

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

I. Project Outline

Background	The Republic of Moldova, one of the least developed countries in Europe, imports approximately 80% of its power consumption (2008). In order to promote sustainable socioeconomic development, an important issue common to all sectors was to ensure necessary power sources through utilizing domestic energy sources including renewable energy, and improving self-sufficiency of energy. Particularly, giving consideration of objectives for reduction of greenhouse gases (GHG) emissions expressed by the European Union (EU), Moldova was required to establish country's institutional setup in line with a Moldova's plan to become an EU member. Therefore, there was an increasing need to introduce the renewable energy including solar energy.			
Objectives of the Project	To increase power generation capacity, diversify power sources, and raise awareness of people of Moldova on renewable energy by procurement of Photovoltaic (PV) system and related equipment in Chisinau, the capital of Moldova, and by providing technical assistance for capacity development of technical personnel, and thereby contributing to publicity of Japan's initiative for promoting measures against climate change both by developed and developing countries.			
Contents of the Project	<ol style="list-style-type: none"> 1. Project Site: Oncology Institute (OI) /the central Chisinau 2. Japanese side <ul style="list-style-type: none"> (1) PV generation system (PV modules (289kW*), Power conditioner, Data management and monitoring system, Meteorological observation instruments and others) * At the time of ex-ante evaluation, 250kW was planned, but the capacity was increased by utilizing the project fund remained. (2) Technical assistance (soft component): Training on basic knowledge, preventive maintenance, and troubleshooting of grid connected PV system 3. Moldovan side: <ul style="list-style-type: none"> (1) Demolition of existing building and site clearance, (2) Asphalt pavement and others, (3) Renovation for monitor room and (4) Security measures for PV system to be installed on ground with structural steel frames 			
Project Period	E/N Date	May 11, 2011	Completion Date	October 2, 2013
	G/A Date	July 18, 2011		(Completion of soft component)
Project Cost	E/N Grant Limit / G/A Grant Limit:417 million yen, Actual Grant Amount: 394 million yen			
Executing Agency	Oncology Institute (OI)			
Contracted Agencies	Contractor : ITOCHU Corporation Consultant : ORIENTAL CONSULTANTS Co., Ltd.			

II. Result of the Evaluation

1 Relevance
<p><Consistency with the Development Policy of Moldova at the time of Ex-Ante and Ex-Post Evaluation></p> <p>The project has been highly consistent with the development policy of Moldova. At the time of Ex-Ante Evaluation (2011), the Government of Moldova developed "the National Energy Strategy to 2020" in 2007 and aimed at increasing the ratio of renewable energy to the total energy consumption from approximately 3% in 2007 to 20% in 2020. At the time of Ex-Post Evaluation, "the Energy Strategy of the Republic of Moldova until 2030", the most recent energy strategy continuously prioritizes the promotion of renewable energy.</p> <p><Consistency with the Development Needs of Moldova at the time of Ex-Ante and Ex-Post Evaluation></p> <p>The project has been also highly relevant with development needs of Moldova for renewable energy. At the time of Ex-Ante Evaluation, Moldova was heavily reliant on the import for its energy consumption (more than 80% of total energy consumption) in 2008. At the time of Ex-Post Evaluation, annual electricity consumption in Moldova was 4,218 GWh (2016), and the amount of electricity generated within the country was 897 GWh. In order to compensate for the above shortage, 3,321 GWh was imported. Therefore, the necessity of promoting renewable energy in the country is still high.</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. The project was implemented under the scheme of Grant Aid for Environment and Climate Change, which was newly introduced by the Government of Japan in 2008. The purpose of this scheme is to provide assistance to developing countries which aim to contribute to climate change measures, but are short of capacity and funds to achieve both GHG emission reduction and economic growth. In the basic policy of assistance to Moldova, the Government of Japan highlighted its strong attention to building basis for economic development through the improvement of socio economic infrastructure.¹.</p> <p><Evaluation Result></p> <p>In light of the above, the relevance of the project is high.</p>
2 Effectiveness/Impact
<p><Effectiveness></p> <p>The project has mostly achieved its objectives. Quantitative effects such as "Net power generation" (indicator 1), "Reduction in power purchase expenditure" (indicator 2), and "Reduction in CO2 Emission" (indicator 3) have been obtained, meeting the targets set at the time of Ex-Ante Evaluation.</p> <p>The project expected that a newly installed display would help promote the use of PV power, providing information on electricity</p>

