

TECHNICAL ASSISTANCE COMPLETION REPORT¹

Division: EAEN

Division: EXE

TA No. Country and Name:			Amount Approved: \$400,000	
TA 3965-MON: Renewable Energy Development in Small Towns and Rural Areas			Revised Amount: \$400,000	
Executing Agency: Department for Fuel and Energy of the Ministry of Infrastructure		Source of Funding: Government of Denmark	Amount Undisbursed: \$152,269.81	Amount Utilized: \$247,730.19
TA Approval Date:	TA Signing Date:	Fielding of First Consultant:	TA Completion Date Original: 31 July 2004 Account Closing Date Original: 31 July 2004	
4 November 2002	2 December 2002	1 July 2003	Actual: 31 December 2008 Actual: 20 April 2009	
Description:				
<p>With its vast land, sparse population, and hundreds of isolated small settlements throughout the country, the reliability of electricity supply in Mongolia varies widely and is worst in the poorest villages, which are not connected to the grid. Because of rough terrain and significant distances between population centers, and the volume of electricity consumption due to small population, diesel generation is the most economic source of electricity for some province centers. Diesel needs to be imported, transported, and stockpiled at high volumes, and supply interruptions can cause severe power shortages. Lack of critical spare parts for regular maintenance, and pressure of recurrent expenditures increase the frequent interruptions of supply making diesel generation extremely unreliable. This is a major concern to ensure success of ADB's poverty reduction intervention in the health, education, and municipal services in rural areas and small towns. Mongolia has great potential to benefit from the appropriate technology in renewable energy. Large scale use of renewable energy will require policy support, substantive capital investment, skilled labor to operate and maintain the system, regular maintenance, and stable supply of spare parts. These have technical and financial implications, which may be why the country has used only limited renewable energy.</p>				
Expected Impact, Outcome and Outputs:				
<p>The TA impact was to promote economic development and poverty reduction by satisfying electricity demand for remote rural customers. The outcome was to develop a renewable energy policy for isolated rural areas. The outputs were: (i) an exhibition of small-scale wind, solar, and hybrid renewable technology suitable for the harsh Mongolian winter; (ii) recommendation for affordable practical wind and solar hybrid solutions for schools and hospitals in the 197 isolated village centers; and (iii) overseas study tour to Inner Mongolia, Peoples' Republic of China (PRC) and two other countries to study practical application of hybrid renewable schemes.</p>				
Delivery of Inputs and Conduct of Activities:				
<p>An international consulting firm (the consultant) with expertise in renewable energy from the United Kingdom (with associated national experts) was engaged in accordance with ADB's <i>Guidelines on the Use of Consultants</i> to implement the TA. The consultants commenced their services in July 2003. Inputs consisted of 8.0 person-months of international and 10 person-months of national consulting services. A key part of the TA was to assist the Ministry of Infrastructure to develop a draft Renewable Energy Action Plan (REAP) in order to facilitate the electrification of rural soums with renewable energy technologies where appropriate. A review of existing energy laws in Mongolia as well as relevant laws and policies of other countries were conducted. A workshop was held in September 2004 to discuss the REAP with national and international stakeholders, and the REAP was further revised incorporating comments from the workshop. The workshop was organized in conjunction with "Sustainable Energy Week" jointly organized with GTZ, and included an information dissemination seminar on Sustainable Energy and Energy Efficiency for Small Towns and Rural areas. In May 2004, two separate study tours were conducted to the USA and PRC. The US study tour was to learn about renewable energy approaches and technology developments, and the PRC study tour enabled the participants to attend a renewable energy conference and to visit institutional and private sector organizations in the renewable energy and energy efficiency sectors.</p>				
<p>Two pilot projects were developed as part of the TA and the sites were selected in consultation with the Ministry of Infrastructure (MOI). A 6 kWp PV system with battery, controller and inverters was installed in the Zereg Soum center in Khovd Aimag, and was connected to the existing diesel generator and mini grid. Intersolar, a Mongolian firm experienced in installing renewable energy systems, was subcontracted to carry out the installation. During installation it was found that the mini grid and the electrical installations in buildings were in a poor state of repair, and these had to be rectified in order to allow operation of the system. The second pilot project was a wind-diesel hybrid system supplying electricity to the hospital in Darvi Soum center, Govi-Altai Aimag. A 1kW wind turbine was</p>				

