FY2016 Project for Ministry of the Environment Japan

# FY2016
# Feasibility Study of Joint Crediting Mechanism Project by City to City Collaboration
## (Study of Energy Saving Sector in Ulaanbaatar, Mongolia)

# Report

February 2017

Overseas International Environmental Cooperation Center, Japan

# FY2016
# Feasibility Study of Joint Crediting Mechanism Project by City to City Collaboration (Study of Energy Saving Sector in Ulaanbaatar, Mongolia)

February 17, 2017

Overseas Environmental Cooperation Center, Japan（OECC）

Contents

Attachment

1. Documents of local（Ulaanbaatar）workshop
   (1) Agenda
   (2) Invitation list
   (3) Presentation materials

2. Documents of domestic（Sapporo）workshop
   (1) Agenda
   (2) Invitation list
   (3) Presentation materials

3. Documents of JCM city to city collaboration seminar
   (1) Seminar in Kita-Kyushu City
      - Event in Sapporo city
      - Presentation in Kita-Kyushu
   (2) Seminar in Tokyo

4. MRV methodology and Project Design Document（draft）

I. Overview of the Project

1. Purpose of the study

The population of Ulaanbaatar, the capital city of Mongolia, has been increasing rapidly since the 21st century. In 2000, the city's population stood at 0.7 million; in the space of 15 years, however, it has almost doubled, reaching 1.39 million in 2016.

This population growth has led to serious air pollution and social problems. One factor which is contributing to worsening air pollution includes rising emissions of air pollutants resulting from the increasing consumption of coal. Coal is the cheapest obtainable fuel in Mongolia, and accounts for over 90% of its total fuel consumption, used for such things as power generation, heating and cooking. In particular, in areas where many of Mongolia's low income class lives, known as "ger" area, smoke emitted from coal-fired stoves (ger stoves) used predominantly in these areas is said to be the main cause of air pollution. Mongolia's National Agency of Meteorology, Hydrology and Environment Monitoring reported in December 2015 that it measured PM2.5, PM10, sulfur dioxide and nitrogen dioxide levels that were far in excess of global standards. Today, Ulaanbaatar is known as one of the worst cities in the world for air pollution.

(August, 2014)

(February, 2015)

Air pollution stage of Ulaanbaatar City

In order to promote sustainable development in Mongolia, there is a need to deal with the complex issues that have arisen due to rapid population growth and urbanization, as well as recent individual environmental issues. Japanese municipal governments could play a part in efforts to present effective solutions by providing knowledge of how they overcame similar complex issues during Japan's period of rapid economic growth, and by introducing the kinds of policies and environmentally-friendly / energy-saving technologies that they used to combat these.

Hokkaido Government and Sapporo City are the biggest municipalities in Japan's cold

region. As of 2015, the estimated population of Sapporo was 1.95 million people. As with Ulan Bator, in the 1960s Sapporo's main form of fuel was coal, which it produced in vast quantities within the prefecture, and air pollution resulting from smoke emissions from coal became a major social issue. However, the issue of air pollution in Sapporo was resolved in the 197os through a combination of a switchover from coal to oil and the implementation of environmental policies. Since the 1980s, the city has been pushing forward with energy saving projects, and is currently one of Japan's leading cities in terms of environmental conservation.

Sapporo and Ulaanbaatar are members of the World Winter Cities Association for Mayors, an association with members from 10 countries and 21 cities worldwide. At the 15th conference, held in Ulan Bator in January 2012, the "Ulaanbaatar Declaration" was adopted. This declaration contains a number of goals, such as curbing emissions of greenhouse gases, cutting energy consumption volumes and the realization of urban activities of a kind that have a low impact on the environment.

In March 2015, Hokkaido signed a memorandum with Mongolia's Department of Energy concerning economic and technological exchanges in the field of energy, and is striving to further technological cooperation between Mongolia and private enterprises in Hokkaido.

"Ulaanbaatar Declaration (Jan. 2012)"
City of Sapporo & City of Ulaanbaatar

Memorandum Signing Ceremony between Hokkaido Government and Department of Energy Mongolia (Mar. 2015)

This project seeks to promote City-to-City collaboration between Ulan Bator and Hokkaido Government, a municipality in Japan's cold region, and Sapporo City, and to disseminate Japan's outstanding low carbon technologies through a Joint Crediting Mechanism (JCM). Specifically, at the same time as cutting Greenhouse Gases (GHG), it aims to implement projects to introduce facilities for cutting environmental pollutants and energy use based on a framework of collaboration between cities.

2. Contents of the study

(1) Feasibility study on introduced technologies, systems and services

Here, we undertook studies on the following two projects scheduled for the environs of Ulaanbaatar in cooperation with Hokkaido and the city of Sapporo.

① Project for introduction of heat pumps to beverage factories

② Project for introduction of thermal storage heaters

The main points of consideration for feasibility were as follows.

① Project for introduction of heat pump to beverage factories

(a) Implementation structure

We looked into ways of introducing heat pumps to two factories in Ulaanbaatar; however, in both cases, we found that facility investment is on hold until the economy recovers. Furthermore, ownership rights of the factories have been transferred to another company, which means we would have to start discussions from scratch again, so we have shelved the proposals for offering facility assistance to either factory in this fiscal year.

(b) Consideration of the impact of the revised energy saving law

In November 2015, we visited the energy regulating committee to gather information about the issues we should find out about in relationship to the details of the revised energy saving law. The law is expected to be enacted in 2017.

(c) Financial structure for clients and partners

We acquired information on the financial structures, capital borrowing capacity and credit status of both the parties where the heat pumps would be installed and the Japanese representative company, and confirmed that pledges could be kept if the projects were implemented. Nevertheless, this time round, we have shelved the project.

(d) Confirmation of support structure for facilities

We did not consider a support structure because we have shelved the project for the meantime.

(e) Consideration of work feasibility and economic feasibility

We have written up again the report on the heat pump cases and the profitability (investment recovery years) that were produced when the factories were diagnosed for energy saving in 2014. If the projects were to be developed, both of them show good prospects for investment recovery in a short period.

② Project for introducing thermal storage heaters to contribute to the task of reducing air pollution

(a) Implementation structure

Through discussions with the deputy mayor who is in charge of environment issues in Ulaanbaatar and the air pollution reduction department (APRD), we were able to confirm that introduction of the thermal storage heaters will be covered by the budget for Ulaanbaatar. And, after trial introductions at six sites in the city, the plan is to carry out full introduction. At time of the full introduction, we will illustrate by way of example the structure required for a JCM project, and press ahead with discussions together with stakeholders.

(b) Financial structures for clients and partners

As this case will be covered by the Ulaanbaatar budget, the city of Ulaanbaatar will be the source of the order.

The financial circumstances of the city are tough at present, but we believe the plan will be certainly implemented.

We are considering several candidates as the Mongolian representative company. And all of the candidates are group companies that are involved in various business enterprises. The financial statements of all of these groups have been made public and we are checking them to make sure there are no problems. Meanwhile, as the representative company candidate is a Hokkaido company, we have started discussing with them how the project can be formed. Also, we have received the financial statement of that company, and are checking it to make sure there are no problems.

(c) Schedule for introduction plan

At present, the period for the trial introduction has been set, yet the period for the full introduction is unsettled. And, depending on the timing of the full introduction, there is a possibility that it will not match the period of time needed to apply for JCM facility assistance. Therefore, as one of the issues from here on, we will work to find out the ongoing circumstances.

(d) Order configuration for facilities

The business undertakings of municipalities are fundamentally based on the process of making tenders. However, for the trial introduction this time round, a German company has been nominated to provide the thermal storage heaters, and it is believed that they have a limited tender contract. Therefore, from here on, we will check to see if the full introduction is to proceed with the same ordering configuration or not.

(e) Configuration of support structure for facilities

The thermal storage heaters to be used in the trial introduction of this plan will

be German ones. And, with regard to forming this project, we will need to discuss business aspects with either the German company or their Mongolian branch office. In a scenario where the German manufacturer is made the supplier, there should be no problems with the support structure for facilities.

(2) Workshops in Mongolia and in Japan

The following workshops have been held between concerned parties from both Japan and Mongolia in an effort to encourage the formation of proposals at an early stage and form new proposals.

① Workshop in Mongolia

A workshop was held in Ulaanbaatar on October 27, 2016. Experts from Hokkaido and Sapporo participated in this workshop, during which they introduced successful examples of energy saving.

② Workshop in Japan

A workshop was held on January 20, 2017, on parallel with the below seminar in Tokyo. Experts from Ulaanbaatar Department of the Natural Environment were invited to this workshop.

(3) Conferences, Monthly reports and Progress report briefing sessions

① Attend at conferences

Representatives from Hokkaido and Sapporo attended the following two domestic conferences that were specified by the Ministry of the Environment.

- Feasibility Study of Joint Crediting Mechanism Project by City to City Collaboration Kitakyushu Seminar (October 20 – 21, 2016)

- Feasibility Study of Joint Crediting Mechanism Project by City to City Collaboration Tokyo Seminar (January 23, 2017)

A request was made by the office to invite to representatives from Ulaanbaatar, and experts from the city's departments related to the environment (Air Pollution Reducing Department and Natural Environment Department) participated in the workshop.

②Monthly reports

During the period in which surveys were carried out (April 2016 – January 2017), the progress of the surveys was ascertained using Gantt charts submitted at the time of application and a monthly mail was sent out reporting the status of progress for each month.

③ Meetings in Japan

The following meetings were held in Japan during the period in which the survey was being carried out. Representatives from Hokkaido and Sapporo were requested to attend the Progress Report Briefing Sessions.

- Kick-off Meeting (May 10, 2016)
- Progress Report Meeting (July 6, 2016)
- 1st Progress Report Briefing Session August 8, 2016)
- Progress Report Meeting (September 15, 2016)
- Progress Report Meeting (November 25, 2016)
- 2nd Progress Report Briefing Session (January 12, 2017)
- Final Progress Report Briefing Session (February 9, 2017)

II. Feasibility study on introduced technologies, systems and services

1. Project for introduction of heat pump to beverage factories

(1) Outline of the project

In 2014, we selected two beverage factories (T and C) of M company expected to have comparatively high energy saving potential, and we diagnosed their energy saving possibilities. The results of those checkups show that if heat recovery heat pumps (double bundle heat pumps) were applied to the water heating process for sterilizing containers and the cooling process of the refrigerant for freezers, energy saving could be enhanced immensely.

The effectiveness of energy saving can be shown by coefficient of performance (COP). When T factory was given a checkup, we obtained diagnostic results that show the promise of a total COP (heating COP + cooling COP) calculation value of 6.2 or higher. Even at C factory, the diagnosis shows the promise of a total COP of 5.3, which, yet again, illustrates high performance.

As steam and power consumption at beverage factories tend not to vary greatly, there should be no reason to stop at just the project for M company's T and C factories, it should be easy enough to laterally spread this project to other big beverage manufacturers/retailers in Ulaanbaatar, such as companies like A, C and V – in particular, the Toshiba heat pump showed great results in the diagnosis process, so it is conceivable that the above companies would be readily agreeable to such a project.

The following shows the energy saving results of the diagnosis implemented in 2014.

① Selected factory

Table 1-1 T factory of M company

| | |
|---|---|
| * Products | Alcoholic beverages such as beer |
| * Energy sources | Electricity, coal (Nalaikh coal: Calorific value of around 4,700ca/kg) |
| * Heat source equipment owned | Steam boiler (4t/h): 2 boilers, Freezer (NH3): 1 freezer |
| * Production processes (heating and cooling processes) | Prep → Boil → Ferment → Store → Fill → Pack → Ship<br>Heating: Apart from prepping/boiling, heating from steam source is used for warmer after filling, washing (CIP) and air conditioning<br>Cooling: Cooling in freezer for fermenting and storing processes |

Table 1-2　C factory of M company

| | |
|---|---|
| * Products | Teas, juices, carbonated drink |
| * Energy sources | Electricity, coal (Nalaikh coal: Calorific value of around 4,700ca/kg) |
| * Heat source equipment owned | Steam boiler (6t/h): 2 boilers, (4t/h): 1 boiler,<br>Screw chiller (R134a): 1 chiller |
| * Production processes | Juice line: Prep → Sterilize → Fill → Cool → Label → Pack → Ship<br>Carbonate Line: Prep → Sterilize → Fill → Cool → Label → Pack → Ship |
| (Heating and cooling processes) | Heating: Apart from prepping, sterilizing and filling processes, heating from steam source is used for washing (CIP), air conditioning and hot-water supply<br>Cooling: Screw chiller (via cold water tank/cooling water tank [both using brine]) is used for cooling (including for syrup), filling process and pasteurizer cooler |

② Contents of energy saving diagnosis

Based on an advanced study and onsite study (hearing, etc.), we compiled and analyzed electric current measurement results for one month, to clarify as much as possible the status of energy use at both factories. From these results, we grasped the potential for reductions in energy and CO2 emissions, and considered a system that could be expected to effectively save energy via the introduction of heat pumps.

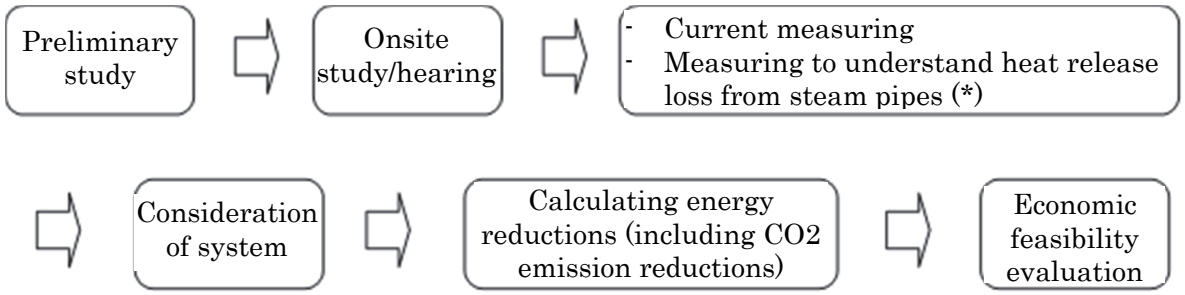



Fig. 1-1　Energy saving diagnosis process diagram

③ Outcome of consideration

Based on the energy saving diagnosis results, the following show the energy saving benefits and profitability that could be expected if each factory introduced heat pumps.



