Mongolia

Ex-Post Evaluation of Japanese ODA Grant Aid Project "The Project for Improvement of Waste Management in Ulaanbaatar City" External Evaluator: Nobuko Fujita,

Foundation for Advanced Studies on International Development (FASID)

### 0. Summary

This project was implemented to improve waste management including the collection, transportation, and disposal of waste in the midst of a growing need for better waste management in line with the rapidly increasing population of Ulaanbaatar, therefore its relevance was high. The construction of a new disposal site and procurement of compactors and dump trucks for waste collection helped introduce sanitary landfill management and efficient garbage collection, and thereby increased the capacity of waste disposal. Furthermore, the sanitary landfill method employed has helped improve the environment near the disposal site as well as provide a safer working environment for waste pickers. A considerable impact of the project is that the sanitary landfill method employed at the new disposal site has begun to spread to cities in other prefectures, making it the national standard for waste disposal. Despite the harsh Mongolian winters that limited the time available for construction, the project was completed in time and under budget. There is no major problem regarding the systemic, technological, and financial sustainability of the project's operation and maintenance. In light of the above, the project is evaluated to be highly satisfactory.

## 1. Project Description



**Project Location** 



Narangiin Enger Disposal Site

## 1.1 Background

In 2006, Mongolia had a population of approximately 2.59 million and a GDP per capita of US\$998. Its largest city and capital, Ulaanbaatar, had a population of 970,000<sup>1</sup>. A rapidly growing population and a changing life style which have led to an increase in garbage production have raised serious challenges regarding waste management. Trucks for garbage collection/transportation were decrepit and insufficient in numbers. Furthermore, at final disposal sites, waste was simply dumped and not

<sup>&</sup>lt;sup>1</sup> Mongolian Statistical Yearbook 2009. In 2011, population in Mongolia was 2.81million, and per capita GDP grew to US \$2,562(http://www.mofa.go.jp/mofaj/area/mongolia/data.html).

covered by dirt. Especially at the largest disposal site, Ulaan Chuluut Disposal Site, trash which had scattered to the neighbouring area, had severely damaged the environment, while frequent fires broke out from incinerated coal ash. This posed a threat to the residents in neighbouring district as well as the waste pickers at the disposal site.

In this project, a new waste disposal facility, the Narangiin Enger Disposal Site (NEDS) was to be built to replace the Ulaan Chuluut Disposal Site, which was approaching its capacity. In addition, heavy machineries would be provided to make sanitary landfill possible, and vehicles for waste collection would be provided to improve waste collection, and thereby improve waste management in Ulaanbaatar city.

## 1.2 Project Outline

The objective of this project is: to properly collect, transport, and dispose waste in Ulaanbaatar city by constructing the Narangiin Enger Disposal Site (NEDS); to procure tools and equipment for landfill, waste collection, and the Central Workshop; and to deliver technical assistance.

| Grant Limit / Actual Grant Amount | ant 1,014 million yen / 990 million yen                 |  |  |  |  |  |
|-----------------------------------|---|--|--|--|--|--|
| Exchange of Notes Date            | June, 2007  |  |  |  |  |  |
| Implementing Agency               | City Maintenance and Public Utilities Agency under the  |  |  |  |  |  |
|                                   | Mayor of Ulaanbaatar City(CMPUA)                        |  |  |  |  |  |
| Project Completion Date           | December, 2008  |  |  |  |  |  |
| Main Contractor(s)                | Dai Nippon Construction                                 |  |  |  |  |  |
| Main Consultant(s)                | Kokusai Kogyo, Co. Ltd.                                 |  |  |  |  |  |
| Basic Design                      | "Basic Design Study on the Project for Improvement of   |  |  |  |  |  |
|                                   | Waste Management in Ulaanbaatar City in Mongolia"       |  |  |  |  |  |
|                                   | JICA/Kokusai Kogyo, Co. Ltd., May, 2007                 |  |  |  |  |  |
| Detailed Design                   | July-September, 2007                                    |  |  |  |  |  |
| Related Projects                  | "The Study on Solid Waste Management Plan for           |  |  |  |  |  |
|                                   | Ulaanbaatar City in Mongolia"(2004-2007)                |  |  |  |  |  |
|                                   | "Technical Cooperation Project for Strengthening the    |  |  |  |  |  |
|                                   | Capacity for Solid Waste Management in Ulaanbaatar      |  |  |  |  |  |
|                                   | City"(2009-2012)  |  |  |  |  |  |
|                                   | Senior Overseas Volunteer (Waste management,            |  |  |  |  |  |
|                                   | Maintenance of collection trucks. 2005-2007, 2010-2012) |  |  |  |  |  |
|                                   | Japan Overseas Cooperation Volunteer (Environmental     |  |  |  |  |  |
|                                   | education, 2006-2012)                                   |  |  |  |  |  |

|  | Recycle Grant Assistance for Grassroots Human Security  |
|--|---|
|  | (Kawasaki city 2006, Sapporo city 2007)                 |
|  | Donation of used collection trucks (Kashiwa city, 2006) |

### 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Nobuko Fujita, The Foundation for Advanced Studies on International Development

#### **2.2 Duration of Evaluation Study**

Duration of Study: November 2011–January 2013 Duration of Field Study: March 26<sup>th</sup>, 2012 –April 7<sup>th</sup>, 2012 and June 11<sup>th</sup> – June 16<sup>th</sup>, 2012

## 2.3 Constraints during the Evaluation Study (if any)

None.

