



Sustainable Buildings in CHINA

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NRDC

- One of the leading non-profit NGOs in the U.S. to protect human health and the environment
- Over 300 lawyers, scientists and specialists, and 1.2 million members and online activists

NRDC has been working in China for more than 10 years

- Beijing office was officially registered in China in 2007
- Working at the national, provincial and local levels

Key areas

- Climate and clean energy
- Responsible sourcing
- Environmental governance and law

Green building and sustainable development

- One of the priorities
- National building energy codes
- The 1st green building standard
- The 1st building energy rating standard
- The 1st LEED-certified building



Based on a joint research by NRDC and the Boston Consulting Group (BCG)

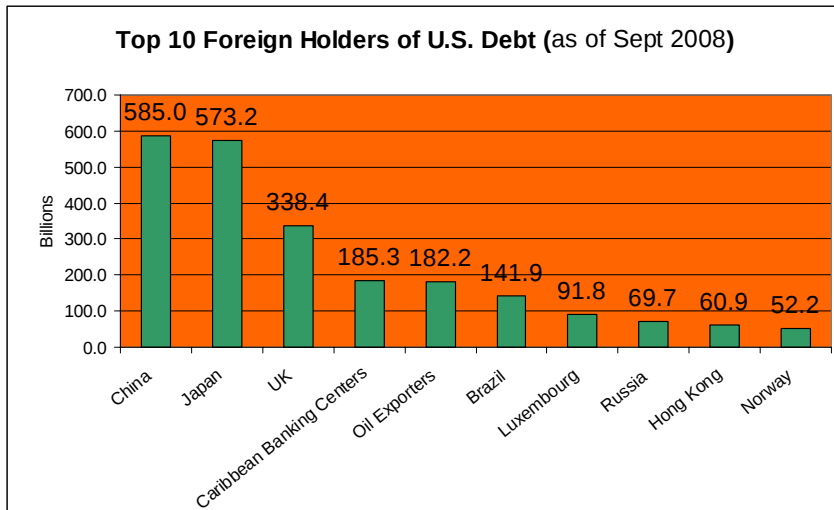
- Literature review
- Stakeholders interview
- Building energy expert advice
- Government policy review

Analyze split incentives of building sector's stakeholders and make policy recommendations on improving building energy performance

Today's presentation focuses on local governments

A final report is to be published soon

Chinese economy maintained **double digit** rate in the past **three decades** since 1979



Source: U.S. Treasury Website. <http://www.treas.gov/tic/mfh.txt>

Milestones in 2007

- Internet users surpasses U.S.
- Mobile phone users surpasses U.S.
- 2007 economic growth was revised to 13% from 11.9% that had been revised from 11.3%
- Surpasses U.S. as No.1 CO2 emitter

Milestones in 2008

- Surpasses Japan as largest holder of U.S. debt
- Surpasses Germany as world's No.3 economy

Milestones in 2009

- Auto sales surpasses U.S.
 - The auto industry tripled three times in five years
- World's top 5 banks by market value (Jan 2009)
 - ICBC (China)
 - China Construction Bank (China)
 - Bank of China (China)
 - HSBC holdings (UK)
 - JP Morgan Chase (US)

