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Ex-post Evaluation Report on the Project for Improving the District Heating and Water Supply System in Ulaanbaatar, Mongolia

2013. 12

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한국국제협력단



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KOICA conducts evaluations within different phases of projects and programs, such as ex-ante evaluations, interim evaluations, end-of-project evaluations, and ex-post evaluations. Moreover, sector evaluations, country program evaluations, thematic evaluations, and modality evaluations are also performed.

In order to ensure the independence of evaluation contents and results, a large amount of evaluation work is carried out by external evaluators. Also, the Evaluation Office directly reports evaluation results to the President of KOICA.

KOICA has a feedback system under which planning and project operation departments take evaluation findings into account in programming and implementation. Evaluation reports are widely disseminated to staffs and management within KOICA, as well as to stakeholders both in Korea and partner countries. All evaluation reports published by KOICA are posted on the KOICA website. (www.koica.go.kr)

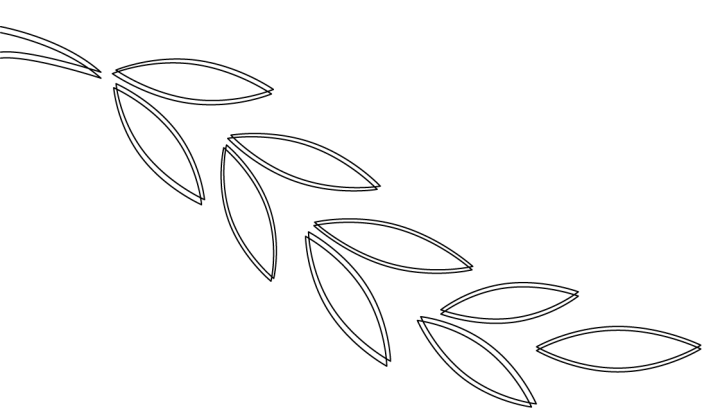
This evaluation study was entrusted to GGlobal Development Cooperation Consulting (GDC) by KOICA for the purpose of independent evaluation research. The views expressed in this report do not necessarily reflect KOICA's position.

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Summary



Summary

I. Overview and methodology

1. Overview of the Evaluation Project

1) Background

- (Deteriorated heat supply system) Ulanbaatar's heat supply system was constructed in 1978 with the aid from the Soviet Union. The system has exceeded its lifespan of 20 years and has been unable to provide stable heat and water supply due to poor condition of its facilities such as leakage, inadequate insulation of pipes, and low water pressure.
- (Subarctic climate during winter) Ulanbataar is known for cold and dry weather and the temperature reaches as low as -40°C during the winter, making the city the coldest capital city in the world. Heating service and hot water supply are among bare necessities for 9 month-long winter.
- To address this urgent need, the Mongolian government has improved its outdated district heating system and water supply system since 1990s with the aid from international organizations and bilateral aid agencies such as ADB and GIZ. KOICA also collaborated with the Mongolian government and decided to support the title project in an effort to improve the urban infrastructure with the expertise and experience in Korea.

2) Purpose

- The evaluation is a ex-post evaluation and focuses on whether the objective of improving the heat and water supply system in Ulaanbaatar, Mongolia is successfully achieved. To this end, the evaluation was conducted based on 5 criteria of OECD/DAC: the relevance, efficiency, effectiveness, impact and sustainability.
- The evaluation focuses on learning lessons and making recommendations based on the analysis of the project-related data in order to improve KOICA's future projects in terms project formation, planning, design, implementation, and evaluation.

3) Description of the Evaluated Project

- The table below summarizes specifics of the projects including project duration, purpose, scope, and so forth.

<Table 1-1 Project under the evaluation>

Project Title	Project for improving the heat and water supply system in Mongolia
Period	2007-2009
Purpose	To contribute to the stable and sufficient heating and water supply, improvement in the energy efficiency and upgrading quality of lives by improving the heat and water supply system in Ulaanbaatar, Mongolia
Project Scope	Improvement construction of the heating and water supply facilities (Design, audit and test run support to exchange machines including the hot/cold water pumps and heat exchangers) Dispatch experts: Specialists in the equipment operation and automatic control Training by inviting managers to Korea: Machine (6 people, 10 days), equipment operation (6 people, 10 days)

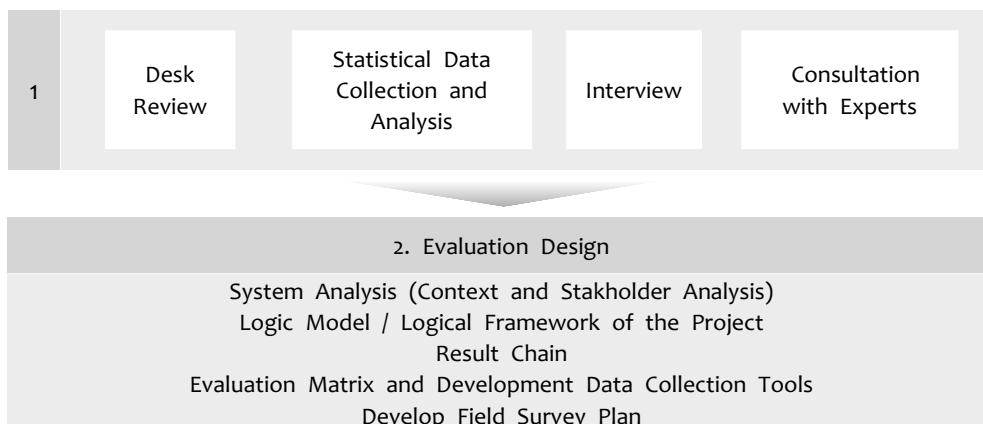
Budget	million US dollar
Project Site	Khan-Uul District, Ulaanbaatar, Mongolia
Beneficiary	Up to 100,000 people in Ulaanbaatar
Implementing Agencies	Korea - KOICA
	Mongolia - Ulaanbataar Municipality

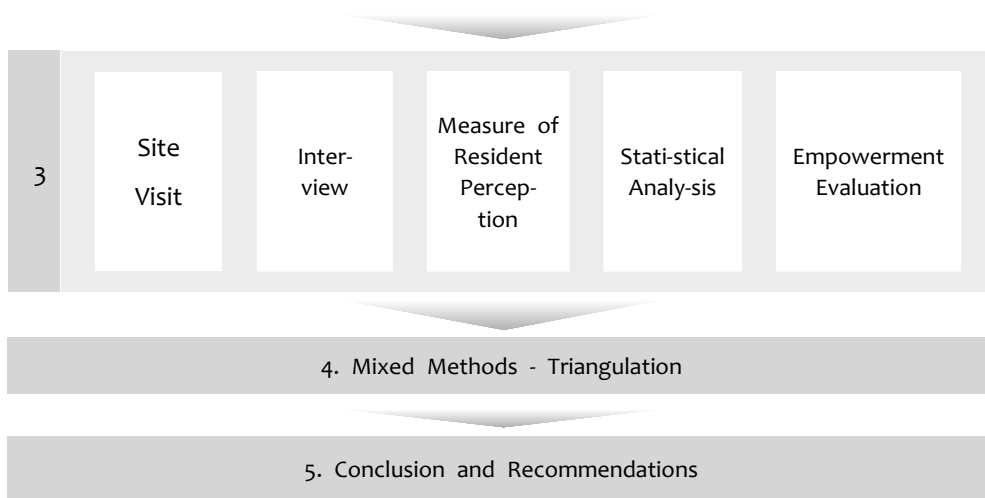
- The project was scheduled to complete in 3 years from 2007 to 2009 with the budget of USD 5 million US dollars. The project scope includes a) the replacement of equipment in 44 substations which supply heat and water in the residential areas of Ulaanbaatar, and b) training personnel for building capacity for operation and maintenance of the facilities.

2. Evaluation Methodology

1) Methods

- The evaluation design of the current evaluation is summarized with systematic and scientific data collection and analysis processes and methods as shown below





3. Limitations of the Evaluation

- (Difficulties in obtaining data) The biggest hurdle of the current evaluation project was difficulties in obtaining hard data such as operating cost of a renovated substation. In particular, it was difficult to draw conclusion regarding effects of the project due to lack of local indicator data to measure the mid- and long-term effect of the project, the major evaluation item.
- (Timing of site survey) The site survey was conducted during summer when the city did not provide the heat and hot water. It was not possible to observe operation of the facilities and end-user's condition in order to understand how the project affect different beneficiaries.
- (Preliminary study for effective evaluation) The scope of evaluation project only allowed one site survey, which meant preparation for the field survey including desk review had to be done in Korea. However, desk review is not sufficient to design evaluation and plan field survey for effective and

efficient evaluation. Therefore, it is required to add a preliminary study trip to ensure quality of the evaluation as a preparation prior to the main field survey trip to the project site.

II. Result

1. Evaluation Result by DAC Criteria

1) Relevance

(1) Evaluation of the project formation

- The project formation is an important evaluation subject as it is the first step to understand the project and establish the proper approaches and strategies.
- To evaluate the project formation, 3 items were reviewed and analyzed through the document, interviews and other data: a) relevance to the development policies of the partner country, b) relevance to the supporting strategies of Korea, and c) relevance of the project selection to the development needs of the partner country. Overall evaluation was 'very proper' regarding relevance of project formation.
- The project is propelled to improve the living conditions and upgrade the energy efficiency in Ulaanbaatar where more than half of the Mongolian population reside.
- The title project for the Ulaanbaatar is prioritized in the national development agenda.

- Also, the project was assessed proper and crucial considering the climate of Mongolia with 9 months of winter and requiring hot water even in the summer.
- Most residents appreciated the improvement. However, some residents do not recognize the difference that the project was supposed to bring due to the problems in the end-user's facilities (apartment machine rooms that maintain water pressure of the building).

(2) Evaluation of the project planning

- The evaluation of the project planning reviews whether the planning and design are properly established based on the information achieved from the project formation process and the project direction configured by the development strategies of the configuration country and KOICA.
- The planning and design to improve the project effectiveness are not clearly stated due to fixed approaches and implementation of the project planning due to the features in the project. Therefore, it is judged that the consideration on the factors which affect various projects and reflection on the project design are done by the basic researches and surveys at the proper level during the planning process of the project.
- However, the project is assessed 'partially proper' because it is impossible to check whether the project elements are reflected on the design (ex, logical relation with the achievement) considering the proposed target and development effectiveness and insufficient document data for the specific grounds.

2) Efficiency

(1) Evaluation of the project implementation

- The evaluation of the project implementation is largely related to the efficiency and considers the items below during the implementation process.
- The implementation against the plan is achieved as planned without diminishing the range of the project or large modification and the injected elements are assessed as effectively
- The elements understood as the structural causes are managed not to largely impede the project through the aggressive communication and efforts by the residing officials and the cooperation country join the project implementation process at the proper level based on the implementation agreement, contributing to the successful implementation of the project.
- The evaluation of the project implementation is very effective of 83.3% against the total score (10/12) (Meet the evaluation score guideline which instructs to assess effective when the project is performed within 100% of the budget - refer to the attached 'Evaluation criteria').

3) Impact evaluation of the project performance (performance evaluation)

- The project performance is a crucial element in the ex-post evaluation.
- The evaluation configures the result chain by specifically classifying the performance from mid- and long-term and short-term output and collects document, interview and survey data to assess the item with various indicators.

- The project performance is classified as short-, mid- and long-term output and indicators are selected for each performance to review the effectiveness and impact through the survey, statistical data and interview for each indicator.
- (Short-term performance) First, the improvement in the heat efficiency in the water supply is achieved (about 30%) among the primary output of the project and no more suspension on the heat supply due to errors or misuse of the machine room or the equipment is reported owing to the stabilization in the system.
- However, the data including the cost and profit structure for the actual heat supply and equipment operation are not provided, failing to be reflected on the evaluation.
- The short-term performance felt by the residents include the stable supply of the hot water, benefit increase by reducing the standby time in use and saving the cost for the hot water due to reducing the wasted hot water.
- However, in some cases, the beneficiaries felt no changes because the equipment in the end-user including the pumps installed in each building occurred.
- (Mid-term performance) There is no meaningful and realistic cost reduction (more than 10 - 20%) for the heating cost among the residents.
- The local officials and residents do not recognize the mid- and long-term effects.
- (Long-term effect and impact) It is difficult to expect a wide range of economic and social impact due to partly improving the cold and hot water supply system.

- However, it is assessed that the project partly contributed to the development impact and the ripple effect from the viewpoint of Ulaanbaatar and Mongolia including the mid-term development plan in that the project contributes to long-term development through support which meets the urban development strategies and implementation goals of the Mongolian government.
- Therefore, the score is assigned not the impact evaluation now, but the expected impact in the future. The residents show very positive attitude to the long-term performance and have positive views on the development in the industrial development long-term economic growth.
- The project may be categorized as "more than 80% of the planned effect" and assessed effective.

4) Sustainability

- The sustainability, one of the 5 DAC benchmarks, is reviewed by 2 viewpoints below.
- The district heating system in Ulaanbaatar was established from the aid of the former Soviet Union and the equipment and facilities were outdated. However, the human system for the management and operation is relatively well-organized.
- In addition, the manpower and the management system to collect the fees as a measure to secure the financial stability. The water supply is immediately suspended without paying the fees in the due date and most users faithfully pay the fees for the water use.
- The financial revenue additionally secured by upgrading the heat efficiency

is used for the improvement project by the Public Facility Management Administration, maintenance and establishment of the central control system, meaning to secure the financial sustainability.

- Based on the issued mentioned above, the project is assessed "very sustainable

III. Suggestions for the similar future projects

A. Result-based design and management

- The final goal and the result-based design and management - Understand the process of finding out the result in the reverse direction with the final goal as the starting point and reflect on the project design by understanding major factors for the performance.
- Not only the design, but also the major process in achieving the goal is used as the milestone for each phase to effectively perform the result-based project management.
- Such result of the project eventually provides the basic framework for the monitoring and evaluation, as well as the monitoring information required for the project entities to enable them to make decisions based on the objective data and information.

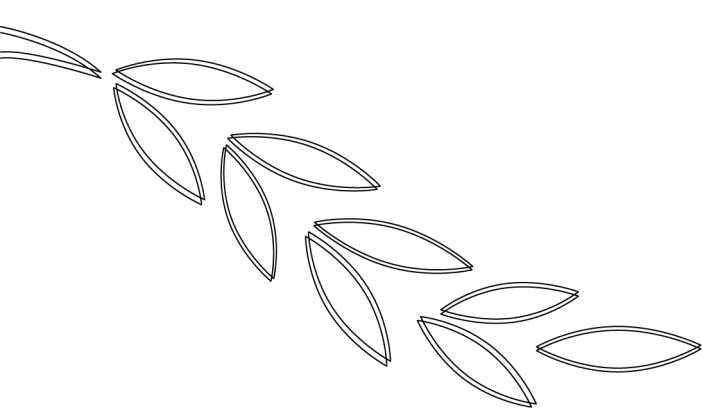
B. Thorough analysis of context, stockholders, issues, and culture

- The mandatory ex-ante studies and surveys shall be performed to plan the management and the result-based project design.

- The factors which affect the project shall be understood and the interaction and correlation of the project elements, national, regional and cultural factors shall be analyzed to provide required data for the design and plan on improving the effectiveness.
- This includes the research topics or ex-ante evaluation which may assess the effect or impact through the national strategies and future projects and establishment of the program theory or logic model through in-depth studies or surveys.

C. Meet the international standard and high quality

- The project attempts to use high quality materials and meet the international standards and above. It is desirable to continuously observe the standards to reduce the maintenance cost and upgrade the durability of the facilities even though the scope of the project is contracted in the future.
- Also, the possibility for joining the future development project may be increased by building the confidence on the companies and upgrading the image of Korea in the cooperation country.
- The result of the interview with the administrator of the public facility management states that most of the equipment is made in Korea and there exists difficulties in supplying the part during the maintenance and it would be easy to supply additional parts even after the project under the direct ties with the Korean manufacturers.



I . Evaluation Overview

1. Overview
2. Evaluation Methodology
3. Limitations of Evaluation



I Evaluation overview and methodology



1. Overview

1) Background

- (Poor district heating facilities) The district heating facilities installed in 1978 from the aid of the former Russian Federation exceed the lifecycle of 20 years and show difficulties in providing stable district heating and water supply due to leakage, high power loss and unstable water pressure. Here, Ulaanbaatar is performing the master plan to replace the heat supply system including the cold and hot water supply facilities from 2002 to 2020 but there only exist some progress due to difficulties in the budget and technologies.
- (Poor climate) Mongolia has the cold with dry winter climate and the temperature reaches as low as -40C, making the city the coldest winter in the world and requires to provide heating service for 9 months due to long winter and short summer. This requires the stable heating.
- (KOICA) KOICA plays a decisive role and provide support for the industrial energy in the process of the national development and recongnizes that is is crucial to achieve the MDGs. In this respect, KOICA plans to perform the DEEP 'Establishment project for the master plan to develop mineral resources, build the infrastructure and supply financial sources' with the project for 2 years from now.

2) Purpose

- The evaluation is an ex-post evaluation of the heat supply system in Mongolia and focuses on whether the purpose of improving the heat and water supply system in Ulaanbaatar, Mongolia is achieved. To this end, the evaluation performs the analysis based on 5 criteria of the OECD/DAC including the relevance, efficiency, effectiveness, impact and sustainability.
- The evaluation focuses on discovering the lessons from the project to utilize the evaluation result in future similar projects. To find out the lessons from the project, here is to propose foreign free aid projects, heat supply system policies and project implementation by KOICA, project formation, planning, implementation and overall improvement in the evaluation.

3) Description of the Evaluated Project

- The table below contains the period, purpose, contents, scale, area and beneficiaries for the project under the evaluation.

