

ChinaFAQs

The Network for Climate and Energy Information



Building Energy Efficiency in China: Policies and Markets

Why is building energy efficiency important in China?

In its climate action plan for the 2015 landmark Paris Agreement on climate change, China formalized its commitment to reach a peak in its carbon emissions around 2030, pledging its best efforts to peak sooner. A key component of achieving this goal will be to address the energy consumed by buildings, which in 2011 accounted for 28% of China's energy consumption.¹ Moreover, in much of the country, residential and commercial energy use is the largest contributor to air pollution-related deaths.² China's building energy use will see upward pressure in the coming years from population and economic growth, urbanization, and increasing standards of living.³

Taking action on building efficiency

In light of this trend, China's Paris climate plan—or nationally determined contribution (NDC)—includes plans to improve building efficiency and the quality of construction, “[extend] buildings’ life spans,” “intensify” energy-saving retrofits of existing buildings, and “[promote] the construction of green buildings and the application of renewable energy in buildings,” among other goals. The document also puts forward a target for green buildings to comprise half of newly built buildings in cities and towns by 2020.⁴ (See the Appendix to this fact sheet for a list of building energy efficiency measures in China's NDC.) Though these new measures indicate enhanced ambition, China's commitment to improving the energy efficiency of

buildings is not new. In recent years, China has enacted a suite of policies to promote building energy efficiency, including mandatory building energy codes for urban residential and commercial buildings, a voluntary energy code for rural residential buildings, policies and incentives based on green building ratings, and building retrofit programs. While some industry experts say that additional private financing will be needed to fully unlock China's building efficiency potential,⁵ these policies could yield significant savings of both energy and greenhouse gas emissions. As an ancillary benefit, they have created a burgeoning market for energy-efficient materials and products such as wall and roof insulation; doors and windows; heating, ventilation, and air conditioning; and lighting, which U.S. businesses are poised to help supply.

Plans, Targets, and Investment

As with other industries, China has carefully planned out the development of energy-efficient buildings, having set a series of targets for the end of 2015—the construction of a billion m² of green buildings, energy savings of 81.2 Mtoe, and a 10% reduction of energy use per square meter of floor space. The 12th Five Year Plan (2011-2015) called for stronger standards for new buildings and looked to expand the scope of energy efficiency programs. China's recently-released national 13th Five Year Plan indicates the country will build on these measures and further improve building energy efficiency and the stringency of building energy codes. Below is an overview of China's main building energy efficiency policies:

**Except as noted, this fact sheet is largely based on Yu, S., M. Evans and Q. Shi, Analysis of the Chinese Market for Building Energy Efficiency. Pacific Northwest National Laboratory. March 2014. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22761.pdf*

Key Points

- As of 2011, buildings accounted for 28% of China's energy consumption. Upward pressures on building energy use include population and economic growth, urbanization, and rising living standards.
- China has adopted a series of domestic policies, including building energy codes, policies and incentives based on green building ratings, and building retrofit programs, to increase the energy efficiency of buildings.
- China's building codes could reduce building energy use by 13-22% and CO₂ emissions by 14-20% from business-as-usual by the end of this century, depending on their stringency and coverage.
- China's nationally determined contribution for the Paris Agreement and 13th Five Year Plan indicate stronger action on building energy efficiency.
- Building efficiency policies have created a market in China for energy-efficient materials and products, which U.S. companies are poised to help supply.

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Building Energy Codes

China's building energy codes establish minimum standards for the energy efficiency of building components such as envelope; heating, ventilation, and air conditioning (HVAC), and the power system. These codes are mandatory for residential and commercial buildings in urban areas, while compliance with rural residential building codes is promoted through incentives. Recent research has found that these building codes could drive significant reductions in China's building energy use (between 13 and 22%) and CO₂ emissions (14-20%) from a business-as-usual scenario by the end of this century, depending on their stringency and coverage.⁶

Both the rigor and reach of these codes has expanded dramatically in the past decade. Not only have codes become more stringent, compliance checks and incentives have significantly increased their impact. As of early 2014, China's building energy codes required energy savings of 65% compared to 1980 buildings, and the 2015 code for commercial buildings calls for 20-23% greater energy efficiency than its predecessor in 2005. China has taken steps in recent years, through evaluations and inspections, to promote robust enforcement of these codes during the process of building design and construction.⁷ China also launched its first voluntary energy code for rural houses in 2013 and encouraged energy efficient construction in rural areas. China developed the Code for Acceptance of Energy Efficient Building Construction in 2007 to address energy code enforcement through construction inspection and pre-occupancy inspection and compliance checks.⁸ The Code for Acceptance lays out step-by-step actions to demonstrate compliance and is utilized by designers and builders to demonstrate compliance and by code officials and inspectors to verify compliance. Since its launch in 2007, the compliance rate has been significantly increased, but compliance capacity in smaller cities and towns still needs to be improved.