## 3. Results of the Evaluation (Overall Rating: A<sup>2</sup>)

## 3.1 Relevance (Rating: $3^2$ )

3.1.1 Relevance with the Development Plan of Mongolia

In the development plan of Ulaanbaatar city, "Ulaanbaatar City Development Strategy" (2001~2020), the reduction of environmental pollution, and the building of a system for solid waste management are listed as goals. The current national development strategy, "Millennium Development Goals Based Comprehensive National Development Strategy of Mongolia" (2008-2012) stresses the improvement of waste management in Chapter 6"Environmental Policy." In "The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia" (2007, hereafter M/P)<sup>3</sup>, the construction of a new disposal site and improving waste collection are identified as priority projects.

#### 3.1.2 Relevance with the Development Needs of Mongolia

Ulaanbaatar's rapid population growth was becoming a challenge in regards to waste management. Especially in the Gel area, Zodo (damage to crops and livestock caused by extreme cold weather) generated a population influx which expanded its residential area and increased the area that needed waste collection. To date, the influx of rural population to the capital continues and garbage

<sup>&</sup>lt;sup>2</sup> ③: High, ②: Fair, ①: Low

<sup>&</sup>lt;sup>3</sup> Japan International Cooperation Agency conducted "The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia" from November 2004 to February 2007, and formulated a M/P drawing a road map to improve waste management in Ulaanbaatar by 2020.

output per capita has also been increasing, resulting in a large growth of waste generation<sup>4</sup>. Furthermore, the Ulaan Chuluut Disposal Site, an open dump<sup>5</sup> established without any environmental considerations to its neighbouring area, was about to shut down at the end of 2008 and a replacement was urgently needed.

## 3.1.3 Relevance with Japan's ODA Policy

Japan's Country Assistance Program for Mongolia (2004-2009) lists environmental preservations as one of the four important areas for cooperation and in particular stresses the improvement of urban environments.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

## 3.2 Effectiveness<sup>6</sup> (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

For this project, two quantitative indicators were set and accomplished: waste collection rate and ratio of sanitary landfills. Furthermore, the capacity to dispose waste was enhanced.

#### (1) Waste Collection Rate

This project aimed at an increase in the waste collection rate in Ger area by procurement of 43 compactor/dump trucks and another 43 dump trucks to be purchased by Ulaanbaatar city. The city purchased 70 Chinese dump trucks and 13 compactors in 2009, exceeding their procurement plan. In consequence, as shown in table 1, collection rate in Ger area increased from 42% (2007) to 83% (2011), exceeding its target of 80% (2010).

<sup>&</sup>lt;sup>4</sup> The population of Ulaanbaatar has increased from 0.97million in 2007 to 1.16million in 2011. (Ulaanbaatar City Statistics Department)

<sup>&</sup>lt;sup>5</sup> Open dump is a way to simply dump and stack the garbage. Garbage decomposes little by little but non-degradable plastics often make the environment surrounding the dump area deteriorated. Natural fire by fermenting and heat of combination could easily occur as well in open dump. In a sanitary landfill, on the other hand, garbage is pressed with heavy machinery and covered with dirt within a day of dumping, thereby preventing bugs and flies. Also, pipes to allow gas to escape from underground are placed to prevent explosion, and exudation from garbage to underground water is prevented by seepage control work.

<sup>&</sup>lt;sup>6</sup> Sub-rating for Effectiveness is to be put with consideration of Impact.

| Indicators  | Baseline<br>(2007) | Target (2010)     | Actual (2011) |
|---|--------------------|-------------------|---------------|
| Waste collection rate per<br>population<br>Apartment area<br>Ger area | 100%<br>42%        | 100%<br>80%       | 100%<br>83%   |
| Sanitary disposal rate of the garbage generated in Ulaanbaatar city   | 0%                 | More than 9<br>0% | About 95%     |

Table 1 Waste Collection Rate and Sanitary Disposal Rate

Source : Basic Design Study for 2007 and 2010. CMPUA for Collection Rate in 2011 (calculated from garbage generation per capita and amount brought in to the disposal sites). Sanitary disposal rate is calculated from Table 3.

|                 | Baseline   | Actual      |
|-----------------|------------|-------------|
| Apartment area  | 86% (2007) | 100% (2012) |
| Ger area        | 12% (2004) | 80% (2012)  |
| C = M/D = C = 1 |            | 4 1         |

Table 2 : Collection Rate for Garbage Collection Fee

Source : M/P for baseline and CMPUA for actual

According to the Ulaanbaatar City Environmental Pollution and Waste Management Department (EPWMD), upon completion of this project in 2009, the waste collection rate in the Ger area had surpassed 90%. Later in July of 2011, the method of fee collection was changed from a door to door collection method to a system which tacked the waste collection fee on to the electricity fee. That helped increase the collection rate substantially (Table 2). It also meant that there was an increase in the number of households qualifying for garbage collection, resulting in an overall decrease in the frequency of collection<sup>7</sup>. Nowadays collection service is once every two months on average in Ger area where it used to be once a month in 2006 (a collection frequency target was not set at the time of the Basic Design of this project, however it was planned for twice a month in 2010 in M/P)<sup>8</sup>.