Increased Energy Use and Import

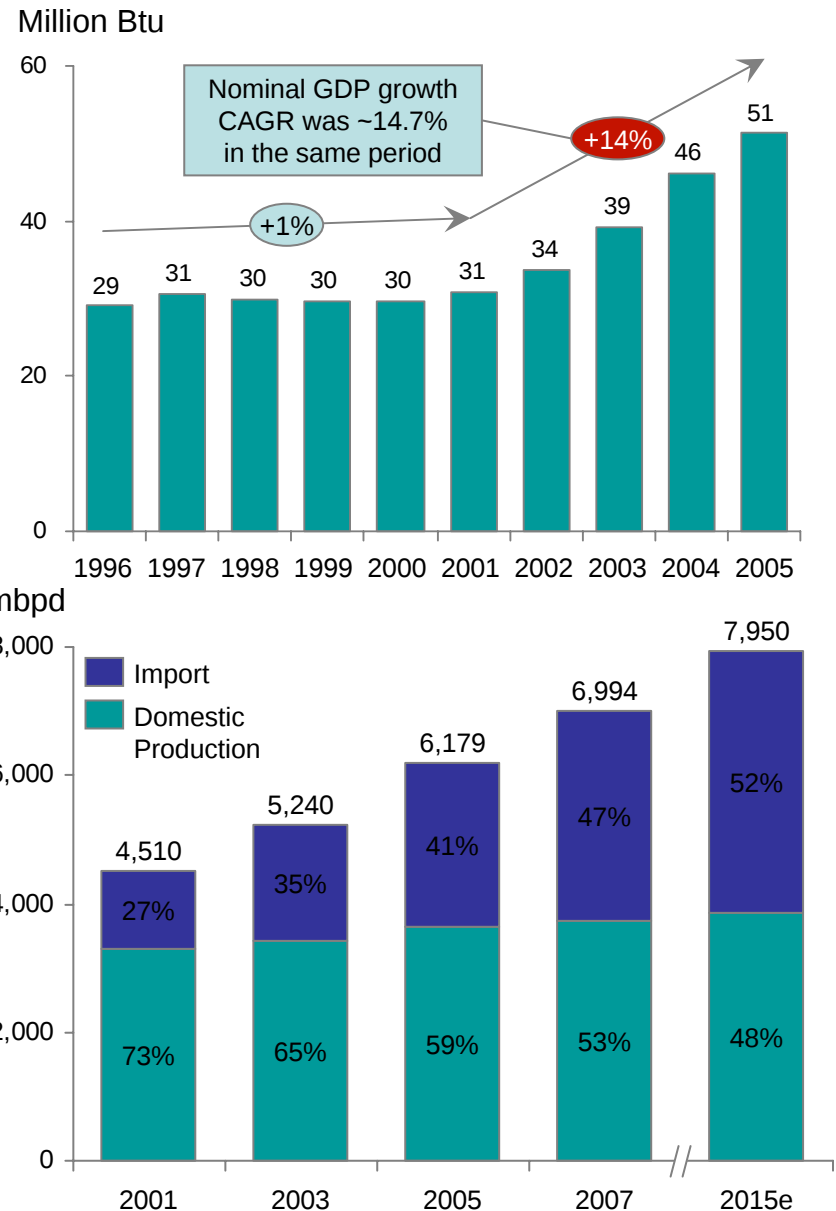
Energy consumption has increased dramatically

- Per capita primary energy use ('96-'05)

China is relying more and more on import

- Crude oil import and domestic production ('01-'15 e)
- Energy shortage
- Energy security

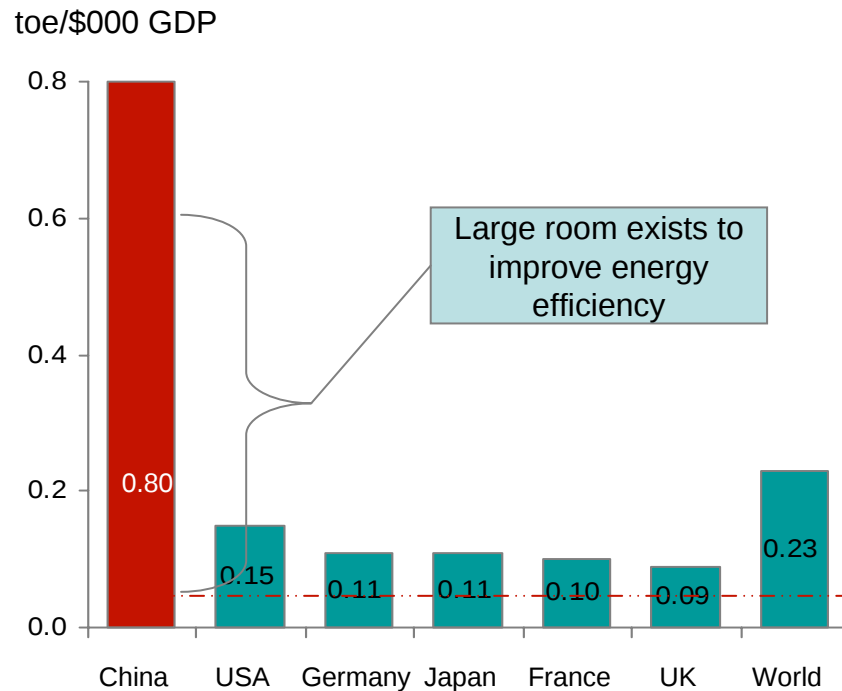
Energy efficiency is a must



Source: International Energy Annual 2005, US-China Economic and Security Review 2005

Less Energy Efficient Per Unit of GDP

World energy efficiency comparison (2005)