Ratings and Incentives

An important turning point in China's policy on building energy efficiency was the establishment in 2006 of the Three-Star Rating System for green buildings. This system rates buildings' savings of land, energy, water, and materials, as well as other environmental considerations such as use of renewable power. This standard has become widely accepted in major urban areas, and has been promoted through incentives and subsidies at both the national and local levels, with some local governments tying the system to mandatory

requirements for new buildings. By 2013, China was the third-largest market globally for buildings certified for Leadership in Energy and Environmental Design (LEED), with 1,500 projects covering more than 67 million m².

Retrofits

Along with designing new buildings in a more energy-efficient way, China also provides technical support and financial incentives for retrofits of existing buildings to comply with today's stringent energy codes, especially in residential buildings in northern China and in public buildings nationwide. China's rural retrofit policies simultaneously advance two of China's paramount objectives—poverty reduction and low-carbon development⁹—by providing heating systems for homes while strengthening the energy efficiency of the building. China's Ministry of Housing and Urban and Rural Development (MOHURD) began these rural retrofits in 2009, covering around 540,000 homes in the first five years, and has also given subsidies to energy-efficient rural homes. Some provinces have followed their lead, tacking on subsidies of their own for energy-efficient retrofits. China's 2013 Green Building Action Plan calls for over 0.4 billion m² of 3.5 billion m² of housing in the northern heating zone to receive code-compliant retrofits, and for all eligible buildings in the region to receive retrofits by the end of 2020. This target has been overachieved. As of October 2014, 0.75 billion m² of housing in the northern heating zone have been retrofitted¹⁰. The city government of Beijing has been a leader on retrofits, having set a goal to upgrade an amount of floor space in 2011 to 2015 equal to the floor space retrofitted over the previous five years in all of northern China combined.

A Market for Energy-Efficient Products

China's policies promoting building energy efficiency have created a market for energy-efficient products which help achieve compliance, providing an opportunity for U.S. companies. (See Table 1) For instance, according to China Real Estate Business, as of 2012 energy-efficient doors and windows saw profit rates of 12-15%, compared to 3-5% for traditional products. Windows with low-emissivity coatings are increasingly being used from high-end to average buildings to improve energy efficiency. From 2006 to 2010, China's total consumption of low-emissivity glass grew at an average of 58% per year, compared to 6.5% for construction glass writ large. As of 2014, due to patents, almost all of China's low-emissivity glass was manufactured on production lines designed in Germany or the United States.

China's HVAC market is now the largest in the world, and is growing at a rapid rate. For example, Johnson Controls has tapped into the demand for energy-efficient HVAC products in China, bringing in over a billion dollars in HVAC sales to China in fiscal year 2012.¹¹

Table 1: Energy-efficient building technologies benefiting from China's policies
• Wall and roof insulation
• Doors and windows
• Heating, ventilation and air conditioning (HVAC)
• Controls
• Lighting

China's markets for low-emissivity windows, indoor heating and cooling, lighting and other technologies will likely continue their trend toward greater efficiency, providing further opportunities for producers of energy-efficient products. The Pacific Northwest National Laboratory's report, "Analysis of the Chinese Market for Building Energy Efficiency", provides a closer look at the markets for each of these technologies.

Conclusion:

China's recently-released planning documents indicate that the country will continue to strengthen its efforts to promote energy efficiency in its building stock. China's cabinet, the State Council, has issued guidelines on urbanization highlighting resource and energy conservation and environmental protection in building design and construction. The document also aims for renovation of rundown urban areas by 2020.¹² Moreover, China's 13th Five Year Plan, which runs from 2016 through 2020, stresses the implementation of green planning and standards for design and construction of buildings, sets a target to reduce the country's energy use per unit of GDP by 15% from 2015 levels by 2020, and calls for eliminating restrictions on foreign participation in services including building design.¹³

China is expected to continue its trend toward increased urbanization for the near future, as the government aims to add at least 50 million jobs in cities by 2020.¹⁴ China's expanding cities, along with the country's implementation of its Paris commitments and its efforts to ameliorate its hazardous urban air pollution, will provide opportunities for the deployment of energy-efficient technologies, which U.S. companies can help provide.

Appendix:

Table 2: Building energy efficiency measures in China's NDC ¹⁵
• To effectively control emissions from key sectors including... building materials... through energy conservation and efficiency improvement
• To embark on a new pattern of urbanization, optimizing the urban system and space layout, integrating the low-carbon development concept in the entire process of urban planning, construction and management
• To enhance low-carbonized urbanization, improving energy efficiency of building and the quality of building construction, extending buildings' life spans, intensifying energy conservation transformation for existing buildings, building energy-saving and low-carbon infrastructures, promoting the reutilization of building wastes
• To accelerate the construction of low-carbon communities in both urban and rural areas, promoting the construction of green buildings and the application of renewable energy in buildings, improving low-carbon supporting facilities for equipping communities and exploring modes of low-carbon community operation and management
• To promote the share of green buildings in newly built buildings of cities and towns reaching 50% by 2020
• To encourage public institutes to take the lead to: advocate low-carbon government buildings, campuses, hospitals, stadiums and military camps

