Results of Heat-Source Energy Use in Beijing, Winter of 2007/2008



GEF Tianjin Project Heat Consumption at Building Level, Winter of 2007/2008



World Bank project document, 2008

What's Next: More of the Same and More Market Transparency

BEEC implementation has come full cycle: many provinces are now ahead of the central government in introducing more stringent BEECs

- ❖ Central and provincial governments need to keep the pressure on BEEC compliance enforcement and strengthen capacity in medium and small cities
- ❖ Accelerate heating reforms: heat metering and consumption-based billing – impetus for consumer behavior change
- ❖ Require labeling and certification for insulation materials and fenestration products
- ❖ Increase consumer awareness of developer obligations on BEEC compliance through mandatory information and warranty disclosures

Chinese Lessons: It Takes Time and Requires Political Commitment

- ❖ Be practical and cost conscious and start with the market segment where BEEC impact is large
- ❖ Streamlined and transparent construction management system paves the way for integration of BEEC compliance procedures
- ❖ An enforcement system relying on third party due diligence can work well but government oversight remains crucial
- ❖ Development of domestic manufacturing capacity for compliance materials and products is important for a large construction market like China
- ❖ Leadership and persistence of national government on energy efficiency in general and BEEC in particular have been crucial



Thank You !