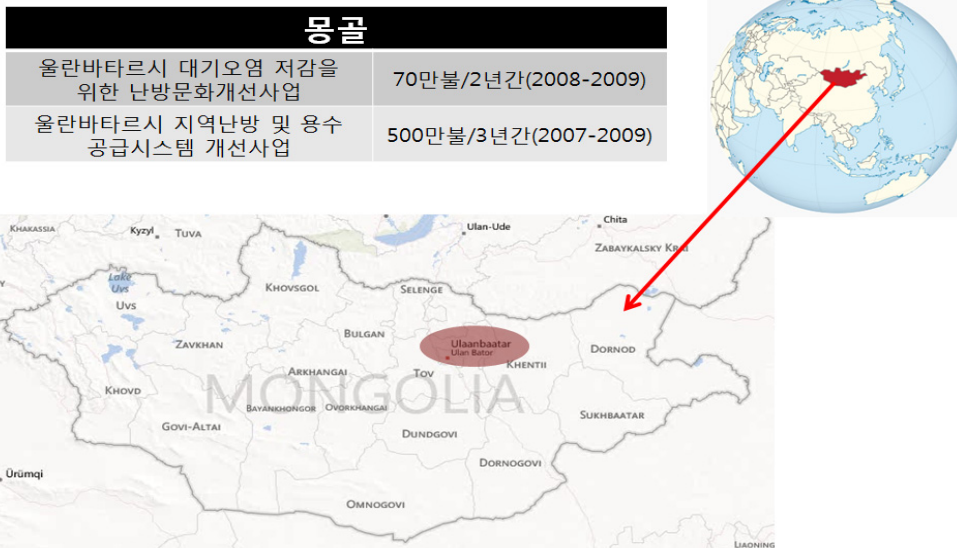
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Scale	USD 5million
Area	Khan-Uul District, Ulaanbaatar, Mongolia
Beneficiary	Up to 100,000 people in Ulaanbaatar
Implementing Agencies	Korea - KOICA
	Mongolia - Ulaanbataar Municipality

- The project period is 3 years from 2007 to 2009 with the cost of USD 5 million. The project includes the replacement of equipment in 44 machines rooms which supply heating and water in the residential areas of Ulaanbaatar and training support for equipment operation, maintenance and capacity building.
- The project is to improve the issues of degraded heat efficiency due to aging district heating facilities built by the support from the former Soviet Union in the 70s and to upgrade the benefits for the residents by producing and supplying inexpensive and abundant heat energy for the purpose of 1) upgrading the heat efficiency of the water supply system through supporting the equipment and construction services, 2) upgrading the maintenance and operation of the water supply facilities by providing invitation training and dispatching experts for Mongolian engineers and 3) promoting the excellence in the advanced facilities of Korea to lead the local facility companies to enter the Mongolian market.
- The project achieves the targeted improvement and shows positive effects including the energy efficiency upgrade, effective post management of the recipients and propelling the improvement project on its own. However, the mid- and long-term effects and the impact of the project are limited.

<Figure 1-2 Project area in Mongolia>



4) Evaluation Scope

○ The range of the ex-post evaluation is as follows.

Evaluation Design	Local Study	Site survey	Result Analysis	Write and submit the report
<ul style="list-style-type: none"> ■ Evaluation criteria and methodology ■ Assignment of roles for the evaluation team ■ Write interview and survey questions ■ Establish the evaluation plan 	<ul style="list-style-type: none"> ■ Document study ■ Policy documents of KOICA and other organizations ■ Heat supply system document and the Mongolian national development ■ Major social and economic indicator survey 	<ul style="list-style-type: none"> ■ Establish the site survey timetable ■ Beneficiary interview and visit the site ■ Survey for the beneficiaries ■ Report the site survey result 	<ul style="list-style-type: none"> ■ Collected data Analysis with mixed methods 	<ul style="list-style-type: none"> ■ Report meeting and Review ■ Final adjustment ■ Submit the report

5) Schedule

○ The project performs the evaluation with the stages below.

num ber	Task level	Action plan	Output	Schedule
1	Initiation Report session	<ul style="list-style-type: none"> • Ex-post evaluation design • Initiation report session 	<ul style="list-style-type: none"> • Initiation report 	6/4
2	Local ex-ante survey	<ul style="list-style-type: none"> • Document survey, statistical survey • Consultant, local expert selection, interview 	<ul style="list-style-type: none"> • Basic survey and local research product • Interview questionnaire, transcript, recorded file, consulting report 	May - mid June
2	Establish the evaluation plan	<ul style="list-style-type: none"> • Determine the evaluation standard and survey method under the cooperation with KOICA • Establish specific plans for the ex-post evaluation • Propose the ex-post evaluation standard and methodology • Develop the local survey tools 	<ul style="list-style-type: none"> • Service plan • Local survey tools - Questionnaire, interview questionnaire, etc. 	5/30
3	Site survey Plan and preparation	<ul style="list-style-type: none"> • Select the local data survey • Designate the local coordinator and translator • Set up the site survey timetable • Write and report the site survey plan 	<ul style="list-style-type: none"> • Task implementation plan, service initiation report • Action plan 	Early August
4	Site survey	<ul style="list-style-type: none"> • Site survey - Stakeholder group survey, in-depth interview, focal group discussion 	<ul style="list-style-type: none"> • Survey result, transcript, recorded file 	8/11 - 21

number	Task level	Action plan	Output	Schedule
		<ul style="list-style-type: none"> Meeting - Project plan, task assignment, negotiation and coordination, etc. Secure the basic data and request additional data Site survey Attendance, observation Meeting with local relevant organizations 	<ul style="list-style-type: none"> R/D (Consultation proceeding) Site survey output Field note 	
5	Apply the evaluation strategy and method	<ul style="list-style-type: none"> Apply the implementation, monitoring strategies and method Perform the ex-post evaluation 	<ul style="list-style-type: none"> Apply the evaluation strategy and method 	July to September
6	Data analysis and consulting	<ul style="list-style-type: none"> Data analysis based on the site survey and evaluation data Consulting from relevant organizations and through network 	<ul style="list-style-type: none"> Data with evaluation and analysis 	July to September
7	Interim report	<ul style="list-style-type: none"> Interim report session 	<ul style="list-style-type: none"> Report on the site survey result 	8/27
8	Collect and analyze the survey result	<ul style="list-style-type: none"> Integrate and analyze the Korean and local site survey 		10/16
9	Final Report session	<ul style="list-style-type: none"> Final report session (11/11) 	<ul style="list-style-type: none"> Final report draft (10/30) 	11/11
10	Final report	<ul style="list-style-type: none"> Reviewed and confirmed by the evaluation review board of KOICA 	<ul style="list-style-type: none"> Confirmed report by reflecting the result from the evaluation review board 	Scheduled in the late November

○ Global Development Cooperation Consulting forms the evaluation team as below to perform the evaluation. The team consists of Aaron Kim, a senior researcher Global Development Cooperation Consulting and in charge of the assessment, CEO Jinhwan Yeo at Jinsung E&C, researchers Ina Kang and Youngchang Yoon.

<Table 1-2 The evaluation team>

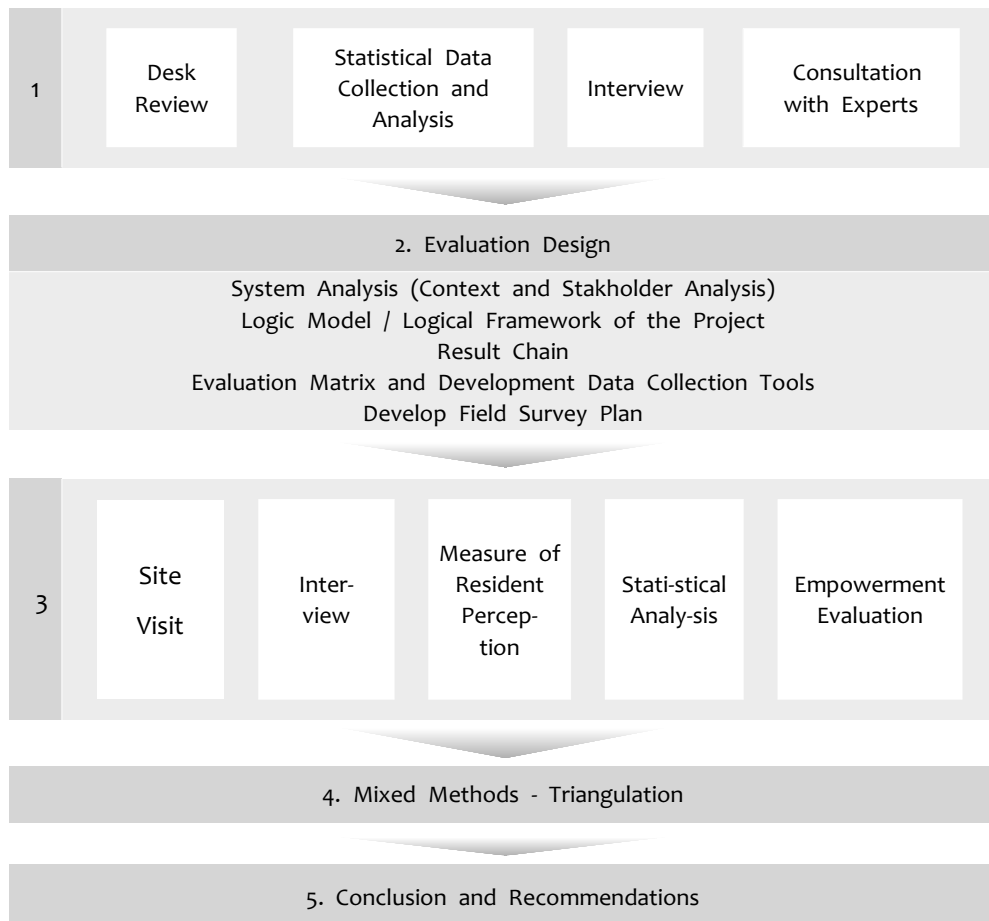
Specification	Name	Organization and title	Role in the team
Senior researcher (PM)	Aaron Kim	Global Development Cooperation Consulting Principal researcher	<ul style="list-style-type: none"> • Oversee the evaluation - Evaluation expert • Oversee the preparation and implementation of the site survey • Design the evaluation methodologies, perform the evaluation and analyze the result • Write the evaluation matrix and questionnaire • Site survey in Mongolia • Write the project evaluation report
Co-researcher (Co-researcher)	Youngwoo Park	Global Development Cooperation Consulting Principal researcher	<ul style="list-style-type: none"> • Design the evaluation methodologies, perform the evaluation and analyze the result • Write the project evaluation report
Co-researcher	Jinhwan Yeo	Jinsung E&C Tech office Representing director	<ul style="list-style-type: none"> • Expert in the heat supply system • Local and foreign document study, analyze the statistical data • Site survey in Mongolia • Analyze the survey result and write the report
Assistant researcher	Ina Kang	Global Development Cooperation Consulting Researcher	<ul style="list-style-type: none"> • Collect the basic data and analyze the document • Collect and analyze the site survey result • Administrative support and assist in writing the report • Site survey in Mongolia
Assistant researcher	Youngchang Yoon	Global Development Cooperation Consulting Researcher	<ul style="list-style-type: none"> • Collect the basic data and analyze the document • Assist in local report • Site survey in Mongolia • Assist in data survey and collection



2. Evaluation methodology

1) Methods

- The survey method of the project may be summarized with the evaluation design based on systematic and scientific grounds, data collection and analysis as shown below.



2) Procedure

(1) Document review

<Table 1-3 List of data for the document study>

Survey data	
Inside KOICA Document	<ul style="list-style-type: none"> • Report on the result of the primary interim evaluation
	<ul style="list-style-type: none"> • Support the equipment
	<ul style="list-style-type: none"> • Industrial energy team (2008), report on the result of the implementation cooperation
	<ul style="list-style-type: none"> • Korea District Heating Corporation (2007), expert report on the implementation cooperation
	<ul style="list-style-type: none"> • Korea District Heating Corporation (2007), report on the result of the ex-ante survey
	<ul style="list-style-type: none"> • Report on the result of the interim evaluation
	<ul style="list-style-type: none"> • Korea District Heating Corporation (2009), report on the result of the training
	<ul style="list-style-type: none"> • KOICA / Korea District Heating Corporation (2009), final report
Recipient country Document	<ul style="list-style-type: none"> • MCA(Millennium challenge account Mongolia) (2012), Monitoring & Evaluation plan mongolia
Others	<ul style="list-style-type: none"> • ODA Korea (2012), National cooperation strategy CPS Mongolia
	<ul style="list-style-type: none"> • Ministry of Foreign Affairs (2012), Status of Mongolia
	<ul style="list-style-type: none"> • ERINA (2013), Trend analysis of Northeast Asia
	<ul style="list-style-type: none"> • Munhwa Ilbo (2000), Toward the Global No. 1 Public companies stretched to the world
	<ul style="list-style-type: none"> • The UB POST(2010), KOICA Project is underway successfully)

(2) Collect and analyze the statistical and status data

- The local statistical data are collected to measure the mid- and long-term project effect and impact to compare and analyze with the statistical data acquired from the ex-ante and ex-post evaluation.
- Analyze the available statistical data selected from each evaluation matrix (ex: Local environment and economic indicators, etc.)
- and utilize the sites from aid-related international organizations including the OECD/DAC, World Bank and UNDP, local survey and statistical data archive¹⁾, other sites from the donating countries and statistical site for the cooperation country

(3) Interview with local officials

- Upgrade the understanding of the complementary project establishment, implementation process and status through individual or group interviews for the poor analysis from the document study.
- Upgrade the understanding of the special knowledge on the evaluation of the project through interviews with heat supply system experts and meeting with project group
- Interview and question
 - Structured interview to secure specific data for each criterion
 - Secure the project-related information and data for successful evaluation

1) <http://www.ksdcdb.kr/main.do>

○ List of the local interviews

Division	Interviewer	
KOICA	Donggu Lee	Head of the Mongolia office
	Jihyun Yoon	Industrial energy team
External expert	Kichang Lee	Korea District Heating Corporation / Team leader
	Bongkyun Kim	Korea District Heating Engineering Co., Ltd. / Section chief

(4) Foreign site survey

- The foreign site survey is performed by various methods including the site inspection, in-depth interviews with the stakeholders and project officials, survey with recipients and in-depth interviews and local workshop.

A. Site survey

- Machine rooms with improved the heat supply system (No. 16-1, 16-2, 15-8, 1-5, 1-2, 6-2)
- Check the improvement in the machine room and output,
 - Interview the machine room manager
 - Check the operation log
- Apartments for the residents where the improved heat supply system is supplied (No. 1-5, 1-2, 6-2 nearby)
- Check the nearby environment of the machine room and interview the residents
- Training center for the hot water heating in the Public Facility Management Administration

- Interview the responsible officials
- Check the equipment and environment in the training center
- Check the output

B. Interview the stakeholders and project officials

- The visit to the major organizations during the site survey is performed for major stakeholders directly engaged in each evaluation related to the ex-post evaluation.
- The key questions for each item are proposed by the proposed evaluation framework, tasks of the interviewees and the participation range of the projects supported by KOICA

Assigned organization	Interviewee	Major collected data
KOICA Mongolia branch	Local office head and deputy head	<ul style="list-style-type: none"> • Project planning, relevance with the implementation process, evaluation and opinion from the responsible government organizations for the efficiency and effectiveness of the project • Related basic data (Document, measured figures, other related data) • Data for handling complaints • Related socioeconomic indicator (Population, income, spending, etc.)
Public Facility Management Administration in Ulaanbaatar	Project implementation (2007 - 2008) Responsible personnel	
Service area	Resident interview	<ul style="list-style-type: none"> • Evaluation and opinion from the beneficiaries for the effectiveness of the project

- Use the structured and in-depth interview
 - The tools for the in-depth interview shall be structured to be compatible

with the ex-ante document study and statistical data analysis The analysis result shall be designed for the complementary and covered

- The data selection tools including primarily developed interview data based on the document study shall be translated to the local language and developed after the pilot use for 1 or 2 local people (The process, called the formative evaluation, is an important process of acquiring required data to check and revise with various standards including accuracy on specific contents, proper language and consistency in the answer with the participants²⁾)
- The validity and reliability of the tools are upgraded through the process
- The following small group test and pilot test are omitted considering the limitation in the time and cost for the ex-post evaluation
- Select a total of 10 - 20 people for each stakeholder group through the local coordinator before the site survey and perform the interview (expected multiple interviews due to time limit)
- Use the structured interview paper and collect the interview data through the field note
- Record the whole interview process and make transcript for the analysis

C. Beneficiary interview and survey

- The interview was performed with residents in the apartments where the beneficiaries lived (around the machine rooms No. 1-5, 1-2 and 6-2)
- The beneficiary survey was translated to the Mongolian language after the cooperation with the local coordinator and the pilot test was performed for the residents in Ulaanbaatar to upgrade the reliability and to verify the clearness and reliability of the questions.

2) Dick, W., Carey, L., & Carey, J. O. (2011). *The Systematic Design of Instruction* (7th. Ed). Merrill/Pearson. Upper Saddle River, N.J.

- The survey was performed by 2 interviewers selected from the interview. The 2 interviewers were directly trained by the PM and the data reliability was secured with face-to-face method.
 - The evaluation team provides the evaluation project and orientation
 - Survey introduction (Purpose, procedure, plan)
 - Role playing, additional training

- The study performs the face-to-face interviews with the residents around the machine rooms No. 1, 3, 4, 13 and 15 to train the survey procedure and method and determines the survey protocol.

<Table 1-3 Basic information on the survey respondents in Mongolia>

Basic information	N	Average	Standard deviation
Age	90	36.66	14.82
Population per household	87	4	1
Household income (monthly)	62	901,501 MNT	690,703 MNT
Size of the house	66	43.78 m ³	21.80m ³

- The questions on the questionnaire are as follows and please refer to the [Attachment 4] for the questionnaire text.

