



# Electricity for Millions

## Developing Renewable Energy in China

What if the world's most populous nation turned towards renewable energy and energy-efficient technologies? Since 1995, the National Renewable Energy Laboratory (NREL), a U.S. Department of Energy National Laboratory, has been working with China to answer that question.

Under a bilateral agreement between China and the United States, NREL's efforts to help develop renewable energy in China have included pilot projects, training, market and business development, and renewable-energy resource assessment. Recent work has focused on bringing renewable energy to people who don't have electricity, reducing rural reliance on diesel, developing markets through policy and programs, capacity building, and helping to form business partnerships. Partners have included the United Nations Development Program, the World Bank, and other international institutions.

## Highlights from Eight Years of Partnership

### Rural Energy Development: *Gansu Solar Home System Project*

Through this project, 320 homes and 10 schools were equipped with PV solar systems by 1998. Gansu Solar Electric Light Fund installed an additional 460 PV systems through a revolving credit fund set up by this project, and the Ministry of Agriculture has now expanded its solar home system project to 10,000 households in 6 provinces.

Credit: Jikedian Renewable Energy Development Center



**This PV system in the Xinjiang Autonomous Region supplies electricity to pump water.**

## Renewable Focus Areas

NREL's international team partners with China to strengthen Chinese use of renewable energy and energy efficient technologies through five means:

**Rural Energy Development**—Bringing biomass, wind, and solar energy to rural villagers who don't have electricity

**Wind Energy Development**—Accelerating sustainable wind generation, for both large-scale grid-connected and off-grid electricity users

**Geothermal Energy Development**—Developing geothermal heat pump markets and the investment projects to help projects succeed

**Renewable Energy Business Development**—Offering outreach and information to U.S. companies to help them develop markets for renewable energy technology in China

**Policy and Planning**—Supporting China's national renewable-energy programs from a policy and infrastructure development viewpoint

## Success Story

Credit: Debra Lew



### Hybrid Renewable Systems for Inner Mongolia

For 402 rural households in the Chinese province of Inner Mongolia, electricity means wind turbines and solar electricity. In 1997, a partnership between NREL, the University of Delaware, and the Inner Mongolia Science and Technology Commission brought about the installation of hybrid PV/wind systems in four Inner Mongolia counties. The province imported the PV from the United States, supplying the wind turbines and the rest of the system domestically. A data acquisition system installed on one hybrid system monitored performance; the data was collected every three months and was analyzed in cooperation with NREL. The Inner Mongolian government has determined that the systems work well enough to warrant the installation of 60,000 similar systems over the next five years, with a small end-user subsidy.

The Inner Mongolia Hybrid Systems Pilot Project, one among many successful pilots that the NREL International Team has undertaken, helps bring renewable energy to thousands of Chinese who previously lived without electricity.



## Wind Energy Development:

### *Xiao Qing Dao Village Power Project*

Commissioned in February of 2001, this pilot project uses a wind/diesel/battery system to bring electricity to 120 households on Xiao Qing Dao Island in the Yellow Sea off Shandong Province.

## Geothermal Energy Production and Use:

### *Potential Project Identification*

This U.S./China partnership project has identified twelve potential geothermal heat pump projects, three of them totaling \$5.3 million. As a result of the project, a Chinese and a U.S. company partnered to win a \$309,000 Trade and Development Agency grant in April 2002. The grant will leverage \$5 to 10 million in several projects to expand the market for geothermal energy. Partnering, training, and monitoring potential sites have led to a rapidly growing Chinese market for geothermal heat pumps.

## Renewable Energy Business Development: Outreach

A Web site ([www.nrel.gov/china](http://www.nrel.gov/china)), and other means of outreach help provide policy, business, and program information for U.S. companies, and facilitate business partnerships between U.S. and Chinese companies.

## Policy and Planning:

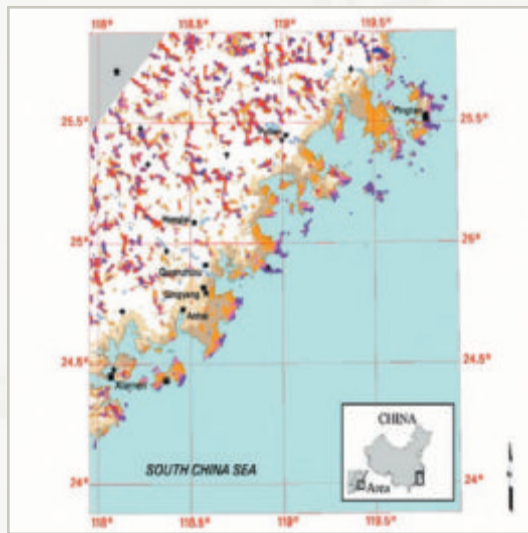
### *National Township Electrification Program*

The December 2002 Village Power Sustainability Workshop in Beijing helped support the \$240 million program that will provide renewable-source electricity to 1,061 Chinese townships. The workshop attracted a dozen foreign experts and 70 Chinese representatives to discuss the technical factors affecting sustainability. The next stage of the program will provide electricity for the people living in the remaining 20,000 villages.

NREL and the Institute for Sustainable Power (ISP) are working with the Jikedian Renewable Energy Center to establish a quality training infrastructure for the Township Electrification Program. A training and information manual on designing, operating, and maintaining village power systems was published in 2003.

## Wind Resource Assessment and Mapping

DOE/NREL, EPA, and the China Hydropower Planning General Institute completed a wind energy resource atlas of southeast China, which identified almost 50 GW of available wind resources within 10km of the coastline along Fujian Province and eastern Guangdong Province. A CD-ROM of these wind maps plus additional recent measurement data, prepared in 2002, is available online at [http://www.nrel.gov/china/wind\\_energy.html](http://www.nrel.gov/china/wind_energy.html).



*Excellent wind resources have been identified along the coast of Fujian Province.*

## NREL Partnerships in China

Ministry of Science & Technology  
National Development and Reform  
Commission  
Ministry of Agriculture

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The following fact sheets on renewable energy in China are available on the National Renewable Energy Laboratory's China Web site ([www.nrel.gov/china](http://www.nrel.gov/china)).

- WB/GEF Renewable Energy Development Project
- Grid Connected Wind Farms in China
- Renewable Energy Policy in China
- China's Townships Electrification Program
- China's Plan for Renewable Energy
- Renewable Energy Business Partnerships in China

These fact sheets were prepared by DOE/NREL and the China Renewable Energy Industries Association under the US/China Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Technology Development and Utilization.

Credit: Jean Ku



*This is the Beijing Concordia International Apartment Building, where geothermal heat pumps have been installed for heating and cooling the building. This demonstration project was part of the U.S.-China Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy and was dedicated in September 2001.*

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