

Country Name	The Project for Introduction of Clean Energy by Solar Electricity Generation System
Islamic Republic of Afghanistan	

I. Project Outline

Background	In Afghanistan, the power demand rapidly increased in the progress of reconstruction of the country. While the needs for stable power supply had been growing, the household electrification remained at low level of 20% in the urban area and 13% in the rural area (2009). In fact, although the constant power supply capacity of the power grid system in Kabul, including the power supply of 40 MW through the North East Power System (NEPS), was 162 MW in 2009, it was estimated the supply capacity could have been far below the power demand by the estimated population of 370,000 applying for power feeding. In addition, the country heavily depended on power supply from Central Asian countries, including Uzbekistan. Extension of power generation using renewable energy was a key not only to cope with the issue of power shortage but also to realize environment-friendly and stable economic growth.				
Objectives of the Project	To enhance power generation capacity, diversify energy sources and increase awareness among the people of Afghanistan and the policy decision makers of the country on utilization of renewable energy by procuring and installing of Photovoltaic (PV) system as well as training technical experts at the Kabul International Airport (KIA) ¹ , as a gateway of the country, thereby contributing to demonstration of initiatives of Japan to promote efforts among both developed and developing countries for climate control.				
Contents of the Project	<ol style="list-style-type: none"> 1. Project Site: The Kabul International Airport, Kabul 2. Japanese side <ul style="list-style-type: none"> (1) Procurement and installation of Photovoltaic (PV) system for 250kWp (PV Generating System, Solar PV Module, Power Conditioner, Transformer Panel, Control Panel, Main Terminal Board, Terminal Board, Thermometer, Switch Panel, etc.), (2) Technical Assistance (soft component for trainings on basic knowledge about interconnecting PV generating system and its operation and maintenance (O&M) including maintenance checks and emergency response and revisions on the O&M manuals) 3. Afghanistan side: <ul style="list-style-type: none"> Securement of site for installation of PV system, provision of soil disposal site, temporary offices for contractor and consultant, water supply and power supply for the construction site and the temporary offices, necessary costs for implementation of the project except the ones the Japanese side's defrayment 				
Ex-Ante Evaluation	2010	E/N Date	March 22, 2010	Completion Date	May 7, 2012
		G/A Date	March 22, 2010		
Project Cost	E/N Grant Limit/ G/N Grant Limit: 700 million yen, Actual Grant Amount: 700million yen				
Implementing Agency	Ministry of Transport and Civil Aviation (MOTCA) (Currently HKIA is under the Afghanistan Civil Aviation Authority)				
Contracted Agencies	Katahira Engineering International, Marubeni Corporation, Harirod Construction Company, Japan International Cooperation System (Procurement Agent)				

II. Result of the Evaluation

< Special perspectives considered in the ex-post evaluation >

[Target year of quantitative effects]

The ex-ante evaluation sheet set the target year of 2014 for the expected quantitative effects of increase in power generation volume and reduction of electricity cost, which could be three years after the project completion. However, since the project complete in year of 2012, the target year of the project objective can be 2015. Therefore, this ex-post evaluation verified the achievement level of project objectives based on the data of power generation and electricity cost in 2014 and 2015.

[Qualitative effects]

The ex-ante evaluation sheet defines as awareness building among the people of Afghanistan on utilization of renewable energy as one of the expected qualitative effects by the project. However, in order to clearly verify contribution of the project, the ex-post evaluation assessed how the PV power generation system in HKIA installed by the project contributed to awareness building among the people on utilization of PV power.

1 Relevance

<Consistency with the Development Policy of Afghanistan at the time of ex-ante and ex-post evaluation>

This project has been highly consistent with Afghanistan's development policy as "extension of electricity" is set in policy documents such as the Afghanistan National Development Strategy (ANDS) (2008-2012) and National Priority Program (NPPs) (2014-2018).

<Consistency with the Development Needs of Afghanistan at the time of ex-ante and ex-post evaluation>

The project has met Afghanistan's development needs for increase in power generation capacity to meet growing demand, including PV system.