<Table 1-4 Question composition in the survey of Mongolia>

Question item	Number of questions
Short-term	7
Cost of the water use per household	1
Stable water supply	6
Field	1
Environment	1
Project formation	1
Relevance	1
Long-term	18
Economic development effect	3
Employment	3
Industrial technology development	1
Upgrade the quality of lives	5
Population increase	2
Revitalize the local economy	3
Other effects on the local community	1
Mid-term	5
Transfer related technologies	2
Save the resources	2
Improve the residential lives	1
Sustainability	1
Sustainability	1
Total	33

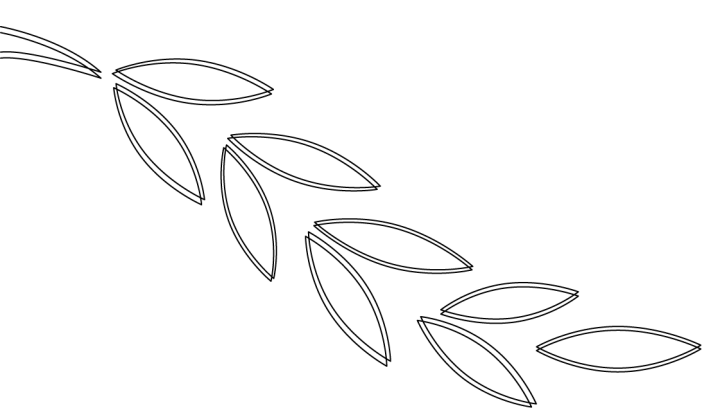


3. Limitation in the evaluation

- (Difficulties in obtaining data) The biggest hurdle of the current evaluation project was difficulties in obtaining hard data such as operating cost of a renovated substation. In particular, it was difficult to draw conclusion regarding effects of the project due to lack of local indicator data to measure the mid- and long-term effect of the project, the major evaluation item.
- (Without the basic statistical data) There is no baseline data for the noise around the machine room before and after the project, limiting to measure the decrease in the illiteracy around the project site, increase the school attendance and upgrade the academic background.
- (Limited evaluation budget and period) The evaluation is limited by a short period of evaluation including the site survey, interview and survey for a wide area and limited budget. The evaluation team visited several places based on arbitrary standards but the limitation exists in the sampling for the analysis with the statistical data for the features in the facilities.
- (Timing of site survey) The site survey was conducted during summer when the city did not provide the heat and hot water. It was not possible to observe operation of the facilities and end-user's condition in order to understand how the project affect different beneficiaries.
- (Preliminary study for effective evaluation) The scope of evaluation project only allowed one site survey, which meant preparation for the field survey including desk review had to be done in Korea. However, desk review is not sufficient to design evaluation and plan field survey for effective and efficient evaluation. Therefore, it is required to add a preliminary study trip to ensure quality of the evaluation as a preparation prior to the main field

survey trip to the projet site.

- (Lack of willingness to provide the information from the recipient organization) The cooperation (beneficiary) organization for the project is the Public Facility Management Administration of Ulaanbaatar and enjoys the largest direct benefits from upgrading the energy efficiency and saving maintenance efforts on the facility upgrade through the project. However, the organization has not provided the basic operation data despite continuous requests from the local coordinator and several visits by the evaluation team.



II . Evaluation Framework and Matrix



Evaluation Framework and Matrix

- The system improvement project for the heat supply in Mongolia focuses on stable water supply.
- The matrix is formed for the performance evaluation based on the result chain below.

Injection (resources)	Activity	Output	Outcome	Impact (long-term outcome)
<ul style="list-style-type: none"> • Budget • Human resources • Project site and space • Knowledge, technology 	<ul style="list-style-type: none"> • Equipment installation • Design and construction • Dispatch experts • Invitation training • Project space • Other supports 	<ul style="list-style-type: none"> • System improvement • Upgrade the heat efficiency • Stable water supply • Elongate the system lifecycle • Capacity building for the managers 	<ul style="list-style-type: none"> • Improve the residential lives • Decrease the diseases • Save the heating costs • Save the costs for the water supply • Save the resources • Transfer related technologies 	<ul style="list-style-type: none"> • Upgrade the quality of lives • Upgrade the health conditions for the residents • Revitalize the local economy • Population increase • Industrial technology development

- In addition to the performance evaluation, the process evaluation matrix is additionally prepared to assess the project formation, planning and implementation and the questions for the interview and questionnaire are prepared based on the matrix to collect the data.

- The matrix plays a role as a table of contents which categorizes, analyzes and is proposed as the result for each evaluation item.
- This facilitates the review and discussions on the result of the evaluation for each project phase and assists in systematically providing the suggestions.
- The process evaluation matrix is as follows.

<Table 2-1 Process evaluation matrix>

Evaluation Benchmark	Evaluation item	Specific question for the evaluation	Evaluation indicator	Data source
① Project formation				
Relevance	1. Consistency with the development policies of the cooperation country	<ul style="list-style-type: none"> ○ Whether the project meets the development strategies and policy direction of the cooperation country 	<ul style="list-style-type: none"> ○ Status of the ODA reception for the cooperation country ○ Weight for each sector and trend ○ Contents of the policy documents and strategic documents 	<ul style="list-style-type: none"> ○ Request for support ○ Report on the project feasibility ○ Plan on the project implementation
	2. Consistency with the support strategies of KOICA	<ul style="list-style-type: none"> ○ Whether the project meets the development strategies and policy direction of KOICA 	<ul style="list-style-type: none"> ○ Support status of the cooperation country by KOICA ○ Portion and trend in the aid budget ○ Priority ○ Contents of the policy documents and strategic documents 	<ul style="list-style-type: none"> ○ Strategic documents for each cooperation country of KOICA ○ Use as the statistical data on the aid for the cooperation country with KOICA
	3. Relevance of the project selection	<ul style="list-style-type: none"> ○ Properness for the survey and study on the project demand ○ Project efficiency 	<ul style="list-style-type: none"> ○ Specific grounds for the demand analysis and basic survey ○ Project element 	<ul style="list-style-type: none"> ○ Survey report on the project feasibility, interview with the officials

Evaluation Benchmark	Evaluation item	Specific question for the evaluation	Evaluation indicator	Data source
		<ul style="list-style-type: none"> ○ Realization of the project ○ Whether the project contains meaningful ripple effect and impact 		
② Project planning				
Relevance	1. Feasibility for the purpose	<ul style="list-style-type: none"> ○ Whether the short-, mid- and long-term goals of the project are properly established 	<ul style="list-style-type: none"> ○ Logical relation with the process in achieving the goals ○ Understand the external factors ○ Understand the major assumptions ○ Whether to reflect on the design 	<ul style="list-style-type: none"> ○ Project feasibility survey ○ Plan on the project implementation ○ Report on the site survey result ○ PDM review
	2. Design Feasibility	<ul style="list-style-type: none"> ○ Whether the project design is proper and the solutions to various issues in the project implementation are appropriate 	<ul style="list-style-type: none"> ○ Relevance of the technical supports related to the feasibility review ○ Relevance of the injection (budget, technology, human resources) - Effective, efficient ○ Allocate the support from KOICA with the cooperation country against the total project cost ○ Select the proper purchase method ○ Consider risks, external conditions and major assumptions in achieving the expected effect of the project 	<ul style="list-style-type: none"> ○ Project feasibility survey ○ Plan on the project implementation ○ Interview the responsible officials ○ PDM review

Evaluation Benchmark	Evaluation item	Specific question for the evaluation	Evaluation indicator	Data source
③ Project implementation				
Efficiency	1. Progress against the plan	<ul style="list-style-type: none"> ○ Is the project completed without modification based on the implementation plan? 	<ul style="list-style-type: none"> ○ Difference in the actual implementation from the plan ○ Delay the project cost, procurement and implementation 	<ul style="list-style-type: none"> ○ Review the project report ○ Interview the implementing organizations ○ Site survey
	2. Injection element	<ul style="list-style-type: none"> ○ Are all the resources effectively injected into the purchase and construction? 	<ul style="list-style-type: none"> ○ Price changes in various equipment during the project ○ Additional cost due to unexpected technical flaws ○ Unexpected cost on the environment 	<ul style="list-style-type: none"> ○ Review the project report ○ Interview the implementing organizations ○ Site survey
	3. Structural issues	<ul style="list-style-type: none"> ○ Are there any structural causes inhibiting the efficiency? ○ Are the problems in the structural causes effectively solved? 	<ul style="list-style-type: none"> ○ Constraints recognized by each stakeholder 	<ul style="list-style-type: none"> ○ Interview with project officials
Effectiveness, Relevance	4. Participation from the cooperation country	<ul style="list-style-type: none"> ○ How much does the cooperation country join the project design and implementation? 	<ul style="list-style-type: none"> ○ Participation of the cooperation country in the project selection and purchase procedure ○ Participation of the stakeholders in the project for support 	<ul style="list-style-type: none"> ○ Request for support ○ Plan on the project implementation ○ Interview with the officials in the cooperation country ○ Interview with the recipients

Evaluation Benchmark	Evaluation item	Specific question for the evaluation	Evaluation indicator	Data source
④ Sustainability				
Unsustainability	1. Sustainability for the human and institutional system	<ul style="list-style-type: none"> ○ Is there any stability in the human or institutional system to back up the project sustainability? 	<ul style="list-style-type: none"> ○ Whether to secure human resources for the proper maintenance and management ○ Concreteness and realization for the exit strategy ○ Concreteness and realization for the following measures ○ Concreteness and realization for the ex-post management ○ Ownership and willingness of the cooperation country for the project 	<ul style="list-style-type: none"> ○ Interview with government officials ○ Implementation cooperation ○ Report on the final construction ○ Interview the responsible officials ○ Interview the implementing organizations
	2. Financial sustainability	<ul style="list-style-type: none"> ○ Is there any financial stability to back up the project sustainability? 	<ul style="list-style-type: none"> ○ Price of the output from the supporting project ○ Financial soundness in the project organizations ○ Secure the budget for the proper management and maintenance 	<ul style="list-style-type: none"> ○ Interview with government officials ○ Financial report from the project organizations ○ Interview with the officials in the project organizations

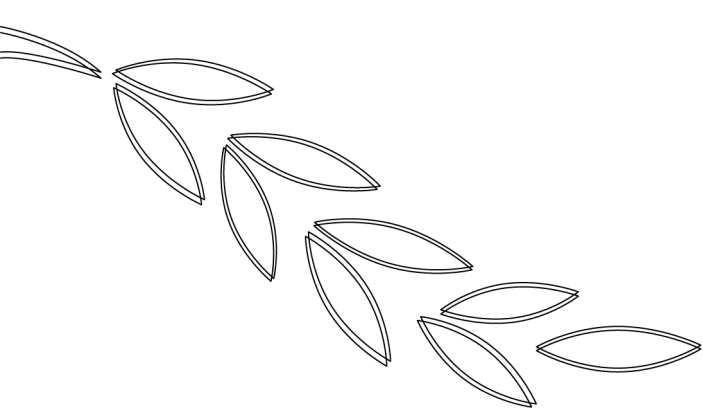
- The performance evaluation matrix potentially selects specific performance indicators from the result chain mentioned above, collects data and uses the questions for the beneficiaries to collect the survey data by developing the questions into each specific category.

○ The performance evaluation matrix is as follows.

<Table 2-2 Outcome evaluation matrix>

Item	Outcome level	Item for the performance evaluation	Outcome indicator	Data source
	Field	Environment evaluation	Air and water quality	Interview, Survey, statistics
Impact	Long-term effect	Quality of life upgrade	Evaluation by the residents in the project site (recognition)	
			Upgrade the life (owing to relatively saving the heating cost)	
		Upgrade the health conditions for the residents	Statistics of the diseases in the winter (Attack rate, death rate)	
		Population increase	Population increase in the project site	
		Local economy Vitalization	Economic indicators in the project site (income, total production)	
		Industrial technology development	Trend in the production based on new industrial technologies	
		Local community Other effects	Satisfaction	
		Employment	Direct and indirect employment	
	Mid-term performance	Residential life upgrade	Evaluation by the residents in the project site (recognition)	
Upgrade the life				
Decrease the diseases		Statistics related to the diseases in the winter (attack rate, death rate)		

		Save the resources	Save the cost for the local heat supply, Save the heating cost for households	
		Related technology transfer	Status of effective maintenance in the local heating facilities Suspend and retrieve the service Exceed the expected maintenance cost Overall issues, solutions and process	
Short-term performance		Water supply cost reduction	Cost of the water use per household	
		Heat efficiency upgrade	Heat efficiency	
		Stable water supply	Supply volume	
			Required volume / Consumed volume	
			User satisfaction	
			Water supply cut	
			Stable temperature and pressure (goal)	
Number of users in the water supply system				



III. Result

1. Result based on the evaluation criteria
 - 1) Relevance
 - 2) Efficiency
 - 3) Sustainability
 - 4) Effectiveness and Impact



III

Result



1. Result based on the evaluation criteria

1) Relevance

(1) Evaluation of the project formation

- The project formation is the first stage to establish strategies and directions to understand the project.
- The feasibility and realization of the project are assumed to be sufficiently reviewed and the project discovery or feasibility review are exempted from the evaluation range.
- The realization and efficiency in the project are considered to assess whether the project site and beneficiary groups are properly selected for more effective and efficient design of the project within the range.
- Specific evaluation items and questions to assess the project formation are summarized in the table below prior to proposing the specific evaluation result.

Item for the specific evaluation	Question for the specific evaluation	Evaluation standard
1. Consistency with the development policies of the cooperation country	Whether the project meets the development strategies and policy direction of the cooperation country	Relevance
2. Consistency with the support strategies of KOICA	Whether the project meets the development strategies and policy direction of KOICA	
3. Relevance of the project selection	Whether the survey and study on the project demand are proper	
	Whether the project shows high effectiveness	
	Whether the project shows high realization	
	Whether the project has meaningful ripple effect and impact	

A. Consistency with the development policies of the cooperation country

a. Document data

- The MGD-Based Comprehensive National Development Strategy of Mongolia focuses on achieving the MDGs through the economic and human resource development, protecting and enforcing the sovereignty of Mongolia and being developed as a middle-income country.
- The strategy selects 6 priorities with 3 categories of "Human and social development", "economic growth and development" and "environment and control" and proposes specific policy tasks as below.

<Fig. 3-1 National development strategy of Mongolia>



* Source: Country cooperation strategy - Bangladesh, Uzbekistan, the Philippines, Mongolia, Cambodia (2012). p. 283

- The MGD-Based Comprehensive National Development Strategy of Mongolia consists of 2 phase with the first stage of achieving the MGDs and intensive economic growth and the second stage of transferring to the economy based on the knowledge.
- Here, the Mongolian government selects the urban development related to the project, economic growth and development policies in the construction development as specific tasks and Korea has supported the infrastructure installation to strengthen the foundation for the sustainable urban development of Ulaanbaatar.
- The specific policy tasks of Mongolia are as follows and the project is considered to be a part of such master plan.

- Master plan on improving the cold and hot water supply center facilities (2002 - 2020)
 - Master plan on the water supply and wastewater treatment in Ulaanbaatar (2006 - 2020)
- In conclusion, it is included in the strategic urban development and the required urban infrastructure considering the demand for the urban heating depending on the district heating for most people in Ulaanbaatar and the climate of Mongolia with more than half of cold period.
- Also, upgrading the energy efficiency contributes to saving the resources and environmental protection, as well as upgrade the welfare by improving the living conditions, meaning a very proper project.

Data source
ODA Korea (2012). Country cooperation strategy - Bangladesh, Uzbekistan, the Philippines, Mongolia, Cambodia
KIEP (2011). The proceedings of in-depth researches on the strategic area IV - Mongolia, Turkey
Climatological Normals of Ulaanbaatar. Hong Kong Observatory. Retrieved from http://www.hko.gov.hk/wxinfo/climat/world/eng/asia/china/ulaanbaatar_e.htm .
KOICA (2009). Final project management report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia

b. Climate data for Mongolia

- (Temperature in Mongolia) The summer is very short for 1 - 2 months in Mongolia (except the areas like the Gobi Desert in the south) and has fresh climate around 20°C but the winter from mid-October to April shows very low temperature between -20 and -30°C.
- The coldest period is mid-December to the end of February with -40°C and under -50°C for some regions.
- (Sunshine in Mongolia) Also, the sunshine lasts 220 to 260 days a year, the annual average rainfall is 216mm with the concentration from June to September.
- (Temperature in Ulaanbaatar) The city is one of the coldest capital cities in the world with the annual average temperature of -2.4°C and the lowest and the higher temperature are -49°C (-56F) and 38.6°C (101.5F), respectively.
- The coldest period, January, reaches the temperature of -36°C (-33F) and -40°C (-40F) right before the sunrise due to the height of 1350m and surrounded by mountains.

Data source
KIEP (2011). The proceedings of in-depth researches on the strategic area IV - Mongolia, Turkey
Climatological Normals of Ulaanbaatar. Hong Kong Observatory. Retrieved from http://www.hko.gov.hk/wxinfo/climat/world/eng/asia/china/ulaanbaatar_e.htm .

c. Interview data

- As mentioned in the climate statistics, the winter of Ulaanbaatar is very long and cold, affecting urban lives in various aspects.
- The fact confirmed from the interviews with the district heating companies and other documents is that the urban development plan was established with the priority for the residential stability in the winter considering such conditions.
- A lot of countries in the former Soviet Union show low temperature in the winter and the fuel supply and the district heating are important urban infrastructure.
- The facilities prior to the improvement from the project are constructed in 1978 with the aid from the former Soviet Union and the heat produced the thermal fusion power plant located on the south of Ulaanbaatar was transferred to the massive residential areas for the district heating system.
- However, the facilities were outdate and poorly efficient and requirement for the improvement existed after the 90s but the residents keep claiming inconvenience due to without additional support.
- The interviews with the residents show that their quality of life in winter is improved by upgrading the heating and hot water facilities for the project.

