



Industrial Energy Efficiency Cooperation

WHY IS INDUSTRIAL ENERGY SO IMPORTANT IN CHINA?

China's energy use more than quadrupled from 1980 to 2007 (see Fig. 1), and continues to grow, due in part to the demands of urbanization (i.e. construction of new buildings and infrastructure), and in part to rising production of manufactured goods.ⁱ Although China has not yet reached the energy consumption level of the U.S, China nonetheless – due to a more polluting fuel mix – recently surpassed the U.S. in energy-related CO₂ emissions.ⁱⁱ

China's energy consumption is dominated by the industrial sector, which accounts for more than two-thirds of total energy. In contrast, industrial energy use in the U.S. is barely one-third of total energy, with the transportation and building sectors comprising the bulk of demand. The industrial sector's large share of energy consumption and CO₂ emissions in China points to the need for continued work on industrial energy conservation, via domestic efforts and international cooperation.

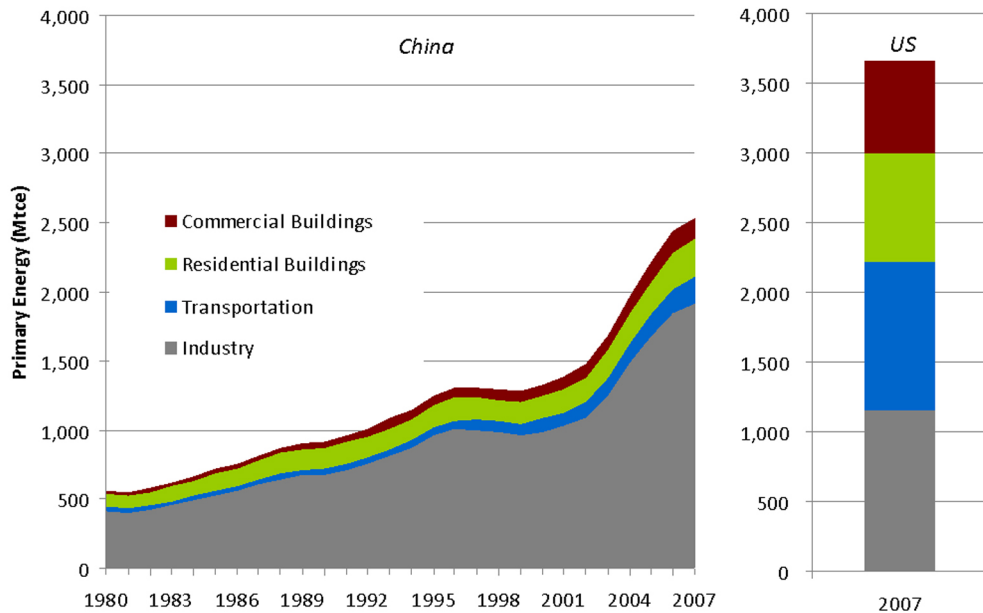


Figure 1. Energy Consumption by Major End-Use Sector in China (1980-2007) and the U.S. (2007)ⁱⁱⁱ

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CHINA'S EXPERIENCE WITH INDUSTRIAL ENERGY COOPERATION

Even with China's domestic efforts on industrial energy conservation since the 1980s [see ChinaFAQs: Timeline of China's Energy Efficiency Policies], and renewed effort during the 11th Five-Year Plan Period (2006-2010) [see ChinaFAQs: An Intense Push for Energy Efficiency; Efficiency, 1000 Enterprises at a Time], there is an important role for international cooperation. Industrial energy efficiency cooperation in China has taken the form of programs funded through multilateral organizations (such as the World Bank and the United Nations Development Programs), via bilateral

agreements, and sponsored by non-profit foundations (e.g., the Energy Foundation). Technical assistance and capacity building are generally provided by expert groups, including national laboratories and government research organizations, universities, and non-governmental organizations (such as the World Resources Institute, the Institute for Sustainable Communities, the Natural Resources Defense Council, the US-China Alliance to Save Energy and the Regulatory Assistance Project), and some business-led organizations (such as the non-profit World Business Council on Sustainable Development).

The table below presents an overview of some of these programs:

Some of the successes of cooperative programs in China include:

- **Capacity-Building for Policy Design and Implementation**

In 2003, Lawrence Berkeley National Laboratory (LBNL), supported by US-based Energy Foundation, partnered with China's Shandong province to undertake a pilot project on energy saving agreements with two iron and steel enterprises. The agreements, which adapted successful international models of government-industry partnership for the Chinese context, in turn served as a model for China's successful "Top-1000" Enterprises Program.^{vi}

- **Development of Industrial Energy Efficiency Standards**

During 2007-2008, the Chinese government developed and published—with analytical support from the UN Development Program (UNDP)—energy-efficiency standards for 22 industries ranging from cement and steel to flat glass and synthetic ammonia. The End-Use Energy Efficiency Program—a 12-year initiative of the UNDP—is supporting implementation of the Chinese industrial energy standards, including workshops and training for plant managers.