Furthermore, the population of the Ger area has increased much more than the M/P estimation (Figure 1) and increased waste contributed to the cut in collection frequency. Heavy traffic on main

<sup>&</sup>lt;sup>7</sup> Rate of fee collection in Ger area was 12% in 2004 (Table 2), and assumedly it was about 40% in 2007(Table 1). With door to door collection, only households who paid the fee were eligible for collection service, but currently 80% (Table 2) are eligible for the service. Calculated from the number of household in Ger area, eligible households increased from 62,000 in 2004 to 246,000 in 2007and 575,000 in 2011. Furthermore, since it is unclear whether or not a particular household paid its electricity fee, virtually all households connected to electricity lines are entitled to service. Also, there was confusion right after changing the fee system, such as garbage collectors doubly charging fee for household, or collecting commercial waste first if paid extra cash. (Ger area survey. Ger area survey was conducted from April 1<sup>st</sup> to 6<sup>th</sup>, 2012 with face-to-face interviews using a questionnaire targeting 50 households living in seven districts prior to 2007)

<sup>&</sup>lt;sup>8</sup> Ger area survey. When collection service is not available, garbage is stored on the premises of residents, or brought to disposal sites by private vehicles. However, some garbage stacks can be seen on roadsides in the Ger area. The study shows the dissatisfaction of residents toward the frequency of collection service (96% of the respondents) followed by the irregularity of service (54% of the answers to open-ended question).

streets also capped the number of trips that could be made.

Ulaanbaatar city is implementing a plan to double the number of collection trucks in 2012. As of June 2012, 28 trucks had been procured by the budget of Ministry of Nature, Environment and Tourism and 162 trucks were in the process of being procured by each district with funds budgeted by Ulaanbaatar city (see 3.5.3(3)). Furthermore, in order to avoid traffic, construction of another disposal site on the east side of the city is underway (figure 2)<sup>9</sup> which should lead to an increase in the rate and frequency of waste collection in the Ger area by the end of 2012.



Figure 1 Population of Apartment and Ger Area in Seven Districts in Ulaanbaatar City<sup>10</sup> Source : M/P for 2010 estimate, Ulaanbaatar City Statistics Department for others

<sup>&</sup>lt;sup>9</sup> Tsugan Davaa Disposal Site in Bayanzurkh district. 30% of the waste (from two eastern districts) currently brought into NEDS will be handled. As of June 2012, environmental impact study, feasibility study are already completed and detailed design study is being conducted. It is planned to commence operation by the end of 2012 (CMPUA hearing).

<sup>&</sup>lt;sup>10</sup> Ulaanbaatar consists of nine districts (six central districts, the Nalaikh district adjacent to the central districts, and two remote districts). This project targeted the six central districts and the Nalaikh district.



Figure 2 Central Ulaanbaatar City and Disposal Sites

## (2) Sanitary Landfill Rate

In regards to sanitary landfill rate, all the waste brought into NEDS are compressed and covered by dirt within a day. NEDS staff using heavy machineries provided by the project also conducted improvement work in May 2011 on the Morin Davaa Disposal Site (a smaller landfill in the southwest of the city which used to be run on open-dumping), and this site is now capable of semi-sanitary landfill<sup>11</sup>. The project has achieved one of its primary goals in that within Ulaanbaatar, today, only a few small landfills are still running on open-dumping, and over 90% of waste qualifies for sanitary landfill.

<sup>&</sup>lt;sup>11</sup> The difference between a sanitary landfill and semi-sanitary landfill is the presence of facilities for garbage flying prevention, gas removal, and fire prevention.

| Dispos<br>al<br>metho<br>d | Disposal site              | 2006 (t/   | /day)        | 2011 (t/day)   |           | Note   | %         |                |  |
|----------------------------|----------------------------|------------|--------------|--|-----------|--|-----------|----------------|--|
|                            | Ulaan                      | summ<br>er | 340          |  |           | _  |           | Closed in 2009 |  |
|                            | Chuluut                    | winter     | 85           |  |           |  |           |                |  |
| Sanitar<br>y               | Narangiin<br>Enger         |            |              | summ 1011<br>er .8                                     |           | Constructed by this project and started operation in 2009. All |           |                |  |
| landfil (NEDS)             |                            |            |              | winter   | 961.<br>4 | waste is processed by sanitary landfill.                       | 94.<br>6~ |                |  |
|                            | Marin Davas er 19 summ 97. |            | 97.1         | Open dump since 1958 and improvement work conducted in | 94.<br>7  |  |           |                |  |
|                            | Morini Davaa               | winter     | 6            | winter   | 64.4      | May, 2011. Now semi-sanitary landfill.                         |           |                |  |
| Open<br>dump               | Nalaikh                    | summ<br>er | umm<br>er 11 |  | 0.58.0    | Started operation in 2010. Open                                |           |                |  |
|                            | INAJAIKII                  | w<br>inter | 6            | 54.0~58.0  |           | mine.  | 5.3<br>~  |                |  |
|                            | Khoroo 21                  | summ<br>er | 4            | summ<br>er   | 3.8       | Unattended dump in Khoroo 21,                                  |           |                |  |
|                            |                            | winter     | 6            | winter   | 5.7       | Songinokhairkhan district                                      |           |                |  |

Table 3 Amount of Waste Treated at Disposal Sites in Ulaanbaatar City

Source : M/P for 2006. CMPUA and Nalaikh District Office for 2011. Amount for Khoroo 21 is estimated based on population (5,500 in the end of 2011)

## (3) Waste Processing Abilities

In the summer and winter of 2011, the amount of waste being processed at NEDS was 1011.8t/day and 961.4t/day respectively, exceeding the estimated value of 704.7t/day (2010) by 30~40%. As the amount disposed after the project is 2~3 times greater than the amount disposed at the Ulaan Chuluut Disposal Site prior to the project (Table 3), it can be said that the garbage processing ability of Ulaanbaatar city has been enhanced greatly.