Economic feasibility evaluation

■T factory of M company

- Introduction of double bundle heat pump

  The cold load is the same, so we considered two systems with different thermal loads. However, compared to thermal load, the cold load is less, so simultaneously introducing two systems will be difficult.
- Preheating warm water for heater + brine production
- System outline:

  The idea is to introduce a double bundle heat pump system that simultaneously uses cryogenic and thermal emissions from the heat pumps. First, warm water (35℃) returning to heating system will be preheated to 38℃. Any thermal shortage in the heating system will be covered by heat using steam from existing equipment, to reduce the amount of coal used. Also, by cooling existing brine tanks, power savings can be made for the existing ammonia freezer.
- Hearing items and onsite study items

  Efficiency of existing boiler: 22.3% (calculation from onsite daily report on amount of steam and amount of coal)

  Temperature of heating system hot water feed: 40-70℃

  Output of existing freezer's compressor: 90kW × 2 compressors

- Envisioned items

  Heating period: 1 October to 30 May (approximately 8 months or 5,832h/y)

  Base heating load: 7,396GJ/y (Supply water: 4℃, Return water: 35℃)

  Existing ammonia freezer COP: 4.1

  (Manufacturer's specs: Brine -5℃ → 0℃, Condensing temperature : 32℃)

  Operating time of existing ammonia freezer: 8,760h/y

  Base cold load: 8,633GJ/y

  (Supply water -4℃, return water -1℃, brine specific heat 0.87kcal/kg-K, brine specific gravity 1,042.5kg/m3))

  Amount of heat produced by double bundle heat pump: Heating heat 7,396GJ/y, cooling heat 5,363GJ/y

- Main equipment specs for new installation

  Double bundle heat pump

  Heating capacity: 393kW, Cooling capacity: 285kW, Total COP: 6.23

  Hot water temperature: 40℃ → 45℃, Brine temperature: -1℃ → -4℃

* Preheating of clean-in place (CIP) hot water + brine water production

- System outline

The idea is to introduce a double bundle heat pump, preheat CIP hot water, and use steam from existing equipment to additional heat to make up any lack of heat, in order to reduce amount of coal used. Also, by cooling existing brine tank, power savings can be made for the existing ammonia freezer.

- Hearing items and onsite study items

Efficiency of existing boiler: 22.3%

Temperature of CIP hot water: Approximately 85℃

- Envisioned items

CIP washing time: 1,656h/y (assumed from measuring results that show operation time of 4.6h/d, 360d/y)

CIP load: 16,464GJ/y

(Supply water (S.W) temperature 8℃, CIP tank temperature 85℃, load factor 70%)

Base cooling/heating load: Same as previous item

Amount of hot water for CIP washing: 66m3/batch

Amount of produced heat by double bundle heat pump: Heating heat 11,905GJ/y, cooling heat 8,633GJ/y

- Main equipment specs for new installation

Double bundle heat pump

Heating capacity: 392kW, Cooling capacity: 285kW, Total COP: 6.23

Hot water temperature: 40℃→ 45℃, Brine temperature: -1℃→ -4℃

Amount of 40℃ hot water produced: Approximately 10m3/h

Hot water tank

Capacity: 70m3

■C factory of M company

- Introduction of double bundle heat pump

- System outline:

The idea is to introduce double bundle heat pumps, and fill existing cold water tank with brine, in order to save on power used for existing brine chiller. Also, unused water tanks will be heated to store heat at 51℃ as hot water tanks, to preheat supply water on each line, so that the amount of coal used will be reduced.

- Hearing items and onsite study items

Existing boiler -29.4% (calculation from onsite daily report on amount of steam and amount of coal)

Existing brine chiller COP: 1.5

(Brine temperature difference of 5℃ calculated from electric current, load factor and amount of current at time of study)

Existing cooling tower's cold water pump: 22kW (11kW × 2 pumps)

Existing cooling tower fan: 6.6kW (1.1kW × 6 fans)

Existing brine pump: 22kW (11kW × 2 pumps)

Existing chiller cooling water pump: 22kW (11kW × 2 pumps)

- Envisioned items

Supply water temperature: 8℃, brine specific heat 3,642J/kg℃, brine specific gravity 1,043kg/m3

Existing brine chiller running time: 3,973h/y

(Calculated from assumed cold load excluding cooling capacity)

Cold load: 6,991GJ/y

(Running time of measured period converted to yearly running time, temperature calculated as difference of 5℃)

Heat load of CIP, boiler supply water, bottle washer and pasteurizer: 14,245GJ/y

(Used measured running time to calculate rise in temperature of supply from 8℃ to 41℃)

Amount of heat produced by double bundle heat pump: Cooling heat 3,771GJ/y, heating heat 5,530GJ/y

- Main equipment specs for new installation

Double bundle heat pump system: 1 system

Cooling capacity: 163kW, Heating capacity: 239kW, Total COP: 5.3

Brine temperature: 3℃ → -2℃, Hot water temperature: 46℃ → 51℃

Fig. 1-2 and Fig. 1-3 show diagrams of the overall processes for each factory.

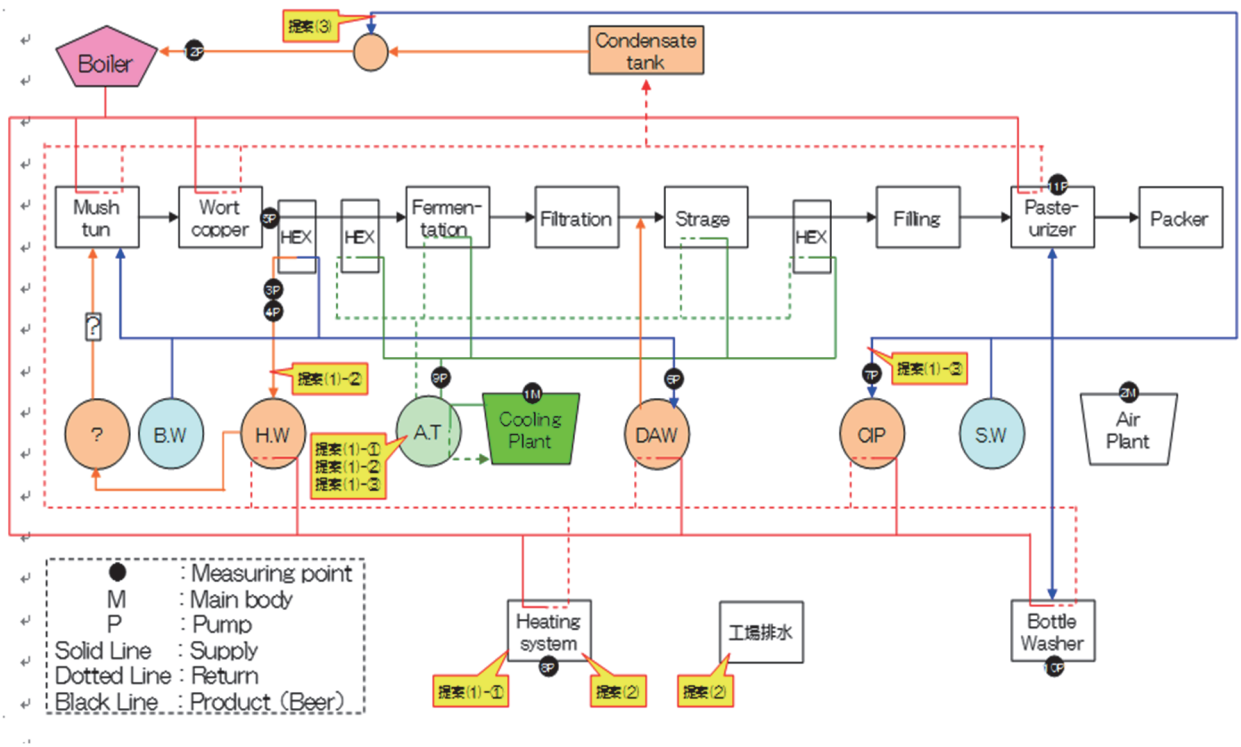



Fig. 1-2 Diagram of overall processes of T factory

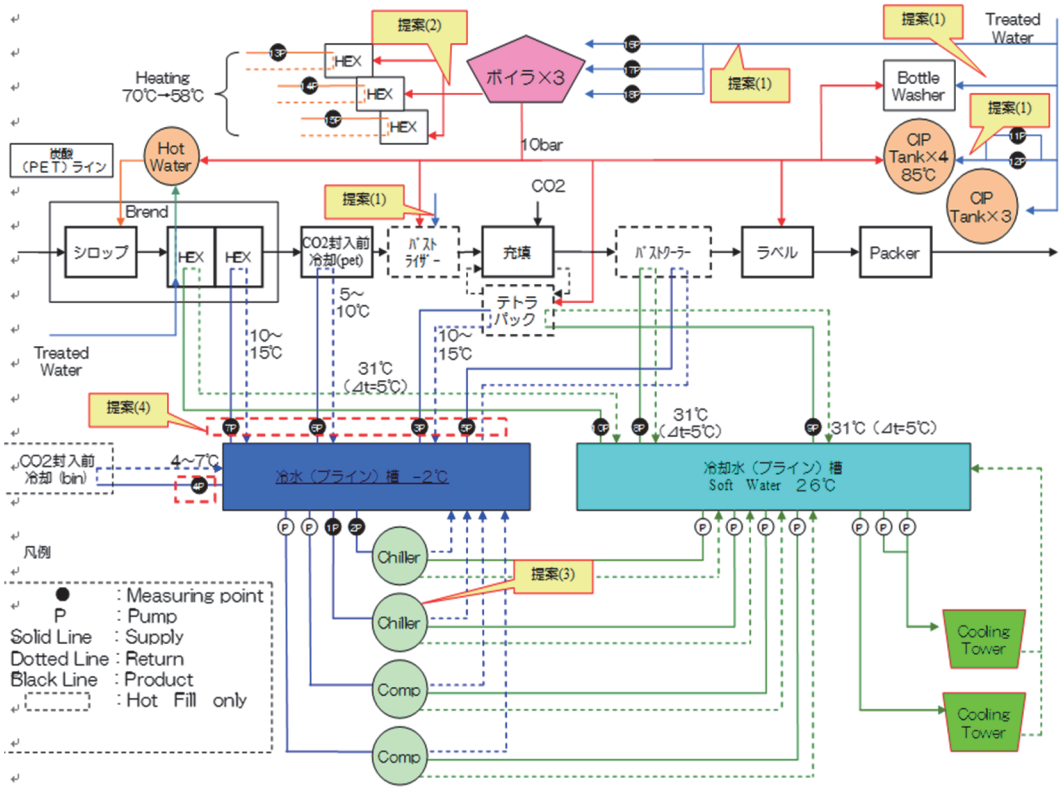



Fig. 1-3 Diagram of overall processes of C factory

It is assumed that the heat pumps to be introduced will be electrical ones, and Fig. 1-4 shows the fundamental principles of the pumps. In the case of beverage factories, heating and cooling processes run simultaneously, so heat pumps can be utilized to their maximum capacity. Thus, in a scenario such as Fig. 1-5, 7kW of output can be obtained from 1kW of power consumption and a COP of 7.0, which is an extremely efficient way of saving energy.

By using this capacity to the utmost for not just individual processes in each factory but all the processes,: the boilers will become highly efficient, coal consumption will be reduced, making CO2 emission reductions a reality, while at the same time offering the operators a good opportunity to make massive savings on costs.

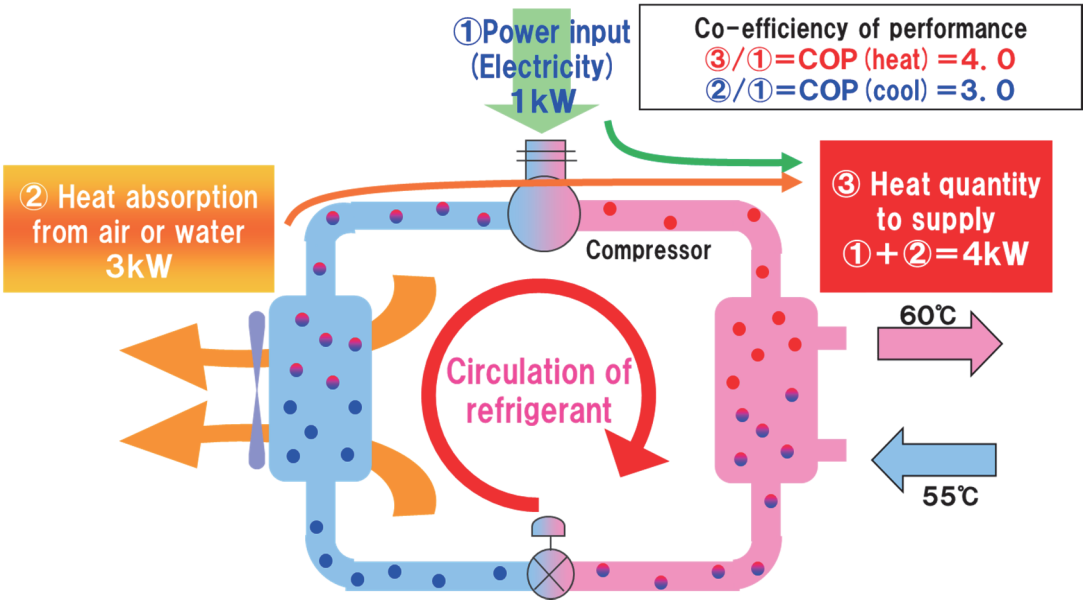



Fig. 1-4 Basic principles of heat pump

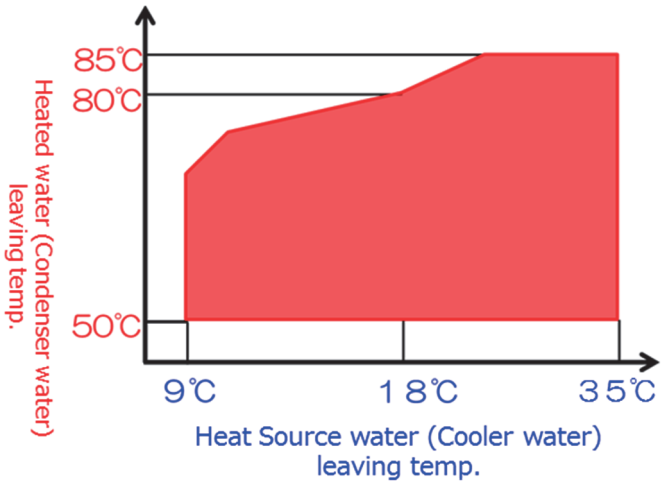



Fig. 1-5 Operation range

Fig. 1-6 shows an image of the heat pump to be used this time.