Sources

¹ Xia, Jianjun, Tianzhen Hong, Qi Shen, Wei Feng, Le Yang, Piljae Im, Alison Lu, and Mahabir Bhandari, "Comparison of Building Energy Use Data between the United States and China". Energy and Buildings (2014). <http://bit.ly/2ce4fHx>

² <http://bit.ly/1VQmFNr>

³ It is worth noting that there is significant variation in the heating and cooling needs of buildings in various parts of the country, due to differences in climate. For instance, heating needs are greater in northeastern China than in the southeastern region, where there is greater demand for cooling. See: International Energy Agency, "Transition to Sustainable Buildings: Strategies and Opportunities to 2050". OECD/IEA. 2013. <http://bit.ly/2bREITX>

For analysis of building energy consumption by fuel and service demand in each climate zone in China, See: Yu, S., Eom, J., Zhou, Y., Evans, M., & Clarke, L. (2014), "Scenarios of building energy demand for China with a detailed regional representation", Energy, 67, 284-297. <http://bit.ly/2bREKeu>.

Sources continued

⁴ “Enhanced Actions on Climate Change: China’s Intended Nationally Determined Contributions”, submitted to UNFCCC June 30, 2015 <http://bit.ly/2bVc45S>

⁵ According to Clay Nesler, Vice President for Global Energy and Sustainability at Johnson Controls, deploying innovative business models in energy performance contracting—where energy efficiency retrofits can be paid for over time with the money gained from reduced energy costs—could more than double the energy service company market in China. Comments made at ChinaFAQs-Environmental and Energy Study Institute briefing, “What Action is China Taking on Climate Change?” July 14, 2015. See link to video below; Nesler’s remarks begin 52:27 into the recording. <http://www.eesi.org/briefings/view/071415china>

⁶ Yu, S., Eom, J., Evans, M., and Clarke, L. (2014). “A long-term, integrated impact assessment of alternative building energy code scenarios in China”. *Energy Policy*, 67(0), 626-639. <http://www.sciencedirect.com/science/article/pii/S0301421513011166>; While commercial buildings compliant with China’s building codes would use more energy than U.S. buildings if they operated in U.S. conditions, Chinese buildings actually use less energy on average than U.S. or European buildings because of different operating practices. For a comparison of Chinese and U.S. building energy use and codes, see: Feng, Wei, Nan Zhou, Stephane de la Rue du Can, Michael Bendewald, Ellen Franconi, “Building Energy Codes in China: Recommendations for Development and Enforcement”. Paulson Institute, CEO Council for Sustainable Urbanization, and China Center for International Economic Exchanges. October 2015, p. 2 http://www.paulsoninstitute.org/wp-content/uploads/2015/10/Building-Code-Roadmap-Oct-2015_vfinal_EN.pdf; Xia et. al., “Comparison of Building Energy Use Data between the United States and China” (2014), pp. 3-4. <http://bit.ly/2ce4fHx>

⁷ In evaluating compliance, most architects and developers in China use software connected to a database of building materials and products to calculate energy saving results, though other methods can also be used to demonstrate compliance. Regular inspections are used to supervise and enforce codes for new buildings in China. Penalties for noncompliance include prohibition of the sale or use of noncompliant buildings, mandatory correction of shortfalls, license revocation, and fines. See: Yu, S. et al., *Analysis of the Chinese Market for Building Energy Efficiency*. Pacific Northwest National Laboratory. March 2014. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22761.pdf

⁸ China: Building Code Implementation – Country Summary, prepared for the IPEEC Building Energy Efficiency Taskgroup, <http://bit.ly/2cEfxWc>. The code enforcement mechanism in China is also discussed in Evans, M, B Shui, Mark Halverson, and A Delgado (2010), *Enforcing Building Energy Codes in China: Progress and Comparative Lessons*, <http://bit.ly/2c1ZmOm>

⁹ Global Commission on the Economy and Climate, “The New Climate Economy report: China Case Study—Executive Summary” (2014) http://newclimateeconomy.net/sites/default/files/china-nce-exec-summary-eng_reduced_1.pdf

¹⁰ http://news.xinhuanet.com/fortune/2015-03/30/c_127635170.htm

¹¹ <http://bit.ly/2c4OIVv>

¹² http://news.xinhuanet.com/english/2016-02/21/c_135117880.htm

¹³ Xinhua News Agency, “People’s Republic of China National Economic and Social Development Five-Year Plan”, March 17, 2016 http://news.xinhuanet.com/politics/2016lh/2016-03/17/c_1118366322.htm

¹⁴ <http://reut.rs/2cm1mBW>

¹⁵ “Enhanced Actions on Climate Change: China’s Intended Nationally Determined Contributions”, submitted to UNFCCC June 30, 2015 <http://bit.ly/2bVc45S>

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