Entrance to NEDS



Heavy machineries provided by the project working at NEDS



Warm garage at Central Workshop

#### 3.2.2 Qualitative Effects

### (1) Enhancement of Waste Collection System

After the implementation of this project, the waste collection system was strengthened. Before the project, waste collection and transportation was conducted by each district's urban maintenance public corporation called TUK<sup>12</sup> and some Khoroo (administrative units under the district), using vehicles which belonged to Ulaanbaatar city. The number of collection trucks in 2006 was 136 (compactors and dump trucks combined), most of them were decrepit and frequently had mechanical troubles. Currently, waste is being collected with 177 trucks belonging to the CMPUA, TUK, some districts, Khoroo, and two private companies<sup>13</sup>.

This project has increased the number of garbage collection trucks by 43 (compactors and dump trucks combined, Figure 3). Moreover, it is apparent that these 43 Japanese trucks incur far fewer breakdowns, and CMPUA and TUK truck drivers have emphasized their reliability and safety during a hearing. The reliability of the project trucks can be deduced from the ratio of the number of trucks possessed and operating. Although project trucks make up 24% of the entire trucks possessed (177), they make up 33% of all operating trucks (43 out of 130)<sup>14</sup>.

For waste collection, 14 out of 20 used garbage collection trucks donated by the Recycle Grant Assistance for Grassroots Human Security (2006, 2007) are also operating in good condition. A Senior Overseas Volunteer (hereafter, SV) helps to maintain project trucks as well as these 14 recycled Japanese trucks.



Figure 3 : Number of Collection Trucks (compactors and dump trucks)

<sup>&</sup>lt;sup>12</sup> TUKs were privatized except for Nalaikh district.

<sup>&</sup>lt;sup>13</sup> On top of it, some TUKs use leased trucks form private companies as necessary.

<sup>&</sup>lt;sup>14</sup> As of the end of 2011, out of 85 Chinese trucks (13 compactors and 72 dump trucks) procured by Ulaanbaatar city, 30% or 28 trucks are inoperable, while all the project trucks are operating without major problems. For example, TUK in Han-Uul district, at least one of 12 Chinese trucks comes back broken every day while two project trucks have no problem (Khan-Uul TUK mechanic hearing).

#### (2) Environmental Improvement surrounding NEDS

The surrounding areas of NEDS have changed drastically compared to the time when the Ulaan Chuluut Disposal Site was in operation. According to a survey conducted in the area, a major change has been a decrease in the number of fires, as well as the smoke and dangers that accompany them<sup>15</sup>. This change can be attributed to sanitary landfill, and the newly installed water truck and heavy machineries that put out flames before a full fire emerges. In addition, citizens have been cleaning their neighbourhoods more often, helping with the hygienic image of the community. Closer ties to neighbouring people compared to before the project was also reported (figure 4)<sup>16</sup>.

Sanitary landfill method and fire extinguishing instructions were conducted at the project site at Ulaan Chuluut during M/P study, and knowledge was quickly transferred to the new NEDS staff. Furthermore, the soft component of this project followed the technical instruction provided during the M/P study. And as stated in the M/P, "Technical Cooperation Project for Strengthening the Capacity for Solid Waste Management in Ulaanbaatar City" (2009-2012, hereafter T/C) further enhanced the ability to manage the facility. Currently, NEDS employees manage the facility without any particular difficulties<sup>17</sup>.



Figure 4 Change in Ger Area near Disposal Sites

<sup>&</sup>lt;sup>15</sup> The survey of residents in neighbourhoods near disposal sites was conducted with 43 households in the vicinity of the NEDS and Ulaan Chuluut Disposal Sites (both disposal sites are situated next to each other) from March 28<sup>th</sup> to 31<sup>st</sup>, 2012, using a face to face interview with a questionnaire.

<sup>&</sup>lt;sup>16</sup> The survey of residents of neighbourhoods near disposal sites

<sup>&</sup>lt;sup>17</sup> NEDS staff hearing

#### 3.3 Impact

#### 3.3.1 Intended Impacts

(1) Environmental Improvement of the Ger Area

It was assumed that illegal dumping would decrease if the collection rate in Ger area increased and that this would contribute to a better living environment. Before the collection fee system changed, illegal dumping in the Ger area decreased due to the increase in collection but also due to the installation of a Weigh bridge<sup>18</sup> at NEDS which made it possible for truck drivers and operators to keep a record of how much trash they carry. The amount recorded is reflected in their salary, and in effect encourages the picking up of illegally dumped garbage on the way to disposal site. As mentioned in 3.2.1 (1), reasons outside of the project have caused a decrease in collection frequency, however this situation will be improved by the end of 2012.

