

Country Name	The Project for Introduction of Clean Energy by Solar Electricity Generation System
Mongolia	

I. Project Outline

Background	<p>In Mongolia, economic growth and population concentration to the capital caused increase of power and heat demands. At the time of ex-ante evaluation, 90% of power generation in Mongolia depended on coal-fired power generation. Use of coal at thermal power plants and low energy efficiency of deteriorated thermal power plants caused the increase of emissions of the air pollutants.</p> <p>Japan had supported developing countries which were willing to contribute to climate stability and in 2008, Japan announced a new funding mechanism in the amount of 10 billion dollars in five years. As part of the mechanism, a new grant aid scheme named “Program Grant Aid for Environment and Climate Change” was created in 2008 to promote clean energy including renewable energy and to utilize Japanese advanced technology.</p>				
Objectives of the Project	<p>To increase power generation capacity, diversify power sources, and raise awareness of Mongolian people for renewable energy by providing photovoltaic (PV) system and related equipment in Ulaanbaatar and by providing technical assistance for capacity development of technical personnel, and thereby contributing to publicity of Japan’s initiative for promoting measures for climate change both by developed and developing countries.</p>				
Outputs of the Project	<ol style="list-style-type: none"> Project Site: Ulaanbaatar (An adjacent area to Chinggis Khaan International Airport) Japanese side: <ol style="list-style-type: none"> PV system* (PV module, PV structure, Power conditioner, Display board, Meteorological monitoring system, Data collecting system, Indoor type 6kV switchboard, Indoor type 400V distribution board, Interconnecting panel, Step up transformer and others) Technical Assistance (soft component of Grant Aid): Training on basic knowledge, operation and maintenance, and troubleshooting of grid connected PV system <p>*The capacity of PV system was originally designed to be 300 kW. During the project implementation, the capacity was expanded to 443.52kW by using the surplus amount of the grant aid funds as a result of lower bidding price.</p> Mongolia side: Acquisition of land for system installation, various procedures for grid connection, proper operation and maintenance of the procured equipment 				
Ex-Ante Evaluation	2009-2010	E/N Date	December 11, 2009	Completion Date	September 19, 2012
Project Cost	E/N Grant Limit: 590 million yen		Actual Grant Amount: 583 million yen		
Implementing Agency	Civil Aviation Authority of Mongolia (CAAM)				
Contracted Agencies	Japan International Cooperation System (The equipment of the project was procured by the Japan International Cooperation System under the Agent Agreement), Nippon Koei Co., Ltd. and Toyota Tsusho Corporation.				

II. Result of the Evaluation

1 Relevance
<p>Consistency with Mongolia’s development policy at the time of ex-ante evaluation and ex-post evaluation</p> <p>This project has been highly consistent with Mongolia’s development policy as increase of the share of renewable energy in national power generation is set in policy documents such as the National Renewable Energy Program formulated in 2005, State Policy on Energy (2015-2030) submitted to the parliament in May 2015 and other documents.</p> <p>Consistency with Mongolia’s development needs at the time of ex-ante evaluation and ex-post evaluation</p> <p>The project has been also highly relevant with Mongolia’s development needs for renewable energy. Renewable energy accounts for only 3.6% and 8% of total power generation and generation capacity at the time of ex-post evaluation. Mongolia has been reliant on coal-fired power generation (Coal-fired power accounts for 96% of total the total power generation at the time of ex-post evaluation) , which heavily emits air pollutant.</p> <p>Consistency with Japan’s ODA policy at the time of ex-ante evaluation</p> <p>The project was also consistent with Japan’s ODA policy at the time of ex-ante evaluation as prioritized areas of Country Assistance Program for Mongolia (November 2004) include “Support for development of infrastructure to promote economic activity” and “Support for environmental protection (“Preservation of the natural environment and appropriate utilization of natural resources” and “Measures against environmental problems in Ulaanbaatar”).</p> <p>Evaluation result</p> <p>In light of the above, relevance of this project is high.</p>
2 Effectiveness/Impact
<p>Effectiveness</p> <p>The project has mostly achieved its objectives, “to increase power generation capacity and diversify power sources”. Power generation in 2012 did not reach the target as the completion of the construction of the facility was in September 2012. However, the power generation in 2013 almost achieved the target¹, and the actual result exceeds the target in 2014. In accordance with the increase of power generation, reduction of CO2 emissions and the reduction of the electricity cost of the Chinggis Khaan International Airport, the user of the electricity</p>

¹ In 2013, parts of the connecting box needed to be replaced, therefore, the actual power generation did not reach the target slightly.

also have achieved the target.

As to the awareness of Mongolian people for renewable energy, the project has demonstrated the effects of the project by setting up a publication panel in the Airport premises. CAAM also has accepted site visits once or twice a year from 2012 to 2014. Approximately 50 individuals participated for each visit and the visitors include students from engineering universities and those from Ministry of Energy. Thus, the awareness for the renewable energy has been enhanced. The technical capacity has been enhanced as a result of implementation of the soft component as evidenced in the smooth operation of the grid connected PV system. Also, various data have been collected and reflected in the operation and maintenance². The soft component aimed that a power purchase agreement (PPA) is signed between CAAM and Ulaanbaatar Electricity Distribution Network Company (UBEDN) for the trading of the reverse power (surplus power), and thereby implementation of succeeding grid connected PV system projects is promoted. However, almost all generated power has been utilized at Chinggis Khaan International Airport and there was no surplus power. In addition, price negotiation with UBEDN did not go well and PPA was not concluded accordingly.