Lags behind world average

- Central and local governments are keen on energy efficiency
- Public is raising more awareness on power shortage, deterioration of environment
- 8x that of France/Japan/Germany/UK
- 5x that of USA
- More than 3x world's average

Building Sector: Largest Energy User

Building sector

- Accounts for 24% of total energy use
- Residential: 16%
- Commercial: 8%

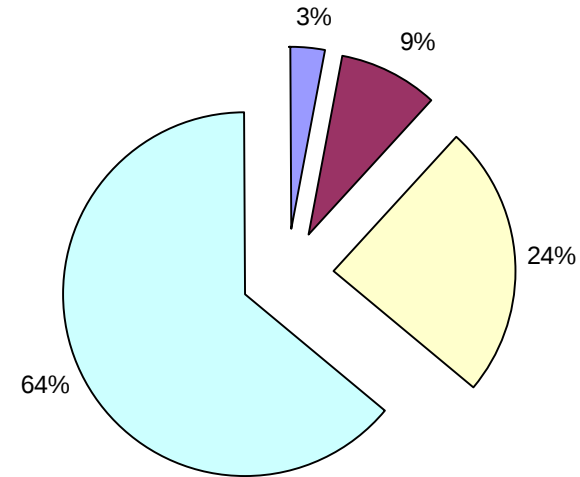
Industry

- 64% of total, *however*
- Iron & Steel: 15%
- Cement: 9%

Building sector =

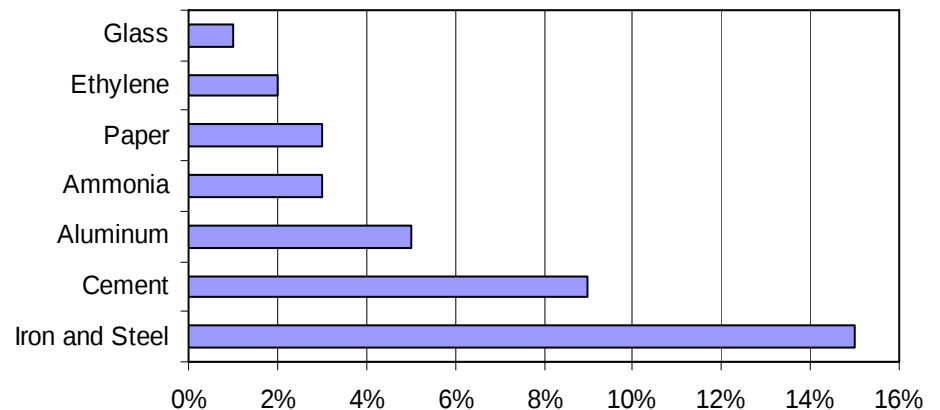
Iron + Steel + Cement

2005 China Energy Use (billions kWh)



■ Agriculture ■ Transport ■ Buildings ■ Industry

2005 Energy Use by Industry (billions kWh)



Source: LBNL Energy Intensity Reduction for 2010 Report

Life Cycle Energy Use Even Higher

Embodied energy in building

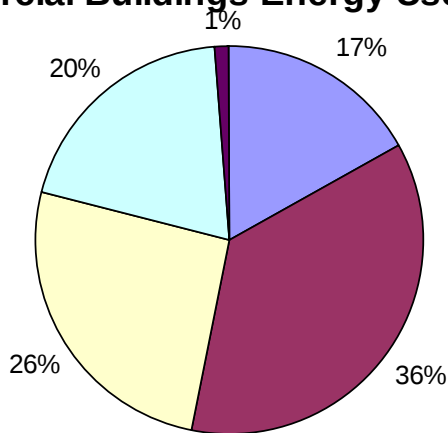
- Materials & Construct
 - High estimate: 10%
 - Low estimate: 5%
- Transport & decommission
 - 1%

Life cycle energy use = 30~35%

- Significant, but hard to calculate accurately
 - Energy use through multiple phases
 - Building life expectancy varies
- Construction and supply sector need to be more energy efficient
 - Reduce energy embodied by industry sub-sectors, e.g., steel, cement, etc.
 - Choose low energy intensity building materials