¹ In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

installed near the hospital to which power was supplied. The pilot projects were smaller than originally envisaged due to higher hardware cost than budgeted. The TA also introduced energy efficiency measures as part of the pilot project: the biggest impact was from replacing incandescent bulbs with compact fluorescent lights (CFLs). The performance of the consultant was rated as satisfactory as the outputs and outcome were met despite difficulties and prolonged delay in the delivery of the final report, which significantly affected timely closure of the TA. However, this delay was balanced by forfeiture of claims for the final report and other TA expenses, contributing to TA savings of \$152,270. The performance of another individual consultant recruited under the TA to research and update data for the Mongolia Renewable Energy and Energy Efficiency Country Report was also satisfactory. The executing agency's counterpart support was adequate, and its overall performance was satisfactory. The ADB conducted regular missions to closely track and monitor the TA activities including a visit to the pilot project sites. The Mongolia resident mission provided in-country support and coordination. ADB's overall performance was satisfactory.

Evaluation of Outputs and Achievement of Outcome

A comprehensive analysis of past renewable energy activities in Mongolia and overseas was carried out. Experiences from these reviews were used to help input into the Mongolia renewable energy policy development. Following the workshop to discuss the REAP, it was submitted to the Parliament of Mongolia, and the Renewable Energy Law was passed in January 2007. The reports also proposed ways for private sector participation in renewable energy hybrid projects, and a financial model was developed to enable the setting of tariffs for soum renewable energy systems and sources of financing were identified.

The pilot PV-diesel hybrid system in Zereg demonstrated that it is technically possible to integrate a relatively small renewable energy system with an existing diesel generator and mini grid, although the number of users served was less than originally envisaged. This was not because of technical problems, but due to social and institutional barriers. People overused the system in terms of power capacity and energy usage. The wind power-diesel system in Darvi supplied electricity to the hospital only, therefore its operation was less complex than in Zereg. The system was operational throughout from installation to the end of the monitoring period, and no problems were reported. Overall, the pilots show that there is a huge potential for energy efficiency. Large energy savings could be realized simply by replacing incandescent bulbs with CFLs that reduced lighting loads by an estimated 75%. The World Bank has replicated the hybrid model established under the TA in their "Renewable Energy and Rural Electricity Access Project" (2006-2010, for \$23 million funded by IDA, GEF, and the Government of Mongolia).

The bulk of the TA activities were completed in 2005. Progress reports submitted were generally of good quality. However, there was a significant delay in the delivery of the final report that may partly be attributed to the difficulty of collecting monitoring data from the pilot projects to be able to develop a larger scale renewable energy hybrid solution for the rural areas. Eventually, after numerous follow-ups, the consultant delivered the final report in May 2007 albeit without first submitting a draft, and without the benefit of input from the executing agency or the ADB. Notwithstanding this, there was sufficient interaction with and training of the local stakeholders in the process. TA was effective in meeting its outcome although it was less efficiently carried out. The passage of the Renewable Energy Law is indication that renewable energy policy will likely be sustained although the challenges of implementing renewable energy in isolated areas must be recognized.

Overall Assessment and Rating

The TA was highly relevant for a country like Mongolia where many communities are not connected to the main grid. It was successful in assisting the Government in developing a REAP, which contributed to the passage of the Renewable Energy Law. Through the pilot projects, the TA was able to identify the issues related to renewable energy projects and how these can be resolved. Overall the TA is rated as successful.

Major Lessons

The pilot projects show that introducing renewable energy without tapping the potential for energy efficiency does not make technical or economic sense. A transition to an energy-efficient soum would require significant cooperation and change of behavior by users. This can be achieved by charging electricity according to usage and to reduce electricity theft through imposition of penalties. For future renewable energy schemes, a two-stage approach is recommended: making successful implementation of demand-side efficiency measures as a prerequisite for the installation of a renewable energy system. The time made available for this project was very short, with limited time available for experts to be in the field. A gradual introduction over a longer period of time might have led to better results and time for data-gathering.

Recommendations and Follow-Up Actions

Lessons learnt in the design and implementation of the pilot projects can be applied to other similar renewable energy hybrid projects. Apart from the technical elements, consideration should also be given to issues such as the state of the electricity distribution system, ownership and operation of the system, potential energy efficiency measures, user behavior, and introduction of consumption-based tariff. A longer time is also recommended to implement renewable energy hybrid systems in Mongolia.