"It was very cold in winter. However, I feel good because I can use the hot water after the construction."

- Therefore, it is judged that the project is very proper considering the living conditions in the winter, document data and climatic features supporting the priority and appropriateness of the project.

B. Consistency with the support strategies of KOICA

- The Mongolia CPS strategic goal of Korea is to "cooperate and contribute to successful implementation of mid-term development plan for Mongolia and help the sustainable development balanced growth of the country".
- Therefore, the cooperation strategies of Korea selects 3 core parts from the 2012 CPS based on the development strategies above and focuses on 70% of the total support.

- ① Upgrade the transparency and efficiency in the public sector → Improve the public administration based on the ICT
- ② Support the balanced national growth and urban sustainable development → Urban development
- ③ Strengthen the food security through upgrading the agricultural production and income growth → Agricultural development

- The project is the urban infrastructure improvement of "Support the balanced national growth and urban sustainable development".
- Also, the project considers the situation where almost a half of population lives nearby the capital city and is highly related to the second point, urban development in the aspect of improving the efficiency by supporting the field with accumulated technologies and capabilities.
- Korea experienced the urban population sprawling and following urban issues due to rapid industrialization and achieved the urban infrastructure supply through the national development plan and urban development plan.
- Here, based on such experience, Korea has supported various projects including heat and water supply, GIS and ITS.
- Here is to summarize the illustration of the support for Mongolia by the ODA Korea and it shows that the project focuses on the balanced national development sustainable urban development.

<Fig. 3-2 National development strategy of Mongolia>



○ The project is proper for helping the cooperation country realize the development policies through the experience and capabilities of Korea meeting such supporting policies.

Data source	
ODA Korea (2012). Country cooperation strategy - Bangladesh, Uzbekistan, the Philippines, Mongolia, Cambodia	

C. Relevance of the project selection

- The evaluation item is the review on the process of selecting the project and assesses whether the reviews and discussions meet the proper level in selecting the project site and contents.

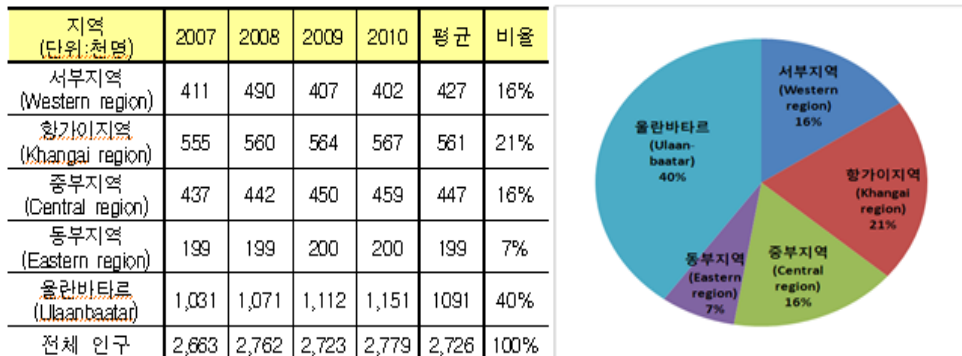
- Whether the survey and study on the project demand are proper
- Whether the project shows high effectiveness
- Whether the project shows high realization
- Whether the project has meaningful ripple effect and impact

a. Document data

[Survey and research on the project demand]

- First, the survey and research on the project demand are considered in the project formation process including ex-ante studies and categorized in the project-related documents, meaning that the analysis is performed for the project site and beneficiary groups.
- (Development demand for Mongolia) As mentioned above, the rapid urbanization of Ulaanbaatar faces various urban issues, requiring to establish the infrastructure based on the urban plans. The project is propelled to improve the living conditions and upgrade the energy efficiency in Ulaanbaatar.

<Fig. 3-3 Number of population and distribution rates in Mongolia (2007-2010)>



*Source: Mongolian Statistical Yearbook 2010 (2011)

- (Population increase) As more and more people move from the rural area to Ulaanbaatar, it is urgent to improve living conditions including drinking water and sanitation facilities and heating. The improvement in the living conditions of Ulaanbaatar where a half of the Mongolian population lives is prioritized in the national development agenda, an important task for the Mongolian government considering the condition of 8 months of winter and requiring hot water even in summer.
- (Status of water supply facilities) The water supply and district heating system built in 1978 with the aid from the former Soviet Union exceed their lifecycle of 20 years, under urgent improvement and the demand will sharply increase due to rapid population growth in Ulaanbaatar.

<Fig. 3-4 Water supply and consumption forecast in Mongolia>

(단위: 10⁶m³/year)

년도	공급량	수요량	부족량
2010	109.9	87.3	(22.6)
2020	142.3	149.6	(7.3)
2030	142.3	220.7	78.4
2040	142.3	305.0	162.7

*Source: Master plan on the water sources development in Ulaanbaatar, Mongolia, KOICA (2012)

- Ulaanbaatar has established and propelled the master plan including the replacement of the cold and hot water supply system from 2002 to 2020 and installation of the wastewater treatment facilities from 2006 to 2020 but there exists only some progress due to difficulties in the budget and technologies.
- Therefore, Ulaanbaatar requests the project for the water (hot and cold) supply facilities through the official channel of the Mongolian government.

Data source
KOICA(2007). Report on the primary survey on improving the hot and cold water supply in Mongolia
KOICA(2008). Project cooperation report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA(2009). Final project management report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA(2012). Master plan on the water source development in Ulaanbaatar, Mongolia
Mongolian Statistics Yearbook 2010 (2011)

b. Interview data

- (By KOICA) It is confirmed that the urgency or priority for the project from the cooperation country is due to the expectation from the project.
- The reason for requesting the project includes energy efficiency, upgrading quality of lives, complementing energy losses and saving wasted resources.
- (Officials and administrator in the Public Facility Management Administration) The purpose of the project is to improve quality of lives and it is said that the project achieves remarkable outcome.

- The major changes from the project answered by the officials and residents are as follows.

"We suspended the operation of the machine rooms in the evening to save the cost for the hot water supply. However, the system changes to the continuous operation system without extra charges and achieves better heat efficiency".

"We can use the hot water even in the evening".

"We had to wait for a long time to use the hot water but don't have to do it any more."

"We saved the cost for the hot water more than expected. It is reduced to a half."

- Also, the local branch of KOICA takes the procedure for checking whether the achievement of the project is returned to the residents and other beneficiaries with meaningful effect through the ex-ante survey and coordination after getting approval from the Mongolian government and KOICA HQ checks the feasibility and realizations through official and unofficial channels to decide the project, meaning that sufficient ex-ante survey is performed in the project formation process.
- The result of the primary project is successful, expanded to the secondary project and it is right before completed when the evaluation team visits the site in August, 2013. The tertiary project is already requested to the Ministry of Economy and Development.
- The primary project selects the areas with high hot water consumption and the result of the current from the first project despite not under the evaluation primarily selects the areas with many heating issues for the second project.
- The consideration on the project for the effectiveness and impact is checked within the general range of the interview.

- As a result, it is understood that there exist reviews at the proper level upon the request from the cooperation country.
- However, the limitation in the 'evaluation of the project formation' is that there is no document or record which may understand the specific review and discussion during the project formation process and totally depends on the interview.

[Project effectiveness - Whether the project effectiveness is properly considered during the project formation process]

- Even though there are some missing points in the survey and research in the project demand, it may be assessed that other specific questions are very proper.
- First, the project is sure to have very high utility considering that the hot water supply is required for the residents.

[Realization of the project – Realized]

- Second, the existing district heating and hot water supply infrastructure (pipe system, organizational and systemic human resources, financial stability, etc.) are prepared and the realization is very high by planning the equipment and construction considering the compatibility with the replaced equipment.

[Ripple effect and impact in the project - Is meaningful ripple effect or impact considered]

- The expected ripple effect in the project formation process includes the technological development related to the district heating and water supply technologies. The water supply equipment improved from the ripple effect of the project is electronically connected and the effort in transforming the

system to the central control system is taken by the project for the Public Facility Management Administration.

- Also, as indicated from the survey on the residents, there exists high expectation for the long-term effect of the project, as well as the economic reinvigoration and technological development (through upgrading the quality of lives) (Refer to 'Assess the effectiveness - Long-term achievement').

D. Evaluation result of the project formation

- As mentioned above for the evaluation of the project formation, the 3 items including the consistency with the development policies of the cooperation country, consistency with the support strategies of Korea and relevance to the project are reviewed by the documents, interviews and other data and the evaluation result based on the relevance is summarized in the table below.

Item for the specific evaluation	Question for the specific evaluation	Score
Evaluation of the project formation - Relevance		3
1. Consistency with the development policies of the cooperation country	Whether the project meets the development strategies and policy direction of the cooperation country	3
2. Consistency with the support strategies of KOICA	Whether the project meets the development strategies and policy direction of KOICA	3
3. Relevance of the project selection	Whether the survey and study on the project demand are proper	2
	Whether the project shows high effectiveness	3
	Whether the project shows high realization	3
	Whether the project has meaningful ripple effect and impact	3

- The overall evaluation of the relevance is 'very proper' (based on the evaluation criteria with 3-point scale for a total score of 17 points from 6 indicators (maximum score: 18, 95% standard) (Refer to the attachment, the 3 points are assigned with more than 66.6% of the total score).

(2) Evaluation of the project planning

- The project planning reviews whether the planning and design are properly established based on the information achieved from the project formation process and the project direction configured by the development strategies of the configuration country and KOICA.
- The evaluation of the project planning reviews whether the goal is properly or logically configured, the project is systematically designed and the plan is properly established to achieve goals.

Item for the specific evaluation	Question for the specific evaluation	Evaluation standard
1. Feasibility for the purpose	Whether the short-, mid- and long-term goals of the project are properly established	Relevance
2. Design feasibility	Whether the project design is proper and the solutions to various issues in the project implementation are appropriate	

A. Feasibility for the purpose

- Documents related to the design check the items below to see whether the project goal is properly configured or the configured goal is proper

- Logical relation with the process in achieving the goals
- Whether to understand the external factors
- Whether to understand the major assumptions
- Whether to reflect on the design

- It is found out that the result chain or the Project Design Matrix (PDM), core documents to check the items above are not prepared during the project planning and design.
- Therefore, the review is performed on setting up the goals based on the ex-ante survey result, implementation result report and interim evaluation report.
- (Logical link with the process in achieving the goal) The purpose of the project during the ex-ante survey is 'to stably supply the drinking water and improve the basic healthcare infrastructure through improving poor cold and hot water supply system'.
- The implementation report states 'The heat efficiency in the machines rooms is improved and contributes to upgrading the quality of life by the improvement in the machine rooms for the district heating and water supply in Ulaanbaatar, Mongolia'.
- The purpose of the project stated in the interim report (with the goal for the development and higher goal) is modified 'Smoothly supply the heating and water source through improving the district heating and water supply machine rooms in Ulaanbaatar, Mongolia, improve the energy efficiency and contribute to upgrading the quality of lives' with 3 goals of heat and water supply, improvement in the energy efficiency and upgrading the quality of lives.
- The logical connection with the process in achieving the goal is not clarified in the ex-ante survey or following reports. However, it is judged to assume the logical relation with improvement in the quality of lives as the urban infrastructure because the water supply is a prerequisite for the living conditions in the city dwellers.

- Also, there is no clear statement on the general injection - activity - output - effect in the result chain but the injection, activities and output are specifically mentioned in the report, meaning that the process in the achieving the goal is sufficiently understood for the project design.
- However, it is found out that the sophisticated design and implementation are not clearly mentioned in the planning stage and the contents below appear when 74% of the budget is executed in the interim report.

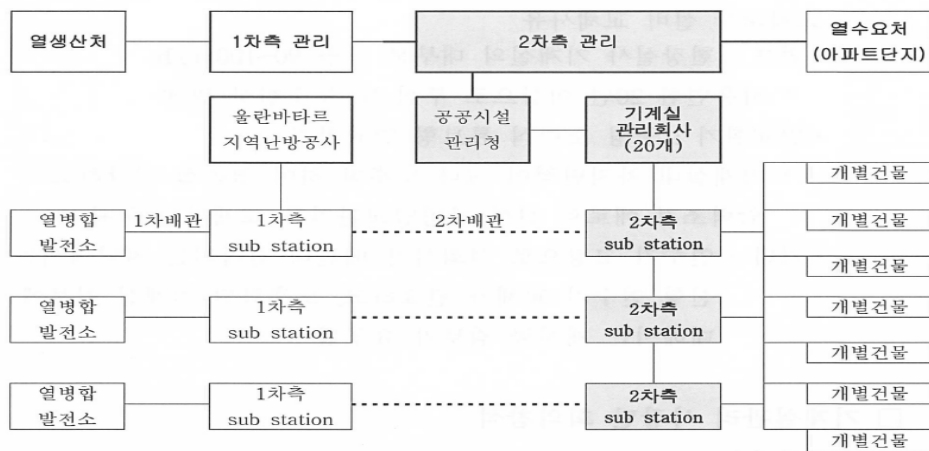
<Table 2-2 Interim report p. 5>

	Contents
Major project output (Output)	<ul style="list-style-type: none"> • Replace 44 machine facilities (pump, heat exchangers, etc.) • Enforce the management capabilities for the heat supply system
Project beneficiaries	<ul style="list-style-type: none"> • Ulaanbaatar citizens, engineers in the heat supply facilities - 44 areas, a total of 34,434 households, 120,980 residents
Major injection and activities	<ul style="list-style-type: none"> • Recipient country • Demolish existing facilities, provide new materials, support local engineers • Donating country (KOICA) <ul style="list-style-type: none"> - Supply equipment like pumps and heat exchangers, dispatch experts, invite trainees, etc.

- (Whether to understand the external factors and major assumptions) The analysis of the external factors and environment which may affect the successful implementation from the ex-ante survey to the final evaluation are classified in all the reports.
- Major schedules during the ex-ante survey are the interviews with the officials and site survey. In particular, the interview with the officials are with the representing directors in private companies which operate the machine room, a feature in the water supply system in Mongolia.

- It is confirmed that the complicated management system related to the water supply system is understood as a result of the ex-ante survey and the task range is understood and defined for each management entity and organization (Report on the ex-ante survey by experts, p. 15)

<Fig. 3-5 Management entity and task range for each organization>



- Also, various information including the understanding of the basic project subject of general status of Mongolia, climate, residential types and various environmental information is proposed as 'the contents of the feasibility survey' (Report on the ex-ante survey by experts, pp. 6 - 12).
- However, there is no discussion on how variable external factors affect the project, what the expected risk factors are and how political and cultural elements shall be managed for the successful project.
- Also, the prerequisites in the project procedure for the successful implementation (ex, period for the customs clearance, retention of the partners and related decision-makers for the project) are not clearly understood and failure to prepare the measures and risk management plans

shall be improved.

- (Reflection on the design) It is found out that no document related to the project design exists and it is difficult to understand whether major information and external factors for the project through the ex-ante survey and discussion in the project design are reflected on the targets.

Data source
KOICA (2007). Report on the primary survey on improving the hot and cold water supply in Mongolia
KOICA (2008). Project cooperation report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA (2009) Interim report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA (2007). Report on the primary survey on improving the hot and cold water supply in Mongolia

B. Design feasibility

- It is the discussion on 'whether the project design is proper and other solutions to various issues in the project implementation are appropriate' to achieve the goal depending on the configured purpose and the elements below are checked in the documents related to the project design.

- Relevance of the technical supports related to the feasibility review
- Relevance of the injection (budget, technology, human resources) - Effective, efficient
- Allocate the support from KOICA with the cooperation country against the total project cost
- Select the proper purchase method
- Consider risks, external conditions and major assumptions in achieving the expected effect of the project

- First, it is understood that there are no design documents required to discuss specific items in the assessment.
- Therefore, it is not proper to apply the evaluation indicators above and it is difficult to judge whether the major information, external factors and prerequisite for the process in the ex-ante design and difficult to judge whether the result chain is established.
- However, based on the interim report and the final report, it seems that various external factors and project elements are reflected as features in the machine rooms, selecting the equipment and training programs.
- For example, it seems that major considerations are reflected understood from the survey process of the project design based on the fact that the invitation and local training sessions are provided for the managers and engineers to effectively operate newly installed machine rooms and equipment.
- This is confirmed in the interviews with the PMC organizations and construction companies and even though it is not clarified in the survey and the planning process prior to the project implementation, there exist efforts to improve the effectiveness in the project through activities related to the design.
- There is feedback from the construction companies and cooperation organizations in Mongolia for every effective project management by the PMC in the evaluation of the project implementation and this assumes that the process exists for effective management of the project.
- The interviews with the PMC organizations confirm the possession of the project management and engineers of the PMC employees and the system and capabilities for the district heating company.

- This suggests that the capabilities of the PMC employees effectively perform the project design and implementation through the activities based on the certifications and experiences in the district heating or water supply.

C. Evaluation result of the project planning

- To assess the project planning, specific and feasible planning targets shall be considered to achieve the purpose of the project and shall be logically studied to assess whether the project is properly implemented. The result is as follows.

Item for the specific evaluation	Question for the specific evaluation	Score
Assess the project planning - Relevance		2
1. Feasibility for the purpose	Whether the short-, mid- and long-term goals of the project are properly established	2
2. Design feasibility	Whether the project design is proper and the solutions to various issues in the project implementation are appropriate	2

- The planning and design to improve the project effectiveness are not clearly stated due to fixed approaches and implementation of the project planning due to the features in the project. Therefore, it is judged that the consideration on the factors which affect various projects and reflection on the project design are done by the basic researches and surveys at the proper level during the planning process of the project.
- However, it is assessed 'partially proper' because the elements in the project fail to be precisely reflected on the design considering the development efficiency and insufficient document for the reference (ex, logical relation with achieving the target).