Building Energy Use Profile

Commercial Buildings Energy Use Profile

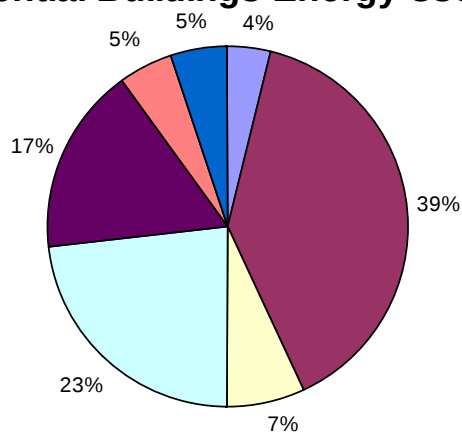


Space cooling Space heating Lighting & plug load Water heating Others

Profile

- Exclude embodied energy
- Operational energy use only
- HVAC accounts for most energy use

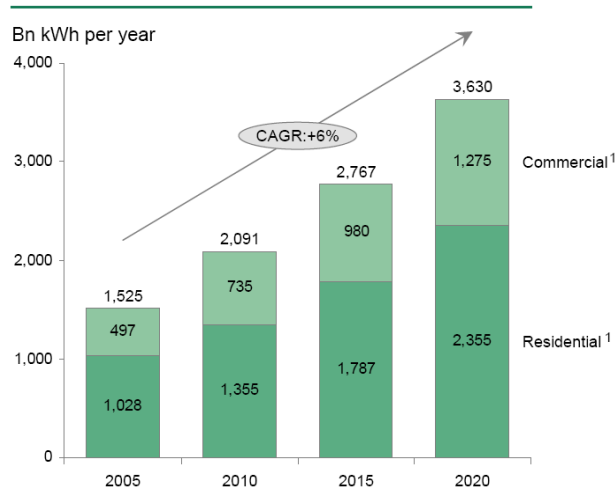
Residential Buildings Energy Use Profile



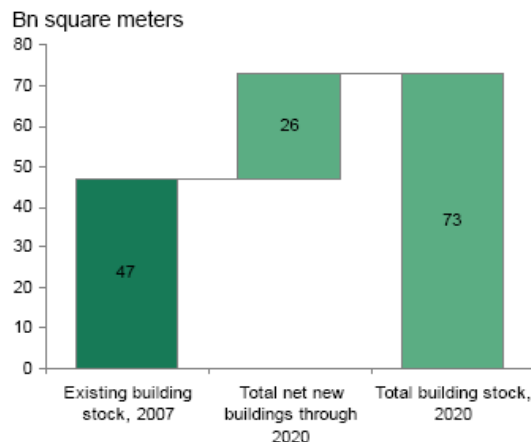
Space cooling Space heating Lighting Water heating Appliances Cooking Others

Massive Size of the Building Market

2005-2020 projected operational energy needs by building type...



China adding around two billion square meters of building area each year



Massive size of China's building market

- Existing buildings: 430 billion sf
- New buildings: 21.5 billion sf annually

It is estimated that only 10~15% new buildings and existing buildings comply with energy code

Even with trend improvements in efficiency, building energy use to grow 6% annually through 2020

Existing building stock is and will remain much larger than new building stock for at least another decade

- Very few of existing buildings complies with building energy codes
- Buildings built from 2008-2020 will account for only 1/3 of total building stock
- Existing buildings represent significant energy saving opportunities

Size Matters

More realistically: successfully "Greening" all of China's buildings would be equivalent to any one of the following every single year...¹



Closing 25
500 MW
coal-fired
power
plants

Filling
11,000
Tiananmen
Squares
with
rainforest^{3,4}

Shutting
down
Baosteel
Group's
capacity



Turning
off all the
lights in
America for
two weeks



Building
15,000 wind
turbines



Removing
all cars
from
Denmark
and Norway

Building
one Three
Gorges
Dam

Halting all
air traffic
globally for
2.5 months³



Based on assumption of 5 % for existing buildings and 60% for new buildings by 2015; operational efficiency only; equivalent to savings of 85 billion kWh or 120 million tonnes of CO2

Central Government Sets Targets

Major targets of energy efficiency work plan for the year 2010

- Reduce energy consumption per unit of GDP by 20%
- Reduce major pollutants discharge by 10%

Key Performance Indices for local officials

- Set environmental indices for assessing the performance of local governments
- Violators will be prosecuted

