

Building Green for China's Future

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When the Summer Olympics opens in Beijing in 2008, visitors will see a green Olympic athletes' center. State-of-the-art and environmentally friendly, the building is now being planned with technical consultation from a group of U.S. energy-efficient building experts led by Joe Huang of Berkeley Lab's Environmental Energy Technologies Division (EETD).



For Huang, the road to the Beijing Olympics began in 1985, when he spent four months in Harbin, a city in northern China, teaching the use of DOE-2, a building-simulation computer program. Meanwhile the Chinese Ministry of Construction, prompted by the rapid growth of new residential construction across the country, began developing energy-efficient building codes.

With support from the San Francisco-based Energy Foundation, Huang provided technical advice to the Ministry starting in the late 1990s, including training and support to the China Academy of Building Research in using DOE-2 and EnergyPlus software. He helped develop new codes aimed at reducing heating and cooling energy use in China's Hot Summer/Cold Winter and Hot Summer/Warm Winter climate zones by 50 percent. The Ministry of Construction adopted the new codes in 2001 and 2003.

LEEDing the way in Beijing

Huang's work on building codes went hand in hand with another ambitious undertaking: designing a showcase energy-efficient office building for Beijing. The goal was a building that could earn a high LEED rating (Leadership in Energy and Environmental Design), verifying its environmental friendliness and energy efficiency. LEED is a voluntary rating system developed by the U.S. Green Building Council to assess a building's environmental performance and ability to meet sustainability goals.

The Agenda 21 Demonstration Energy-Efficient Office Building was a joint effort of the Chinese Ministry of Science and Technology and the U.S. Department of Energy. Huang was the principal technical adviser for the schematic design; using computer simulations, he completed a feasibility study in late 2000 that identified 20 energy-efficiency measures.

"The idea was to design with energy-efficient materials, space-conditioning systems, controls, and design principles that were judged to be widely replicable throughout China," says Huang.

The U.S. analysis team was led by Huang and Ron Judkoff of DOE's National Renewable Energy Laboratory, who used DOE-2 to model energy use in successive iterations of the building's design. Their recommendations to the design team, headed by lead architect Gao Lin of the Beijing Urban Planning and Design Institute, were intended to lower the building's energy use by 40 percent compared to standard practices. Features include efficient lighting, low-emissivity windows, light-colored walls and roofs, energy-efficient chillers, thermal storage, and bi-level switching, allowing occupants to reduce electric lighting during daylight.

Ground-breaking took place in February 2002. Encouraged by Rob Watson of the Natural Resources Defense Council, U.S. companies volunteered their technologies or equipment at no incremental cost to the Chinese partner. The nine-story, 13,000 square-meter (140,000 square-foot) building was completed in spring, 2004.



In 2005, Huang and Xu collaborated with the Natural Resources Defense Council to conduct a LEED analysis. Compared with similarly equipped office buildings in Beijing, the demonstration building uses 60 percent less energy per unit of floor area and 50 percent less water per occupant. In 2005 the Agenda 21 Building received the first LEED Gold rating for a building in China.

The U.S. Green Building Council was not the only organization that praised the energy-efficient design. In 2004 China's Ministry of Construction gave the Agenda 21 Building its top award for best green building in China.

"This honor was totally unexpected, and coming as it did from a different ministry, there could be no suspicion of bias or favoritism," says Huang.

Let the Games begin

In 2002 the Beijing city government held an international symposium to discuss clean energy sources to power the Olympics. Out of that meeting came U.S.-China joint working groups on environmental protection, transportation, information technology, water, and green buildings.

In 2004 DOE's Policy and International Affairs office identified a possible collaboration with the Beijing Science and Technology Commission to develop the Olympic Village. The Guo'ao Development Company was selected to build the Village, and a local firm, the Tianhong Group, was commissioned to design it.

During the Games the 3,000-square-meter building (more than 32,000 square feet) will be a reception center and gathering place for athletes. After the Games it will become a high-end apartment development, and the reception center will become a kindergarten. Guo'ao will continue as the developer and intends to sell or rent all the apartment units.

The design uses only curved walls. The architectural engineering department of Tsinghua University has proposed an innovative HVAC system that combines ground-source heat pumps, radiant floors, and desiccant cooling with active solar regeneration, as well as a seasonal thermal-storage system.

In addition to Huang, other project advisors are EETD's Peng Xu and architect Bob Kobet from Pittsburg, who has more than 20 years' experience designing green buildings, especially schools. The advisors work with the design teams to ensure that the building fabric and HVAC systems are optimized for energy efficiency and are environmentally sound.

In December 2006, Huang held a design workshop in Berkeley with leading local architects and engineers to evaluate the HVAC system proposed by Tsinghua. He and Kobet then traveled to Beijing with their recommendations. Huang and Xu are conducting computer modeling to give the design team in Beijing quantitative assessments of expected building performance.

In China, Huang is recognized as a spokesman for green building technology. Recently he addressed the international Energy Efficient Buildings Forum in Beijing, sponsored by the World Business Council for Sustainable Development and the International Energy Agency, to explore ways in which the developed economies and China can work together to improve the energy efficiency of new buildings in China.



The Olympic Village is intended to showcase China's accomplishments with energy-efficient buildings.

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