#### (2) Decrease in Illegal Dumping of Waste

In addition to the reasons mentioned above, illegal dumping of waste has also seen a decline in apartment areas due to the effect of a series of cooperation in the waste management field offered by Japan that has started to spread. The city's "Clean-up Campaign" has also been a success, as the citizens have adopted an attitude of "garbage is not something to throw away, but something that must be brought to a disposal site and properly dealt with." This caused a substantial decrease in public littering at places such as bus stops<sup>19</sup>.

As for illegal dumping near disposal sites, it used to be that waste was dumped anywhere in the general vicinity of the disposal site since no clear boundary existed between the site and its vicinity. NEDS has improved this situation by limiting the number of entrances to one, and fencing off the land thereby prevented illegal dumping of waste.

#### 3.3.2 Other Impacts

### (1) Impact on the Environment

Environmental impact assessment was conducted in February 2006 and approved by the Ministry of Nature, Environment, and Tourism. Presently, monitoring is conducted by employees who work at NEDS, who test water samples and gas once every week. No irregularities have been found. In October of 2010, the EPWMD confirmed the monitoring guidelines developed by T/C. Based on the guidelines, the Ministry of Nature, Environment and Tourism, Ulaanbaatar city, the Songinokhairkhan district (where NEDS is located), the residents of the district, and an NGO have made a monitoring committee that has met twice so far to discuss environmental implications and the management of the disposal site. No major problem was pointed out.

<sup>&</sup>lt;sup>18</sup> The system is installed based on M/P.

<sup>&</sup>lt;sup>19</sup> Ger district residents' survey

As already mentioned, garbage, dust, and fires have been reduced substantially in the area surrounding NEDS.

### (2) Land Acquisition and Resettlement

There was no resettlement or acquisition of land due to the project.

#### (3) Other Impacts

#### (3)-1. Safe Co-existence with Waste Pickers

At NEDS, depending on the season and weather conditions, between  $100 \sim 500$  people per day come to search recyclables. Because of the change of method of disposal from open dumping to sanitary landfill, the working environment for these workers has greatly improved. According to the survey targeting the waste pickers, reductions in the number of fires and the amount of flying waste are listed as significant changes before and after the project (figure 5)<sup>20</sup>.



Figure 5 Change of Environment in NEDS (Result of survey on waste pickers

To protect these workers and for efficient landfill, the work face is divided into sections such as placing, collection, landfill, back-up, and these lots are used in turn. This made collection work much safer and 78 % of respondents in the survey of waste pickers said injuries are fewer if compared to the Ulaan Chuluut Disposal Site. Since its opening, there have been no accidents involving waste pickers at NEDS. The fact that activities related to the improvement of the disposal process (such as truck control, placing waste, collection of recyclables, and land filling) were introduced as early as the M/P study period, and that their effectiveness was examined by both Mongolia and Japan side as they tried to make improvements, helped smooth the operation of

<sup>&</sup>lt;sup>20</sup> Survey of waste pickers. This survey was conducted with forty waste pickers who have worked both at Ulaan Chuluut and NEDS by face to face interview using a questionnaire from 28<sup>th</sup> to 31<sup>st</sup> of March, 2012.

#### NEDS.

### (3)-2. Dissemination of Sanitary Landfill

When the Ulaan Chuluut disposal site was closed down in 2009, NEDS was able to use its machinery to conduct sanitary landfill (this work was conducted by the Mongolian side). The new disposal site that will be built on the east side of the city will also employ the sanitary landfill method. Introduction of sanitary landfill is being considered at Nalaikh open dump as well<sup>21</sup>.

The practice of sanitary landfill has been spreading to other prefectures outside of Ulaanbaatar as well. After a seminar organised by T/C for persons in charge of waste management from different prefectures to learn how NEDS is operated, Bulgan and Gobi sunbel prefectures have begun planning the renovations of their disposal sites. NEDS has helped spread knowledge of the sanitary landfill method all over the country. The shift from open dumping to sanitary landfill as a standard of final disposal method for Mongolia is a great impact of this project. The funds provided by the Ministry of Nature, Environment, and Tourism to help these undertakings is also a big push in this direction.

This project has largely achieved its objectives, therefore its effectiveness is high.

## 3.4 Efficiency (Rating: ③)

#### 3.4.1 Project Outputs

The project's output was produced as planned. Under CMPUA's management, machinery from NEDS can be transferred and is used when needed where needed with no problems posed. Among the undertakings of the Mongolian side, planting trees on NEDS's greenbelt was not completed because nursery trees could not survive due to strong winds, dry weather, and rocky soil. CMPUA is planning to plant trees when NEDS is closed down in 2020<sup>22</sup>. The distance from the highway to the entrance of the disposal site is 2.9km, 1km of which used to be a gravel road. Ulaanbaatar city converted the road into asphalt in September of 2010, 2 years after the project, allowing for easier transportation of collection trucks, and reducing dust and flying garbage from rocking trucks. Main output is listed in table 4.