Impact

Although the project was expected to promote new grid connected renewable energy projects, no new project has been implemented so far. JICA presented the outline of the project as a good case of Japan's cooperation in the field of renewable energy at various occasions including Global Superior Energy Performance Partnership in Ulaanbaatar on October 2014 and meetings among development partners in the energy sector. Thus, Japan's initiative for promoting measures for climate change has been demonstrated.

No negative impacts on natural environment were observed and no land acquisition and resettlement occurred under this project.

Evaluation result

The project has achieved its objectives such as increase in power generation, diversification of energy source and awareness raising and the project also demonstrated Japan's initiative for promoting measures for climate change. Therefore, effectiveness/impact of the project is high.

Quantitative Effects

	Before the project (2011)	Target figure at target year (2014)	Actual result (2012)	Actual result (2013)	Actual result (2014)
Indicator 1: Net power generation (MWh/year)	0	497 * ¹	254	484	569
Indicator 2: Reduction in CO ₂ Emissions (t-CO ₂ /year)	0	775 * ²	396	755	887
Indicator 3: Reduction in Electricity cost of Chinggis Khaan International (MNT/year)	0	37,175,600 * ³	23,352,000	46,002,649	61,138,331

Note : (1) The target originally set was 335MWh/year, however, the new target of 497MWh/year is set at the time of ex-post evaluation in accordance with the expansion of the capacity. (2) 497MWh/year × 1.560t-CO₂/MWh (The CO₂ emission factor of the central power grid network) =775t-CO₂/year. Original target was 524t-CO₂/year. (3) 497MWh × MNT74.8/kWh. Original target was 25,134,800MNT.

Source : JICA internal documents, CAAM

3 Efficiency

Although the project cost was within the plan (ratio against the plan: 99%), the project period significantly exceeded the plan (ratio against the plan: 256%). Civil work by contractors was scheduled to be completed in three to four months. However, they were not able to cope with the schedule and as a result, the civil work was not completed before the winter period. In the end, it took approximately one year to complete the civil work, which delayed the schedule as a whole. The outputs of the project were produced as planned (with expansion of the capacity). Therefore, efficiency of this project is fair.

4 Sustainability

Institutional aspect

Operation and maintenance (O&M) of the equipment and facilities procured/installed by the project have been carried out by the CAAM, the implementing agency, and Technical Supply Division is responsible for O&M as originally planned. Technical Supply Division (total number of staff is 220, among them 58 members are assigned to Electricity Supply Section) assigns two dedicated staff members to the O&M of the PV system who are able to carry out daily maintenance without trouble.

Technical Aspect

Two assigned O&M staff members have sufficient technical skills. When staff members transfer to other sections/divisions, the skills are transferred to newly assigned staff. The knowledge and skills transferred under the soft component are utilized. In fact, CAAM repaired a problem occurred in 2013 by their own with the skills acquired through the soft component. The skills and knowledge are transferred to other members of CAAM, and the manuals are also well utilized. CAAM carried out repairs in September 2014, and therefore, no technical problem is found with CAAM.

Financial Aspect

No financial problem is found as the equipment and facilities procured/installed by the project are basically maintenance free, the amount of disbursed personnel expenses have been more than the planned, and the equipment expenses have been disbursed whenever necessary.

Current Status of O&M

After the project completion, there was a failure in display board, however, the repairs including parts change and connection were carried out. All equipment items including the display board are in good condition and operate properly. Maintenance activities include daily checkup of the collected data, checkup of the equipment once/twice a week, monthly inspection and biannual inspection. In addition, spare parts are managed well Thus, O&M activities are appropriately carried out.

Evaluation result

² Engineers in charge are able to judge whether the system works properly by checking the collected data. For example, by analyzing the data on power generation, the engineers can identify whether any problem occurs and can carry out simple repair and maintenance based on the data.

In light of the above, the sustainability of effects of this project is high, as there are no problems in institutional, technical and financial aspects as well as the current status of the facilities and equipment.

5 Summary of the Evaluation

The project has achieved its objectives, “to increase power generation capacity and diversify power sources, and raise awareness of Mongolian people for renewable energy” as net power generation has increased, and CO2 emissions as well as electricity cost have been reduced. Also, the demonstration of PV power generation was conducted. A positive impact was also observed as Japan’s initiative for promoting measures for climate change has been demonstrated.

As for sustainability, the implementing agency has no problems in the institutional, technical and financial aspects, as well as the current status of the facilities and equipment. As for efficiency, the project period exceeded the plan.

In light of the above, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

Lessons learned for JICA:

The soft component under the project aimed that CAAM signs PPA with UBEDN to trade the surplus power flow to the grid, and thereby promoting renewable energy. CAAM requested Energy Regulatory Commission (ERC) which has authority to decide the power selling price to set the price several times. However, ERC finally instructed that the price should be decided through negotiation between CAAM and UBEDN, and the negotiation started accordingly. However, CAAM gave up signing PPA as the price proposed by UBEDN was very low and little surplus power was actually generated.

On the other hand, the facility accepted the site visits constantly and therefore, the renewable energy has been promoted through this project to certain extent. Although the project included the signing of PPA as the undertaking of the Mongolian side, under the circumstance such as generation of surplus power is limited and there is no incentive for the stakeholders to enter into PPA, it was difficult for the Mongolian side to fulfill this undertaking. When designing a future project of promoting renewable energy, instead of emphasizing only signing of PPA, a soft component could be designed in a way to support an implementing agency to draw up a PR strategy by using the concerned project as a showcase.



PV modules



Publicity panel (in the Airport)