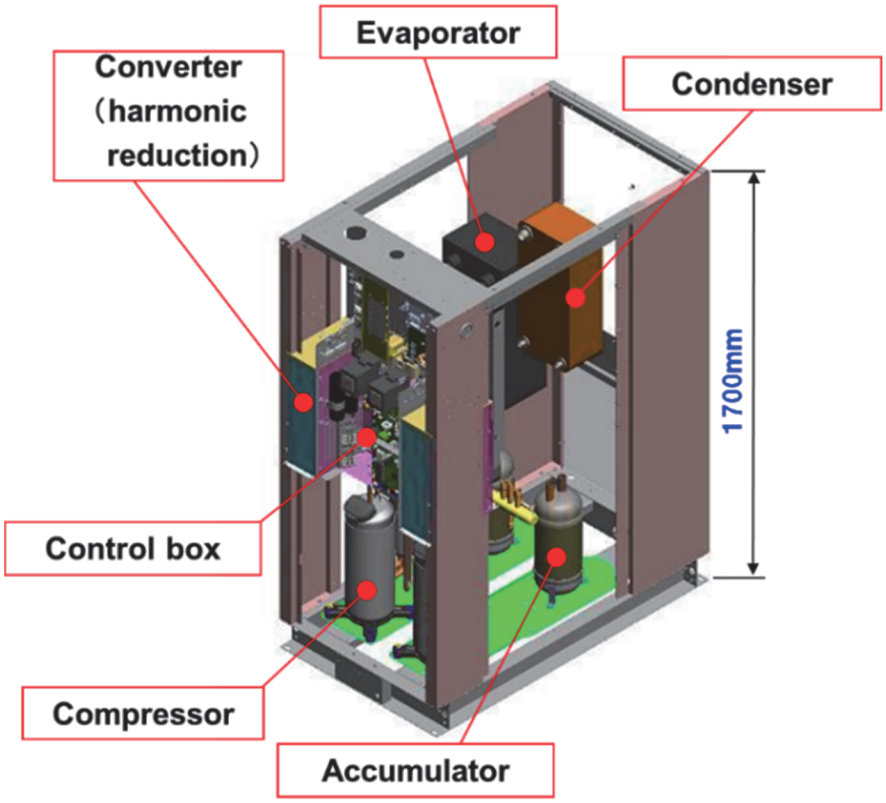



Fig. 1-6 Image and features of heat pump

(2) Feasibility study

Of late, companies are holding back on facility investment due to the economic situation in Mongolia. Likewise, with this case, even though we looked at ways to introduce heat pumps into the beverage factories, the prospective candidate, M company has frozen facility investment for both the T and C factories until the economy recovers. Furthermore, with regard to T factory, it has been taken over by another of Mongolia's big beverage manufacturers (A company), so the contact person has changed. Hence, we have had to shelve the proposal of facility assistance for this fiscal year for both factories.

① Implementation structure

We have reproduced the diagram showing the implementation structure for this case.

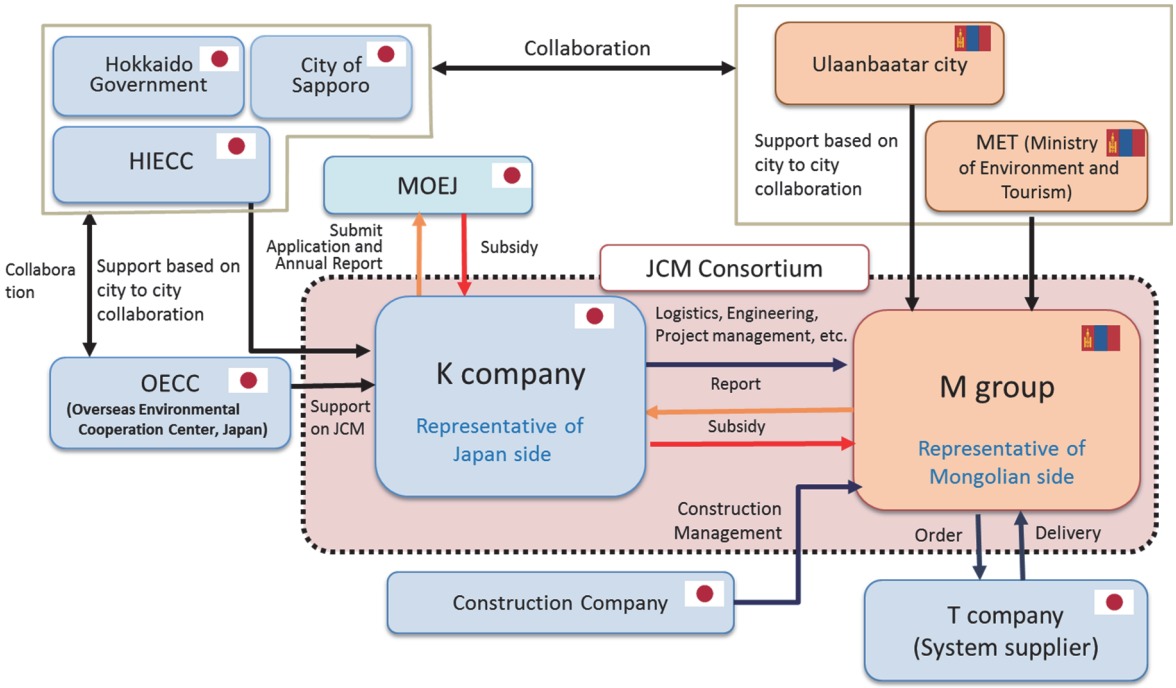



Fig. 1-7 Implementation structure diagram for introduction of heat pumps

② Impact of revised energy efficiency and conservation law

The revised energy efficiency and conservation law was approved by the Mongolian parliament in October 2015. In June and December of 2016, OECC visited the Energy Regulatory Commission (ERC), the body that audits the energy efficiency and conservation law, to conduct a hearing related to the law. The outline of those hearings is as follows.

(a) Outline of energy efficiency and conservation law

At the June 2016 visit, we found out about the operating regulations related to the energy efficiency and conservation law before they were formally announced. The cover sheet of the operating regulations is shown on the right. And an extract of the regulations is shown below.


**III: Requirements for auditing bodies and specialist bodies**

**3.1. Auditing body will fulfill the following requests.**

**3.1.1. Be registered in Mongolia, and undertaking activities in electricity and construction.**

**3.1.2. Have three or more electricity auditors and engineers, and economic specialists working.**

**3.1.3. Auditors must be employees of that body.**

**3.1.4. Must have documents, such as criteria, standards, manuals and methodologies related to energy saving based on the inventory made available by the energy saving committee.**

**3.1.5. Must possess the necessary measuring instruments, equipment and software for electricity auditing activities.**

**V: Training and study for qualifications for auditors and managers**

**5.1. Educational bodies must teach study programs that are approved by the energy saving committee.**

**5.2. Training and study directed at developing auditors and managers.**

**5.2.1. Electricity auditors/manufacturers and services (electricity, thermal, gas)**

**5.2.2. Electricity auditors/construction**

**5.2.3. Energy saving managers**

**5.3. Educational bodies must inform the general public about study programs via mass media and the website of the energy saving committee at least one month in advance.**

**5.4. Candidates who fulfill the requirements of 4.1 of these regulations and who have arranged the documents designated in 4.2 of these regulations will be registered by the educational bodies, and taught.**

**5.5. Educational bodies will hand over to the energy saving committee within three days of completion of study the documents attached with the students' application forms that include a study reports together with any written applications for authoritative exams for auditors and managers.**

**5.6. The energy saving committee will hold authoritative exams for auditors and managers in the seven-day period after the study program, and will post exam percentages on their website to inform the general public.**

**5.7. The energy saving committee will evaluate educational bodies' students by surveying them in student questionnaires, looking at student achievements and using other new methods.**

(b) Audit structure

Energy Efficiency and Conservation Division (the body that plans how to operate energy efficiency and conservation law) was established in February 2016, and at the time of our visit in June, this body was being run by eight people.

As described above in the operating regulations, establishment of auditing body and educational body has been settled, and the educational body is active already.

Once audit body personnel have been chosen and facilities prepared, establishment of the auditing body will be announced officially.

(c) Auditing targets

The targets of auditing are to be heavy power consumers like mines, factories and companies, with those mines, factries and general companies that exceeded fixed power consumption figures or heat consumption figures over three years from 2013 to 2015 being the audit targets. The consumption figure for mines is defined as 5GWh, the figure for factories is 3GWh/y and the figure for general companies is 2GWh/y. There are approximately 150 companies targeted for auditing under these official regulations. And, we have confirmed that M company's T and C factories are subject to this auditing.

Mines targeted for auditing are now obligated to deploy energy saving managers. And, as of December 2016, some 30 people have completed energy saving auditing and management training, and gained the relevant qualifications.

(d) Auditing method

At first, the talk was that the government would create a list of highly efficient energy saving equipment, and make it obligatory for audit-targeted mines to introduce such equipment. However, the list has not been made, and instead the energy saving managers at audit-targeted mines have the job of planning energy saving measures that will then be evaluated by a third party, and assistance provided to introduce the necessary energy saving equipment.

Implementation of the energy efficiency and conservation law is expected to be announced some when in 2017. And, with the law being put into practice, the energy saving managers of the targeted mines doubtless will start pushing ahead with plans to introduce energy saving equipment. Therefore, we at OECC have been working to promote the introduction of energy saving facilities using JCM to the main mines and companies in Mongolia. From here on also, we will visit ERC, and continue to make ourselves conversant with the preparation status of the initial implementation of the energy efficiency and conservation law, while also working to catch up on matters in question about JCM work.

③ Financial structure for client and partners

The core of the M group is involved in various forms of business in Mongolia, and

the beverage business is a joint venture concern with companies from Europe and America, with management undertaken in a western style. Furthermore, A company, which has bought out T factory, is a big beverage manufacturer in Mongolia. And reviews of both companies' financial details that have been made public prove them both to be sound. Meanwhile, a review is underway to confirm that the officially announced financial reports of the Japanese partner (K company) are sound, as well.

④ Consideration of support structure for facilities

We did not get as far as considering the configuration of the support structure for this case. Yet, in conjunction with client moves and the enactment of the energy efficiency and conservation law, we will investigate the feasibility of introducing energy saving equipment.

⑤ Consideration of business feasibility and economic feasibility

The following show the prerequisites and results of trial calculations on the energy saving efficacy of heat pumps in a scenario where double bundle heat pumps are introduced into M company's T and C factories.

Table 1-3 Prerequisites of trial calculations

○ Circumstances of energy usage

| | Amount used | Amount of $CO_2$ emissions | Running costs |
|---|---|---|---|
| Electricity | 2,322 MWh/y | 2,561 t-CO2/y | 262,404 kMNT/y |
| | | 23% | 37% |
| Coal | 4,394 t/y | 8,749 t-CO2/y | 439,400 kMNT/y |
| | | 77% | 63% |
| Total | - | 11,310 t-CO2/y | 701,804 kMNT/y |

* Actual values for January to December 2013

○ Unit price

- Electricity unit price 113 MNT/kWh
- Coal unit price 100 MNT/kg

○ CO2 emissions factor

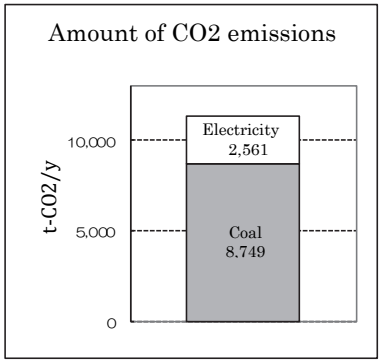
- Electricity 1.103 kg/kWh
- Coal 1.991 kg/kg

○ Primary energy factor

- Electricity 9,760 MJ/MWh
- Coal 19.67 GJ/t
- Crude oil equivalent 0.0258 kL/GJ

Amount of CO2 emissions

| | Cost | Amount of $CO_2$ emissions | Primary energy |
|---|---|---|---|
| Coal | 439,400.0 | 8,749 | 2,230 |
| Electricity | 262,404.2 | 2,561 | 585 |