<sup>&</sup>lt;sup>21</sup> Nalaikh district office hearing

<sup>&</sup>lt;sup>22</sup> CMPUA hearing

|                                      | Items  | Planned  | Actual   |
|--------------------------------------|--|--|--|
| <Japan side                          | e>   |  |  |
| Facility                             | Construction<br>of disposal site             | Narangiin Enger Disposal Site  | As planned   |
| Equipment                            | Waste<br>collection<br>equipment<br>(number) | Compactors (30)<br>Dump trucks (13)<br>Wheel loader (1)  | As planned<br>(Wheel loader is used at Central<br>Workshop)  |
|                                      | Landfill<br>equipment<br>(number)            | Bulldozer (3), Excavator (1),<br>Dump truck (2), Water truck<br>(1), Wheel loader (1),<br>Environmental monitoring<br>equipment (gas detector) (2) | As planned<br>(Wheel loader is used at Central<br>Workshop)  |
| Equipment for<br>Central<br>Workshop |  | Maintenance equipment  | As planned   |
| Soft Component                       |  | Management and operation of disposal site  | <ul> <li>Sanitary landfill (8 participants),<br/>Environmental monitoring (6<br/>participants)</li> <li>organizing waste pickers. Holding<br/>11 meetings for safe collection<br/>with 10 group leaders, OJT for<br/>sanitary landfill.</li> </ul> |
|                                      |  | maintenance of equipment   | 18 participants  |
|                                      |  | Dispatching plan   | 2 participants   |
|                                      |  |  | Total 3.49MM   |
| < Mongolia                           | side>  |  |  |
| Items                                |  | Telephone and electricity line installation  | Electricity line is installed. Cell<br>phone is used instead without any<br>particular inconvenience.  |
|                                      |  | Access road  | Constructed.   |
|                                      |  | Construction of Central<br>Workshop  | Constructed.   |
|                                      |  | Greenbelt for NEDS   | Planting was tried but did not survive.  |

# Table 4Summary of Output

## 3.4.2 Project Inputs

## 3.4.2.1 Project Cost

The project cost was lower than planned as shown in table 5.

|               | 14010 5 1105000 0050                                  |   |
|---------------|---|---|
|               | Planned   | Actual  |
| Japan side    | 1,014 million yen                                     | 990 million yen (97.6%)                                     |
| Mongolia side | 512.3 million MNT<br>(51.2million yen <sup>23</sup> ) | 350million MNT (68.3%)<br>(27.6 million yen <sup>24</sup> ) |

| Table | e 5 | Projec | t Cost |
|-------|-----|--------|--------|
| I uon |     | 110,00 | 1 0000 |

## 3.4.2.2 Project Period

Project period was as planned. Although temperatures in Mongolia can fall to 30 degrees Celsius below zero and limit the months in a year that can be used for construction, the project was completed in 19 months as planned, from June 2007 to December 2008.

Both project cost and project period were mostly as planned, therefore efficiency of the project is high.

## 3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

EPWMD, newly established by the Ulaanbaatar's Mayor Office in January 2009, is in charge of policy planning and coordination related to organizations in the field of waste management, and CMPUA, a subsidiary of the Mayor's office, manages waste disposal sites and part of waste collection.

Collection and transportation of waste is handled by TUK, and other private institutions in addition to CMPUA. Its break down is shown in the table below. Since there are many parties involved in waste management, EPWMD was established as a coordinating agency. However, since this department is new with a total of 7 officials (a director and one official for each of the 6 central districts), the T/C project is currently working on its human resource development.

 $<sup>^{23}</sup>$  It is calculated at 9.83MNT/1yen  $\,$  (based on Basic Design Study Report)  $\,$  .

<sup>&</sup>lt;sup>24</sup> It is calculated at 12.67MTG/yen at median rate of 2008.

|                               | percentage | (based on pop | oulation) |
|-------------------------------|------------|---------------|-----------|
|                               | Apart      | Ger           | total     |
|                               | ment area  | area          |           |
| CMPUA                         | 9.9        | 17.4          | 14.6      |
| TUKs                          | 70.8       | 60.5          | 64.3      |
| Khoroo, private institutions, | 10.2       | 22.1          | 21.1      |
| etc.                          | 19.5       | 22.1          |           |
| total                         | 100.0      | 100.0         | 100.0     |

Table 6 Waste Collection in 7 Districts of Ulaanbaatar city

Source : Population and Waste & Fee Collection Organizations by Khoroo (2012/3/29)

CMPUA has 280 employees as of March 2012, with 37 at NEDS<sup>25</sup>, 86 at the Central Workshop<sup>26</sup>, 68 working for public cleaning, 20 in management, and 69 working in other positions. Because of a planned new disposal site, it is anticipated that the number of workers for disposal sites will double to 74. At the Central Workshop, with the addition of 11 new garbage trucks in May 2012, it is estimated that workers will total 122. NEDS, which is under CMPUA management, along with the Central Workshop have enough workers for operation and maintenance.

### 3.5.2 Technical Aspects of Operation and Maintenance

With regards to the technical aspect of the final disposals, there were some problems with installation of gas pipes at the time of starting operations. However, with the timely start of T/C in September 2009, technical advice was provided, and now NEDS is operated without any problems. Appropriate steps are also followed in terms of sanitary landfill to protect waste pickers.

In Mongolia, vehicle maintenance is generally conducted by its drivers. As for soft component<sup>27</sup> for vehicle repair, operation and maintenance technique is reinforced by timely technical advice by SV stationed at the Central Workshop, and maintenance seminars run by T/C team (covering hands-on training on fieldstrip of cylinder, way to reinforce hinge, fixing oil leak from hydraulic cylinder, etc.), therefore there is no particular problem. In October 2010, SV in maintenance of collection trucks was timely and properly introduced and has been stationed at the Central Workshop since March 2011. SV is offering support for checkups and repair for trucks which spent four harsh winters in Ulaanbaatar and started showing some minor problems.