Table 1. International Cooperation on Industrial Energy Efficiency in China^{iv}

Lead Cooperation Organizations	Cooperation Program
US Energy Foundation	China Sustainable Energy Program (CSEP) – Industry Program
United Nations Development Program (UNDP)/ Global Environment Facility (GEF)	End-Use Energy Efficiency Program (EUEEP)
World Bank/ Global Environment Facility (GEF)	Energy Conservation Project on Energy Service Corporations (ESCOs) ^v
United States (DOE, EPA, DOC)	US-China bilateral cooperation
Japan (METI, JICA, NEDO, ECCJ, IEEJ)	Japan-China bilateral cooperation on clean and efficient energy
European Union (EU) and EU Member States	Energy and Environment Program (EEP), UK-China Climate Cooperation, etc.
State of California	California-Jiangsu cooperation on Demand-Side Management (DSM) and Efficiency Power Plants (EPP)
Australia, Canada, China, India, Japan, South Korea, and the US	Asia Pacific Partnership (APP) for Clean Development and Climate
International Energy Agency (IEA)/ World Bank	Energy Efficiency Indicators Project (for +5 Countries)

- **Benchmarking for Energy-Intensive Industries**

A team of organizations, including LBNL, China's Energy Research Institute, the China Building Materials Academy, and the China Cement Association, worked together to develop a Benchmarking and Energy-Saving Tool (BEST) for China's cement industry. This cooperation was supported by the U.S.-based Energy Foundation, along with support from U.S. agencies and companies; the work was also coordinated with UNDP efforts. The BEST-Cement tool not only compares a cement plant's energy use to best practice in China and internationally, but also provides information on relevant steps to take to enhance energy-efficiency, with information about these measures' capital cost, energy savings, and payback time.^{vii} The project team conducted a series of workshops for about 300 cement plant staff from over 200 facilities, training attendees in the use of the BEST tool, resulting in positive feedback from the industry, and continuing requests for training. This team, working with the World Resources Institute (WRI) also helped implement the WRI/WBCSD Greenhouse Gas Protocol in the cement industry, so that companies could track their energy and greenhouse gas emissions effectively and the

government would have a standard for this type of data collection.

- **Innovative Financing for Efficiency Investments**

Lack of access to capital has been identified as a common barrier to industrial efficiency investments in China. To address this, international support by the World Bank and Global Environmental Fund sought to promote the development of Energy Service Companies in China. These ESCOs, also called "Energy Management Companies" in China, facilitate financial and technical aspects of energy efficiency improvements. In cost-and-risk-sharing agreements with Chinese plants, the ESCOs facilitated over 400 energy conservation projects in 2006, saving an estimated 21 million tonnes coal equivalent. A 2008 World Bank report says that "ESCOs in China saved about as much energy in 2006 and 2007 as France consumed in standard grade coal."

- **Strengthening energy conservation institutions**

China's Energy Conservation Centers, or ECCs, are a collection of government agencies at the provincial, municipal, and city levels tasked with helping industrial enterprises save energy through assistance with reporting requirements,

audits, training, and more. Supported by the UNDP and GEF and other organizations, renewed attention is being given these institutions, as well as the need for a central coordinating body. US-based Energy Foundation, in cooperation with China's Energy Research Institute, set up a non-profit center to help coordinate training, provide information sharing and fill other needed functions.

LESSONS LEARNED FROM COOPERATION

- **Cooperation efforts are most effective when connected with specific Chinese policies.**
The above-mentioned cooperation on standards development and energy-saving agreements were designed to support China's "Top-1000 Enterprises" program, which seeks to curb the energy consumption of its largest businesses. This program, in turn, is central to one of China's key goals: by 2010, to reduce energy use per unit GDP by 20% compared with 2005 levels.

- **Widespread results can be realized with cooperation on sector-specific implementation plans and tools that can be used across the country.** Benchmarking tools and audit guidelines were adapted to a Chinese context, and implemented with specific industrial sectors, such as cement and ammonia, in mind. Because the tools were tested locally and designed with nationwide use in mind, they were able to achieve broad results.
- **Cooperation is sustained by fostering long-term relationships, matching appropriate working-level partners on both sides.** The most successful cooperation involves ongoing working-level relationships among international experts and Chinese partners, coupled with high-level dialogue. On-going partnership between the US national labs and agencies and Chinese government and industry experts—supported by regular funding—is a successful model for programmatic cooperation.
- **Local-level efforts are needed, in addition to national-level cooperation, to realize implementation of Chinese policies.** Bottom-up experience through pilot projects to strengthen implementation

can inform and enhance national policy. For example, cooperation between the Shandong Energy Conservation Office and Lawrence Berkeley National Laboratory provided a model, based on international practice, of drawing up energy-saving contracts between local government and industry.