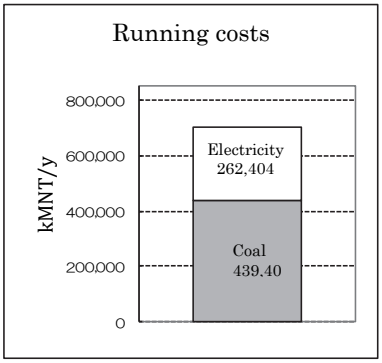




Table 1-4 Estimation for T factory

| | Proposal items | Amount of Electricity (kWh) | Amount of coal (ton) | Amount of CO2 (t-CO2) | Running costs (kMNT) | Construction costs (kMNT) | Investment recovery years |
|---|---|---|---|---|---|---|---|
| Proposal (1) | Introduction of double-bundle heat pump | — | | | | | |
| ① | Preheating warm water for heater + brine production | ▲235,805 | 1,689 | 3,104 | 142,293 | 590,000 | 4 |
| ② | Preheating CIP warm water + brine production | 9,101 | 229 | 466 | 23,942 | 493,333 | 21 |
| ◎③ | Introduction of heat recovery heat pump | ▲382 | 2,719 | 4,993 | 228,746 | 773,333 | 3 |
| Proposal (2) | Preheating warm water for heater (making use of wastewater as a thermal source) | — | | | | | |
| | Introduction of air cooling heat pump | ▲69,037 | 186 | 294 | 10,806 | 183,333 | 13 |
| Proposal (3) | Heating of boiler make-up water | — | | | | | |
| | | ▲45,064 | 71 | 92 | 2,047 | 45,000 | 22 |
| Total | | ▲114,483 | 2,977 | 5,380 | 241,598 | 956,666 | 4 |

Table 1-5 Estimation conditions for C factory

**Calculating out boiler efficiency**

The following show the relationship between amount of steam and amount of coal from the data received.

| Month | Amount of steam | | Amount of coal | |
|---|---|---|---|---|
| | For production (t) | For heating (t) | For production (t) | For heating (t) |
| 1 | 600 | 308 | 300 | 236 |
| 2 | 544 | 280 | 272 | 224 |
| 3 | 784 | 236 | 392 | 186 |
| 4 | 624 | 254 | 312 | 123 |
| 5 | 816 | 248 | 408 | 0 |
| 6 | 776 | 240 | 388 | 0 |
| 7 | 944 | 248 | 472 | 0 |
| 8 | 704 | 232 | 352 | 0 |
| 9 | 816 | 212 | 408 | 0 |
| 10 | 913 | 158 | 456.5 | 236 |
| 11 | 568 | 450 | 284 | 225 |
| 12 | 744 | 434 | 372 | 217 |
| Total | **8,833** | 3,300 | **4,417** | 1,447 |

Calorific value of coal and steam pressure value are taken from the hearing.
Calorific value 4500 Mcal/t (18.837 GJ/t)
Steam pressure 10 bar (gauge pressure)
Specific enthalpy of saturated steam is as follows. 2780.6672 MJ/t
Sensible heat is 33.488 MJ/t if supply water temperature is assumed to be 8 °C
The figure is 293.02 MJ/t if the return temperature of steam for heating is assumed to be 70 °C
Sensible heat is 104.0769 MJ/t as weighted average supply water temperature is 24.9 °C

And, water supply rate is 12,133t if blow rate is presumed to be 0%
Therefore, the amount of energy suppliable as production steam is:

(2,780.6672 MJ/t - 104.07694 MJ/t) × 12,133t = 32,475 GJ/y

Production steam productivity is: 32,475 GJ/y / 18.837 GJ/t / 5,864t = **29.4%**
We have left out the amount of coal for heating as some amounts were not recorded.

**Reference**

Steam table source: 1999 JSME steam table
Steam pressure (absolute pressure): 1.1 MPa
Saturated steam temperature: 184.0697 [C]
Steam latent heat: 1999.4694 [kJ/kg]
Specific enthalpy of saturated water: 781.1977 [kJ/kg]
Specific enthalpy of saturated steam: 2780.6672 [kJ/kg]
Specific volume of saturated steam: 0.1774 [m3/kg]
Specific volume of saturated water: 0.001133 [m3/kg]

Emission factor

| | | |
|---|---|---|
| Electricity | kg-CO2/kWh | 1.103 |
| Coal | kg-CO2/GJ | 101.2 |
| | kg-CO2/ton | 1,906 |

Unit price

| | | |
|---|---|---|
| Electricity | Tg/kWh | 113 |
| Coal | Tg/ton | 68.000 |

Whole structure

| | | |
|---|---|---|
| Amount of power | 4,927,000 | kWh |
| Amount of coal | 6,104 | ton |

Reduction regarding whole structure

| | Amount of power (kWh) | Amount of coal (ton) | Amount of CO2 (t-CO2) | Running costs (kMNT) |
|---|---|---|---|---|
| Current situation | 4,297,000 | 6,104 | 17,071 | 971,823 |
| Amount of reduction | 234,222 | 998 | 2,162 | 94,358 |
| Reduction rate | 5% | 16% | 13% | 10% |

Table 1-6　Estmation results for C factory

| | Proposal items | Amount of Electricity (kWh) | Amount of coal (ton) | Amount of CO2 (t-CO2) | Running costs (kMNT) | Construction costs (kMNT) | Investment recovery years |
|---|---|---|---|---|---|---|---|
| Proposal (1) | Introduction of double-bundle heat pump | 234,222 | 998 | 2,162 | 94,358 | 553,333 | 6 |
| Proposal (2) | Preheating warm water for heater (making use of wastewater as a thermal source) | ▲540,223 | 646 | 636 | ▲17,109 | 565,000 | - |
| Proposal (3) | Renewal to provide highly efficient brine chiller | 370,808 | 0 | 409 | 41,901 | 588,333 | 14 |
| Proposal (4) | Introduction of variable flow control to conveyance system pump | 58,868 | 0 | 65 | 6,652 | 219,167 | 33 |
| Total | | 123,675 | 1,645 | 3,271 | 125,802 | 1,925,833 | 15 |

For the T factory, the trial calculations show that the investment recovery would be three years, which would be a good result from an extremely effective introduction in Proposal (3) above, where the introduction would be a heat pump for the simultaneous processes of CIP warm water heating and brine water production.

Moreover, in the case of C factory, the investment recovery would be six years for Proposal (1) processes, where a double bundle heat pump would be introduced.

(3) Consideration of CO2 reductions

For the T factory, the trial calculations show that approximately 5,000 tons of CO2 would be reduced using Proposal (3) above, where the introduction would be a heat pump for the simultaneous processes of CIP warm water heating and brine water production.

Also, in the case of C factory, some 2,000 tons of CO2 would be reduces with processes, where a double bundle heat pump would be introduced.

(4) MRV methodologies and PDD (setting for reference scenario)

For T factory, a double bundle heat pump would be applied to the heating process for hot water used in sterilization washing of containers and the cooling process for the refrigerant used in the freezer, which would enhance the efficiency of the freezers on the production lines of the beverage factory as well as coal consumption being reduced by residual heat from CIP washing.

The following are the specs of the existing freezers.

- Brine exit temperature: -5℃
- Brine entry temperature: 0℃

- Cooling water entry temperature: 32℃
- Cooling capacity: 588kW
- Power consumption: 145kW
- COP: 4.06

② Deciding capacity of heat pump

■ Assumed heating load from power consumption of CIP pump

Power consumption 4kW → Assumed load 4,000kW

CIP hot water volume: 44.1m3/h (= 4kW × 6,120 × 0.6 × 20m)

Heat load: 3,945kW (= 44.1m3/h × (85-8)℃ = 3,393Mcal)

■ Assumed cold load from power consumption of two brine pumps

Base power consumption 5kW → Assumed load 274kW

Peak power consumption 20kW → Assumed load 698kW

■ Heat pump capacity (catalog values)

Cooling capacity: 285kW (> 274kW)

Heating capacity: 393kW

Rated power consumption: 109kW

■ Capacity when heat pump is running

Cooling capacity: 274kW → 986MJ/h

Heating capacity: 378kW (= 274/285 × 393) → 1,359MJ/h

Power consumption: 105kW (= 109 × 274/285) + 6.45 = 111.45kW

③ Energy consumption before heat pump introduction (reference)

■ Heating of CIP washing water

Given heat energy: 16,464GJ/y (assumed to be heated for 4.6h/d, in operation 1,656h/y)

⇒ Required amount of coal: 3,761t/y (= 16,464/0.223*19.7GJ/t)

Boiler efficiency: 22.3%

Coal heat capacity: 19.7GJ/t

■ Freezer cooling energy: 8,633GJ/y (= 986MJ/h × 8,760h/y)

Amount of power consumption: 591MWh/y (= 8,633/3.6/freezer COP (= 4.06))

④ Energy consumption after heat pump introduction (project)

■ Preheating CIP washing water

Heating energy: 11,905GJ/y (= 1,359MJ/h × 8,760h)

⇒ Lacking energy: 4,559GJ/y (16,464GJ/y – 11,905GJ/y)

Required amount of coal: 1,041t/y (= 4,559/0.223*19.7)

■ Cold energy: 8,633GJ/y (= 986MJ/h × 8,760h)

■ Monitoring points

1) Amount of power consumption by heat pump

2) Tank exit calorific values (set calorimeters)

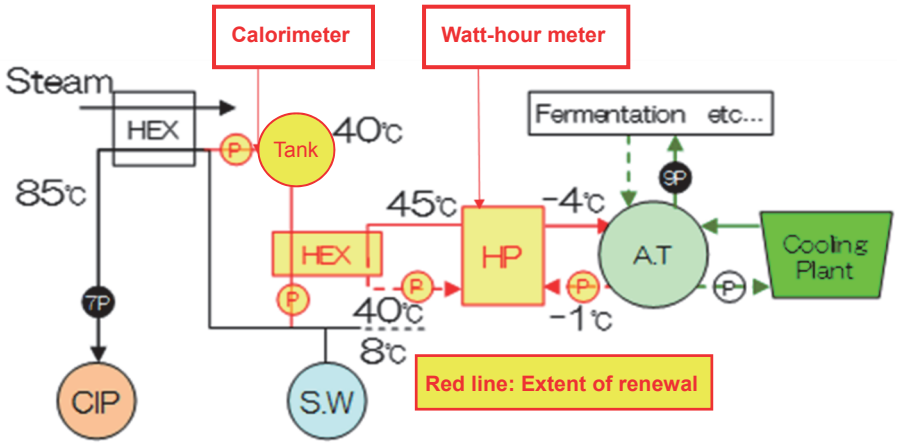



Fig. 1-7 Monitoring points

⑤ Amount of reduction in energy consumption provided by heat pump introduction (project)

■ Amount of reduction in heating energy for CIP washing water

Amount of coal consumption reduction: 2,720t/y (= 3,761t/y - 1,041t/y)

⇒ Amount of CO2 emission reduction: 5,416t/y

■ Amount of freezer cooling energy reduction:

8,633GJ/y - 8,633GJ/y = 0 ⇒ same capacity as existing freezer

■ Amount of power consumption reduction:

591MWh/y - 974MWh/y = ▲383MWh/y

⇒ Amount of CO2 emission reduction: ▲305 tCO2 (＝▲ 383×0.797)

Grid emission factor: 0.797tCO2/MWh

■ Amount of CO2 emission reduction: 5,111 tCO2/y (= 5,416–305)

⑥ Evaluation of economic feasibility for heat pump introduction (project)

Heat pump: 28 million yen
Service life: 10 years
Power charge: ¥6.5/kWh
Coal price: ¥1,450/t
⇒ Cost saving: 1.51 million yen per year
Saving due to coal consumption reduction: 4 million yen per year
Additional load to power charge: 2.49 million yen per year

Investment efficacy: ¥274/tCO2
Subsidy: 14 million yen
Amount of CO2 emission reduction:
51,110 tons over 10 years

(5) Problems in future

The problem of introducing energy saving equipment is to make savings on energy consumed. However, the state of the economy is such that the tendency is to give priority to product manufacturing, which makes it hard for us to conclude business. Indeed, if the saving from an introduction is not that great, then it is difficult to envisage a fast recovery of investment.

Preparations are underway in Mongolia for the enactment of the energy efficiency and conservation law in 2017. Once the law is enacted, the auditing body will audit mines, and energy saving plans will be evaluated. Therefore, from here on too, we will push ahead with studies to ascertain the feasibility of introducing energy saving equipment in line with client trends and the status provided by enactment of the energy efficiency and conservation law.

2. Project for introduction of thermal storage heaters to contribute air pollution reduction

(1) Outline of the project

① Background to proposal on this project

The greatest problem in Ulaanbaatar is air pollution caused by coal-burning stoves and heat only boilers (HOB). And the Ministry of Environment, Green Development & Tourism (MEGDT) and the Air Quality Agency of Capital City (AQDCC) have been working on measures to solve the problem caused by these stoves and boilers. In 2016, APRD ran a study and MET selected seven kindergartens as targets for air pollution action, which is now being implemented. The action involves changing the coal-burning HOB to electrically heated HOB at the kindergartens.

As has been reported by the renewable energy sector, the demand for nighttime electricity in Mongolia is small, so spare power is transmitted at a cheap price to Russia. And, during winter, low-income residential areas are able to get power with nighttime power charges almost free, which is stimulating demand.

As an alternative form of heating of that provided by coal-burning HOB, the thermal storage heater, which uses nighttime power, is full of potential when it comes to drastically improving air pollution. The thermal storage heaters in question are sold and installed by a company in Hokkaido, which has provided some thermal storage heaters for trial use to the National University of Mongolia.

We obtained information saying that the thermal storage heaters are one of the items being considered in plans to reduce air pollution in Ulaanbaatar. Therefore, we held discussions with MET and APRD to look into the feasibility of creating some JCM facility assistance work with a project to introduce thermal storage heaters to homes in Ulaanbaatar using funds from the city budget.