At the Central Workshop, periodical check-ups on the procured vehicles are conducted twice a year. T/C team gives technical advice on check-up items and the timing to change parts.

<sup>&</sup>lt;sup>25</sup> Break down of these 37 employees are 2 managers, 2 experts(1 each for landfill and hazardous waste), 1 mechanic, 4 registrars in charge of Weigh bridge, 3 truck control, 8 heavy machinery operators, 3 boiler men, 3 cleaners (all for NEDS), 6 staff for Morin Davaa, and 2 staff for Ulaan Chuluut.

<sup>&</sup>lt;sup>26</sup> Break down of the 86 employees of the Central Workshop are 1 director, 3 mechanics, and the rest are truck drivers, operators, boiler men, and cleaners.

<sup>&</sup>lt;sup>27</sup> Out of the 18 participants including mechanics and drivers, who undertook Soft Component training in operation and maintenance of equipment, 15 still remain showing a high retention rate.

#### 3.5.3 Financial Aspects of Operation and Maintenance

#### (1) Composition of Fund for Waste Management

The financial resources for waste management come from the city budget, which is used for NEDS's operation, and collection fees, which is used for collection by CMPUA, TUKs, and other waste collectors. The current amount collected far exceeds the planned amount due to subsidies from the districts (See table 7). Necessary funding is provided and no financial problems have been observed.

|          |                 | 2004   | 2010    | 2011   | 2012      |
|----------|-----------------|--------|---------|--------|-----------|
|          |                 | Actual | Planned | Actual | Expected  |
| city     | Collection fee  | 1,506  | 4,225   | 4,300  | 5,000     |
|          | General budget  | 28     | 591     | 680    | 1,05<br>0 |
|          | Others          | 18     | 0       | 0      | 0         |
|          | Sub total       | 1,55   | 4,81    | 4,98   | 6,05      |
|          | Sub-total       | 3      | 6       | 0      | 0         |
| District | District budget | 0      | 0       | 2,700  | 5,560     |
|          | total           | 1.553  | 4.816   | 7.680  | 11.610    |

Table 7 Source of Waste Management (comparison with the plan, million MNT)

Note: Rounding error may be found in "2004 actual." Source : M/P for 2004, B/D for 2010, EPWMD for 2011-12

## (2) Fund for Final Disposal

CMPUA's waste disposal budget is based on the amount of waste processed and is provided by the general budget of the city. The budget for the final disposal is noted in the graph below, and as can be seen, the budget is proportional to the amount of waste processed.



Figure 6 CMPUA's Budget and Annual Amount of Final Disposal Source : CMPUA

## (3) Fund for Collection and Transportation

Waste collection, including the cost for fuel and operation and maintenance is financed by

collection fees. In Apartment areas, collection fees are paid together with maintenance fees, through the housing service company to the district. In Ger area, it is collected on top of electricity fees through an electricity distribution company and paid in to the district development account after deducting a 25% commission. Then, it is distributed to each waste collector (Figure 7). <sup>28</sup> The collection fee is 2,500MNT/HH/month<sup>29</sup>, and the annual amount collected is estimated to be about 4,300 million MNT (2011) , which is about equal to the planned amount, 4,225 million MNT (2010).

Of the 43 procured trucks, 31 collection trucks are rented to TUK (a private entity), but ownership remains with the Mayor's office (table 8). CMPUA collects 200,000 MNT/month/truck from TUKs, for check up and maintenance. Some TUKs are behind in this payment; however Ulaanbaatar city and the TUKs signed a new contract in January 2012 to improve this situation.

Funds to purchase parts for vehicles and do necessary repairs by CMPUA and TUKs comes from waste collection fees and is currently secured. Increases in personnel, fuel, and operation/maintenance costs are expected with the increase in the number of vehicles. As to the cost uncovered by collection fees, the City Council is going to assess the cost increase, and the city will authorize a budget to cover necessary costs<sup>30</sup>. As already mentioned, in 2012, 28 new collection trucks are being procured by the Ministry of Nature, Environment and Tourism, and an additional 162 trucks are in the process of procurement by city budget (about 14,850 million MNT).

<sup>&</sup>lt;sup>28</sup> Collection fees go into a Waste Service Fund in Chingeltei district. The Waste Service Fund, which was established in each district in 2007 was dissolved in November 2011, except in the Chingeltei district.

<sup>&</sup>lt;sup>29</sup> In the Nalaikh district, the collection fee is 1200MNT in apartment area, and 1500MNT in Ger area.

<sup>&</sup>lt;sup>30</sup> CMPUA hearing



\* In Songinokhairkhan district, Khoroo21, which cover, collection of fee and waste together is excluded

\*\* Only Nalaikh TUK is not privatized and belong to the district \*\*\*Each TUK is in charge of public area dea ning just like CMPUA, and its cost is financed by each district.