<Consistency with Japan's ODA Policy at the time of ex-ante evaluation>

The project was consistent with Japan's ODA policy for Afghanistan based on the Economic Cooperation Policy Dialogue and the New Strategy to Counter the Threats of Terrorism in 2009 prioritizing support for infrastructure development including energy, at the time of ex-ante evaluation. In addition, the project was implemented under a scheme of "Program Grant Aid for Environment and Climate Change", which the government of Japan newly introduced in 2008 in order to support developing countries with willingness to

¹ The name of the airport (KIA) changed to the Hamid Karzai International Airport (HKIA) in 2015.

contributing to mitigation of climate change but with lack of capacity and fund to balance between their economic growth and greenhouse gas reduction.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Effectiveness>

The project achieved its objectives to enhance power generation capacity and to diversify energy source, and achieved to increase public awareness on utilization of renewable energy to some extent at the time of ex-post evaluation. In 2014 which is the original target year for the project, the PV system introduced by the project generated 351,337kWh (88% of the target volume) and the annual power generation volume reached to 395,034 kWh (99% of the target volume) in 2015. The system has been stably operated at the level of more than 350,000 kWh for the period from 2013 to 2015 since the PV system installed by the project, including all the PV panels, has been functioning and there has been no change in the power generation capacity of the system. Also, HKIA diversified energy sources through utilization of the power generated by the installed PV system in addition to purchase electricity from Afghanistan Electric Corporation (DABS: Da Afghanistan Breshna Sharikat). Furthermore, it was estimated that HKIA has saved their annual electricity cost by more than 4 million Afghani (AFN) for the period from 2013 to 2015 while the annual electricity consumption of HKIA supplied by DABS has been constant at 2,400MW and the electricity tariff charged by DABS has increased from 10 AFN per kWh in 2010 to 12 AFN in 2015. Seven out of the eight HKIA staffs trained by the project have been properly maintaining the PV system installed by the project. Both the Afghanistan Civil Aviation Authority (ACAA) and HKIA have been highly satisfied with effects in energy efficiency and cost saving by the utilization of the PV system. According to the interviews with five visitors of HKIA as passengers, they welcomed utilization of the PV system. Although the utilization of PV system at HKIA increased the public awareness about the PV system to some extent, there is no awareness building activities to promote the PV systems in the country by the government of Afghanistan, so far.

<Impact>

The project aimed at contributing to demonstration of initiatives of Japan to promote efforts for climate control. Although there was not any specific initiative of Japan on climate change policy for Afghanistan but Japan is the first donor to address introduction of renewable energy which is one of countermeasures against climate change. There is no other positive impact and no negative impact observed at the time of ex-post evaluation.

<Evaluation Result>

In light of the above, the effect of the project has been observed mostly as planned. Therefore the effectiveness/impact of the project is high.

Quantitative Effects

Indicators	Baseline 2010 Baseline Year	Target 2015 3 Years After Completion	Actual 2013 1 year after Completion Year	Actual 2014 2 Year After Completion	Actual 2015 3 Years After Completion
Indicator 1: Power generation volume at transmission end (kWh/year)	0	400,000 (400 MWh)	364,356 (91% of the target)	351,337 (88% of the target)	395,034 (99% of the target)
(Indicator 2) Annual savings of electricity cost of HKIA by the PV power generation system**	0	4 million AFN*	Approximately 4 million AFN	Approximately 4 million AFN	Approximately 4.7 million AFN
(Supplemental Information 1) No. of PV panel functioning	0	1,386	All (1,386)	All (1,386)	All (1,386)
(Supplemental Information 2) Power generation capacity (kWp)	0	250***	250	250	250

Source : Data provided by the HKIA Electricity General Management

* The annual savings of electricity cost is derived from the following calculation; 400,000kWh (power generation volume by the PV system) x 10 AFN (electricity tariff per kWh charged by DABS) = 4 million AFN. The exchange rate is 1 AFN=1.8383 Japanese Yen (as of December 2015, JICA exchange rates (JICA website))

** The annual savings of electricity cost is estimated from the power generation volume of the PV system multiplied by the average electricity tariff charged by DABS to HKIA: 11AFN in 2013, 11.5 AFN in 2014 and 12 AFN in 2015.

