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Solar Cooking for Human Development and Environmental Relief
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SOLAR COOKING IN CHINA: A CDM Project

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4 December 2012

11,805,185 TONS OF CARBON DIOXIDE EQUIVALENT SAVED

548,800 HOUSEHOLDS **2,176,006 PARTICIPANTS**

Situation

Whilst China has experienced rapid development over the past 2 decades, regions of the Northwest remain among the poorest. Average 2011 per capita annual income is estimated at US$400. The population suffers severe desertification.

On the other hand, a large part of the region experiences high levels of sunshine, making it an ideal place to profit from free solar energy. Annual sunshine time averages 2,675 hours with irradiance value averaging 593 W/m^2, ranging from 402 (Dec) to 722.1 W/m^2 (July). Whilst location allows for solar cooking 9 to10 months of the year, the enhancement of high altitude allows cooking year round.

In this part of rural China the predominant fuel for cooking and heating is coal. Evidence on associated adverse health effects is strong, especially on high incidence of lung cancer, acute respiratory infection, and chronic obstructive pulmonary disease (Zhang JJ, 2007). The WHO estimated that solid fuels used in Chinese households cause approximately 420,000 premature deaths annually (Smith KR, 2004).

Chinese Government Action

In an effort to combat these impacts and to meet growing fuel needs and environmental commitments, the Chinese government set a target to raise non-fossil fuel energy consumption from 8.3% in 2010 to 11.4 percent of the energy mix by 2015, as part of its 12th Five Year Plan. In 2011, the government spent $52 billion on renewable energy, almost a fifth of the world's total $257 billion investment. Solar energy led investment globally, accounting for $147 of the $257 billion (REN21, 2012). Alongside larger scale projects, the Chinese government welcomed introduction of the Clean Development Mechanism (CDM) solar cooking initiatives documented here.

CDM Participation

As a result of the *Kyoto Protocol* [1] of 1998, CDM was created to reduce environmentally damaging behaviour. It certifies projects designed to reduce green house gas emissions and issues Certified Emissions Reduction Credits, (CERs)[2] for projects meeting its criteria. These CERs may be used in emissions trading[3], of which China is a major world player (Guoyi Han, 2012). The process of certification is rigorous[4] and CDM project monitoring data can be used with confidence.

Action Taken

As illustrated in Fig.1, China has ten 10-year CDM certified solar cooking projects**, involving 1,223,200 people in 305,800 households; and with global warming savings projected at 7,238,625 tCO2e[5].** Located in Northwestern China and covering approx. 21,646 km_2 around latitude North 35°20' N and 99°35' E. The first of the projects commenced in 2009.

Five similar Chinese projects are currently awaiting CDM registration. They are projected to **involve a further 243,000 households and 952,800 people and additional savings of 4,566,560 tCO2e.**