② Outline of thermal storage heater

An image of the thermal storage heater and its configuration are shown in Fig. 2-1。

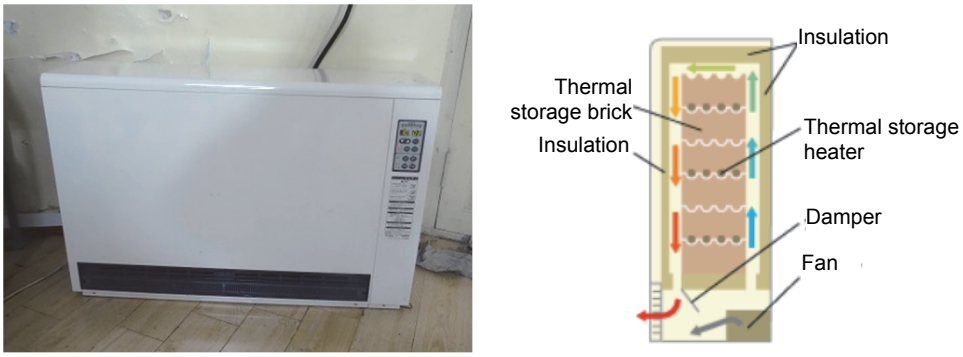



Fig. 2-1　Thermal storage heater (heat capacity 4kW)

Thermal storage heaters have a simple construction, where heaters are sandwiched between thermal storage bricks, and the bottom of the heater holds a fan and a vent for hot air to be released, with heat being stored at nighttime and released during the daytime to provide heating.

Nighttime electricity is used to store the heat in the heater, with the storage time usually being eight hours between 10:00 pm and 6:00 am the following morning. The heat capacity of the heater is determined by the size of the room to be heated. For the simple Mongolian homes known as "ger" or "pao", where coal-burning stoves are currently used, the thermal storage heater capacity under consideration for introduction is a 4 to 6kW one.

The following is a list of features of the thermal storage heater.

(a) Easy installation

As long as the homes are electrically wired, heaters just need to be plugged into wall power sockets, and then they are ready to be used. And, as long as electrical wiring and meter capacity are sufficient, then extra wiring is not required.

(b) Fuel supply not needed

There is no need to buy in supplies of fuel because the release of heat from the thermal storage heater is run by electricity.

(c) No air pollutants emitted

Unlike coal-burning stoves, as fuel is not used, there are no air pollutants emitted. Furthermore, the thermal storage material is brick made of clay – so, even if deteriorated bricks are thrown away, they will not pollute the local environment.

(d) Easy maintenance

The thermal storage heater has a simple construction that combines heater, thermal storage bricks, a fan, insulation material and controller. Indeed, the fan is the only moving part, so none of the components tend to breakdown. Also, the thermal storage bricks and the heating elements can be replaced easily.

(e) Easy heat adjusting

By just controlling the air flow from the fan enables the user to change between rapid heating and prolonged stable heating. Simultaneous thermal storage and heat release is possible, as is 24-hour heating.

(f) Heater housing is comparatively big and heavy

Bricks are used as the thermal storage material, which is surrounded by insulation material, to retain heat – therefore, the thermal storage heater is heavy and has a big housing case compared to other heating facilities.

(g) Consideration of auxiliary heating facilities

Storing heat during a power cut is not possible, though heating can be sustained at times other than prolonged power cuts during daytime. Nevertheless, in the severe Mongolian winter, it would be advisable to have auxiliary heating facilities to ensure some form of heating.

③ Cooperating with the National University of Mongolia

The thermal storage heaters in question are sold and installed by a company in Hokkaido, where many such heaters have been installed successfully. The following shows the sales results.

Table 2-1 Thermal storage heater sales results

| Date of supply | Delivery location | Outline |
|---|---|---|
| Nov 2010 | Sapporo apartment block | 85 heaters installed, with 5 types used to suit room sizes |
| Jun 2011 | Eniwa apartment block | 34 heaters installed, with 2 types used to suit room sizes |
| Feb 2014 | Sapporo apartment block | 76 heaters installed, with 3 types used to suit room sizes |
| Dec 2014 | Homes for elderly in Eniwa | 37 heaters installed, with 2 types used to suit room sizes |
| Oct 2014 | National University of Mongolia | 2 heaters introduced for research, and running on trial |
| | | 232 heaters (5 types) have been installed from 2010 onward |

From the Tohoku earthquake (March 2011) onward, the use of nuclear power stations was suspended, which caused a drop in excess power supply capacity. Thus, power is being generated to just meet the demand, and the difference in daytime and nighttime power charges is disappearing. And, as using cheap nighttime power for storing heat is a big factor in making the thermal storage heater attractive to use, the demand for such a heater in Japan has dropped.

Hokkaido/Sapporo has been cooperating up to now with Ulaanbaatar at municipal and business level with regard to reducing air pollution. And, this time round, through mutual interaction in 2012, a Hokkaido company also participated in a meeting to exchange views with the National University of Mongolia. And when the company found out about the situation in Mongolia, they proposed the use of the thermal storage heater. Indeed, in 2014, the company offered thermal storage heaters free of charge for research purposes, asking for the university to collect research data on issues such as the change in room temperature at the installation site. The graph shows an example of the results.

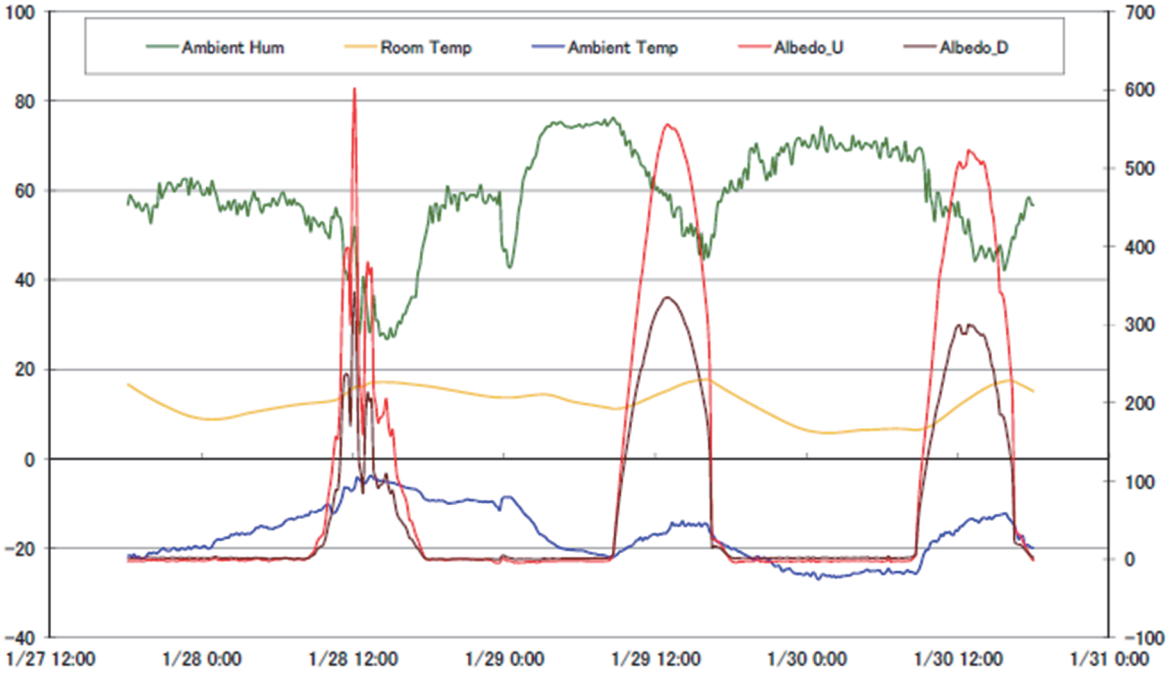



Fig. 2-2 An example of operating results for thermal storage heater

With the university and others announcing the operating results, it is thought that the publicity about the efficiency of the thermal storage heater has earned it a place in Ulaanbaatar's planned proposal to find an alternative to coal-burning stoves.

④ Ulaanbaatar's air pollution plan

After the Mongolian general election in June 2016, environment-related authorities in Mongolia as well as organizations in Ulaanbaatar were reorganized. And, along with that, the department overseeing air pollution reductions and its role changed too.

(a) Role before general election

- The city organization (AQDCC) oversaw studies related to countermeasures on air pollution reductions.
- The authorities (MEGDT) oversaw the drafting of plans and their implementation based on the results of studies by AQDCC.

(b) After reorganization

- MEGDT assumed the new name of MET (Ministry of Environment & Tourism), which now oversees the drafting of plans to counteract environmental pollution.
- AQDCC assumed the name APRD (Air Pollution Reducing Department), which now decides the detailed implementation items and budgets for drafted plans as well as overseeing the implementation of items.

Having been enlarged from an agency to a department while at the same time having its authority strengthened, APRD will implement air pollution countermeasures in Ulaanbaatar from now on in a step to put the city at the heart of the effort.

With this strengthening of Ulaanbaatar's authority, air pollution countermeasures have become even more important as part of the municipal link up with Hokkaido/Sapporo. And, as part of that, in our study in October 2016, together with Sapporo city, we met and discussed issues with the deputy mayor who is in charge of environment issues. An outline of those discussions is as follows.

(a) Explanation from deputy mayor

- Half of the households in Ulaanbaatar (190,000 homes) are in ger (yurt) areas. And improving the residential environment of such ger areas is a pressing issue.
- Mongolia is in an economic slump at the moment, but necessary issues are being thought about in environmental measures, and the city does want to cooperate with others to find some concrete solutions.

(b) The wishes of Sapporo and OECC

- This year, Hokkaido and Sapporo are pushing ahead to establish business by collaborating with other cities. And one such business proposition is thermal storage heaters that use nighttime electricity. A Hokkaido company and the National University of Mongolia are collaborating in heater trials, so the Japanese side would like to see a heater introduction plan included for the coming fiscal year.

(c) Reply from deputy mayor

- Part of my job is to negotiate for an environment countermeasure budget at the city council. As to the negotiations, basically your proposal will be included in the plan.
- As there will be several options in the plan, I would like you to proceed further with talks with APRD in order to get your proposal adopted.

As the above states, we confirmed that the proposal for introducing thermal storage heaters is included in the Ulaanbaatar's environment countermeasure plan. At the October mark, the plan had yet to be approved by the city council, so we discussed the plan's approval and concrete solutions with APRD during our study trip in December 2016. The information we gained from APRD is as follows.

- The thermal storage heater introduction plan was approved, and is scheduled to start in January 2017. However, the budget amount has yet to be approved.
- Five heaters will be introduced on a trial basis per area in six areas in Ulaanbaatar, to carry out a demonstration test on reductions in emissions.
- It has been decided that the thermal storage heater to be introduced will be a German company's product. The assumption is that full introduction will be decided in the latter half of 2017 onward, and the decision will be based on the results of the demonstration test.

Thus, in this way, we were able to confirm that the thermal storage heater introduction plan is to go ahead on a city budget. From here on, we will push ahead with issues such as constructing a structure to turn this case into a JCM project and confirming implementation schedule.

(2) Feasibility study

① Implementation structure

The following shows an example of the implementation structure for this case.

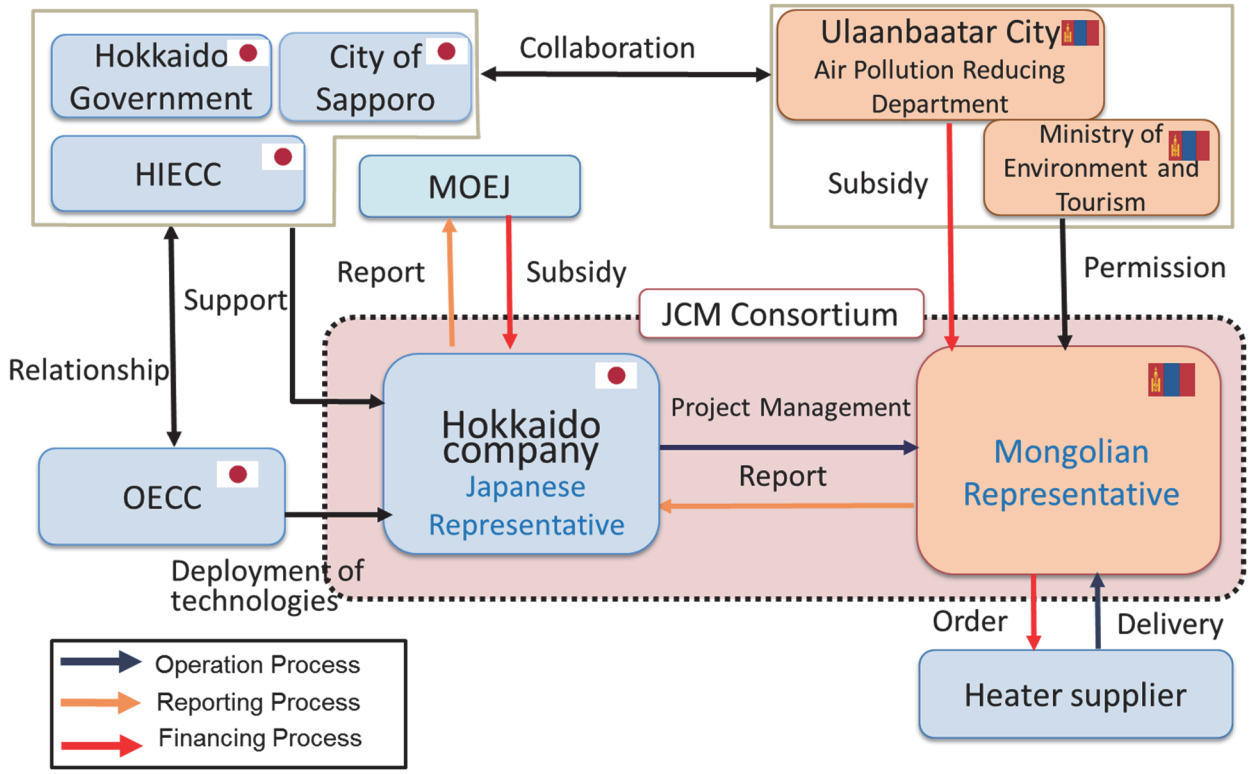



Fig. 2-3 Project implementation structure

As we have confirmed that this case is to proceed on an Ulaanbaatar city budget, we know there is no funding problem. We are proceeding with discussions with the Hokkaido company that is the Japanese representative business candidate. We are thinking of several companies that could be the Mongolian representative business candidate, and we intend to proceed with discussions at the point when we clearly know that the full introduction plan has the go ahead.