2) Efficiency

(1) Evaluation of the project implementation

- The evaluation of the project implementation is largely related to the efficiency and considers the items below during the implementation process.

Item for the specific evaluation	Question for the specific evaluation	Evaluation standard
1. Implementation against the plan	Is the project completed without modification based on the implementation plan?	Efficiency
2. Injection element	Are all the resources effectively injected into the purchase and construction?	
3. Structural issues	Are there any structural causes inhibiting the efficiency? Are the problems in the structural causes effectively solved?	
4. Participation from the cooperation country	How much does the cooperation country join the project design and implementation?	Relevance, Effectiveness

- The document data reviewed to assess the project implementation are as follows.

Data source
KOICA (2007). Report on the primary survey on improving the hot and cold water supply in Mongolia
KOICA (2008). Project cooperation report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA (2009) Interim report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia
KOICA (2009) Final project management report on the improvement project for the heat and water supply system in Ulaanbaatar, Mongolia

A. Implementation against the plan

- The implementation against the plan is reviewed from 2 aspects.

- Difference in the actual implementation from the plan
- Delay the project cost, procurement and implementation

- (Difference between the plan and the implementation) Based on the site survey result and the request from Mongolia, the improved machine rooms and the facility specifications are selected (considering the population, households, current usage and volume requested by Mongolia, completion report p. 4-3)
- The facilities selected based on the systematic and scientific data are installed without any large difference.
- (Project cost and delay in the procurement and implementation process)
The heating in Mongolia starts in September at the latest and the winter starts from October, confirming that the timetable is without delay.
- The original construction schedule is to start the construction at the end of March, 2009 and complete all the construction and test runs at the end of August in the same year.
- A total of 7 groups including the machine team (4 groups, 6 workers each), electric team (4 workers each) and basic construction team (2 groups, 3 workers each) are injected to demolish - install - test run for 44 machine rooms under the organic management of the construction companies.
- The first machine room will be completed in April 14, 2009 and the last test run for the machine room is terminated in August 28, 2009 according

to the final report and this means that there is no delay against the timetable.

- The PMC mentions the specific equipment list and construction timetable for 44 machine rooms with the demolition, installation and test run for each date.
- There exists the delay of 2 months due to the delayed renovation of the machine room building in Mongolia but the 7 groups are organically cooperated to manage the timetable, causing to complete the project without affecting the project timetable and construction cost.
- The interview with the PMC, construction companies and KOICA confirms that the project was effectively completed with no different opinion on the implementation.
- In particular, the residents in the project were not aware of the delays in the water supply due to the project delay.
- Therefore, the implementation against the plan is considered very effective.

B. Injection element

- It is the item to check whether all the resources are effectively injected during the purchase and construction and considers the issues below.

- Price changes in various equipment during the project
- Additional cost due to unexpected technical flaws
- Unexpected cost on the environment

- The 3 issues mentioned above focus on the measures against the situation including additional cost from the common plan and how to solve the issues from the actual implementation process.
- The project clarifies the measures against the construction cost increase, plan to secure the spare parts and issues after the construction (Final report, p. 3-11 - 13).
- For example, the labor cost would rise due to the reinvigorating local construction market. Therefore, it is agreed to adjust the construction cost based on the cooperation with the Project Steering Committee and the increase would be reflected by adjusting the cost for the machine room renovation based on the proceedings³⁾.
- There is no unexpected additional cost which affects the range of the project in the implementation process. Rather, the project elements not included in the range to upgrade the effectiveness and the development of the project are proposed and implemented after reviewing the feasibility.
- Improving the image of the machine room building and constructing the training center for the district heating are implemented with the budget of 180 million KRW (177,724,800 KRW), meaning that it is the result of the effective financial and project management and considered as an exemplary case of improving the effect of the project.
- The table below shows the summary of the project contents and budget.

3) The project steering committee (PSC) consists of the KOICA HQ, KOICA Mongolia branch, PMC companies, construction companies, Ulaanbaatar government and relevant organizations including the Public Facility Management Administration

<Table 3-2 Final report, p. 4-48>

Project name		Expected project cost(KRW)	Period
Improvement in the image of the machine room building	Painting construction	134,084,800	About 45 days
	Replace the entrance door	18,360,000	
	Install the signboard	8,800,000	
	Sub-total	161,244,800	
Project for supporting the construction of the district heating training center		16,480,000	
Total		177,724,800	

C. Structural issues

- It is to check structural issues which may impede the successful project implementation mainly by the interviews with the stakeholders.

- Constraints recognized by each stakeholder

- It is understood that no special structural issues only for the project was found except common issues including not residing the PMC organizations, issues due to not being familiar with the culture and custom of Mongolia, difficulties in the cooperation due to low sense of owner with the officials in the cooperation countries.
- However, construction companies and the PMC requiring close cooperation face clear limitations in the special political situation in Mongolia that all the public officials are replaced if the regime changes by the presidential election.

- Also, complicated interest among a lot of organizations involved in the district heating may impede the efficiency and effectiveness.
- For example, the heat fusion power plant is in charge of producing the heat mainly with coal and there are other organizations in charge of transferring the heat (Ulaanbaatar District Heating Company) and in charge of delivering the heat from the residential area to the end users (Public Facility Management Administration).
- In addition, there are other management entities in the apartments where the residents or end-users live and machine rooms equipped with pumps and equipment with different specifications depending on the stories of the apartment.
- The study seems to understand such systematic problems in the project formation and planning process and take measures in the discussion process but some apartments fail to experience the improvement.
- It is discovered from the interview that there is no flowing pipe in some apartments, failing to exert the function of the pump.
- Most apartment buildings have pipes to supply the heat water and the pipes returning to the machine room (to maintain the pressure and re-heat the cooled hot water to the proper temperature).
- It is said that the exceptional cases fail to be understood because there is no total enumeration on the environment for the end-users (understood by the sampling during the ex-ante survey for the design).
- It is found out from the interview with the construction companies and residents that the equipment on the end-user side has not been improved at all. This suggests that it is important to perform the survey and study in the project planning and design phase to upgrade the effectiveness.

D. Participation from the cooperation country

- Participation from the cooperation country is important in the effective project and the success.
- Therefore, the study considers the participation level of the cooperation country in the evaluation of the implementation from the viewpoint of the efficiency and relevance.

- Participation of the cooperation country in the project selection and purchase procedure

- It is the Ulaanbaatar Public Facility Management Cooperation and join the capacity calculation by providing required information in the selection process of the machine room at the early stage by sharing the information on the status of the machine room.
- The administration proposes the capacity of the equipment required for the machine room based on its direct calculation and cooperates with the PMC in the final selection process.
- According to the interim report, the PSC is formed with the KOICA HQ, KOICA Mongolia branch, PMC company, construction companies, Ulaanbaatar government and the Public Facility Management Administration in the planning stage but fails the cooperation on major issues due to not being implemented.
- However, in the process of the implementation discussion process, it seems that it is possible to effectively propel the project in the following implementation process by clarifying the tasks and responsibilities of the

cooperation and donating countries, discussing the solutions in advance and documentating the process (proceedings).

- Here is the summary of the proceedings between the 2 countries for the project direction.

<Table 3-3 Summary of the proceedings between the 2 countries>

Korea	Mongolia
<ul style="list-style-type: none"> • System improvement construction <ul style="list-style-type: none"> - Cold and hot water pumps in the machine room under the project, Design, installation and test run to replace the heat exchangers 4MM to dispatch the experts for the project management and test run - 2MM for the PM and 2MM for the test run and control Provide invitation training and expert dispatch for the related fields - Dispatch experts: 2 in the machine operation (7 days), 1 in the automatic control (3 days) 	<ul style="list-style-type: none"> • Provide visa, tax exemption, safety measures, emergency and office for the Korean experts • Form the project implementation committee and input the proper human resources • Administrative measures including customs clearance for the equipment, in-land transport, storage and approval for the design drawings • Remove the aged equipment in the machine room 1 week before installing the new equipment • Prevent and solve the public complaints due to the construction, promotion to the residents

E. Evaluation of the project implementation

- The evaluation phase reviews the specific items below and the result and score are as follows.
- The implementation against the plan is achieved without large modification or shrinking the range and the injection items are assessed to lead to effective output production without additional cost or losses by proper measures against risk factors within the range of the budget.
- The elements understood as the structural causes are managed not to

largely impede the project through the aggressive communication and efforts by the residing officials and the cooperation country join the project implementation process at the proper level based on the implementation agreement, contributing to the successful implementation of the project.

- The evaluation of the project implementation is effective with 83.3% (10/12) (Assessed effective with the scoring guideline for effective evaluation if the project is performed within 100% of the budget)

Item for the specific evaluation	Question for the specific evaluation	Score
Evaluation of the project implementation - Effectiveness		3
1. Implementation against the plan	Is the project completed without modification based on the implementation plan?	3
2. Injection element	Are all the resources effectively injected into the purchase and construction?	3
3. Structural issues	Are there any structural causes inhibiting the efficiency? Are the problems in the structural causes effectively solved?	2
4. Participation from the cooperation country	How much does the cooperation country join the project design and implementation?	2

3) Sustainability

- The sustainability, one of the 5 DAC standards, is configured as an evaluation item and the sustainability for the project is checked from the 2 aspects below.

Item for the specific evaluation	Question for the specific evaluation	Evaluation standard
1. Human and systematic sustainability	Is there any stability in the human or institutional system to back up the project sustainability?	Sustainability
2. Financial sustainability	Is there any financial stability to back up the project sustainability?	

A. Sustainability for the human and institutional system

- 5 aspects are considered to check the human and systematic sustainability

a. Document analysis

- First, the review is performed on the application of the improved equipment to the life cycle and the existence in the human resources and capability for the maintenance.

- Whether to secure human resources for the proper maintenance and management
- Concreteness and realization for the exit strategy
- Concreteness and realization for the ex-post measures
- Concreteness and realization for the ex-post management
- Ownership and willingness of the cooperation country for the project

- (Whether to secure the human resources for the proper management and maintenance) The Public Facility Management Administration, the inspection organization of Mongolia, has maintained and managed aged water supply facilities and equipment since 1990s and is the organization equipped with administrative power and engineers to handle complaints and collect heating and water fees to the residents, as well as engineers and managers.
- The administration has secured sufficient manpower from the socialist regime and is considered enough number of employees but is not equipped with the capabilities for the maintenance and management of the specially improved equipment and facilities in the machine room.
- Therefore, the project faithfully provides the training to the officials (managers and engineers) in the administration to utilize the improved facilities to the end of the life cycle even after the project.
- The training result is included in the final report and the training programs by the technical experts are provided in Korea and Mongolia. It is reported that all the trainees achieve the knowledge required for the work.
- There are 22 participants in the invitation training and 80 Mongolian technicians in the local training.
- The interview shows that there is no major difficulties in operating the facilities owing to the effective training.
- Here is the overview of the invitation and local training programs.

<Table 3-4 Invitation training>

Course	Contents		
District heating User facilities	Classroom training (4 days)	1 st day	General district heating Customer service activities for the district heating
		2 nd day	Differential pressure in the machine room and flowing adjustment valve Major devices in the user facilities (heat exchanger)
		3 rd day	Pump, expansion tank Automatic controller
		4 th day	Heating gauge for each household, thermostat, heating water quality management
	Field training (6 days)	<ul style="list-style-type: none"> • Features in the facilities of the user machine room • How to operate facilities in the user machine room • How to maintain the user machine room • Customer service • Visit the manufacturing companies 	

<Table 3-5 Dispatch the expert>

Course	Contents	
District heating User facilities	Classroom training (3 days)	General district heating Customer service activities for the district heating Differential pressure in the machine room and flowing adjustment valve
		Heat exchanger, pump, expansion tank Automatic controller
		Heating gauge for each household, thermostat, heating water quality management
	Field training (4 days)	Features in the facilities of the user machine room How to operate facilities in the user machine room How to maintain the user machine room How to respond the customer

- (Specific features and realization of the exit strategy) The training is also a major exit strategy of the project and there is no report or opinion from the interviewees that they feel difficulties due to insufficient training or knowledge except the actual maintenance of the facilities.
- Here, the exit strategy focusing on the training is a realistic alternative due to the limits in the international development cooperation project but in cases, it helps upgrade the sustainability where the additional measures shall be sought due to transfer or retirement of the trained workforce.
- It is possible to transfer the knowledge and technology acquired from the training by nurturing lecturers and providing training programs and it would be desirable to support simple problem-solving capabilities by using tools or data for the manual.
- The construction company produces and distributes the log book for each machine room and manual.
- However, the manual and training materials do not cover the specific issues and all the labels and electronic displays contain only English, failing to understand the on-screen instruction.
- The logbook is provided to cover 2 years.
- It is observed that the logbook provided by the construction companies is thoroughly recorded and managed and the site inspection is performed based on the required capacity and criteria for the actual operation based on the log data. (Refer to the sample of the log)

<Table 3-6 Operation log of the machine room in Mongolia>

УДДТөвүүдийн параметрийн мэдээ

2013 он 07 сар 20 өдөр

УДДТ-өөс гарч буй дулааны параметр				Цэнэр урмы даралт		Харгалзаны халуун ус		Цэнэр урмы тоолуурын замт	Цэнэр урмы тоолуурын замт	4-р хэлтэний даралт	Гарц газрын температур	Машинны гарц/ус
Даралт		Температур		Насаны амьс	Насаны даралт	Даралт	Температур					
P1	P2	T1	T2	P	P	P	T					
а	а	а	а	6.2	5.4	5.2	55	04326.0	а	10.0		
				6.2	5.4	5.2	53	04334.2		10.8		
				6.2	5.4	5.2	54	04341.0		11.6		
				6.2	5.4	5.2	54	04353.8		12.8		
				6.2	5.4	5.2	53	04366.2		10.0		
				6.2	5.4	5.2	56	04378.1		12.1		
				6.2	5.4	5.2	54	4383.3		10.0		
				6.2	5.4	5.2	56	4386.1		10.0		
				6.2	5.4	5.2	48	4418.1				
				6.2	5.4	5.2	50	04427.0		10.8		
				6.0	5.4	5.2	52	04429		11.0		
				6.2	5.4	5.2	50	04458		10.8		
				6.2	5.4	5.2	52	04450.8		11.0		
				6.2	5.4	5.2	52	04454.5		10.8		
				6.2	5.4	5.2	48	04469.0		10.0		
				6.2	5.4	5.2	50	04473.4		10.8		
				6.2	5.4	5.2	54	04483.2		11.6		
				6.2	5.4	5.2	56	04495		12.1		
				6.4	5.4	5.2	56	04512.2		9.6		
				6.5	5.4	5.2	52	04520.3		9.6		
				6.6	5.4	5.2	54	04541		11.4		
				6.2	5.4	5.2	50	04555.8		10.8		
				6.2	5.4	5.2	52	04561.0		10.8		
				6.0	5.2	5.0	50	04582.4		11.0		

- (Specific features and realization of the follow-up measures and management) It is found out that there is no clear project element or measures for the follow-up measure or management.
- However, it is to minimize the requirement for the follow-up management and measure considering that the additional projects (improve the image of the machine room building and establish the training center for the district heating) and the project includes the spare parts in the bidding to upgrade the effectiveness of the project.
- Most of all, the project uses the facilities with parts to be purchased in Mongolia and there are Korean companies in the country, meaning that the follow-up measures and management are highly realized to upgrade the sustainability.

- The 33 findings and improvements relative small compared to the project size are connected to the following project by the discussion with related organizations after the project for the requirement of the follow-up project owing to the confidence with the organizations⁴).
- (Sense of ownership and willingness for the cooperation country government for the project) Even though the project is supported by the free aid from the Korean government, it is clear that the officials in the cooperation country have high interest and sense of ownership by considering that the officials indicate even minor errors and take efforts for the maintenance.
- The Public Facility Management Administration already performs some improvement projects for the heat and water supply system with the ADB and JICA and plans to continuously upgrade the system through paid and free aids with other donating organizations.
- Most of all, the Public Facility Management Administration itself secures the budget after the project to construct the central control system for the heat and water supply system and already starts the task of moving the heat supply pipes and facilities to the underground common area.

b. Interview data

- The interviews with the officials show that the machine rooms and equipment covered by the project are registered and managed by the 'Property Registration Bureau'.

4) The following or the secondary project shows the construction of the workshop to produce the parts for the maintenance of the machine room. It is expected to upgrade the sustainability and capability for the local workforce.

- The Public Facility Management Administration, the executing organization for the project, is a major organization with 50000 employees and 310 engineers joined the training and the certification from the organization is a requirement for the machine room operation, causing 300 engineers to achieve the certificates after the training.

B. Financial sustainability

- Price of the output from the supporting project
- Financial soundness in the project organizations
- Secure the budget for the proper management and maintenance

- The project team requested the Public Facility Management Administration to submit the data for the evaluation but it has not provided the data yet despite the request from the local coordinator and the evaluation team.
- Therefore, it is difficult to assess the financial sustainability due to failing to secure the raw data for the energy efficiency, one of the achievement in the project, securing the budget through the operation data and financial soundness.
- However, as mentioned before, the administration is continuously improve the heating and water supply system by its own budget and seeking to improve the efficiency through the central control system, guessing to improve the financial sustainability.

C. Result of the sustainability evaluation

- The sustainability is assessed by reviewing 2 specific items and the result is as follows.

