

Country Name	The Project for Improvement of Water Supply Facilities in Darkhan City
Mongolia	

I. Project Outline

Background	In Darkhan City, the third largest city of Mongolia, the water supply system constructed under the former Soviet Union was being used, but aging of the system was remarkable due to a disruption of spare parts supply and technical assistance after the collapse of the union. Annual water production decreased from around 7 million m ³ in 2004 to around 5 million m ³ in 2007 because of troubles of main water supply facilities such as pump units, etc., and the development of facilities could not catch up with the increase in the city's population.			
Objectives of the Project	To supply safe water to the people in Darkhan City in a stable manner by developing the water supply facilities and the equipment for water supply and operation and maintenance.			
Outputs of the Project	<ol style="list-style-type: none"> 1. Project Site: Darkhan City, Darkhan-Uul Province 2. Japanese side: <ul style="list-style-type: none"> (1) Construction of facilities and procurement of equipment: (i) rehabilitation of wells and pump houses (10 units), replacement of intake pumps (8 units for replacement and 2 units for backup), and installation of an operation control and monitoring panel at the 1st Station (intake wells); (ii) replacement of transmission pumps (2 units for replacement and 1 unit for backup), repair and renovation of the pump house, replacement of the chlorination system, rehabilitation of the chlorination house, and installation of an automatic control system at the 2nd Station (transmission pump station); (iii) construction of water supply facilities (12 water kiosks¹ and distribution pipes) in the 5th and 6th Bags of the Ger Area; and (iv) procurement of maintenance equipment (truck crane, mobile welder, water quality analysis equipment and flow meters). (2) Technical assistance ("soft component"): training for operation staff of the facilities and equipment (operation of the intake and transmission pumps, operation of the chlorination system, and operation of the relay pump for a water kiosk) 3. Mongolia side: <ul style="list-style-type: none"> Acquisition of necessary land area; provision of information on the location of the existing underground facilities; witness of the excavation work; witness of the connection work between the existing facilities and renewed facilities; water supply for performance test of equipment and hydraulic water test of water pipeline; cooperation for disinfection upon completion; and tie-in of electrical power supply. 			
Ex-Ante Evaluation	2008	E/N Date	July 16, 2009	Completion Date February 21, 2011
Project Cost	E/N Grant Limit:940 million yen Contract Amount: 912 million yen			
Implementing Agency	Water Supply and Sewerage System Co. of Darkhan City (WSSSC-Darkhan) under Construction and Public Utilities Policy Department, Ministry of Construction and Urban Development (MCUD)			
Contracted Agencies	Joint venture composed of Tokyo Engineering Consultants Co., Ltd., Nishizawa Limited, Inc. and Konoike Construction, Co., Ltd.			

II. Result of the Evaluation

1 Relevance	This project has been highly consistent with Mongolia's development policy and development needs from the time of ex-ante to the time of ex-post evaluation. The relevant development policy includes the followings: the Government Action Plan 2000-2004 and the Good Governance for Human Security (a summary of the priority socioeconomic development issues within the Government Action Plan) addressing issues on "to promote regional and rural development as well as infrastructure development;" and the Government Action Plan 2012-2016 and related policies (the National Water Program 2007-2021, etc.) aiming "to improve water supply and sewerage facilities in the city of Darkhan." The relevant development needs include provision of water supply services, including those for industries, in Darkhan City. Further, the project was consistent with Japan's ODA policy at the time of ex-ante evaluation, as the Country Assistance Program (2004) envisaged "to help develop infrastructure which will facilitate industrial development in Ulaanbaatar and regional cities and directly help improve the people's daily lives" under "to promote regional and rural development as well as infrastructure development," one of the four priority areas of assistance. Therefore, relevance of this project is high.
2 Effectiveness/Impact	The objective of this project was "to supply safe water to the people in Darkhan City in a stable manner." While it was confirmed that this project has been effective in stably supplying safe water, the effectiveness is partly limited in terms of the

¹ A water kiosk is a hut type simple water supply facility located at an appropriate point in the area (e.g. ger area) where water supply to individual households is difficult as distribution networks are not developed well. It is operated by WSSSC and a vender is assigned for selling water to the people who carry water containers for themselves. A "bag" (mentioned in the same sentence) is the smallest unit of local administration in Mongolia.

amount of water production compared to the target value. The facilities and equipment developed under this project have been mostly in use without major defects except for some equipment that are not used frequently².