*** Power generation capacity is derived from the following calculation; 180Wp x 1,386 PV panels = 250kWp (249.48kWp)

3 Efficiency

Output of the project was produced as planned. Although the project cost was as planned (ratio against the plan: 100%), the project period exceeded the plan (ratio against the plan: 138%) because dispatch experts on O&M of the PV system for soft component had been delayed due to insecurity in Afghanistan. Therefore, efficiency of this project is fair.

4 Sustainability

<Institutional Aspect>

HKIA is responsible for operation and maintenance (O&M) of the Hamid Karzai International Airport, including the PV system installed by the project, under the control of ACAA. The seven of eight trained staffs of HKIA, have been engaged in the O&M activities of the PV system, including monitoring and reporting the status of the PV system. The number of O&M staffs for the PV system has been sufficient since there is no expansion of the capacity.

<Technical Aspect>

The O&M staffs of HKIA have sustained necessary skills and knowledge for the regular O&M of the PV system installed by the

project despite of no refreshment training for them because they have been continuously using the manuals developed by the project. However, they do not have skills and knowledge to repair serious damages on the PV system and they need to outsource the major repair works. Although the trainings in Afghanistan and Japan were delivered for them by the soft component of the project as planned, according to the O&M staffs of HKIA, the durations of the trainings and the coverage of sessions and materials were not sufficient for them to acquire necessary skills and knowledge on repair of the PV system.

<Financial Aspect>

ACAA and HKIA have not specifically allocated budget for maintenance of the PV system despite that the reduction of electricity cost by the PV power generation could be a source of budget. By the time of ex-post evaluation, the O&M team of HKIA utilized spare parts provided by the project for maintenance of the system and had no necessity of budget for procurement of spare parts. Although there is no source of revenue or no secured budget for O&M of the PV system, no major repair requiring the budget has been necessary by the time of ex-post evaluation. The O&M team of HKIA requested HKIA and ACAA to allocate of the budget for the O&M of the system for the next fiscal year.

<Current Status of Operation and Maintenance>

The most of major equipment of the PV system, such as PV module, a power conditioner, a transformer panel, a control panel and a main terminal board, have been functioning without any problem. The display monitor indicating the power volume generated by the PV system has been damaged and not functioning though it had been installed at the main lobby of the Hamid Karzai International Airport in order to increase public awareness on the PV power generation introduced by the Japanese assistance. There is no plan to repair it, so far, but JICA has commenced follow-up cooperation for the project in order to repair malfunctioning part of the PV system. The O&M team of HKIA has been continuously conducted periodic inspection of the PV system as planned. So far, the spare parts provided by the project, including PV module, Power Conditioner Terminal Board, and so on have been used for the maintenance of the system and sufficient volume of spare parts are available in their stock.

<Evaluation Result>

In light of the above, some problems have been observed in terms of the technical and current status of operation and maintenance. Therefore, the sustainability of the project effect is fair.

5 Summary of the Evaluation

The project has achieved its objectives to enhance power generation capacity and to diversify energy source by the PV system installed by the project. It has also partially achieved an increase in public awareness on utilization of renewable energy, but not fully demonstrated Japanese initiatives for climate control. As for sustainability, there is a concern about major repair due to the limited capacity of the O&M staffs of HKIA. No budget for the O&M of the PV system has been specifically allocated. In addition, the display monitor has not been repaired though the PV system itself has been well functioning without problems, so far. As for efficiency, the project period exceeded the plan.

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

III. Recommendations & Lessons Learned

Lessons learned for JICA:

In countries like Afghanistan where there are limited capacity of economic infrastructure such as power system due to the conflicts, effectiveness of the project supporting installation of infrastructure or equipment not requiring higher and complicated skills and knowledge for O&M can be high since the countries do not have sufficient human capacity for O&M.