¹ Source: ODA Country Databook 2010

amount generated by the PV system to citizens visiting the hospital (the institute is also functioning as a hospital) , so that awareness of citizens was increased. As a result, people who visit the hospital can easily find the amount of electricity generated by the PV system and other related information, since the display was installed in the entrance of OI's building. Furthermore, every year after the completion of the project, a presentation on this PV system is made to first-year medical students visiting OI.

The enhancement of staff's capacity to operate and maintain (O&M) the PV system was also expected in consequence of soft-component. The interviewed current O&M manager did not participate in the training conducted in 2013 because he was not assigned to O&M of this institute at that time. Therefore, the effects of the training under the soft component are not clear. However, according to his explanation, there is no problem so far, as he took part in a wrap-up training carried out by a Japanese survey team for several hours in 2014, and manuals created for the project are also referred when needed.

The manuals are utilized for training of new staff. At the same time, they are being used from time to time to maintain the PV system. Also, editing, processing, and utilization of data collected from the PV system and weather observation devices are appropriately performed. In fact, meteorological data, power generation volume, and CO2 reduction volume are managed on the personal computer and updated constantly, which is displayed on the publicity display.

<Impact>

While this project was expected to show Japan's initiative on climate change measures, cases led by the Government of Japan at symposium and other occasions in direct relation to the project, have not been confirmed at the time of Ex-Post Evaluation. Nevertheless, Energy Efficiency Agency, responsible for energy conservation and renewable energy under the umbrella of Ministry of Economy, organized a contest to introduce excellent efforts on renewable energy utilization in Moldova, supported by the United Nations Development Programme (UNDP). Since this project won the first prize in 2013, it was widely covered by media in Moldova. Also, a video introducing this project has been created, which is open to the public on You Tube. Furthermore, even outside the country, the staff of Energy Efficiency Agency introduced the outcomes of the project as the winner of the above contest.

In addition, this project has an influence on dissemination and promotion of PV power generation. Because of efforts to promote the dissemination of renewable energy by Energy Efficiency Agency and others, 37 new projects have been implemented up to now, which has a total power generation capacity of 2.42 MW. The scale of each facility ranges from a small household type to a large-scale one installed at factories.

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

<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

	Baseline 2009 Baseline Year	Target year Target 2016	Actual 2014 Completion Year	Actual 2015 1 Year after Completion	Actual Target year 2016	Actual 2017*4 3 Years after Completion
Indicator 1: Net power generation (kWh/year)	0	299,400*1	302,068.3	348,681.3	309,328.8	214,590.9
Indicator 2: Reduction in power purchase expenditure (MDL/year)	0	329,340*2	332,275	383,549	340,262	236,050
Indicator 3: CO2 Emission (ton/year)	0	139.3*3	154.6	178.5	158.3	109.8

Source: JICA internal documents, questionnaires and interviews with OI.

*1 Net power generation for 250kW capacity

*2 Calculated by using the unit cost of MDL1.10/kWh as of January 2009 (299, 400kWh x 1.1=329,349)

*3 Reduction of CO2 when the existing power is replaced with PV system (t-CO₂/y): (518.7-53.4) x 299,400/1,000,000=139.3

(CO₂ emission by the existing combined heat and power plant (g-CO₂/kWh): 518.7, Life cycle CO₂ emission by PV system (g-CO₂/kWh): 53.4

*4 As of July 24, 2017

3 Efficiency

Although the project cost was within the initial plan (ratio to the plan: 94%), the project period exceeded the one originally planned (ratio to the plan: 114%). As to output, although 250kW PV system was planned at the onset, the final capacity was increased by utilizing the project fund remained. The project period was extended by extra time for the preparation of procurement at the initial stage of the project, the additional procurement and installation of PV panels for the increased generation capacity.

Therefore, the efficiency of the project is fair.