The amount of water production is smaller than before the commencement of this project. The implementing agency provided a view that the production amount is affected by a sense of water saving cultivated among the people as a result of the wider and faster progress of installation of water meters and the shift of water charges from flat rate to metered rate³. The number of water meters increased from only 600 in 2007 to approx. 17,000 in 2014, so did the installation rate from 20% in 2008 to 92% in 2014⁴. It was further commented that water leakage rate was improved by developing 21km of distribution pipes under a project funded from the national budget, which also contributed to the reduction of non-revenue water ratio from 48% to 20%. In addition, decrease in the amount of water supply to large customers was observed. It was due to an external factor that some large enterprises such as a thermal power plant began self supply of water by digging wells in their premises. These factors are considered to have created a gap between the targeted and actual amounts of water production.

Regarding stable water supply, it was found from the site observation and interviews that the automatization of pump operation and the connection of kiosks to pipeline made it possible to respond to ever changing water supply demand more efficiently. In particular, a problem in the ger area was improved: before the project, kiosks had not been able to sell water after water in their tanks had been finished due to no connection to pipeline; after this project, new kiosks were opened and water supply became possible at any time through the distribution pipes, which resulted in the increased sales of water (see the graph at the end of this report). The pumps and other facilities, the oldest of which had been constructed in 1965, were replaced with new ones under this project, and thereafter, no suspensions of water supply have occurred due to breakdown of such main facilities. In this way, it can be said that the stable water supply was achieved.

As for safe water supply, disinfection by chlorination became possible with the chlorination facilities and equipment developed under this project. The water quality analysis devices have been constantly used for regular analysis of water quality, the result of which shows conformity with the national drinking water standard of Mongolia. Although the frequency of chlorination remains once or twice per month at the time of ex-post evaluation, it satisfies the national standard.

An impact was reported by the implementing agency that the installation of water meters made it possible to charge individual households appropriate fees for the amount of water they used. Other impacts include the growing sense of water saving observed among consumers and the improvement of living conditions reported to have been resulted from the stable water supply.

In sum, although a target value for effectiveness has not been achieved, that can be explained by the changes of circumstances around the project, and positive impacts have been observed; therefore, effectiveness/impact of this project is fair.

Quantitative Effects

Indicator	2003 (Before project implementation) Actual value	2007 (Before project implementation) Actual value	2011 (Target year) Target value	2011 (Target year) Actual value	2012 Actual value	2013 Actual value	2014 (Ex-post evaluation year) Actual value * Up to June
1. Average water production	19,301 m ³ /day	13,575 m ³ /day	21,800 m ³ /day	10,204 m ³ /day	8,954 m ³ /day	9,650 m ³ /day	8,917 m ³ /day
2. Disinfection by chlorination	Not conducted	Not conducted	Ready for chlorination	Ready for chlorination	Ready for chlorination	Ready for chlorination	Ready for chlorination
<Supplemental information> Sales of water at water kiosks to which pipeline was connected under this project (m ³ , annual total)	N/A	N/A	N/A	7,034 m ³ /year	8,363 m ³ /year	10,658 m ³ /year	4,993 m ³ /year

Source: Data provided by the implementing agency

3 Efficiency

It was confirmed that the outputs of the project were produced as planned. Both the project cost and project period are within the plan (ratio against the plan: 97% and 88%, respectively). Therefore, efficiency of this project is high⁵.