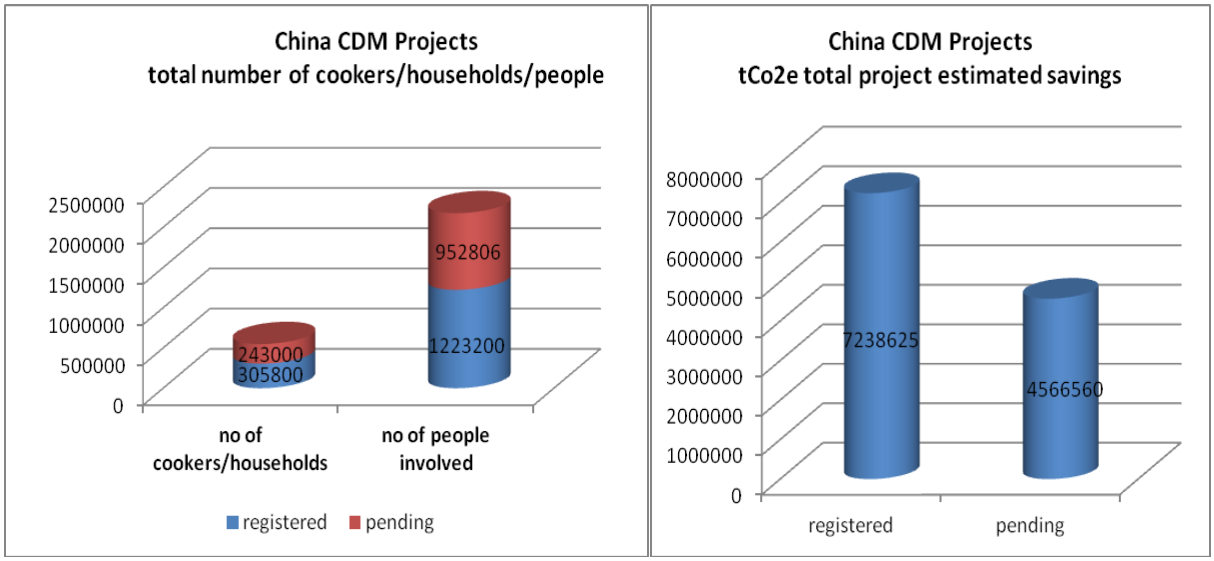

Figure 1 CDM Solar Cooking Projects in North West China (as at October 2012)

[1] http://www.kyotoprotocol.com/

[2] CER (Certified Emission Reduction) – Carbon credits created in accordance with the CDM rules and requirements, which corresponds to 1 tonne of CO2e (carbon dioxide equivalent) emission reductions calculated using global warming potentials

[3] Emissions trading is a market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants

[4] http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php

[5] tCO2e - Tonnes of carbon dioxide equivalent. http://wiki.piggoprojects.com/index.php/CO2e

Finance

Fast start sponsors generally include national governments, international bilateral donors, multi-lateral institutions such as the World Bank and the GEF as well as private sector specialist carbon originating investors. These investors have a range of interests with development agencies motivated by livelihoods, sustainable development as well as returns from the sale of carbon credits.

The original investments in the Chinese CDM projects are on course to provide the anticipated revenue through sale of CERs[6]. Even using a conservative estimate of $8 per carbon credit unit, this accrues to $63,699,896 in CER revenue by project completion. Returns at this level are attractive to a range of investors foreseeing the future maturing of the international carbon market.

To enable adoption, the recipients contributed $5 per unit or less according to their ability to pay. The remainder of costs were covered by the project sponsors, usually bilateral or multi-lateral support or trading organizations working in collaboration with a local host partner.

Equipment

The solar cookers used are parabolic with capacity to reach over 400C. They provide an efficient alternative to the fossil fuel, usually coal, for daily cooking and water boiling. Thermal heat efficiency averages 65% for solar compared with 12.3% for the traditional unimproved coal fires.

The unit cost of manufacturing these parabolic solar cookers averages $44. Cookers are locally manufactured, requiring no externally sourced parts and components are recyclable.

Impact

Annual monitoring data confirms successful adoption of the new technology. The cookers are in continuing use, **averaging 9% higher use than projected, with tCO2e set to be 7,962,487, exceeding the predicted figure of 7,238,625.**

Whilst fostering environmental awareness and good practice, the project has created local jobs and local tax revenue. This ensured critical government support. As noted by one local project partner, "*Without government cooperation, even a project backed by the UN can amount to nothing but paperwork.*" (Tianbi, 2011) At the local sales tax rate of 17% on total cooker sales of approximately US$22,924,000 ($12,232,00 current projects + $10,692,000 pending), potential tax revenue is substantial.

[6] http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php

Figure 2 Solar project in North Western region of PR China (from http://www.myclimate.org/, 2010)

In addition to the documented adoption of the technology, participant feedback has been positive. Coal dependent households with average energy consumption of 1345 kgce[7] have spent between 5 and 25% of their income on fuel (Gregory 2012, Jiang, 2004). Zhang Binglian, a farmer in Pengyang County, has a greatly reduced fuel bill and considers the solar cooker a "*real blessing*". (Tianbi, 2011) Less money and time spent on cooking and cleaning blackened pots, mainly done by women, has allowed time and funds for other activities. Some income earning, such as tea growing. The solar cooking projects have directly created jobs in product manufacturing, servicing, distribution, demonstration and monitoring of usage.

Emissions saved in the registered projects equate to removal of 156,000 cars from the road with potentially a further 89,500 from the five projects pending registration.

Conclusion

This paper provides a summary of all available information to date. Overall, the evidence of current positive impact on climate and quality of life appears to support the continuation and expansion of these and similar solar projects.

[7] Kilogram of standard coal equivalent

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Figure 2 – 3 photos http://www.myclimate.org/carbon-offset-projects/international-projects/detail/mycproject/11.html

Further Information:
Solar Cookers in Tibetan Areas of China: **Video** illustrating difference to life style
http://www.youtube.com/watch?v=c0XWyASyyko
Information on solar development in china
http://www.solarfood.org/solarfood2009/3_Full_papers/Technologies/9_Tingcun.pdf

Appendix 1: