Transforming Markets for Energy-Efficient Buildings in China

Final Report
on Activity Conducted by the Institute for Market Transformation (IMT)
Under Cooperative Agreement DE-FC01-00EE10672
with the U.S. Department of Energy (DOE)

September 2013

In 2000 and 2001, the Institute for Market Transformation (IMT) and its partners executed various activities in support of increased energy efficiency in the building sector of the People's Republic of China. This work was supported in part by Cooperative Agreement DE-FC01-00EE10672 between IMT and the U.S. Department of Energy. This report summarizes the activities and results of this project, including specific information on how DOE funds were applied.

Summary of activity and results

As noted in the initial and revised Technical Application and Project Description, this Cooperative Agreement supported IMT's participation in a broad-ranging joint project led by the Natural Resources Defense Council (NRDC) and partners in China. As originally conceived, the primary focus of the project was to be the development of a new building energy-efficiency code applicable for the city of Chongqing and vicinity. Upon initial discussions, this focus expanded so that the code under development would be applicable not only to Chongqing, but to a much larger climatic transition zone in China. This transition zone would include the Yangtze River basin – home to more than 400 million people, including the cities of Shanghai, Nanjing, Wuhan, Changsha, Chongqing, and Chengdu. Lying between the heating-dominated regions to the north and the subtropical cooling-dominated areas to the south, this zone shows heavy energy use in buildings from both summer cooling and winter heating, requiring different analysis and technical solutions for energy efficiency.

The main executing partner on the Chinese side was the national Ministry of Construction (MOC), especially the Ministry's Department of Norms and Standards. The MOC, in turn, assigned the main technical responsibility for building-code development to the Chongqing Architecture University and the China Academy for Building Research in Beijing, with participation by the the Ministry's own Residential Building Design Research Institute. On the American side, Lawrence Berkeley National Laboratory and consultant John Hogan provided extensive technical assistance.

Work on the new building code involved the following steps:

- Analysis and quantitative simulation of transition-zone building energy use, using the DOE-2 calculation engine with the assistance of scientists from DOE's Lawrence Berkeley National Laboratory
- Analysis of local market conditions, including construction material availability and cost, income, and energy costs
- Assessment of environmental impact of various types of energy use
- Exchange of information between national experts in China and the USA on building energy simulation, building-code development approaches (including those embodied in California's Title 24 and ASHRAE 90.1), and implementation
- Preparation of first draft of transition-zone code, with review by Chinese and American experts
- Preparation of final transition-zone code, with review by Chinese and American experts

For a full summary of the technical aspects of development of this transition-zone code, please see http://eaei.lbl.gov/sites/all/files/lbl-building-ee-standards2001.pdf.

The transition zone was adopted in 2003 and revised in 2010 to include various new elements, including consideration of renewable energy. The project team estimates that implementation of this code results in avoided CO_2 emissions of at least 12 million tonnes per year.

Activity specifically supported by the IMT/DOE Cooperative Agreement: May-June 2000 study tour

Beyond DOE-supported work with IMT, NRDC conducted extensive complementary activity under this same project, but all such additional work was financially supported by outside co-financing. The IMT/DOE Cooperative Agreement primarily supported expenses associated with a study tour in the United States for four Chinese specialists, as listed below.

1. **Lang Siwei**. China Academy of Building Research. Co-Lead Compiler of Transition Zone Code.
2. **Fu Xiangzhao**. Chongqing Architecture University. Co-Lead Compiler of Transition Zone Code.
3. **Tan Hua**. Ministry of Construction of the People's Republic of China. Department of Norms and Standards (the approving body for the TZ Code).
4. **Jin Ruidong**. Ministry of Construction of the People's Republic of China. Residential Building Design Research Institute.

The study tour took place in May and June 2000. The tour included visits to Berkeley, Sacramento, Rocklin, and San Francisco, California. The tour covered all aspects of development of the most advanced and effective building codes in the United States. It included technical training on building energy modeling and use of DOE-2. It also exposed the Chinese participants to the American process of stakeholder input and review. The visit also focused extensively on best practices in implementation

and enforcement, including the fostering of industry awareness and acceptance, financing and organization of inspection and enforcement, and personnel requirements for enforcement agencies.

IMT applied funds from the DOE Cooperative Agreement to help cover international air travel and lodging, plus a share of on-site interpreting fees. The IMT/DOE Cooperative Agreement also supported modest IMT staff participation in organization and review of the technical work of the project team.

In the end, because of the unexpectedly ready availability of co-financing received directly from other funders by NRDC, $7,942.66 of the $17,500 originally committed by DOE for the agreement remained unspent. IMT will make no further claims on these funds. See accompanying documentation for a summary of how DOE funds were spent.