OPPORTUNITIES FOR FURTHER US-CHINA COOPERATION ON INDUSTRIAL ENERGY EFFICIENCY

Based on the lessons learned from cooperation experience to date, and considering the needs and resources of both the US and China, several areas are ripe for future cooperation on industrial energy conservation.

- **Strengthen alignment of U.S. cooperation efforts with China's policies.** Directly connect cooperation efforts with specific Chinese policies to maintain engagement by Chinese partners.
- **Support the establishment of a National Energy Conservation Center (NECC), and support the capacity building of existing local Centers.** Support could include development of information-sharing systems, equipment for energy audits, and

technical training for staff.

- **Support the development of China's University Alliance for Industrial Energy Efficiency, akin to Industrial Assessment Centers based in U.S. universities.**^{viii} This cooperation will facilitate university-industry partnerships, and help develop a workforce trained in energy management.
- **Increase support for auditing and benchmarking tools** in conjunction with sector associations, and in coordination with other international cooperation efforts. Continuing support for translating and 'localizing' guidelines from the U.S. EPA Energy Star industry program, and the U.S. DOE Industrial Technologies Program is worthwhile.
- **Establish a certification program for energy managers** at large energy-consuming enterprises, based on international experience. Continue support for energy management training in the US and China.

The 2009 *U.S.-China Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment* identifies goals and cooperation strategies consistent with the findings noted here.^{ix}

The May 2010 Energy Efficiency Forum and follow-up, as part of the US-China Strategic and Economic Dialogue, hold promise for further strengthening cooperation on industrial energy conservation.^x

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This fact sheet is a product of ChinaFAQs, a joint project of the World Resources Institute and experts from leading American universities, think tanks and government laboratories. Find out more about the ChinaFAQs Project at: <http://www.ChinaFAQs.org/>.

Notes

ⁱ National Bureau of Statistics (NBS). (Various years). China Statistical Yearbooks. Beijing: NBS.

ⁱⁱ US Energy Information Administration (EIA). (2008a). Annual Energy Review. Washington, DC: EIA.

ⁱⁱⁱ LBNL; NBS, various years; US EIA, 2008a.

^{iv} This list includes major cooperation efforts, but is not comprehensive. For further information, see: World Energy Council (2004); Sugiyama and Ohshita (2006); Ohshita (2008). For more on APP, see: <http://www.asiapacificpartnership.org/english/default.aspx>.

^v The terms Energy Service Companies (ESCOs) and Energy Management Companies (EMCs) are used interchangeably in China.

^{vi} Hu, Yuan (2007), "Implementation of voluntary agreements for energy efficiency in China." *Energy Policy*, 35, 5541-5548; Price, Worrell, Sinton, & Jiang, (2003), *Voluntary agreements for increasing energy-efficiency in industry: case study of a pilot project with the steel industry in Shandong Province, China* (LBNL Report, LBNL-52715); Price, Worrell, & Sinton, (2004). *Designing Energy Conservation Voluntary Agreements for the Industrial Sector in China: Experience from a Pilot Project with Two Steel Mills in Shandong Province*, LBNL Report, Berkeley CA; Wang Liting (2007), *Implementation of energy-saving agreements in Shandong Province*. Presentation at the Benchmarking Workshop, Jinan. Available online at: http://ies.lbl.gov/iespubs/Wang_Liting_Presentation_VAs_Jinan.ppt.

^{vii} See: <http://china.lbl.gov/research/industry/benchmarking/best-cement/best-cement-china>.

^{viii} For more information on the US network of university-based Industrial Assessment Centers, see: <http://www1.eere.energy.gov/industry/bestpractices/iacs.html>.

^{ix} US Department of State (July 2009), "Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment": <http://www.state.gov/r/pa/prs/ps/2009/july/126592.htm>.

^x For more information on the first US-China Energy Efficiency Forum in May 2010, and new cooperation among universities on industrial energy efficiency, see: <http://china.lbl.gov/news/lawrence-berkeley-national-laboratory-signed-memorandum-understanding-first-us-china-eeforum> and http://www.ndrc.gov.cn/xwfb/t20100526_348963.htm (in Chinese).

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