② Financial structure for client and partners

This case will be implemented with an Ulaanbaatar city budget, so the client making the order will be Ulaanbaatar city. The financial situation in the city is tough, but we believe the plan will be implemented fully.

We are thinking of several companies that could be the Mongolian representative business candidate, and all the candidates are group companies that are involved in various businesses in Mongolia. We have confirmed that purchase and installation of devices on the scale of thermal storage heaters will be easy for a group-related company to oversee. Moreover, the financial statements of the group company candidates have been published, and we have confirmed that there are no problems.

The partner on the Japanese side is a Hokkaido company, which has experience of delivering thermal storage heaters to Mongolia – albeit, just for research purposes. Also, we have reached an agreement where we will oversee the representative company in the case of JCM business. We have received the financial statement of the company concerned, and are checking to make sure there are no problems.

③ Consideration of facility support structure

This time round, the thermal storage heater to be introduced will be a German company's product. In the scenario where the introduction becomes JCM business, we will need to talk to the German manufacturer or their representative in Mongolia by the time the decision for full introduction is made. If the German manufacturer is made the supplier, we are sure there will be no problem with the facility support structure.

④ Consideration of business feasibility and economic feasibility

As described up to now, the introduction will come from the Ulaanbaatar city budget for this case. Therefore, as funding problems have been resolved, we think the following issues must be observed carefully from here on.

(a) Scale of introduction plan

As stated by the deputy mayor in charge of the Ulaanbaatar environment, the residences to be targeted for air pollution reductions amount to 190,000 households.

We heard from APRD that the German manufacturer of the thermal storage heater to be introduced in the demonstration test is hoping to deliver 15,000 heaters. Under the current situation in Ulaanbaatar, purchasing 15,000 heaters in a single year would be tough for the city. So, we will consider things in multiple years, and look at the initial year's purchase quantity, and take that as a rough measure of business feasibility for the future.

(b) Schedule for introduction plan

At present, the demonstration test introduction period has been decided, but the full introduction period is unsettled. In order to apply for JCM facility assistance business, the body placing the order for the facility must be decided, but the introduction must not have started. Therefore, it may not be possible to make the application because the application period for facility assistance business may not match the period for full introduction.

(c) Order configuration for facilities

The business undertakings of municipalities are fundamentally based on the process of making tenders, so this situation is not just limited to Ulaanbaatar. However, for the trial introduction this time round, a German company has been nominated to provide the thermal storage heaters, and it is believed that they have a limited tender contract. Therefore, from here on, we will need to check to see if the full introduction is to proceed with the same ordering configuration or not.

In addition, the thermal storage heater supply target is unspecified people in "ger" area of this project. We would like to study the case to apply the other support program as SDG (Sustainable Development Goal), etc.

(3) Estimation of CO2 reductions

The following shows the approach to reducing CO2 in this case.

- The following show the areas targeted in plans for air pollution reductions in Ulaanbaatar.

1st Step: City center ger area (Sukhbaatar, Chirgellei): 25,000 to 50,000 units
2nd Step: Bayangol & Songuno: 50,000 to 80,000 units
3rd Step: Remaining areas: 50,000 to 80,000 units

- Of the above, the target of this case is 1st Step City center ger area (Sukhbaatar, Chirgellei): 15,000 units.
- The CO2 emission (REi,y) per household's ger stove (coal-burning stove) is:
  REi,y = 7,200kg × 1.39tCO2/ton = 10.0tCO2
- The specs and operation of thermal storage heater are as follows.
  - ■ Ger's average cubic capacity: 28m3
  - ■ Set temperature: Daytime (6:00 - 19:00) 25℃,
    Nighttime (19:00 - 6:00) 18℃
  - ■ Thermal storage time (band): 6 hours (0:00 - 6:00)
  - ■ Period of use: October-May (8 months, 180 days)
  - ■ Power consumption: 5kW
  - ■ Amount of power consumed: 5,400kWh (= 5kW × 6h × 180d)
  - ■ Amount of heat consumed: 19,440 MJ (= 5,400kWh × 3.6MJ/kWh)

Based on the above approach, the following values can be used to calculate CO2 reductions.

- Total amount of CO2 emissions from 15,000 targeted ger stoves (= Reference Emission: REy)
  REy = Σi = 10.0 × 15,000 = 150,000tCO2
- Grid Emission Factor: 0.797 tCO2/MWh (Mongolian default value)
- Annual amount of CO2 emissions per household: PEi,y = 4.3 tCO2 (= 5.4MWh × 0.797)
- Total CO2 emissions for project: PEy = Σi = 64,500tCO2 (= 4.3 × 15,000)

Therefore, if 15,000 ger stoves where changed to thermal storage stoves, the amount of reductions would be: ERy = REy – PEy = 150,000 – 64,500 = 85,500 tCO2/y

The following is a rough estimate of the cost to introduce one thermal storage heater.
Introduction cost = facility cost + installation cost → 100,000 + 50,000 = ¥150,000

The facility cost is the rough price of the German-made heater and the installation cost is based on installations in Hokkaido.
From the above, if half of the introduction cost for 15,000 thermal storage heaters

(statutory useful life: 6 years) was covered by assistance, then the CO2 reduction unit would be the following.

150,000 × 15,000 / 2 / (85,500 × 6) = ¥2,190 /tCO2

(4) MRV methodology and PDD

① Ger stove (coal-burning stove)

Ger (tent house) size: Average of 24m2

Coal consumption: 7,200kg/ger/y

Heat consumption: 105,840MJ (assuming calorific value of coal to be 3,500kcal/kg)

Fig. 2-4 Ger and ger stove

② Thermal storage heater

Ger (tent house) size: Average of 24m2

Thermal storage heater capacity: 5kW (Japanese model)

Amount of storage heat: 32,200kcal/d □ 240d = 7,728,000kcal = 32,500MJ

Heat consumption: 32,500MJ

(30% of ger stove, assuming reduction of heat release loss)

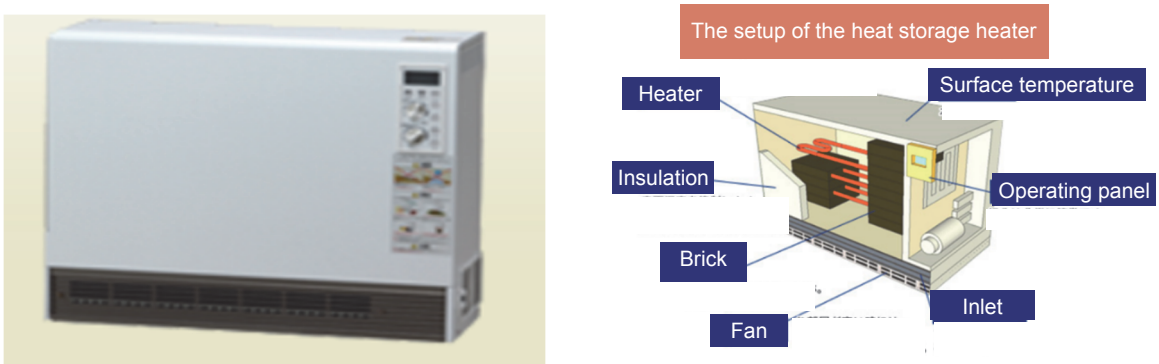



Fig. 2-5 Thermal storage heater

③ Monitoring

The following shows how monitoring will be implemented.

■ 15,000 ger homes will be fitted with the same type of thermal storage heater, with the same storage and release time.

⇒ Annual power consumption will be minimum required value and there will be no monitoring from ger to ger (default value will be used).

■ Annual power consumption for thermal storage period of each ger (ELi) will be:

Eli = STAV × ELAV × D

Average thermal storage time: STAV, Average electricity consumption: ELAV, Number of workdays: D

■ Monitoring items ⇒

1. Number of workdays (determined to be uniform every year)
2. Average electricity consumption (80% of rating)
3. Average thermal storage time (determined to be uniform every year)

The above are the reference scenario for formulating MRV methodologies and creating PDD.

(5) Problems in future

We have mentioned in the "Consideration of business feasibility and economic feasibility" section the items thought to be issues from here on in a scenario where thermal storage heaters are fully introduced using an Ulaanbaatar city budget. Therefore, we will only reproduce the item headings here.

(a) Scale of introduction plan
(b) Schedule of introduction plan
(c) Order configuration for facilities

None of these are decided at present and we will give them consideration when it is clear that they need attention.

III. Workshops in Mongolia and in Japan

1. Mongolia（Ulaanbaatar）Workshop

(1) Purpose of the workshop

A workshop was held to introduce representatives from Ulaanbaatar to the Joint Crediting Mechanism (JCM) and related projects, along with the City to City Collaboration Project between Ulaanbaatar and Hokkaido Government / Sapporo City. The aim behind inviting these representatives to come and hear about the JCM system and overview in person was to obtain their cooperation in existing projects and form new proposals for future projects.

(2) Presentation

① Schedule

Date: October 27, 2016 (Thursday) 09:00～12:00

Venue: "Khaan" Hall, The Ministry of Environment and Tourism of Mongolia (MET)

Organizers:
- Ministry of Environment and Tourism of Mongolia
- Ministry of the Environment, Japan
- Overseas Environmental Cooperation Center (OECC))
- Ulaanbaatar City / Air Pollution Reduction Department (APRD)
- Hokkaido Government and Sapporo City

Please see the attachment list of the details of participant.

② Program

| Time | Topic | Lecturer |
|---|---|---|
| 09:00-09:10 | Introduction | MET |
| 09:10–09:35 | Summary of JCM Project and Study through City to City Cooperation | OECC |
| 09:35-10:00 | Current Development of JCM in Mongolia by Nature Conservation Fund, Mongolia | MET／Nature Conservation Fund |
| 10:00-10:25 | Problem and Plan of Greenhouse Effect Gas Reduction in Ulaanbaatar City | APRD |
| 10:25-10:40 | Coffee Break | |
| 10:40-11:05 | Energy Saving Measures in Sapporo City | Sapporo City |
| 11:05-11:30 | Study of Energy Saving Project in Cooperation with the Company in Hokkaido | Mongolian National University |
| 11:30-11:40 | Closing | Hokkaido Government (HIECC) |

③ Brief of presentation

1) Introduction (Ministry of Environment and Tourism Mongolia)

- In September, registration of Mongolia's first ever JCM Project was approved and

credit was issued. Following on for this, the methodology for two solar power generation factories was approved and work is in progress on constructing these facilities.

- My hope is that this workshop will help improve understanding of JCM and lead to the formation of new projects to follow on from these.

2) Summary of JCM Project and Study through City to City Cooperation (OECC)
   - Sequence of events leading to the staging of this workshop
   - Overview of JCM and projects to fund facilities
   - Overview of City to City Collaboration Surveys
3) Current Development of JCM in Mongolia by Nature Conservation Fund, Mongolia (MET／Nature Conservation Fund)
   - Overview of JCM and an introduction to the survey proposals for Mongolia
   - Overview of MRV and third party organizations (in Mongolia, NREC is registered as a local organization)
4) Issues with curbing Greenhouse Gases in Ulaanbaatar and Countermeasures (APRD)
   - Examples of measures that have been introduced to curb greenhouse gases in Ulaanbaatar
   - Case studies of renewable energy (solar power, wind power, hydropower, earth thermal power, solar heat power) and issues
5) Energy Saving Projects in Sapporo City (Sapporo City)
   - Introduction to Sapporo City (population: approx. 1.9 million people, with a total area of 1/4 of Ulaanbaatar)
   - Transitions in annual emissions of greenhouse gases in Sapporo City (tendency to decline from 2006, but rising once more in the wake of the Great East Japan Earthquake (2011))
   - Initiatives to put in place energy saving measures
   - Assistance for the introduction of renewable energy and next generation automobiles
6) Demonstrating the Effects of Energy Saving through Cooperation with Businesses in Hokkaido (National University of Mongolia)
   - Introduction to thermal storage heater sold by Kita Denryoku Setsubi Koji
   - Explanation of the progress of experiments with solar water heaters
7) Closing remarks (Hokkaido Government (HIECC)))
   - Introduction to HIECC (explained by Mongolian word)
   - Comparison between the situation in Hokkaido 50 years ago and Ulaanbaatar
   - Environmental measures take time, but their effectiveness increases as steady steps

are taken to address the issues. We look forward to your ongoing cooperation in the future.

④ Questions and Answers

1) Is a change of fuel source from coal to gas really effective? (Mongolia Water Partnership)
   Efforts to address the problem of global air pollution are being made in a step by step manner. These efforts also change according to the economic circumstances of cities and other factors. In Mongolia, gas fuel is currently twice as expensive as electricity and four times as expensive as coal, but in order to improve the situation concerning air pollution, it will be necessary to make the change to gas over the long term. (Ministry of Environment and Tourism)
2) Will the city consider putting in place large solar power generation factories in the future, too? And how would you go about connecting small solar power generation factories to the system? (Department of Energy Regulations)
   We will continue to expand the number of large factories into the future as long as budget allow. Solar power is subject to large fluctuations, so we would deal with the second issue through standardization. (Department for the Reduction of Air Pollution)
3) What is the cost of thermal storage heaters?
   A 2kW costs in the region of 120,000 yen, so they are not cheap. But I think the cost will come down in the future with mass production. (National University of Mongolia)
4) Will it be possible to manufacture thermal storage heaters in Mongolia?
   They are not high tech products, so it would be possible in the long term. In Japan, there is not much difference between electricity during the day and night, so there is very little need for heaters. It would be possible if each of the production lines could be moved to Mongolia. (National University of Mongolia
5) Is it possible to adjust or stop the heaters?
   It depends on the level of stored heat, but in principle there are in continuous operation. The heat capacity can be switched between high, medium and low. (National University of Mongolia)

(Reference) Workshop in progress

(3) Results and problems

① Results

- This workshop created new business chances through direct contact with people from the Ministry of Environment and Tourism and organizations from Ulaanbaatar, with whom we had had no previous connections.
- In connection with the workshop, we were able to generate publicity of the JCM Project among newly appointed members of the government and businesses.

