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
Part 1: Overview of China’s Energy Efficiency in 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

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

Less Energy Efficient Per Unit of GDP

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

World energy efficiency comparison (2005)

Source: EIA, BP, literature research
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

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

Profile

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

Commercial Buildings Energy Use Profile

- Space cooling: 1%
- Space heating: 36%
- Lighting & plug load: 26%
- Water heating: 20%
- Others: 17%

Residential Buildings Energy Use Profile

- Space cooling: 4%
- Space heating: 39%
- Lighting: 23%
- Water heating: 7%
- Cooking: 5%
- Appliances: 17%
- Others: 4%

Legend:
- Space cooling
- Space heating
- Lighting & plug load
- Water heating
- Others

Natural Resources Defense Council
Massive Size of the Building Market

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

Source: LBNL Energy Intensity Reduction for 2010 Report
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 rainforest²,³,⁴
- Shutting down Baosteel Group’s capacity
- Turning off all the lights in America for two weeks
- Efficient buildings²
- 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

<table>
<thead>
<tr>
<th>Phase</th>
<th>Missions</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st phase: 1980-1996</td>
<td>Save 30% from the baseline of 1980</td>
<td>30%</td>
</tr>
<tr>
<td>2nd phase: 1996-2005</td>
<td>Save 30% over the 1st phase</td>
<td>50%</td>
</tr>
<tr>
<td>3rd phase: 2005-present</td>
<td>Save 30% over the 2nd phase</td>
<td>65%</td>
</tr>
</tbody>
</table>

Existing Building Retrofit by 2010
- Large cities: 25% of the building stock
- Mid-sized cities: 15%
- Small cities: 10%
Stakeholders

- Get serious about enforcement
- Train more experts for inspection, design etc.
- Use more performance-based incentives
- Offer expedited approval for building "Green"
- Launch building energy labeling system
- Raise public awareness

- Understand efficiency levers and do cost-benefit analyses/energy audits
- Start industry body to drive voluntary standards, skills training, awareness etc.
- Try new business models

- Help create "Green" business directory
- Consider different ways of going to market
- Form association to push market development and product certification

- Provide greater support to cause

Governments

Developers and building owners

Commercial tenants

"Green" material and service suppliers

Residents

Donors

Improving building efficiency

- Understand levers and payoffs from going "Green" – do an energy audit
- Demand "Green" buildings from developers

- Understand levers and payoffs from "Green" buildings
- Demand "Green" buildings from developers
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

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
<table>
<thead>
<tr>
<th>Codes and standards</th>
<th>Enforcement</th>
<th>Incentives</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New building</strong></td>
<td><img src="https://via.placeholder.com/15" alt="Checkmark" /> Laggards to implement 50% standards for all cities as soon as possible, while leaders pilot and develop implementation guidelines for more advanced standards</td>
<td><img src="https://via.placeholder.com/15" alt="Checkmark" /> Enforcement process to start with key check points, requiring proper reporting and auditing</td>
<td><img src="https://via.placeholder.com/15" alt="Checkmark" /> Develop integrated incentive systems for building energy efficiency</td>
</tr>
<tr>
<td></td>
<td>Develop clear roadmap and timeframe for industry to reference and develop</td>
<td>Understand and pilot 3rd party certification and audit in the mid-long term</td>
<td>Create incentives that induce greater consumer demand</td>
</tr>
<tr>
<td><strong>Existing building</strong></td>
<td><img src="https://via.placeholder.com/15" alt="Checkmark" /> Accelerate energy efficiency quantification, audits &amp; disclosure to government and large-scale public building</td>
<td><img src="https://via.placeholder.com/15" alt="Checkmark" /> Launch labeling system for existing buildings doing retrofitting</td>
<td>Involve MOHURD, NDRC, MOF, CBRC and etc. to start research pilot on financing policies</td>
</tr>
<tr>
<td></td>
<td>City or provincial level construction bureau to develop overall policy frameworks and technical specifications</td>
<td>Adopt more channels to experience sharing</td>
<td>Coordinate efforts from the Governor/Mayor’s level</td>
</tr>
<tr>
<td></td>
<td>Pilot Hong Kong model to form owners’ cooperation to make decisions for the whole building</td>
<td></td>
<td>Support EMC/ESCO industry and green building material industry</td>
</tr>
</tbody>
</table>

- **Top 5 to advocate**
Shanghai

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: ¼
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

Energy Efficiency Grade | EEI range
--- | ---
non EEB V | 200 < EEI
non EEB IV | 175 < EEI ≤ 200
non EEB III | 150 < EEI ≤ 175
non EEB II | 125 < EEI ≤ 150
non EEB I | 100 < EEI ≤ 125
★ | 90 < EEI ≤ 100
★★ | 80 < EEI ≤ 90
★★★ | 70 < EEI ≤ 80
★★★★ | 60 < EEI ≤ 70
★★★★★ | 0 ≤ EEI ≤ 60
Cao Bei

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