Item for the specific evaluation	Question for the specific evaluation	
Assess the sustainability		3
1. Human and systematic sustainability	Is there any stability in the human or institutional system to back up the project sustainability?	3
2. Financial sustainability	Is there any financial stability to back up the project sustainability?	3

- The local heating system in Ulaanbaatar was established from the aid of the former Soviet Union and the equipment and facilities were outdated. However, the human system for the management and operation is relatively well-organized.
- In addition, the manpower and the management system to collect the fees as a measure to secure the financial stability. The water supply is immediately suspended without paying the fees in the due date and most users faithfully pay the fees for the water use.
- The financial revenue additionally secured by upgrading the heat efficiency is used for the improvement project by the public facility management administration, maintenance and establishment of the central control system, meaning to secure the financial sustainability.
- Therefore, it is assessed "very sustainable".

4) Effectiveness and Impact (Outcome evaluation)

- The project performance is a crucial element in the ex-post evaluation.
- The evaluation configures the result chain by specifically classifying the performance from mid- and long-term and short-term output and collects document, interview and survey data to assess the item with various indicators.
- The evaluation analyzes the project goal including the improvement in the living conditions and heat efficiency and provides the evaluation items below.

Evaluation item	Item for the specific evaluation
Mid-term performance	Improve the residential lives
	Decrease the diseases
	Save the resources
	Transfer related technologies
Short-term performance	Save the costs for the water supply
	Upgrade the heat efficiency
	Stable water supply

A. Short-term performance

- The short-term evaluation items are to save the cost for the water supply, improve the heat efficiency and stably supply the water.

a. Save the costs for the water supply

Survey data

- (Cost for water use per household) Average 3.6/5 point
- 3.6 points for the saving costs with a lot of positive answers
- Meanwhile, the respondents give 2.7 points for saving the living cost in the winter.
- This suggests that the cost for the household water use is saved but there exists limitation in the actual cost cut due to reducing the cost by increasing other expenses.

Interview data

- Most of the residents in the interviews answer that they do not recognize the satisfaction.

"The water cost is a little higher than expected."
"I pay a lot of money compared to the size of the house."

b. Upgrade the heat efficiency

Document data

- (Upgrade the heat efficiency) The water supply system is improved and the overall heat efficiency is improved with saving 20% of the electricity, 10% of the heat and 15% of the water, as well as reducing unnecessary leakage (Source: The UB Post (2009))

Interview data

- The interviews with the officials in the Public Facility Management Administration show that the pumps for hot water heating are replaced from Russian to Korean products, improving the efficiency.

"The efficiency and effectiveness are upgraded by replacing the pumps to Korean ones.

The usage is saved by 18% for the electricity, 11% for the heating and 9% for the water supply.

Meanwhile, the Russian pumps show poor performance due to 24-hour operation but the Korean pumps show high efficiency for the operation depending on the uses."

c. Stable water supply

Document data

- (Number of users) The beneficiaries for the project are more than 300 companies and organizations and 7,555 households living in 75 apartments in Bayangol (Source: The UB Post (2009)).
- The number of users, configured as one of the specific indicators for the stable water supply, shows no large changes before and after the project.
- This is because that the people live in the apartment with a predefined number of residents.
- Therefore, the result suggests that the number of users is not a proper indicator.

Survey data

- (Stable water supply - supply volume) Average 2.3/5 and 3.2/5 points
 - Most respondents show negative opinions on the 'stable water supply'.

- They answer normal for the 'sufficient electric supply - (Stable water supply - Expected life cycle of the equipment) Average 3.4/5 point - There exist a lot of positive answers on the question that the heat supply system may be used for a long time in the future.
- (Stable water supply - number of users) Average 3.0/5 points
 - The respondents answer normal on the item of more beneficiaries after the project.
- (Stable water supply - consumption)
 - Average 3.1/5 points on the question, 'Increase the demand for the electric service'
- Average 3.1/5 points on 'Increase the actual use amount'
 - Positive answer of 3.6/5 points on the item, 'The project was required at that time'
- (Stable water supply - suspension rate) Average 2.3/5 and 2.1/5 points
 - A lot of negative opinions on 'The electric supply is sometimes suspended'. It means that there are a lot of opinions which agree the suspension.

Interview data

- The interviews with the local residents show that the user satisfaction is not high. It is due to frequent water supply suspension and failing to stably supply the water.

"The water supply is suspended twice a year."

"Only cold water is supplied in the morning and hot water in the evening. Also, the temperature difference is too large."

"I cannot feel warm at all due to too large temperature difference."

"The temperature has been stabilized after the project."

"I am spending winter wearing more clothes due to cold."

"The hot water supply is still suspended for a long time in the summer."

B. Mid-term performance

- The mid-term performance includes the improvement in the residential life, decrease in the diseases, saving resources and related technology transfer.
- The reliability for the evaluation is upgraded by collecting the same document, interviews and survey data to review the mid-term performance.

a. Upgrade the residential lives

Document data

- (Satisfaction) The UB Post shows that the beneficiaries for the project are largely satisfied with the improvement in the water supply from the satisfaction survey.

Survey data

- (Improve the residential lives - Satisfaction) Generally, the respondents give 2.3/5 points average on the question of satisfying the improved system from the project.
- Also, a lot of people fully agree that they are under the benefit from the heat supply system with the average score of 4.06/5.

Interview data

- The people used to wait up to 5 minutes to use the hot water. However, the system improvement provides the hot water without delay, causing to save the water cost from Mongolian and Korean officials. The interview result of the building workers is as follows.

"I sometimes use the shower room in the building for smooth supply of cold and hot water where I did not use in the past."

- Most of the residents do not recognize the cost save, not affecting the quality of lives in the aspect of the cost.

"The water cost is a little higher than expected."
"I pay a lot of money compared to the size of the house."

- However, there are a lot of positive answers from being convenient to daily lives including washing the dishes, laundry or shower.

"I feel comfortable in using the hot water for the dish washing or laundry."
"It is convenient to always take a shower."

b. Disease decrease

Survey data

- (Disease decrease) The respondents fully agree 'They do not feel bad often thanks to the improved living condition (from upgrading the heat supply system)'.
○ Other significant data for the disease decrease is found except the survey.

Interview data

- It is specifically questioned in the interviews with the residents but they strongly feel the winter diseases due to the air pollution rather than the improved living condition from the hot water supply, failing to check the contribution from the water supply in other data.

c. Save the resources

Survey data

- (Save resources - Heating cost in the winter per household) The respondents agree 'The improved system helps save the resources' with the average score of 3.8 points.

Interview data

- The interviews with the residents show that they do not recognize the saving in the household heating cost as satisfied but answer that the system helps save the resources including 'less leakage' and 'save the time and water'.

"(Heating cost per household) The water cost is higher than expected."
"(Heating cost per household) I pay a lot of money compared to the size of the house."
"Less leakage of the tap water"
"Save the time and water"

d. Transfer related technologies

Document data

- (Transfer related technologies) The UB Post reports that the maintenance becomes easier owing to the effectively improvement in the maintenance and management of the district heating facilities, saves the operating cost and upgrades the equipment durability.

Survey data

- (Transfer related technologies - acquire new technologies) The question on achieving the new technologies from the project achieves the average score of 3.5/5 points.
- (Transfer related technologies - status of the system maintenance) The average score of the question on the well maintenance of the system is 2.1/5 points.

Interview data

- The interview with the head of the Public Facility Management Administration shows that most engineers who joined the invitation training by KOICA enabled to achieve the certifications for the machine room operation.

"310 engineers attended the training and 300 engineers enabled to achieve the certifications thanks to the invitation training by KOICA.

Only those who have the certifications are allowed to operate the machine room by the Public Facility Management Administration and a lot of engineers can operate the machine room."

- Also, there are small machine rooms privately operated to supply the hot water and heating to apartments in Ulaanbaatar and they request the training and consulting.

C. Long-term performance and impact

- Various items below may be considered for the long-term performance and impact

- Upgrade the quality of lives
- Upgrade the health conditions for the residents
- Population increase
- Revitalize the local economy
- Industrial technology development
- Other effects for the local communities
- Employment
- Economic development effect

- Various data are reviewed and the overall efforts in the economic development by Mongolia, support from the international community and revitalizing the resources market shift the long-term performance items upward.

- (Population increase) The population of Ulaanbaatar gradually increases in 2000s and it is found out that most of the population is concentrated in the city considering less population changes in the outside urban region.

<Table 3-6 Status of the population change in Ulaanbaatar and Mongolia>

Unit : people

	2007	2008	2009	2010	2011	2013
Ulaanbaatar	1025,274	1067,472	1106,719	1161,785	1,206,610	1,226,991
Urban	1601.00	1659.20	1713.30	1760.40	-	-
Rural	1034.20	1024.30	1022.50	1020.40	-	-
Total	2,595,068	2,632,834	2,672,223	2,712,738	2,754,209	2,796,484

*Source: NSO(National statistical office of Mongolia), Statistics Department of UB 2012

<Table 3-8 Trend in the population change in the districts of Ulaanbaatar>

	2006	2007	2008	2009	2010	2011
Baganuur	25,731	25,969	25,877	25,875	26,905	27,036
Bagakhangai	3,827	3,864	3,742	3,615	3,647	3,727
Bayangol	160,818	165,159	169,278	174,851	185,104	192,111
Bayanzurkh	211,614	221,565	235,192	250,241	265,997	283,289
Songinokhai rkhan	211,056	220,295	232,326	241,410	252,264	257,140
Sukhbaatar	123,041	129,486	133,108	135,103	136,917	137,834
Nalaikh	27,297	28,152	29,115	30,215	31,458	32,513
Khan-Uul	90,925	94,670	98,815	104,166	112,055	119,843
Chingeltei	132,883	136,014	140,019	139,765	147,438	153,117
Ulaanbaatar total	987,192	1,025,174	1,067,472	1,106,719	1,161,785	1,206,610

*Source: Population and economic activities of UB. Division economic statistics of statistics

- ((Economic development) The monthly household income of Mongolia including Ulaanbaatar is considered as the indicator on the economic development and it shows that the average income of the Ulaanbaatar residents is above the national average.

<Table 3-9 Average household income in Ulaanbaatar and Mongolia>

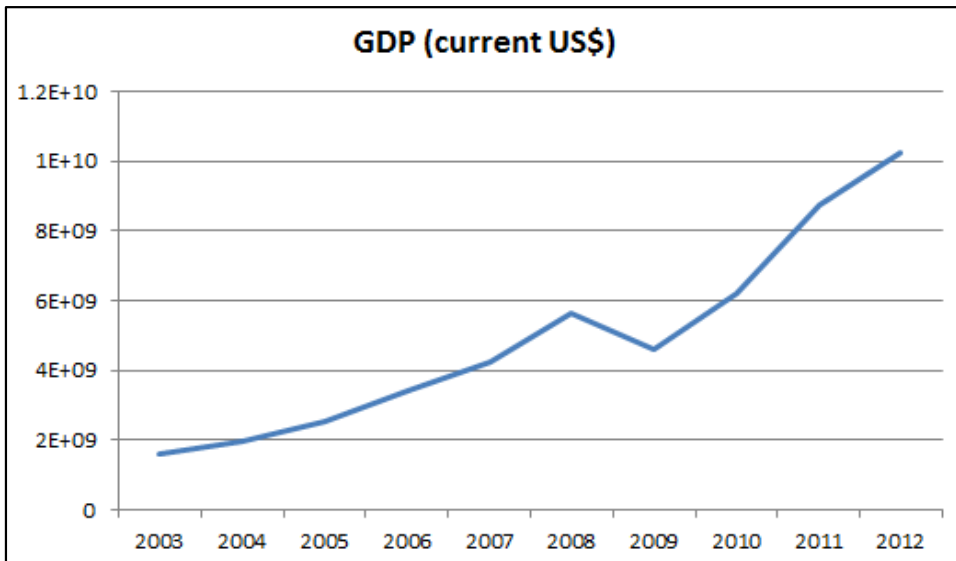
Unit : MNT

Item	2007	2008	2009	2010	2011
Average household income in Ulaanbaatar in Mongolia	290,755	425,327	487,093	529,302	697,554
Average household income in Mongolia	263,681	363,594	402,525	448,027	573,541
Average household income difference between Mongolia and Ulaanbaatar	27,074	61,733	84,568	81,275	124,013

*Source: NSO(National statistical office of Mongolia), Statistics Department of UB 2011

- The GDP of Mongolia gradually increases from 2003 to 2011.
- However, it may be considered that the economic development based on the economic indicators mean the efforts from the cooperation country for overall development and growth and the attendance to the infrastructure improvement project rather than the direct impact from the project.
- It is impossible to perform the evaluation at the proper level only with such a macroscopic indicator. The evaluation secures the complementary data through the recognition test for the mid- and long-term project through the survey and the evaluation is performed with the triangulation, as well as the survey result.

<Fig. 3-10 GDP>



*Source: WB Indicators

Survey data

- (Long-term performance - Impact on the local community) Most respondents do not agree 'The improved heat supply system rarely affect the local community' with 2.13 points. It means that the system is effective.
- (Long-term performance - employment) Most respondents agree 'More employment in the local community' with 3.4 points, suggesting the revitalizing economy in the region. However, it shall not be interpreted as the direct result of the project.
- (Long-term performance - revitalizing the local economy) In addition to the project, the residents positively expect that the local economy would be revitalized in the future from the efforts of Mongolia and international community. (3.81)

- (Long-term performance - industrial technology development) The respondents fully agree 'There would be technical development from the project in the long term' with 4.1 points, meaning that the people expect the technological development as a long-term performance.
- (Economic development) In addition, the respondents show negative opinion on that the project brings negative impact and positive changes (3.54), meaning more positive evaluation.
- However, in the long term, most respondents do not agree that the project would upgrade the quality of life at the local or individual level (2.33, 3.05).

Interview data

- (Upgrade the quality of life) The interview with the head of the Public Facility Management Administration shows that the project positively impacts the upgrade of the quality of life.

"The main purpose of the project is to provide water supply and heating without inconvenience to the beneficiaries. The project achieves remarkable performance and reported by the news media."

"The actual benefit for the beneficiaries is that they can use the hot water even in the evening because the system continuously operates, meet the satisfaction of the water degree (50℃) and saves the water uses."

D. Evaluation of the effectiveness / impact (result of the performance evaluation)

- The project performance is classified as short-, mid- and long-term output and indicators are selected for each performance to review the effectiveness and impact through the survey, statistical data and interview for each indicator.
- First, here is the recognition in the development effect felt by the beneficiaries. The data are collected from the survey and quantified based on the performance evaluation matrix. It may be considered as the effect assessed by the residents and reflected 50:50 on the final score and the overall score from the evaluation team.

Evaluation entity/item	Resident recognition
Short-term	2.96
Cost of the water use per household	3.58
Stable water supply	2.85
Mid-term	2.89
Transfer related technologies	2.82
Save the resources	3.28
Improve the residential lives	2.26
Long-term	3.45
Economic development effect	3.41
Employment	3.18
Industrial technology development	4.06
Upgrade the quality of lives	3.24
Population increase	3.72
Revitalize the local economy	3.81
Other effects on the local community	3.26
Sustainability	3.39
Grand Total	3.28

- (Short-term performance) First, the improvement in the heat efficiency in the water supply is achieved (about 30%) among the primary output of the project and no more suspension on the heat supply due to errors or misuse of the machine room or the equipment is reported owing to the stabilization in the system.
- However, the data including the cost and profit structure for the actual heat supply and equipment operation are not provided, failing to be reflected on the evaluation.
- The short-term performance felt by the residents is the improved convenience including stable hot water supply and saving the standby time, as well as saving the hot water cost owing to reduced amount of the water waste.
- However, in some cases, the beneficiaries felt no changes because the equipment in the end-user including the pumps installed in each building occurred.
- (Mid-term performance) There is no actual and meaningful cost decrease (more than 10 - 20%) in the heating cost for the residents.
- The local officials and residents do not recognize the mid- and long-term effects.
- Here is the scoring result of the project for the short- and mid-term performance.

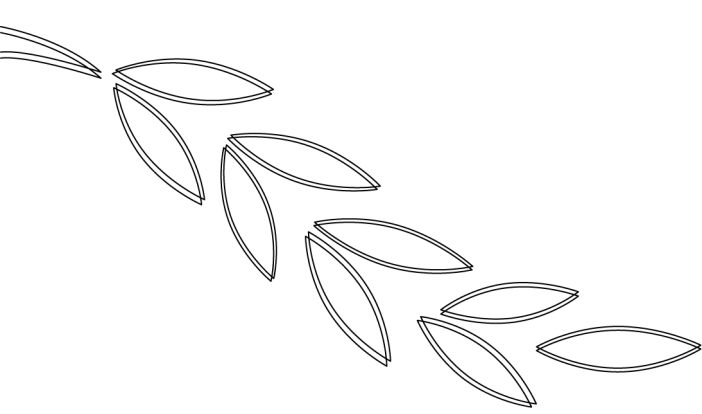
Evaluation item	Specific question for the evaluation	Score
Improve the residential lives	Recognition from the residents in the project site	1
	Upgrade the life	
Decrease the diseases	Save the heating cost for households	1
Transfer related technologies	Effective maintenance status of the district heating facilities (Service suspension, overall problems, solving and process)	3
Save the costs for the water supply	Cost of the water use per household	3
Upgrade the heat efficiency	Heat efficiency	3
Stable water supply	Supply volume	3
	Required volume / Consumed volume	
	User satisfaction	
	Water supply cut	
	Stable temperature and pressure	
	Number of users in the water supply system	
Total score for the project effect (Short – and mid-term performance)		14/18

- (Long-term effect and impact) It is difficult to expect a wide range of economic and social impact due to partly improving the cold and hot water supply system.
- However, in the aspect that the project contributes to the long-term development through the support meeting the goals and the urban development policies of the Mongolian government, the project may contribute to bringing the ripple effect and the impact on the national and Ulaanbaatar efforts including the mid-term development plan to some extent.
- Therefore, the score is assigned not the impact evaluation now, but the expected impact in the future. The residents show very positive attitude to

the long-term performance and have positive views on the development in the industrial development long-term economic growth.