② Problems

- There are many organizations and business, also those who did not participate in the workshop, who wish to see projects take shape, and further work needs to be done in terms of promotion and disseminating information.
- In order for projects to take shape, the participation of organizations and business from Japan, especially Hokkaido, is desirable. At the Sapporo workshop, businesses from Hokkaido will give an introduction to their initiatives.

(4) Discussions and consultations related to the workshop

① Discussions with the Deputy Mayor in charge of the environment (October 27)

Following the workshop, Ulaanbaatar City Department for the Reduction of Air Pollution arranged for us to meet with the Deputy Mayor, who is in charge of the environment, with whom we held an exchange of opinions. Also present during these discussions was the Director of Ulaanbaatar City Department for the Reduction of Air Pollution and the Director of the Department for the Natural Environment, as well as other experts connected with the environment.

1) Explanation from the Deputy Mayor

- The population of Ulaanbaatar City is 1.3 million people, 1.7 million people when including those who commute from the suburbs.
- Half of the households in Ulaanbaatar (190,000 households) live in ger districts. Improvements to the living environments of people in ger districts is a pressing issue.
- 2016 was an election year, and there were many changeovers among government and city assembly members. Over the next 4 years, different policies will be pursued than before.
- Mongolia is currently suffering from economic stagnation, but I believe environmental policies are vital, and therefore ask for your cooperation in making sure projects take shape.

2) Explanation from OEC

- Since 2013, OECC has been engaging in fully fledged initiatives aimed at improving the environment in Mongolia, especially turning proposals for measures to curb greenhouse gases into reality.
- Various initiatives are taking shape through JCM's project to fund facilities, with 3 projects having gotten off the ground in Mongolia from last year to this year with the involvement of OECC.
- This year has seen the establishment of projects through City to City Collaboration between Hokkaido and Sapporo, one of which is a thermal storage warm air heater that utilizes nighttime electricity. This is the result of a collaboration between businesses in Hokkaido and the National University of Mongolia, and we would like to see plans put in place to introduce this system in the next fiscal year.
- Concerning a separate survey, we would be grateful if you would consider gas fired heaters from manufacturers who are working to make improvements to HOB as a substitute for HOB.

3) Answers from the Deputy Mayor

- We are set to negotiate budgets for environmental measures at the city assembly. As part of these negotiations, we have included the proposals from OECC.

- The plan contains several options, so I would like to see dialog continue with the Department for the Reduction of Air Pollution concerning the adoption of the proposals from OECC.

Meeting with Deputy mayer

② Meeting with Ulaanbaatar City Department for the Natural Environment

We received a request for a meeting regarding the JCM Project from the Director of the Department for the Natural Environment, who was in attendance at the meeting with the Deputy Mayor. On the day after the workshop, we met with the Head of the Natural Environment Resources Division in place of the Director to exchange opinions.

1) Explanation from the Head of the Division

Following a personal introduction from the Head of the Division and an explanation of the Natural Environment Resources Division, we were provided with an account of the problems and challenges facing the city in the field of the environment.

a) Problem of lack of infrastructure development (wells, sewage systems etc.) in holiday home areas in the suburbs (areas in which companies created vacation facilities for workers during the country's period of socialism) and ger districts.

b) Under the system of grid connection power purchasing inscribed in the country's Renewable Energy Law, renewable energy is limited to the 3 fields of solar power, wind power and hydropower. Therefore, the use of renewable energy through geothermal power and heat supply is not included within the scope of this law. Also, grid connection requires a high voltage of 35kV and had not been extended to 350V for the distribution system, meaning that there is no incentive for grid connection from solar panels installed on the roofs of houses in urban areas.

c) Power distribution systems are becoming increasingly outdated. As such, the problem of grid instability will occur if thermal storage heaters are running simultaneously.

d) There are predicted to be water shortages by 2050. Underground water is being pumped up from wells close to the eastern section of the city. Water volumes are being further secured by moving pumps to inland regions. One of the reasons why work has yet to begin on CHP-5 is this issue of securing water and problems with wells.

e) Water resources – food – excretion – decomposition – soil… Natural cycles such as these have been severed, and this has led to problems with soil contamination in ger areas. The Department for the Natural Environment is receiving support from the U.S. Million Development Fund for projects to combat soil contamination.

2) Opinion exchange

- Explanation of JCM City to City Collaboration (OECC)
- Explanation of Sapporo's sewage treatment system (Sapporo City)

  The city's sewage system is 99.8% complete. There are 10 sewage treatment factories, covering 930,000 households. This means an average of 1 sewage treatment factory per 100,000 households. Sapporo's total area is 1,120m2, and has a rate of conversion of toilets to flush toilets of 99.9%.
- Regarding issues with sewage treatment (Department for the Natural Environment)

  There are two distinct problems with sewage treatment in Ulaanbaatar: first, the improvement of facilities and measures to make them more energy efficient, and second, the construction of sewage treatment systems in ger areas etc. in the suburbs.
- Example proposal for a waste water treatment system (OECC)

  At OECC, we investigated a case in Erdenet for curbing greenhouse gases by cutting the amount of power needed to draw water from wells through the installation of a waste water treatment system.

3) Possibilities for JCM projects

a) Waste water treatment system

- Condominium developments are gaining pace in the airport area and I believe they are not connected to the existing sewage treatment system, so would it be possible to consider standalone sewage treatment systems like these for JCM?
- Plans for the city's sewage treatment systems are investigated by the Department for the Natural Environment.

b) Measurement to automobile exhaust gas

- Exhaust gas from automobiles is another factor behind the city's air pollution.

While automobile inspections are carried out on an annual basis, testing and measurements for exhaust gas are not in place. I feel that there is a need to construct testing centers for automobile inspections and to establish proper methods for measuring exhaust gas.

- In the past, OECC investigated the possibility of a JCM project to introduce electric automobiles.

c) REDD+

- The Department for the Natural Environment has plans to factory 4,000 ha of greenery along rivers within the city.
- While greening plans are handled by a different department, I would like you to consider the application of REDD+.

(Concerning this matter, we have received a reply stating that they would like us to consult with the person in charge at the Ministry of Environment and Tourism.)

d) Treatment of waste disposal

- All refuse in Ulaanbaatar goes to landfill. There are two landfill sites, one located in the northeast of the city and the other the southeast. 80% of the daily refuse amount from 4 districts in the city goes the one on the northeastern side.
- It seems that plans are in place to turn refuse sent to the northeastern landfill site into biomass.
- While there has been a JCM project for power generation in refuse incinerators in Myanmar, in Mongolia's case, consideration needs to be given as to whether it would be profitable in terms of scale.

③ Meeting with the Mayor of Ulaanbaatar

The president of an influential company in Mongolia arranged for us to meet with the Mayor of Ulaanbaatar. The following is a summary of this meeting.

1) Explanation from the company president

- I have heard that there are plans in place to construct a subway system in central Ulaanbaatar.
- The costs for constructing a subway system are high and the construction period is long. Compared with this, trams cost a lot less and take less time to construct.
- Last month, I met with representatives from Hokkaido (HIECC) in Sapporo and found out that they would be visiting Ulaanbaatar with representatives from Sapporo City, which is why I arranged a meeting and requested an explanation be given to the Mayor.

- If the Mayor is interested in the construction of a tram system, I would like him to write a letter to Sapporo City requesting cooperation.

2) Explanation of the status of Sapporo's tram system

- Hokkaido (HIECC) and Sapporo City gave an explanation on the total length of the existing tram system, along with details on such things as who it is run and maintained.

3) Reply from the Mayor

- I am quite interested in constructing a tram system. I think it is a very good idea.
- We will hold discussions with ADB on 10/31 concerning a construction project for a dedicated roadway for buses (BRT). If possible, I would like to have trams run along this BRT, but I would need to consult with ADB on this matter.
- Would it be possible to receive support in terms of an international yen loan etc. for laying down tram lines?
- I can send a request for support to Sapporo City, but where should I send it?

4) Reply from Sapporo City

- First of all, please send your request for cooperation to the office of the President of the World Winter Cities Association for Mayors.
- The members of our party on this visit are not in a position to provide an answer concerning this matter, and have yet to discuss it with the relevant parties in Sapporo City (International Department, Transport Department etc.).
- The sudden arrival of such a letter would probably create confusion among the relevant parties there. Therefore, those of us present today will explain this matter immediately upon our return, so please wait a little while before sending the letter.
- We at Sapporo City would like to do whatever we can to cooperate with you, and hope to discuss the details with Ulaanbaatar on a separate occasion.

5) Future action

- Ulaanbaatar and Sapporo City will discuss the possibility on introducing a tram system.
- We will ask Sapporo City to enquire with JICA etc. about the possibility of funding in the form of an international yen loan etc.
- Concerning the applicability of this matter under the JCM Project, it will be difficult to use it as an alternative proposal for fuel, given that diesel fuel for buses and the emission factor for Mongolia's electricity are reversing.
- Concerning Ulaanbaatar's urban plan, ALMEC VIP has been commissioned by the Ministry of Economy to carry out surveys, so we will exchange opinions on the possibility of introducing a tram system.


Meeting with the Mayor of Ulaanbaatar

2. Japan (Sapporo) Workshop

(1) Purpose of the workshop

In the course carrying out surveys in the current fiscal year, the following issues became apparent.

- An insufficient grasp of the environmental technologies for cold regions possessed by organizations in Hokkaido (businesses, research institutes etc.)
- Lack of promotional activities for the JCM Project aimed at organizations in Hokkaido
- Lack of PR concerning the environmental technologies desired by the Mongolian side

Taking into account the above, a workshop was held in Sapporo with the cooperation of municipalities to facilitate relationship building and direct dialog between organizations.

(2) Presentation

① Schedule

Date : January 20, 2017 (Fri.), 13:30 - 15:30
Venue : TKP Sapporo Business Center Conference Room, Sapporo City, Hokkaido
Attendees : Hokkaido Government, Sapporo City, HIECC, representatives from Ulaanbaatar City, businesses and organizations from Hokkaido

Please refer to the attachment for more details on the attendees.

② Program

| Time | Session | Speaker |
|---|---|---|
| 13 : 30 | Opening session | HIECC |
| 13 : 33 | Overview of the JCM System and City to City Collaboration Surveys | OECC |

| | | |
|---|---|---|
| 14 : 30 | Regarding the Possibility of Introducing Thermal storage Heaters in Mongolia through the JCM Project | Kita Denryoku Setsubi Kouji Co. Ltd. |
| 14 : 50 | Possibilities for the JCM Project through Technologies in Cold Regions | Hokude Sogo Sessei Corporation |
| 15 : 10 | Question and answer session | Presenter : HIECC |
| 15 : 40 | Closing of session | |

③Overview of the session

a) Opening of session (Mr. Yoshimura, HIECC)
   - Mr. Delgerekh, Director of Ulaanbaatar City Department for the Reduction of Air Pollution, was originally scheduled to give a talk today, but unfortunately could not make it. He is not able to participate due to an urgent situation concerning air pollution in Ulaanbaatar.
   - Mr. Delgerekh has sent the materials he was due to use in his talk, so Mr. Nishimura of OECC will give an explanation in his place.
   - Mr. Bolortuya, Director of Ulaanbaatar Department for the Natural Environment, is taking part in today's workshop, and will kindly say a few words following the talk from OECC.

b) Overview of the JCM System and City to City Collaboration Surveys (Mr. Nishimura, OECC)

   Mr. Nishimura gave the following explanation.
   - Purpose of holding this workshop
   - Overview of JCM and projects to fund facilities
   - Overview of proposals underway through City to City Collaboration Studies
   - Explanatory materials from Ulaanbaatar City Department for the Reduction of Air Pollution (current situation concerning air pollution and countermeasures)

c) Remarks (Mr. Bolortuya, Ulaanbaatar Department for the Natural Environment)

d) Regarding the Possibility of Introducing Thermal storage Heaters in Mongolia through the JCM Project (Mr. Fushiki, Kita Denryoku Setsubi Kouji Co. Ltd.)

   Mr. Fushiki gave the following explanation.。
   - Company profile of Kita Denryoku Setsubi Kouji Co. Ltd.
   - Regarding the company's connections with Mongolia
   - What is a thermal storage heater?
   - Regarding the possibility of introducing thermal storage heaters in Mongolia

e) Possibilities for the JCM Project through Technologies in Cold Regions (Mr. Shinohara, Hokuden Sogo Sekkei Corporation)

   Mr. Shinohara gave the following explanation.

- Things which unite technologies in cold regions and the JCM Project
- Introduction to specific technologies in cold region

f) Question and answer session (Answerer: Mr. Yoshimura, HIECC)
- The content of this question and answer session is detailed in the following section.

g) Closing of session (Mr. Yoshimura, HIECC)

④Total question and answer

Are there any technologies under the JCM Project for areas outside cold regions? (Mr. Maeda, ELCOM))

The purpose behind this workshop was to introduce those technologies that are effective for cold regions. One example of a technology which is effective for other regions is the introduction of heat pumps to heating and cooling lines in drinks factories. (OECC)

a) What about the method of gasification power generation utilizing poultry manure? (Mr. Kagami, Setec)

To begin with, we aimed at a method of generating electricity which utilizes gas generated through methane fermentation, but with gave up on this for various reasons. At present, we are proposing binary power generation which utilizes the heat generated from the carbonization of poultry manure. (OECC)

b) Has Kita Denryoku Setsubi Kouji Co. Ltd. been able to gain inroads into Mongolia with its construction systems? (Mr. Ide, Sekisui Chemical Hokkaido Co., Ltd.)

Not yet. But if Mongolia's economy picks up in the future, there is the potential for us to participate there with construction companies. (Kita Denryoku Setsubi Kouji Co. Ltd.)

c) What advice would you give those who wish to turn candidate JCM proposals into reality?