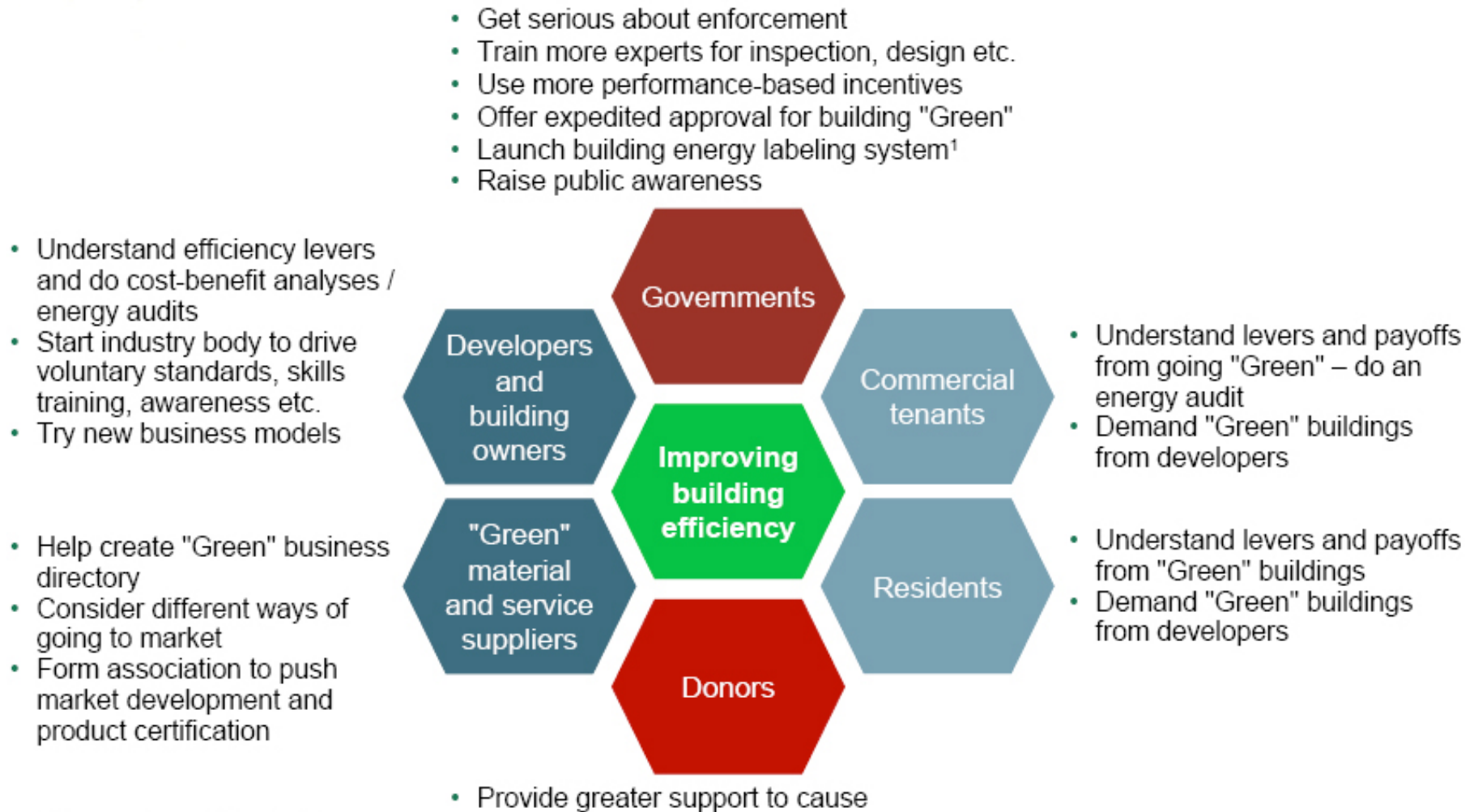
New Buildings

Phase	Missions	Goals
1 st phase: 1980-1996	Save 30% from the baseline of 1980	30%
2 nd phase: 1996-2005	Save 30% over the 1 st phase	50%
3 rd phase: 2005-present	Save 30% over the 2 nd phase	65%

Existing Building Retrofit by 2010

- Large cities: 25% of the building stock
- Mid-sized cities: 15%
- Small cities: 10%

Stakeholders



Central government is keen on energy efficiency

- Energy consumption in China has grown significantly and require urgent actions
- Building efficiency level is low and has large room for improvement

Central government has set energy savings targets and related Key Performance Indices