² It was confirmed from the implementing agency's record of operation hours of the pumps, the interviews and the site observation that the operational status of the facilities and equipment was mostly good, although there were some problems mentioned in "4 Sustainability."

³ In the ex-ante evaluation, the size of the facilities was designed based on the forecast that the population of Darkhan City would increase from 75,000 in 2007 (before project implementation) to 91,000 in 2011. However, according to the data obtained from the Statistical Office of Darkhan City, the actual population was 75,494 in 2011 and 76,428 in 2013, remaining almost the same level as before the project. This can be strongly related to the fact that the assumed large population increase resulting from business advances did not take place due to factors such as the slumping economic conditions. It was planned to increase per capita water supply in the apartment areas and the ger areas on average (calculation: produced water/city population) from 181 liters/day in 2007 to 240 liters/day in 2011 under the assumption of the deterioration of non-revenue water ratio. However, the actual amount of supply was only 135 liters/day in 2011 and 126 liters/day in 2013 reflecting the decrease in water production and water demand. Besides, WSSSC-Darkhan has a view that even in the same apartment areas, water usage significantly varies according to with or without water meters, i.e. average water usage is estimated at 75 liters/day with meter and 230 liters/day without meter.

⁴ Among the water meters installed, 1,500 pieces were procured under this project.

⁵ The project cost expended by the Mongolia side exceeded the planned amount. The implementing agency pointed out as a major reason

4 Sustainability

The operation and maintenance (O&M) of the facilities and equipment developed by the project have been carried out by WSSSC-Darkhan, the implementing agency. It was found that the organizational structure of WSSSC-Darkhan was different from what was assumed in the ex-ante evaluation, e.g., the number of water supply operators at each of the 1st and 2nd stations was reduced from two persons at one time to one person, while the number of expert personnel in charge of repair work, etc. became five⁶, due to the on-going process of gradual personnel rearrangement for streamlining an organization. According to WSSSC-Darkhan, such changes were made as it did not have to hire as many employees as before due to the promotion of efficiency and automatization of its work. Eight staff members work in relays around the clock (i.e. a total of 28 staff members is in charge of water supply operation). It was confirmed that the backup system was well secured in a way that in case of absence of or a problem in the assigned operator, another operator is deployed.

For the technical aspect, there is no problem in the skills of water supply operation in general, which had been established to a certain extent even before this project. Regarding the development of younger staff members, as well, the organization is being systematically strengthened such as through recruiting university or technical school graduates in relevant areas of specialization and providing them with regular training. This project provided technical assistance on operation of the equipment it procured. Operators and repair staff of the implementing agency said that the assistance was useful, but there was also an opinion that it would have been better if they had opportunity to learn how to repair the equipment according to cause of trouble (it is considered that this opinion came against a background of the difficulties in repairing part of the equipment newly introduced by this project, such as the remote control system, as described below). In addition, it was found that some of the manuals provided under this project were scattered and lost.

In the financial aspect, WSSSC-Darkhan has produced a surplus, and most of its O&M budget is spent for the replacement of aging pipeline in the city. As it has been only a few years since completion, this project has not come with a large amount of O&M cost up to present: in case of breakdown of the equipment, WSSSC manages to use money from its budget to fix it. In this way, there is no problem in the current situation, while it is uncertain whether a necessary budget for O&M of the project facilities and equipment will be allocated in WSSSC's medium and long-term repair plan.

The O&M equipment procured under this project has been utilized for O&M of the existing facilities (in particular, the mobile welder is dispatched frequently in response to water leakage from the existing pipeline). Also, WSSSC-Darkhan makes and implements monthly maintenance plans. However, it has not been able to find solutions to troubles of some existing equipment, and measures are still being sought⁷. Besides, it was confirmed that the spare parts provided by this project have not been used yet and consumables are in stock.

Therefore, while it was found some aspects should be improved, sustainability of the project effects is fair.