Figure 7 Flow of Fund for Waste Management

| Table 8 | Main | Users | of Equipment | Procured | by the | Project |
|---------|------|-------|--------------|----------|--------|---------|
|         |      |       | 1 1          |          | 2      |         |

|                     | CMPUA |                     |                        |                      |                        | TUK                  |                        |                                  |                     |       |
|---------------------|-------|---------------------|------------------------|----------------------|------------------------|----------------------|------------------------|----------------------------------|---------------------|-------|
|                     | NEDS  | Central<br>Workshop | Chingeltei<br>district | Khan-Uul<br>district | Bayanzurkh<br>district | Bayangol<br>district | Sukhbaatar<br>district | Songino<br>khairkhan<br>district | Nalaikh<br>district | Total |
| Compactor           | -     | -                   | 5                      | 2                    | 5                      | 7                    | 5                      | 4                                | 2                   | 30    |
| Dump Truck          | 3     | 11                  | -                      | -                    | -                      | 1                    | -                      | -                                | -                   | 15    |
| Water Truck         | 1     | -                   | -                      | -                    | -                      | -                    | -                      | -                                | -                   | 1     |
| PC200 (Excavator)   | 1     | -                   | -                      | -                    | -                      | -                    | -                      | -                                | -                   | 1     |
| D65 (Bulldozer)     | 3     | -                   | -                      | -                    | -                      | -                    | -                      | -                                | -                   | 3     |
| CASE (Wheel loader) | -     | 2                   | -                      | -                    | -                      | -                    | -                      | -                                | -                   | 2     |
| Total               | 8     | 13                  | 5                      | 2                    | 5                      | 8                    | 5                      | 4                                | 2                   | 52    |

Source: NEDS, Central Workshop, TUKs

## 3.5.4 Current Status of Operation and Maintenance

(1) Final Disposal Site

NEDS is working with no particular problems. The scattering of garbage has been reduced by installing fences and with regular cleaning and, because the water content of the waste is low, no run off has been observed.

## (2) Collection Trucks and Machinery

Garbage collection trucks run 6 days a week, and heavy machinery is used regularly for sanitary landfill. Including the trucks rented to TUKs, there have been no major problems with vehicles. Minor breakdowns are fixed either by the drivers or the central workshop.

As for procurement of spare parts, compared to Russian and Chinese manufacturers, Japanese parts are more expensive and take longer to obtain, but there have not been much difficulty in acquiring the parts so far. This is due to finely-textured assistance from Japan, which included conducting a joint market survey (Japan and Mongol sides) from the time of the M/P study up to the T/C. For heavy machinery, a contract is signed between the CMPUA and the local agent of the manufacturer, so that maintenance can be done by a specialist.

It is expected that collection trucks will be kept in good condition by semiannual check-ups, and prompt repair. Most drivers are in charge of a particular vehicle and look after their assigned vehicles as if they were their own: washing and checking their assigned vehicle for any problems on a daily basis. Maintenance supplies are stored and used at the central workshop without any problems.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.



Changing tires outside the Central Workshop. Trucks can leave only after passing a harsh braking test.



A compact cluster of houses (Chingeltei district)

#### 4. Conclusion, Lessons Learned and Recommendations

## 4.1 Conclusion

This project was implemented to improve waste management including the collection, transportation, and disposal of waste in the midst of a growing need for better waste management in line with the rapidly increasing population of Ulaanbaatar, therefore its relevance was high. The construction of a new disposal site and procurement of compactors and dump trucks for waste collection helped introduce sanitary landfill management and efficient garbage collection, and thereby increased the capacity of waste disposal. Furthermore, the sanitary landfill method employed has helped improve the environment near the disposal site as well as provide a safer working environment for waste pickers. A considerable impact of the project is that the sanitary landfill method employed at the new disposal site has begun to spread to cities in other prefectures, making it the national standard for waste disposal. Despite the harsh Mongolian winters that limited the time available for construction,

the project was completed in time and under budget. There is no major problem regarding the systemic, technological, and financial sustainability of the project's operation and maintenance. In light of the above, the project is evaluated to be highly satisfactory.

#### 4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

In order to continue semiannual vehicle inspections, CMPUA needs to work with TUKs in full cooperation. In the Ger district, while the frequency of collection is expected to increase, fixing the date/time should also be considered since there were strong requests (according to the Ger area residents' survey) for the scheduling of waste collection times. Furthermore, although waste management capacity has surely been enhanced, from now on, measures to reduce waste generation should be enhanced.

4.2.2 Recommendations to JICA None.

## 4.3 Lessons Learned

This project was conducted as a priority project based on M/P which contained a road map for waste management policies up to 2020 with concrete halfway goals and strategies in the field of waste management in Ulaanbaatar city which did not have clear strategies before. The city also made a great effort to realize M/P by prompt procurement of additional collection trucks and worked sincerely to improve waste management, which led to a great achievement.

This project was also conducted as a part of a series of cooperation for improvement of waste management which started with the M/P study in 2004 and included the dispatching of JOCV (in the field of environmental education) and SV (in the field of urban sanitation, and maintenance of collection trucks), and an ongoing technical cooperation project. The effectiveness of this project can be attributed to the timely implementation of T/C and the dispatching of SV. T/C was implemented immediately after this project and helped in the maintenance of the procured vehicles, management of final disposal site, and dissemination of sanitary landfill method. SV, who was dispatched after the TC started, contributed enormously to the operation and maintenance of the procured vehicles. It can be said that this is a good example that the formulating of an M/P in an area with clear development needs, and providing a series of appropriate components of comprehensive cooperation following M/P finally paid off.