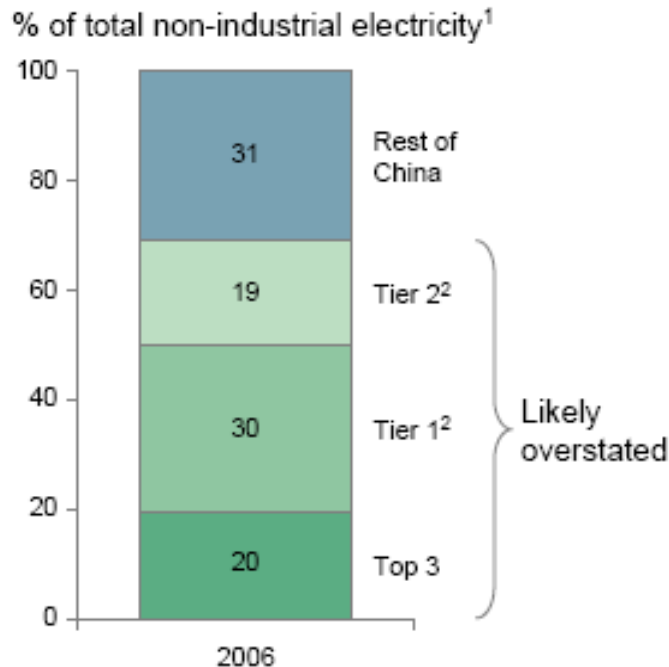
- Targets and KPIs on building energy efficiency are both expected to be more specific and stringent in the future
- Compared to industries, building energy efficiency requires limited resources but need to start soon
- Some cities have started significant effort on building energy efficiency, so no more time for delay

Building energy efficiency also offers other benefits

- Developing energy efficient building market helps upgrade the housing market's value chain and create green jobs
- Lowered energy consumption means less capital expense on power plants, savings on energy cost and better environment over time

Top 3 Cities Take Lead

Top 3 cities account for <20% of China's non-industrial electricity use¹



Building energy consumption in the top 3 cities accounts for less than 20% of national total building energy consumption

- Shanghai
- Beijing
- Tianjin

The top 3 lead the way in building energy efficiency efforts

- Higher compliance level
- Stronger enforcement with building code
- Set up examples and test new policies
- More international cooperation

Other large cities (Tier 1) are typically a couple of years behind Top 3 in policy adoption

To claim building efficiency “prize”, much broader geographic “penetration” is needed

Matrix

	Codes and standards	Enforcement	Incentives	Others
New building	1 ✓ Laggards to implement 50% standards for all cities as soon as possible, while leaders pilot and develop implementation guidelines for more advanced standards Develop clear roadmap and timeframe for industry to reference and develop	2 ✓ Enforcement process to start with key check points, requiring proper reporting and auditing Understand and pilot 3rd party certification and audit in the mid-long term	5 ✓ Develop integrated incentive systems for building energy efficiency Create incentives that induce greater consumer demand Involve MOHURD, NDRC, MOF, CBRC and etc. to start research pilot on financing policies Coordinate efforts from the Governor/Mayor's level	6 ✓ Government to accelerate development as influential building end-user Organizational improvement in government agencies Education programs on general awareness Launch education programs to fill industry capability gaps Support EMC/ESCO industry and green building material industry Launch DSM pilot
Existing building	3 ✓ Accelerate energy efficiency quantification, audits & disclosure to government and large-scale public building City or provincial level construction bureau to develop overall policy frameworks and technical specifications Pilot Hong Kong model to form owners' cooperation to make decisions for the whole building	4 Launch labeling system for existing buildings doing retrofiting Adopt more channels to experience sharing		