Evaluation item	Specific question for the evaluation	Score
Upgrade the quality of lives	Residents in the project site Self-recognition	2
Population increase	Population increase in the project site	3
Revitalize the local economy	Economic indicators in the project site	3
Industrial technology development	The project technologies	3
Other effects for the local communities	Satisfaction	3
Economic development effect	Household income	3
Total		17/18

- The evaluation score of the effectiveness / impact uses the total score after assigning scores for each indicator and the final score is calculated by divide with the maximum available score. The total score of the effectiveness and impact is 31, 86% of the maximum score of 36.
- Therefore, the project performance may be assessed "More than 80% of the plan" and effective.



IV. Conclusions and Recommendations

1. Overview of the evaluation result
 - 1) Summary of the evaluation
 - 2) Grade
2. Recommendations



1. Overview of the evaluation result

1) Summary of the evaluation

- The 'project for improving the district heating and water supply in Ulaanbaatar, Mongolia' is assessed proper and effective in the aspect of the project formation, planning, implementation and effect. The Ulaanbaatar Public Facility Management Administration, the first beneficiary in the cooperation country, is very satisfied with the project result and wishes additional support and facility improvement through following projects.
- The residents or final beneficiaries do not recognize the system improvement project but state that they recognize the changes in the hot water supply and are satisfied with the result as a whole.
- It is assessed as an exemplary case considering the 5 evaluation items of the DAC.
- (Relevance) The project is assessed very proper for the local demand, supporting strategies of Korea, specific policy tasks and national development strategies of Mongolia.
- Also, it is assessed that the request from the cooperation country and the expertise in Korea are sufficiently considered in the project selection process.

- (Efficiency) The project is assessed efficient through the efforts from construction companies with rich experience and systematic management of the special organizations.
- (Effectiveness/Impact) Most expected performances including upgrading the heat efficiency and stable heat supply are achieved but some beneficiaries do not feel the improvement because the old apartment facilities inhibit the improved functions. Also, the cost of the heat supply reduced from the improved efficiency is not reflected on the supply cost for the financial beneficiaries, making the people still pay high price.
- However, all the beneficiaries show positive forecast on the long-term impact and expect the economic and technological development in the long term from the project.
- Therefore, the effectiveness is assessed 'more than 80% of the expected effect'.
- (Sustainability) The project is assessed to keep providing the heating and hot water to stabilize social stability in the aspect of quality of life

2) Grade

Grade	Relevance	Effectiveness /Impact	Efficiency	Sustainability	Total
Very Successful	3	3	3	3	12



2. Recommendations

A. Result-based design and management

- The final goal and the result-based design and management - Understand the process of finding out the result in the reverse direction with the final goal as the starting point and reflect on the project design by understanding major factors for the performance.
- Not only the design, but also the major process in achieving the goal is used as the milestone for each phase to effectively perform the result-based project management.
- This eventually provides the basic framework for the monitoring and evaluation, as well as the monitoring information required for the project entities to enable them to make decisions based on the objective data and information.

B. Thorough analysis of context, stockholders, issues, and culture

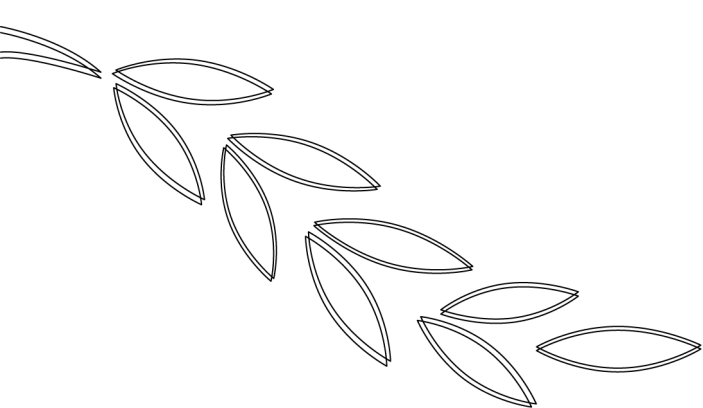
- The mandatory ex-ante studies and surveys shall be performed to plan the management and the result-based project design.
- The factors which affect the project shall be understood and the interaction and correlation of the project elements, national, regional and cultural factors shall be analyzed to provide required data for the design and plan on improving the effectiveness.
- This includes the research topics or ex-ante evaluation⁵⁾ which may assess

the effect or impact through the national strategies and future projects and establishment of the program theory or logic model through in-depth studies or surveys

C. Meet the international standard and quality

- The project attempts to use high quality materials and meet the international standards and above. It is desirable to continuously observe the standards to reduce the maintenance cost and upgrade the durability of the facilities even though the scope of the project is contracted in the future.
- Also, the possibility for joining the future development project may be increased by buliding the confidence on the companies and upgrading the image of Korea in the cooperation country.
- The result of the interview with the administrator of the public facility management states that most of the equipment is made in Korea and there exists difficulties in supplying the part during the maintenance and it would be easy to supply additional parts even after the project under the direct ties with the Korean manufacturers.

5) The concept is in contrast with the ex-post evaluation and it is the evaluation which may review the effect and the impact of the project based on the model by understanding the factors which affect the project prior to the implementation and establishing the model. The ex-ante evaluation has benefits to facilitate various ex-post evaluation and effective management of the project, as well as decision-making.



Attachment



[Attachment 1. Evaluation standard]

Evaluation standard		Definition		
		3	2	1
Relevance	<ul style="list-style-type: none"> • Coincidence with the requirement, goal and strategies of the development for the recipient country • Coincidence with the policies enhancing the sense of ownership for the recipient country • Coincidence with the living methods and cultural background of the beneficiaries • Properness for solving development issues in the aspect of technology 	Very proper	Partly proper	Improper
Effectiveness /Impact	<ul style="list-style-type: none"> • Degree of achieving intended output, purpose and goal • Situation changes through certain project, not external impact 	More than 80% of the expected impact	50 - 80% of the expected impact	50% of the expected impact or less
	<ul style="list-style-type: none"> • Positive or negative impact on the people, system and environment • Judgment on the project impact from the beneficiaries and stakeholders • Confirmed changes from the project 	Positive Only indirect impact	Positive + Partially negative	Issue + Negative
Efficiency	<ul style="list-style-type: none"> • Whether the evaluation item is effectively operated • Whether more results are achieved from the same resources • Whether to prepare other alternatives with lower cost • Economic value of the project compared to other alternatives 	Efficient (Within 100%)	Partially efficient (100 - 150%)	Inefficient (More than 150%)
Sustainability	<ul style="list-style-type: none"> • Whether the project meets the effective demand and priority for the recipient country • Degree of sense of ownership in the project site • System and organization for effective operation • Financial capability to maintain the project outcome after the project 	Very sustainable	Sustainable by improving issues	Unsustainable



[Attachment 2. Evaluation grade]

Grade	Relevance	Effectiveness /Impact	Efficiency	Sustainability	Total
Very Successful	3	3	3	3	12
	3	3	3	2	11
	3	3	2	3	11
	3	2	3	3	11
	2	3	3	3	11
	Relevance	Effectiveness /Impact	Efficiency	Sustainability	Total
Successful	3	3	2	2	10
	3	2	3	2	10
	2	3	3	2	10
	3	2	3	1	9
	3	2	1	3	9
	2	3	3	1	9
	2	3	1	3	9
	2	2	3	2	9
	Relevance	Effectiveness /Impact	Efficiency	Sustainability	Total
Partly Successful	3	2	2	1	8
	3	2	1	2	8
	3	2	1	2	8
	3	3	1	1	8
	2	2	3	1	8
	2	2	2	2	8
	2	3	2	1	8
	2	3	1	2	8
	3	2	1	1	7
	3	2	1	1	7
	2	2	2	1	7
2	3	1	1	7	
	Relevance	Effectiveness /Impact	Efficiency	Sustainability	Total
Insufficient	2	2	1	-	5
	3	1	-	-	4
	2	1	-	-	3
	1	-	-	-	1

* It is assessed insufficient if both the efficiency and the sustainability have 1 point unless the accumulated value of the relevance and effectiveness is more than 5



[Attachment 3. Timetable for the site survey]

○ Period: August 11 - 17, 2013 (6 nights and 7 days)

Date		Activity
08.11 (Sun.)	19:50 -22:20	○ Move from Incheon - Ulaanbaatar (KE867)
08.12 (Mon.)	09:00	○ Visit the KOICA branch - Discussion about the evaluation plan, - Discussion about the evaluation method and schedule
	11:00	○ Interview with the officials in the Gwanghae Management Corporation - Interview with the officials
	13:00	○ Visit the Ulaanbaatar Air Quality Management Administration - Ex-post evaluation briefing, interview with the officials and data request
08.13 (Tue.)	09:00	○ Visit the Public Facility Management Administration - Inspect the Main Plant
	11:00	○ Public Facility Management Administration - Inspect the Sub-station (visit the machine room and interview the officials)
08.14 (Wed.)	09:00	○ Visit the UBCAP and interview the officials - Share the project and request the data
	13:00	○ Public Facility Management Administration - Inspect the Sub-station (visit the machine room and interview the officials)
	19	○ Interview the officials - Interview the manager in the briquette manufacturer (Interviewer: Eogi / Venue: KOICA)
08.15 (Thu.)		○ Off for the Liberation Day
08.16 (Fri.)	11:00	○ Visit the NGO related to the air quality project - Interview the branch head of Good Neighbors, Mongolia
	13:00	○ Visit the heater company - Visit the G-Saver heater company of Good Neighbors and Gerr
	23:55	○ Departure of the evaluation management team from Mongolia
08.17 (Sat.)	10:00	○ Visit the Khan-Uul district office and interview the officials - Interview the officials, request data - Workshop and interview with Gerr residents in the project site to improve the heating culture
	23:55	○ Departure of the evaluation team from Mongolia



[Attachment 4. Survey for the beneficiaries and survey result]

1. Survey for the beneficiaries

User Satisfaction Survey
District Heat Supply System of Ulaanbaatar

What is your age: _____ Gender(Circle one): Male Female

What is your address?

What is your educational background? (highest degree and major if applicable)

What do you do for a living (occupation)?

How much do you make (monthly income)?

How many people live with you in your residence?
(If you live with your family), what is your household income per month?

What is type or size of your residence?

What is the main method of heating your house?

Is your residence in the district where the heat supply system was renovated in 2010?

What is the heating cost on average during the winter before and after the renovation?

[only the respondents live in the service area] What is the highest and lowest monthly payment during the last winter?

Please briefly answer the following:

0	1	2	3	4	5
N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

○ Please rate the following statements in the scale of 5.

After the heat supply system was renovated, :	NA	SD	D	N	A	SA
The heat supply became sufficient.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The actual heating usage increased.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The renovated heat supply system helped improve the quality of my life one way or another (directly or indirectly).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The renovated system is helping conserve natural resources.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More people want to live in the areas with the renovated heat supply system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have seen people moving to better jobs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The heat supply was often interrupted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The system renovation was what we really needed at the time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The demand for heating increased.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The operators of the system seem to be well-trained and good at what they do.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Due to reduced heating cost, I was able to use the saved money for something else.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Now we have acquired new technology and learned new skills because of the renovated system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average household income has increased.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More people have jobs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have also seen new building and businesses start in my community.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The system seems to be well maintained.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The heat supply became stable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The heating cost decreased.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

There was no effects of the renovated heat supply system on the local economy	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
In the long run, the renovated system helped raise the living standard of the average households.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
I expect more technological advances on the way as a long-term effect of the renovated heat supply system.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
New types of jobs and industries have been created.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Local economy improved after the renovation of the heat supply system.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
I expect the system will continue to provide heat for a long time.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
More people are benefiting from the renovated heat supply system.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
More people are paying the heating charge on time.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Due to reduced heating cost, the saved money helped improve the living condition of our family.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
In the long run, the renovated system is going to raise the living standard of the average households.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
My community has changed positively.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
The heat supply system has helped the community advance economically.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Air quality decreased.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
In general, I am satisfied with the renovated heat supply system.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
The renovated system consumes more nature resources such as natural gas and water.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Living expense during the winter went down.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
The improved living condition helped me avoid getting sick during the winter.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
The number of people who live in the service area has increased.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
There are more employment opportunities.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
I have seen people making more money	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
The renovated heat supply system has brought some negative impacts on the local environment.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Please briefly answer the following:

What changes did the renovated electricity supply system bring to your life?

Do you see any changes in the communities within the service area?

What do you think your community needs the most in order for economic and social development?

Any other comments?

Thank you very much for your participation!

2. Survey result

The survey is performed based on the 5-point Likert scale.

0	1	2	3	4	5
N/A	Very nunsatisfied	Unsatisfied	Normal	Satisfied	Very satisfied

○ The survey result on the residents is listed in the table below.

#	Basic infromation	Scale	Average	Standard deviation
1	Age	90	36.66	14.82
2	Population per household	87	4	1
3	Household income	62	901,501 MNT	690,703 MNT
4	House size	66	43.78 m3	21.80m3

<Table 3-1 Survey on the residents>

#	Question	N	#NA	M	SE
1	The heat supply became sufficient.	69	21	3.25	0.13
2	the actual heating usage increased.	80	10	3.08	0.11
3	The renovated heat supply system helped improve the quality of my life one way or another(directly or indirectly)	63	27	3.05	0.13
4	The renovated system is helping conserve natural resources.	52	38	3.90	0.11
5	More people want to live in your neighborhood.	55	35	3.71	0.11
6	The heat supply was often interrupted.	75	15	2.81	0.14
7	The demand for heating increased.	72	18	3.92	0.11
8	Due to reduced heating cost, I was able to use the saved money for something else.	69	21	3.58	0.10
9	Average household income has increased.	76	14	3.33	0.16
10	More people have jobs.	66	24	2.89	0.14
11	I have also seen new building and businesses start in my community.	52	38	3.50	0.15
12	The system seems to be well maintained.	60	30	3.40	0.14
13	The heat supply became stable.	78	12	3.35	0.11
14	The heating cost decreased.	82	8	3.28	0.12

15	There was no effects of the renovated heat supply system on the local economy	68	22	2.13	0.16
16	In the long run, the renovated system is going to raise the living standard of the average households.	54	36	2.33	0.17
17	I expect more technological advances on the way as a long-term effect of the renovated heat supply system.	65	25	3.58	0.14
18	New types of jobs and industries have been created.	71	19	4.04	0.10
19	I expect the system will continue to provide heat for a long time.	53	37	3.34	0.17
20	More people are benefiting from the renovated heat supply system.	80	10	4.06	0.08
21	More people are paying the heating charge on time.	62	28	3.74	0.14
22	Due to reduced heating cost, the saved money helped improve the living condition of our family.	61	29	3.39	0.14
23	My community has changed positively.	63	27	3.03	0.16
24	The heat supply system has helped the community advance economically.	67	23	3.54	0.10
25	Air quality decreased.	49	41	3.41	0.14
26	In general, I am satisfied with the renovated heat supply system.	79	11	3.51	0.12
27	The renovated system consumes more nature resources such as natural gas and water.	42	48	3.26	0.18
28	Living expense during the winter went down.	72	18	2.26	0.17
29	The improved living condition helped me avoid getting sick during the winter.	86	4	3.84	0.11
30	The number of people who live in the service area has increased.	37	53	2.73	0.22
31	There are more employment opportunities.	49	41	3.73	0.13
32	I have seen people making more money	56	34	3.38	0.15
33	The renovated heat supply system has brought some negative impacts on the local environment.	43	47	2.51	0.20

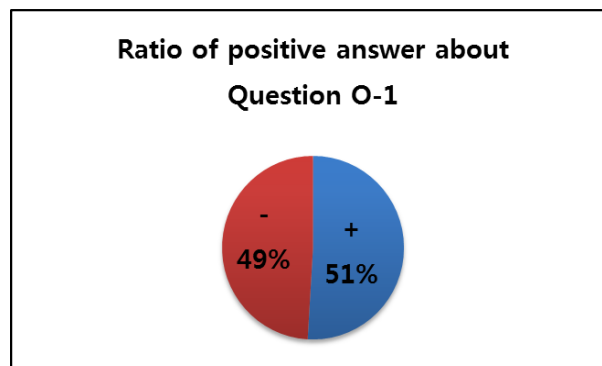
Summary of the survey on the residents

- Most of the respondents are satisfied with 'Whether the improved system helps save resources' with the average point of 3.90.
- Most respondents do not agree 'The improved heat supply system does not affect the local community' with 2.13 points. It means that the system is effective.
- Many people are very satisfied with the benefits from the heat supply system with the average 4.06 points.
- Meanwhile, the respondents give the average 2.26 points for saving the living cost in the winter.

○ The subjective survey result on the residents is listed in the table below.

Subjective question
1. How does the project for improving the district heating and water supply affect your life?
2. Are there any changes in the local community after the project?
3. What do you think the local community needs the most for the economic and social development?
4. Any other opinions?

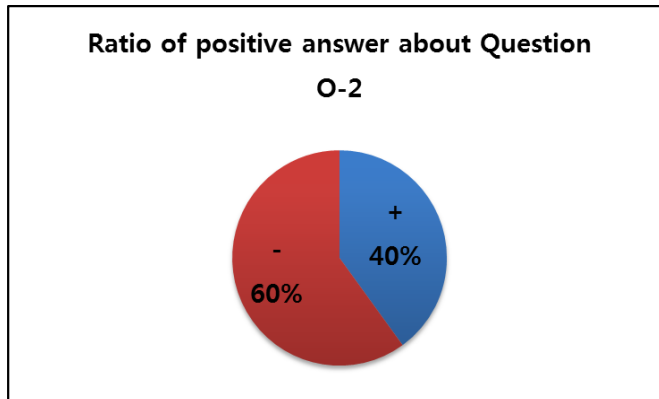
○ The residents show positive (51%) and negative (49%) answers on the question 1.