5 Summary of the Evaluation

The objective of this project was "to supply safe water to the people in Darkhan City in a stable manner." The amount of water production was below the level of before project implementation reflecting factors such as the growing sense of water saving among residents in the apartment areas. However, effects of the project were observed: water stoppage was eliminated and the response to the ever changing water demand became efficient as a result of the development of key water supply facilities and equipment such as pumps; and water sales increased as a result of the development of water kiosks that can supply water to the ger areas all the time. As for sustainability, while no serious problems were observed in the structural, technical and financial aspects of the implementing agency as well as the current O&M status at the time of ex-post evaluation, some issues were found in relation to securement of O&M budget in the medium and long-term and responses to troubles in part of the existing facilities and equipment.

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

III. Recommendations & Lessons Learned

Recommendations to implementing agency:

The issue of inadequate management of manuals needs to be addressed. Also, a medium and long-term O&M plan for the facilities and equipment developed under this project should be formulated, and allocation of the necessary budget for it should be considered. In addition, it is expected that know-how and experiences on addressing problems in operating the facilities and equipment (the ones that have troubles among others) be accumulated based on advices given by the construction supervision consultant of this project and others.

Lessons learned for JICA:

In Mongolia, the price level of water charges was high under the flat rate system, and therefore, a shift to metered rate was effective in saving water charges. With the residents who understood this fact, the installation of water meters took place fast.

that the cost for clearing obstacles and compensation to the residents for installation of the transmission pipes was much higher than estimated. As there were lands owned by individuals above the transmission pipeline to be installed, more time and money than planned were spent for explanations to the residents and compensation.

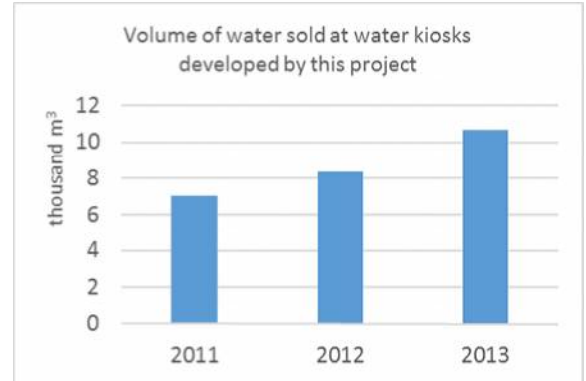
⁶ Arrangement of those expert personnel was not assumed in the ex-ante evaluation.

⁷ Main problems observed at the time of ex-post evaluation were as follows. (1) One part of a well (connecting bolts of the cable connected to the pump) has defects repeatedly. (2) There has been more breakdowns of the remote control system of the pumps. According to the implementing agency, the breakdowns are considered to be due to influence of radio waves depending on climatic conditions, but the underlying causes and solutions could not be identified. Therefore, the system is operated with no problem in clear weather, and when it does not work well in rainy weather, the pumps are operated manually (this problem is not serious in Mongolia, where rainfall is low). (3) A flow meter installed at the high reservoir is not used as it shows abnormal values for unknown reasons (there are no agents that can handle the problem in Mongolia).

Accordingly, people's sense of water saving increased, which is considered to be a reason for the gap between the planned and actual amount of per capita water usage. When setting a target value of water production and making the project plan in the planning stage of a project, a consideration should be given to water saving effects of installation of water meters, while having a good grasp of the situation of the country (in many countries and regions, installation of water meters and accompanying transition of the water fee structure to metered rate-based does not progress smoothly). In the same target setting, appropriateness of estimation of per capita water usage should also be confirmed well, and setting different target values according to purpose of use of water should be considered. In case of this project, while the target value of water production was calculated in a simple manner based on per capita water usage and water supplied population, the actual values were different for domestic use water, industrial water, etc.



Pump house and pipes of a transmission pump



Source: Prepared based on data provided by the implementing agency.