✓ Top 5 to advocate

The largest city in China

8th largest in the world

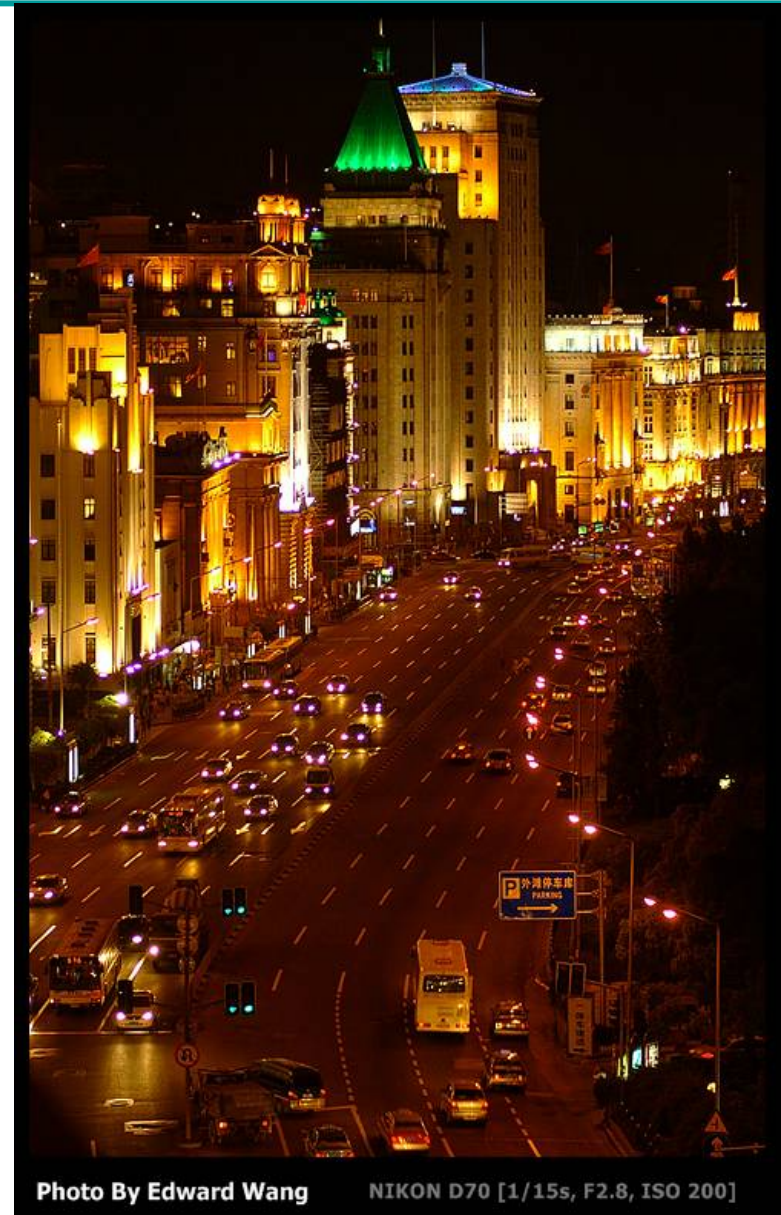
Downtown

- 2,648 square kilometers, No.2
- Population: 14.4 million, No.1

GDP per capita, \$10,706, No.1

National status

- Area: 0.06%
- Population: 1%
- Tax revenue: 1/8
- Harbor cargo: 1/10
- Exports/imports: 1/4



Shanghai

- 7.53 billion square feet, existing building stock
- 4.3 billion square feet, existing housing stock

Challenge

- Only 13.7% new buildings and existing buildings comply with code
- Simply doubling the compliance rate would save 23 billion kWh/yr, offsetting 6 coal plants in year one.

Goals by 2010

New buildings targets

- Build 1.9 billion sf new buildings
- 50% above 1980 baseline mandated for all new houses and new government buildings, optional for other buildings
- 65% above 1980 baseline for pilot projects

Existing building retrofit targets

- 108 million sf, house retrofit
- 215 million sf, public building retrofit

Solution

- Energy labeling program to increase compliance rate

Shanghai RESNET Project

Partners

- RESNET
- Natural Resources Defense Council (NRDC)
- Shanghai Real Estate Science Research Institute (SRESRI)

NRDC

- One of the leading nonprofit NGO in the U.S. protecting human health and the environment
- Maintained presence in China for more than 10 years, promoting building energy efficiency, environmental laws, responsible sourcing, clean technology and sustainable development
- Beijing office opened in 2007
- Over 300 lawyers, scientists, specialists and 1.2 million members/online activists
- Coordinate the 1st LEED-certified building in China

SRESRI

- Founded in 1975
- Affiliated to the Shanghai Municipal Bureau of Housing, Land and Resource Administration
- Conducts research in housing economics, building technologies, and materials

Agreement on Cooperation

Goals

- Harmonize building energy rating methodology in US and Shanghai
- Increase code compliance through consistent practices, protocols and methods for determining the energy efficiency of a building.
- Monetization of the savings from a high performance home as part of an international carbon emissions cap and trade market

RESNET

- SRESRI becomes RESNET's accredited provider
- Help develop local energy labeling standards and rater framework
- Work with SRESRI to adopt a uniform calculation of carbon savings

SRESRI

- Adopt the RESNET HERS methodology
- Adopt rating standards and procedures

NRDC

- Coordinate the development of the Shanghai local standards based on local requirements
- Provide comments and technical input on local program development
- Help SRESRI develop policies and strategies to transfer HERS into the Chinese market