○ 51% of the respondents answer the improvement project for the heat supply system is effective in the quality of life and it is good to have convenience by saving time and water.

○ However, 49% of the respondents provide negative answers, saying they did not recognize the changes before and after the project. Even 27% answer they did not realize the project, meaning poor promotion for the project.

- The residents show positive (40%) and negative (60%) answers on the question 2.



- 40% provide positive and 60% provide negative answer on the question of changes in the local communities.
- The answers are sharply divided 'yes' and 'no' including good for hot water and no significant changes, respectively.
- There are 45 answers in the question 3 and 22% answer there are insufficient places for children including the daycare centers or playgrounds. Then, 16% answer that the road is narrow, complaints on the poor construction, street light installation and traffic issues to form the nearby environment. There are various opinions but the most urgent issues are transport, road, cultural space and daycare centers.

Classification	Number of answers	Rate(%)
Environment(greenery)	2	4.4%
Waste treatment and cleaning	6	13.3%
Form nearby environment(Cultural space, noise pollution from pleasure resorts, street light installation, etc.)	7	15.6%
Job	2	4.4%

Children(daycare center, playground)	10	22.2%
Water and sewage	6	13.3%
Heating	2	4.4%
Road – Expand parking lot and road	7	15.6%
School	2	4.4%
Electricity bill	1	2.2%
Total	45	100%

○ There are 10 positive and 47 negative opinions on the question 4.

- 38% of the negative opinions are inconvenience due to water cut off (particularly, hot water) with the highest. Then, the weak water pressure (17%) and rust (13%) take the large portion.
- Meanwhile, most of the positive answers include satisfaction with the project, appreciation and opinions to expand the project to other regions. Also, the feedback is reflected real time.

Negative			Positive		
Classification	Number of answer	Rate(%)	Classification	Number of answer	Rate(%)
Weak water pressure	8	17	Satisfied	8	80
Pipe	2	4	Feedback reflection	1	10
Water supply cut	18	38	Expand the project to Gern and oher regions	1	10
Sanitation	1	2	Total	10	100
Tax	2	4			
Rust	6	13			
Waste	3	6			
Construction period	3	6			
Otehs	4	9			
Total	47	100			



[Attachment 5. Inspection data for the machine room]

○ Date: Aug 13, 2013

○ Project number : 1st-8 (Mech. no 16-1)

By: Jinhwan Yeo

No	Status of the installation		Remarks
1	Heat Exchanger (for heating)	-	
2	Heat Exchanger (for hot water)	1	
3	Cold water unit (Booster pump)	3	
4	Heating water circulation pump	-	
5	Hot water circulation pump	2	
6	Expansion tank	1	
7	Main control panel operation	Y	
8	Failure, repair, operation suspension	N	
9	Record the log	Y	
10	Understand the operation manual	Y	
11	Management status of the hot water	Y	
12	Damaged insulator	N	
13	Management and cleaning status of the equipment	Y	
14	Leakage around the equipment pipes	N	
15	Power supply	Y	
16	Water supply	Y	
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools		

Site picture



○ Date: Aug 13, 2013

○ Project number : 1st-9 (Mech. no 16-2)

By: Jinhwan Yeo

No	Status of the installation		Remarks
1	Heat Exchanger (for heating)	-	
2	Heat Exchanger (for hot water)	1	
3	Cold water unit (Booster pump)	3	
4	Heating water circulation pump	-	
5	Hot water circulation pump	2	
6	Expansion tank	1	
7	Main control panel operation	Y	
8	Failure, repair, operation suspension	N	
9	Record the log	Y	
10	Understand the operation manual	Y	
11	Management status of the hot water	Y	
12	Damaged insulator	N	
13	Management and cleaning status of the equipment	Y	
14	Leakage around the equipment pipes	N	
15	Power supply	Y	
16	Water supply	Y	
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools		

Site picture



○ Date: Aug 13, 2013

○ Project number : 1st-22 (Mech. no 15-8)

By: Jinhwan Yeo

No	Status of the installation		Remarks
1	Heat Exchanger (for heating)	-	
2	Heat Exchanger (for hot water)	1	
3	Cold water unit (Booster pump)	3	
4	Heating water circulation pump	-	
5	Hot water circulation pump	2	
6	Expansion tank	1	
7	Main control panel operation	Y	
8	Failure, repair, operation suspension	N	
9	Record the log	Y	
10	Understand the operation manual	Y	
11	Management status of the hot water	Y	
12	Damaged insulator	N	
13	Management and cleaning status of the equipment	Y	
14	Leakage around the equipment pipes	N	
15	Power supply	Y	
16	Water supply	Y	
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools		

Site picture



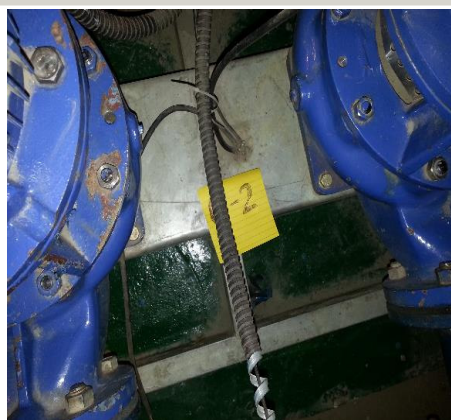
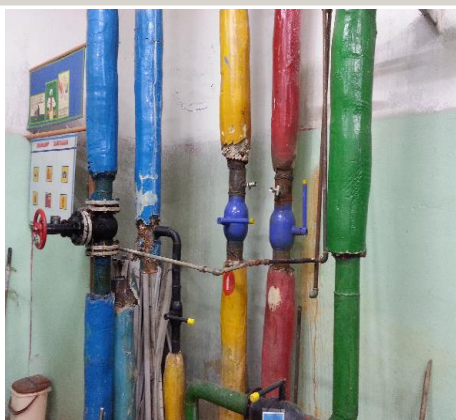
○ Date: Aug 14, 2013

○ Project number : 1st-43 (Mech. no 1-5)

By: Jinhwan Yeo

No	Status of the installation		Remarks
1	Heat Exchanger (for heating)	-	
2	Heat Exchanger (for hot water)	1	
3	Cold water unit (Booster pump)	3	
4	Heating water circulation pump	-	
5	Hot water circulation pump	2	
6	Expansion tank	1	
7	Main control panel operation	Y	
8	Failure, repair, operation suspension	N	
9	Record the log	Y	
10	Understand the operation manual	Y	
11	Management status of the hot water	Y	
12	Damaged insulator	N	
13	Management and cleaning status of the equipment	Y	
14	Leakage around the equipment pipes	N	
15	Power supply	Y	
16	Water supply	Y	
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools		

Site picture



○ Date: Aug 14, 2013

○ Project number : 1st-42 (Mech. no 1-2)

By: Jinhwan Yeo

No	Status of the installation		Remarks
1	Heat Exchanger (for heating)	-	
2	Heat Exchanger (for hot water)	1	
3	Cold water unit (Booster pump)	3	
4	Heating water circulation pump	-	
5	Hot water circulation pump	2	
6	Expansion tank	1	
7	Main control panel operation	Y	
8	Failure, repair, operation suspension	N	
9	Record the log	Y	
10	Understand the operation manual	Y	
11	Management status of the hot water	Y	
12	Damaged insulator	N	
13	Management and cleaning status of the equipment	Y	
14	Leakage around the equipment pipes	N	
15	Power supply	Y	
16	Water supply	Y	
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools		

Site picture



○ Date: Aug 14, 2013

○ Project number : 1st-30 (Mech. no 6-2)

By: Jinhwan Yeo

No	Status of the installation	Remarks
1	Heat Exchanger (for heating)	-
2	Heat Exchanger (for hot water)	1
3	Cold water unit (Booster pump)	3
4	Heating water circulation pump	-
5	Hot water circulation pump	2
6	Expansion tank	1
7	Main control panel operation	Y
8	Failure, repair, operation suspension	N
9	Record the log	Y
10	Understand the operation manual	Y
11	Management status of the hot water	Y
12	Damaged insulator	N
13	Management and cleaning status of the equipment	Y
14	Leakage around the equipment pipes	N
15	Power supply	Y
16	Water supply	Y
17	Others 1) The SB pump shall have the block valve closed. 2) Require the pump earth wire to be fixed 3) Request to prepare spart parts and tools	

Site picture





[Attachment 6. Interview the responsible officials]

1. Head of the Public Facility Management Administration

- Date: 2013. 8.13. (Tue) 11:00
- Venue: Office of the Head of the Public Facility Management Administration
- Attendant
 - Byambajav. Ch (head of the administration)
 - Aaron Kim (GDC)
 - Hangjoo Kim (Head of the evaluation department, KOICA)
 - Jiyoung Lee (Specialist, KOICA)
 - Youngchan Yoon (GDC)

Major contents

- On behalf of the Ulaanbaatar government and citizens, thank you for the support.
- The Public Facility Management Administration is a large organization with 5000 employees.
- The property management bureau registers and manages the equipment for the project.
- The construction company completed the tasks while observing the timetable.
- Currently, the 2nd project is almost completed and the 3rd project is requested to the Ministry of Economic Development.
- The purpose of the project is for the beneficiaries to use water supply and heating without inconvenience. The project achieves remarkable result and is promoted through the media.
- 310 engineers joined the training. Only those who have certification may operate the machine room and 300 engineers achieve the certification through KOICA.
- The project supplies water and heating to 8,300 households and 55 machine rooms are newly established by the KOICA project.
- A lot of new apartment are being built in Ulaanbaatar. There are small-sized machine rooms operated by private companies and they request to provide consulting and training.
- However, it is difficult to find parts during the maintenance because the equipment is made in Korea. We want to have direct ties with Korean manufacturers.

2. Officials in the Public Facility Management Administration

- Date: 2013. 8.13. (Tue) 15:00
- Venue: Meeting room in the Public Facility Management Administration
- Attendant
 - Enkybold.N (Representative of the USIP)
 - Aaron Kim (GDC)
 - Hangjoo Kim (Head of the evaluation department, KOICA)
 - Jiyoung Lee (Specialist, KOICA)
 - Youngchan Yoon (GDC)
 - Jinhwan Yeo (CEO of Jinsung ENC), officials in the Public Facility Management Administration

Major contents

- There are a total of 127 machine rooms under the Public Facility Management Administration. (Except the private machine rooms) The total length of the heating and hot water pipes are 150.4km and 115km, respectively. They cover 270,000 people in 80,000 households.
- 26 engineers were trained in Korea and 70 in Mongolia.
- The efficiency and effectiveness of the pumps for hot water heating are improved. The power consumption, heating and water are saved by 18%, 11% and 9%, respectively. The old (Russian) pumps show low efficiency due to operating 24-7 but the Korean pumps show high efficiency for the operation depending on the use.
- The 2nd project is ongoing for good performance from the 1st project. The 1st project covers the water supply, cold and hot water but the 2nd includes the heating.
- A total of 43 machine rooms, 13 heating equipment and 29 water supply equipment are replaced.
- By itself, the project is on the way to install the ground machine rooms and pipes underground. Currently, the length, height and width are 196m, 2.3m and 3m, respectively. The project from 2010 takes the progress of 10% and is on the way through the support from the central government. It is a comprehensive tunnel construction for not only water and sewage and heating pipes, but also communication and power lines.
- The 3rd project under request is to connect 86 machine rooms improved from the 1st and the 2nd projects for the automation system. Another future project is to replace old sewage pipes.

- The actual benefit for the beneficiaries is to use the hot water even in the evening. The machine room stops its operation in the evening to save the cost. Also, the project provides the expected water temperature (50C) and saves the water wasted until the desired temperature meets.
- The households which install the gauge may enjoy saving the heating costs. Other households pay the heating cost in proportional to the area.
- The 1st project designates area with large consumption on the hot water and the 2nd project primarily selects the area with poor heating. Some machine rooms are covered by both projects or just one project.
- It is the system which provides the hot water / heating to the residential area when the power plant transmits the hot water to 9 sub-stations, the sub-station transfers the hot water to the machine rooms in each area and performs the heat exchange. The Public Facility Management Administration is in charge of the route from 8 sub-stations to the residential area.

3. People near the machine rooms

- Date: 2013. 8.13. (Tue) 14:00
- Venue: Meeting room in the Public Facility Management Administration
- Attendant
 - Aaron Kim (GDC)
 - Hangjoo Kim (Head of the evaluation department, KOICA)
 - Jiyoung Lee (Specialist, KOICA)
 - Youngchan Yoon (GDC)
 - Local residents

Major contents

- The project team visits the site under the improvement project for the hot water and heating, asks the opinion on the satisfaction, quality of life and convenience and collects various opinions. There are people who complain the heating and other people satisfied with the service depending on the region.
 - "I just have cold water in the busy morning and hot water in the evening. But it's too hot. The heating is moderate for the last 2 years. It used to be good (A female in early 20s, 6th floor)"
 - "No big difference from the past. Sometime it is cut off but cold and hot water is provided well. However, the cost is a little bit high. I am enjoying the heating service"

without large inconvenience. Sometimes, people on the upper floor said it's cold (4 females in their 60s, the 1st floor)"

- "The temperature changes too much...Heating is fine. Especially, the hot water is fine after the construction (A mother in early 20s, 7/9 floor, 7 minutes)"

- The questions are modified based on the interviews and reflected on the translation, survey method and training the interviewers.



[Attachment 7. Standard questionnaire for the interview with the officials]

Evaluation for	Evaluation item	Interview question	Interview For who
Project formation	Consistency with the support strategies of KOICA	<ul style="list-style-type: none"> • There are a lot of opinions that it is important to discover the project meeting the demand for the cooperation country to improve the effectiveness. Please assess whether the survey and study on the demand are sufficient and meet the proper level for the successful project. • (At the time of project discovery or selection) What are the long-term effects, unexpected result or (positive or negative) effect from the project? • What would you do if you are a decision-maker and in charge of the project formation? (Lead specific discussion on the process, strategy and criteria) 	KOICA, officials in the executing organization
	Consistency with the development policies of the cooperation country		
	Relevance of the project selection		
	Efficiency in the process of the project formation		
Project plan	Feasibility for the purpose	<ul style="list-style-type: none"> • Please assess whether the project design (purpose, scope, strategy, implementation plan) are well organized to achieve goals. It would be good to classify strength and insufficiency. 	
	Design feasibility		

		<ul style="list-style-type: none"> • The development project may encounter unexpected issues. Please explain whether the problem-solving strategies or plans are well established and the consideration on the risk factors are well reflected on the design. • What would you do if you are a decision-maker and in charge of the project formation? (Lead specific discussion on the process, strategy and criteria)
Progress	<p>Implementation against the plan</p> <p>Injection element</p> <p>Participation from the cooperation country</p> <p>EIRR</p> <p>Structural issues</p>	<ul style="list-style-type: none"> • Please assess how the project plan is well executed. • What are the problems in the implementation process and how did you solve? What did you do to solve the issue if you discover a problem in the implementation process? • How much does the cooperation country contribute to and what is the role? • (In your opinion) Do you think the project achieves its intentions? Otherwise, what are the causes? • What are the causes to degrade the efficiency in the project? (Are there any systematic problems?) • If you take the same project as a PM, what would you do for effective and efficient project?
Sustainability	<p>Sustainability for the human and institutional system</p> <p>Financial sustainability</p>	<ul style="list-style-type: none"> • What do you think the measures (follow-up measures, following management, human and systematic support) for the maintenance and development after the project ends? • Do you find any support from this project? • What do you think the roles of each entity for the sustainable project output? What are the requirements for the cooperation country? Please explain based on the human, systematic and financial fields.

Overall issue	<p>Consider and reflect issues related to the environment</p> <p>Consider and reflect issues related to the gender</p>	<ul style="list-style-type: none"> • Are the issues including the environment or female considered or reflected on the project planning and implementation? If so, please explain the level and which issues are reflected on the project. 	
Output	<p>Upgrade the heat efficiency</p> <p>Stable heat supply</p> <p>Elongate the system lifecycle</p> <p>Capacity building for the managers</p>	<ul style="list-style-type: none"> • Briefly assess the convenience, efficiency and satisfaction from the viewpoint of the actual system operator. • Please assess the current system maintenance level and explain expected issues or life cycle. • Please assess how much the operation team is capable to manage and operate the system. If not, please explain the deficiencies. 	Officials in Manbai, system operator
Short-term performance	<p>Reduce the cost for the heat supply</p>	<ul style="list-style-type: none"> • There exists the cost saving from the increased heat efficiency among the expectations. How much does the cost reduction contribute to saving the living cost for a household? 	
Mid-term performance	<p>Improve the residential lives</p> <p>Decrease the diseases</p> <p>Save the resources</p> <p>Transfer related technologies</p>	<ul style="list-style-type: none"> • What are the advantages or benefits for the residents from the project? (Guide to specifically mention with keywords) 	
Long-term effect	<p>Upgrade the quality of lives</p> <p>Upgrade the quality of lives</p> <p>Upgrade the health conditions for the residents</p> <p>Population increase</p> <p>Revitalize the local economy</p> <p>Industrial technology development</p>	<ul style="list-style-type: none"> • What are the expectations from the project to the long-term effect or ripple effect? (Use the keyword) 	

Overall effect	Overall evaluation	<ul style="list-style-type: none"> • Does the project faithfully realize as it is? • Does the implementation process achieve the purpose well? 	
		<ul style="list-style-type: none"> • (In your opinion) Do you think the project achieves its intentions? Otherwise, what are the causes? 	
		<ul style="list-style-type: none"> • What makes the project more successful if the same project starts from scratch? 	

**Ex-post Evaluation Report on the Project for Improving the District Heating
and Water Supply System in Ulaanbaatar, Mongolia**

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