4 Sustainability

<Institutional Aspect>

O&M of the PV system developed under the project is carried out by OI. The institute has an O&M department, and a total of 4 staff members are assigned to the O&M of the PV system. According to the O&M manager, there is no problem with carrying out daily operations at the present stage in terms of the number of O&M staffs. However, because the staff of the O&M department has also maintenance work of other equipment as well as the PV system, they cannot deal with some periodic inspection items such as open voltage².

<Technical Aspect>

All of the staff members have expertise in electrical engineering. One of the four staff members assigned to O&M is a manager who has a master degree of electrical engineering, and the others are graduates of electrical vocational training courses. Manuals developed through the project are effectively used in carrying out O&M. Even though there is no systematized training program, the necessary training is individually delivered by using the manual when a new staff member is assigned.

² Maximum voltage when not connected to the terminal (not operating).

<Financial Aspect>

The following table shows the revenue and expenditure of OI.

Table : Financial Balance of OI (unit: thousand MDL)

	2014	2015	2016
Revenue	215,379	278,655	288,902
Expenditure	263,878	268,801	317,954
(O&M expenses)	5,452	7,603	11,457

It shows that there was a year when the balance between revenue and expenditure was in deficit. The shortage of budget is addressed by carry-over of payment to the subsequent year or the financial support by the central government. O&M expenses are on an increasing trend, covering personnel and social security expenses of the O&M staff in charge of the PV system and other equipment. The PV system installed under the project has required no repair up to now. Therefore, OI did not have to secure expenses appropriated directly for the PV system. However, it is unclear whether repair costs can be secured in the future event of a breakdown.

<Current Status of Operation and Maintenance>

Basic daily inspections are carried out as originally planned. However, some periodic inspections were not implemented. In case of the open voltage, inspections were not conducted because the inspection of open voltage takes a whole day. Even though there is no case where repairing the PV system was required so far, doing repairing is considered possible because agents dealing with PV system exist in Moldova, and can be contacted in such an occasion.

<Evaluation Result>

Consequently, some uncertainty has been observed in terms of institutional and financial aspects, such as staffing shortage and future repair costs. The sustainability of the project effect is fair.

5 Summary of the Evaluation

The project has mostly achieved its objectives, “to increase power generation capacity, diversify power sources, and raise awareness of people of the Moldova on renewable energy by providing PV system and related equipment in Chisinau, the capital of Moldova, and by providing technical assistance for capacity development of technical personnel”. The targets have been met for indicators such as net power generation. Also, the PV system has been demonstrated at various opportunities. As for sustainability, some uncertainty has been observed in terms of institutional, technical and financial aspects such as lack of personnel and structured training system, and future repair cost. However, there is no major problem so far. As for efficiency, although the project period exceeded the initial plan, the project cost was within the plan.

Considering all of the above points, this project is evaluated to be satisfactory.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

- The staff of the O&M department has also maintenance work of other equipment as well as the PV system. Therefore, they cannot deal with periodic inspection for some items such as open voltage. In order to operate the PV system in a stable way until the end of durable time, OI is recommended to ensure that periodic inspection is fully implemented for all the items including open voltage, whose periodic inspection has not been undertaken so far due to the insufficient number of personnel.

Lessons Learned for JICA:

- Contributing to publicity of Japan’s initiative for promoting climate change measures was set as one of the objectives of this project. Ministry of Economy, responsible for energy sector, has promoted this project through the executing agency under the ministry. Therefore, it is judged that certain effects have been made for this goal. On the other hand, the ministry responsible for this project is Ministry of Health and the executing agency is a medical institution, whose main obligation is not to raise awareness on the use of renewable energy. This time, it was possible to achieve the objective due to the spontaneous efforts of the Moldovan side. However, in order to ensure achievement of the objective, the project should have teamed up with Ministry of Economy, as the responsible ministry of energy sector. Establishing such a framework before or during the project implementation should have been ideal, so that JICA and the responsible ministries could develop a detailed strategy on how to raise awareness and dissemination of the use of renewable energy through implementation of the pilot project. If JICA plans to carry out a future project with the same objective, it is necessary that JICA and the appropriate ministries and agencies of the recipient country fully discuss the activities that should be performed to achieve the objective before project completion.



PV modules installed on the roof of the building of OI



Display showing the amount of electricity generated etc. installed at the front entrance of the OI building