Shanghai RESNET Certificate

建筑能效证书

Buildings Energy Efficiency Certification

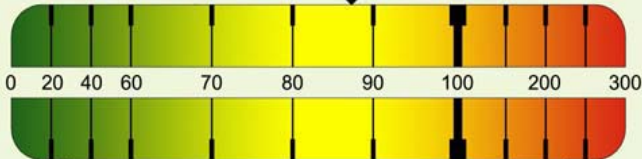


建筑名称
建筑类型
建筑面积
竣工时间



能效总体评价





能效高

能效低

能效指数
88.1

能效等级
☆☆☆☆☆

可再生能源利用等级
☆☆☆☆☆

★ 能效指数100表示，在标准运行工况下，与被评估建筑相对应的节能基准建筑的能效水平。

授权机构
AAA

负责人签名

评估机构
BBB

负责人签名

发证日期
20XX年XX月XX日

证书编号：2007011号

Energy Efficiency Grade	EEI range
non EEB V	$200 < EEI$
non EEB IV	$175 < EEI \leq 200$
non EEB III	$150 < EEI \leq 175$
non EEB II	$125 < EEI \leq 150$
non EEB I	$100 < EEI \leq 125$
★	$90 < EEI \leq 100$
★★	$80 < EEI \leq 90$
★★★	$70 < EEI \leq 80$
★★★★	$60 < EEI \leq 70$
★★★★★	$0 \leq EEI \leq 60$

National Building Energy Rating Guideline



NO: 000000S000000

建筑代码
实测值S,理论值L
行政区划代码

建筑能效测评等级证书

Jian zhu neng xiao ce ping deng ji zheng shu

建筑名称: _____

测评机构: _____

测评等级: ★★★★★

测评时间: 2008年12月(有效期伍年)

中华人民共和国住房和城乡建设部

二〇〇 年 月



建筑能效测评标识内容

建筑基本信息		
建筑名称	XX综合楼	
建筑类型	公共建筑	
所属气候区	夏热冬冷地区	
建筑所在地	XX市XX路XX号	
竣工时间	2006年7月	
占地面积	XX万平方米	
建筑面积	XX万平方米	
层数	地上24层, 地下3层	

建筑能效理论值		
基础项	规定项	选择项 (加分)
单位面积采暖 空调耗能量 $\text{KW} \cdot \text{h}/(\text{m}^2 \cdot \text{a})$ 节能率 (理论值)	围护结构 节能性能	可再生能源 ☒ 10 自然采光与 通风设计 ☒ 5
	采暖空调 节能性能	新型节能 技术和产品 ☒ 15 用能管理 ☒ 10
满足要求		70分
建筑能效实测值		
基础项	规定项	选择项 (加分)
单位面积采暖 空调耗能量 $\text{KW} \cdot \text{h}/(\text{m}^2 \cdot \text{a})$ 节能率 (实测值)	室内热舒适度	可再生能源 设备应用效果 ☒ 20
	采暖空调系统 运行效率	新型节能技术 和产品应用效果 ☒ 35 用能管理 ☒ 10
满足要求		75分

Cao Bei

- First residential high-rise in Shanghai, built in 1976
- Approximately 40% energy savings – 1.3 million kWh/yr.



Demonstration Projects



Long Hua Xilu

- Built in 1984
- Approximately 18% energy savings – 600,000 kWh/yr.



Demonstration Projects



RESNET Training in Shanghai

1st Training

- January 12-13, 2009
- SRESRI Offices, Shanghai, China

Attendees

- RESNET/NRDC/SRESRI
- Shanghai Pudong District Commission of Construction
- Shanghai Bureau of Safety and Quality Supervision
- Shanghai Bureau of Market Management
- Top 10 Shanghai development companies

Day 1

- Introduction by all attendees
- Q&A session

Day 2

- Steve Baden presented RESNET standards, including HERS Index, rater certification and recertification, provider accreditation, quality assurance, code of ethics, rater discipline procedures, consumer complaint resolution, discloser of conflict of interest, etc.
- Q&A session



- Florida Solar Energy Center to customize EnergyGauge Summit for Shanghai
- SRESRI to customize/localize RESNET standards and get RESNET accreditation
- Provider and first generation rater training
- Replicate Shanghai experience to other Chinese cities and promote RESNET standards in China
- In return China experience informs both high-rise residential and commercial labeling
- Potential for further international expansion



Thank YOU!

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