To take solar power generation as an example, Japanese operators have already achieved success in terms of projects to fund facilities in Mongolia. When carrying out work, there are several items that operators need to get the green light for, such as authorization from the Mongolian government and electricity purchasing contracts, but overall things should proceed smoothly. Also, if a collaborative system between Mongolia and Japan can be established, there is the possibility of project applications at the beginning of the next fiscal year. (OECC)

(3) Results and problems

(Results)

- In this workshop, we were able to provide organizations and businesses in Hokkaido and explanation of the JCM Project and request them to consider the possibility of initiating projects.
- The participants actively fielded questions and seemed to be eager to engage with the project.

（Problems）

- Engaging in this project on an ongoing basis will result in success, something which municipalities also requested. We will put our utmost efforts into upcoming surveys.
- While Japan's tradition of technology is an important part of getting projects off the ground, some requested a more active stance in terms of interaction between people from both sides. In future surveys, we will consider the possibility of having people from Mongolia come to Japan for training and other purposes.

（Reference） Workshop in progress

(4) Discussions and consultations related to the workshop

In line with the workshop, a visit was made to the Central Energy Center of Hoku Netsu Corpration, which received an explanation of the project at an event held in Sapporo in October. Here, we received an explanation on the status of hot water supplies using biomass.

Attendees: Department of Environment and Lifestyle, Hokkaido Government, Hoku Netsu Corpration (3 people)
Ulaanbaatar City Department for the Natural Environment, HIECC, OECC

① Overview of the Central Energy Center

- Commences running as 1971 a facility for local heating in central Sapporo City.
- To begin with, its main source of heating was coal fired boilers. From 1986, it installed additional boilers fired by kerosene and natural gas, with today's heat supply coming mainly from these boilers.
- At one point, the coal fired boilers had biomass mixed in, but from 2009 the company started firing these boilers using biomass alone.

② Biomass boiler

- The boiler is a stoker type (moving bed combustion).
- The boiler is fired by wooden biomass, such as waste construction materials, timber from forest thinning and branches from when processing wooden materials.
- The amount of generated heat is 113GJ/h and the rate of consumption of biomass is 5t/h.
- Biomass creates a lot of moisture, so a natural gas boil has been put in place as a way of regulating heat volumes.
- The Central Energy Center supplies heat at 190 °C, which then cools down to 100 °C. This is determined by the diameter of the hot water piping and the amount of heat supplied.

(Questions)

- From where do you procure your biomass?

  We procure our biomass from a variety of sources, including construction companies, paper manufacturers and cement companies in the Sapporo City area. We supply combustion ash to cement companies at a cost.

・Is the biomass procurement enough?

  We procure around 40,000 tons of biomass on an annual basis. Every year, around 100,000 tons of construction waste is generated in the Sapporo City area. In addition, waste is also generated through timber from forest thinning, so at present we have plenty of biomass for our needs.

・Are you considering power generation using biomass?

  Our site is not very big and it would be difficult to expand our facilities to include power generation. Other reasons we are not considering moving in this direction include the presence of nearby houses and environmental measures.

（Reference） Workshop in progress

Biomass (consisting mainly of waste construction materials)

Boiler combustion section
(manufactured by Hitachi Zosen Corporation)

IV. Attend and presentation at Conference

1. JCM City to City Collaboration Seminar (Kita-Kyushu)

(1) Overview of the seminar

① Events in Sapporo

Around the time of the Kitakyushu seminar, a series of events and visits between cities were planned involving representatives from Ulaanbaatar. In addition to the events held by Hokkaido Government Office (Hokkaido International Exchange and Cooperation Center (HIECC)), the following presents an overview of the kinds of questions that were fielded on this occasion.

| | |
|---|---|
| Date : | October 18, 2016 (Tue.), 13:00 – 15:00 |
| Venue : | Hokkaido Government Office/ Hokkaido International Exchange and Cooperation Center (HIECC) 12th Floor Meeting Room |
| Attendees : | Ulaanbaatar Department for the Reduction of Air Pollution<br>National University of Mongolia<br>Department of Environment and Lifestyle, International Affairs Division Office of the Governor, Hokkaido Government (2 people)<br>Sapporo City (2 people), HIECC (2 people), OECC |

Program

| Time | Topic and Presenter |
|---|---|
| 13:15-13:25 | Opening remarks (OECC), Introduction of attendees (HIECC) |
| 13:25-14:00 | Energy Saving Initiatives in Hokkaido Prefecture centering on Earth Thermal Heat Pumps<br>Hokkaido Research Organization |
| 14:00-14:20 | Regarding District Heat Supplies in Central Sapporo City<br>Hoku Netsu Corporation (2 people) |
| 14:20-14:40 | Q & A and discussion |
| 14:40-14:45 | Closing remarks (HIECC) |

Speakers
(members of an industrial research institute and a heating supply company)

Q&A session in progress

1. Energy Saving Initiatives in Hokkaido Prefecture centering on Earth Thermal Heat Pumps

(1) Regarding heating systems utilizing horizontal reheating type underground thermal heat pumps

- Advantages and challenges of earth thermal heat pumps (short construction period but a temperature difference of around 10 °C)
- Overview of research (resin heat exchangers and laying them underground in shallow sections (1.5 – 2 m)
- Outline of resin palisaded earth thermal heat exchangers
- Heat collection experiments at trial homes

(2) Regarding hot water supply preheating systems in hot spring areas

- Background of research on utilizing the heat from hot springs (utilizing unused springs and waste hot water following use)
- Issues with conventional heat exchangers (metal and resin circular type)
- Outline of resin palisaded earth thermal heat exchangers
- Outline of hot water supply preheating systems at hot spring facilities and heat recovery experiments

(Questions)

- How much time is required to lay heat exchangers underground? → Work can be completed within a matter of hours when using heavy machinery.
- Are resin palisaded earth thermal heat exchangers only available through the company introduced during the talk?
  → I heard that they possess patents etc. for this equipment.

2. Regarding District Heat Supplies in Central Sapporo City

(1) District heat supplies in central Sapporo City

(A central energy sensor supplies heat at 190 °C and cools it down to 100 °C.)

(2) Initiatives utilizing cogeneration

(3) Utilization of unused energy etc. (Snow melt water (45 °C) is supplied in addition to hot and cold water.)

(4) Effects through the development of energy throughout the whole area

(5) Future initiatives in central Sapporo City (Increase the number of energy supply points.)

(Questions)

- Have you decided on the locations where you will increase the number of energy supply points?

→ So far, we have decided on 1 location. We will sound out other potential locations in cases where plans for major construction work are in place. This is because the heat supply factories cannot be easily installed unless the site has a space of 100,000 m2 or more.

- Will installation not be carried out under the supervision of the municipalities concerned? □ The way in which we go about this is for public corporations to request private corporations to explore the potential for installation at sites.

(Results)

- The Japanese company Sekisui Chemical Co. Ltd. has already successfully installed earth thermal heat pumps in Ulaanbaatar.
- With this project, there is the possibility that Hokkaido Research Organization and other public bodies will act as the representative operators on the Japanese side for subsidized work to put facilities in place.
- District heat supplies have been installed in central Ulaanbaatar and there is the potential to introduce further systems when expanding the number of heat supply districts in the future.

② Seminar in Kita-Kyushu

Following the events held in Sapporo, we travelled to Kitakyushu City and participated in a seminar held there. The schedule for the program was as follows.

| | |
|---|---|
| Date : | October 20, 2016 (Thu.), 09:30 – 17:40 |
| Venue : | Riga Royal Hotel Kokura “ORCHID” (Kokurakita Ward. Kita-Kyushu City) |
| Attendees : | International Cooperation Office, Ministry of the Environment |

Representatives from Mongolia, Indonesia, Vietnam, Thailand, Myanmar, Cambodia and Malaysia
City to City Collaboration representatives from Japan (Kanagawa Prefecture, Yokohama City, Kawasaki City, Fukushima City etc.)
Institute for Global Environmental Strategies (IGES)
Kita-Kyushu Urban Center
Air Pollution Reducing Department of Ulaanbaatar City,
Hokkaido Government, OECC

Program

| Time | Presentation Topic |
|---|---|
| 09:30-09:35 | Opening remarks　Mr. Mizutani, Ministry of the Environment |
| 09:35-10:10 | JCM City to City Collaboration Project and JCM Finance Support Scheme |
| 10:10-10:50 | Examples of proposals for JCM projects (Kitakyushu City, Yokohama City) |
| 10:50-11:05 | Coffee Break |
| 11:05-11:45 | Technology Selection and Budgeting in General Waste Disposal<br>Kita-Kyushu International Techno-cooperative Association |
| 11:45-12:30 | Examples of Initiatives carried out by Overseas Municipalities participating in the Fiscal Year 2016 City to City Collaboration Project (Part 1)<br>(Cambodia (2 titles), Indonesia, Malaysia) |
| 12:30-13:30 | Lunch |
| 13:30-14:30 | Examples of Initiatives carried out by Overseas Municipalities participating in the Fiscal Year 2016 City to City Collaboration Project (Part 2)<br>(Mongolia, Myanmar (2 titles), Thailand, Vietnam) |
| 14:30-15:40 | Discussion 1 – "Current Status of Surveys and Issues in getting Projects off the Ground"<br>(Hokkaido, Fukushima City, Kanagawa Prefecture and related parties) |
| 15:40-16:00 | Coffee Break |
| 16:00-17:30 | Discussion 2 – "Current Status of Surveys, Issues in getting Projects off the Ground and Proposals for Solutions"<br>(Kawasaki City, Yokohama City, Kitakyushu City and related parties) |
| 17:30 | Closing remarks |

(2) Presentation

Representatives from Ulaanbaatar Department for the Reduction of Air Pollution and the National University of Mongolia were invited as key players involved with the environment in Ulaanbaatar. The content of their talks in the "Examples of Initiatives carried out by Overseas Municipalities" segments is as follows.

"Current Status of Air Pollution in Ulaanbaatar" (Ulaanbaatar Department for the Reduction of Air Pollution)

- Causes of air pollution in Ulaanbaatar

- Monitoring of soot and dust
- Transitions in air pollution

Representatives from Hokkaido Government were invited as a Japanese municipality to give a talk along with OECCC on the "Current Status of Surveys and Issues in getting Projects off the Ground," the content of which is as follows.

"Regarding District Heat Supplies in Central Sapporo City"

- Background behind the surveys
- System under which the surveys were implements and targets of the surveys (3 sectors)
- Past case studies from Hokkaido and Sapporo City

There were no questions concerning Mongolia, given that this was the first instance of participation and that there are yet to be any examples of projects that have been put into practice.

(3) Results of the seminar and impression

(Results)

- This workshop facilitated the sharing of a wide range of information, including the status of municipal collaboration in other countries and examples of specific case studies, thus serving as a useful point of reference for dealing with future proposals.
- The municipalities participating in the workshop were able to exchange views on each municipality's systems for dealing with projects.

(Impression)

- The talks given by each country and municipality were extremely long and the content was wordy, which meant that the speakers spoke too quickly and it was difficult to pick up and understand everything.
- In the talks given by representatives from other countries, much of the content consisted of specific requests rather than expectations for the City to City Collaboration Project. We felt that it would be difficult for municipalities to meet these requests.
- Even in cases where projects had materialized, some were of the opinion that the overseas subsidiaries of Japanese companies would need to assume main control over projects.

2. JCM City to City Collaboration Seminar (Tokyo)

(1) Overview of the seminar

We participated along with representatives from Ulaanbaatar, Mongolia in a seminar

on surveys for City to City Collaboration held by the Ministry of the Environment in Shinbashi, Tokyo. For this session, there was a closed seminar in the morning and a public seminar in the afternoon. During the morning seminar, the participants were split into two groups and reported on the state of progress of the proposals for the current fiscal year. In the afternoon, a panel discussion was held among municipalities.

Date : January 23, 2017 (Mon.), 09:00 – 11:00, 14:00 – 17:00

Venue : TKP Shinbashi Conference Center (morning)
Iino Hall and Conference Center (afternoon)

Attendees : International Cooperation Office, Ministry of the Environment
Representatives from Mongolia, Indonesia, Vietnam, Thailand, Myanmar, Cambodia and Malaysia
City to City Collaboration representatives from Japan (Kanagawa Prefecture, Yokohama City, Kawasaki City, Fukushima City etc.)
Institute for Global Environmental Strategies (IGES)
Kita-Kyushu Urban Center
Air Pollution Reducing Department of Ulaanbaatar City,
Hokkaido Government, OECC

Program

Morning (closed seminar)

<table>
<tr><th>Time</th><th colspan="2">Topics</th></tr>
<tr><td>09:00-09:05</td><td colspan="2">Opening remarks from the organizers Mr. Mizutani, Director of the International Cooperation Office, Ministry of the Environment</td></tr>
<tr><td>09:05-09:10</td><td colspan="2">Move to venue (Group B moves to a separate room)</td></tr>
<tr><td rowspan="2">09:10-10:10</td><td colspan="2">Section 1: Reports on proposals</td></tr>
<tr><td>Group A<br>- Siem Reap City, Cambodia<br>- Bali Province, Indonesia<br>- Ayeyarwady Region, Myanmar<br>- Rayong Province, Thailand<br>- Phnom Penh Municipality, Cambodia<br>- Haiphong City, Vietnam<br>- Iskandar Development Area, Malaysia</td><td>Group B<br>- BatamCity, Indonesia<br>- Yangon City, Malaysia<br>- Bangkok City, Thailand<br>- Ulaanbaatar City, Mongolia</td></tr>
<tr><td>10:10-11:30</td><td colspan="2">Coffee Break</td></tr>
<tr><td>10:30-11:00</td><td colspan="2">Part 2: Overview of the Funding Support Scheme<br>(1) Projects to fund facilities<br>Mr. Bannai, Global Environment Centre Foundation<br>(2) JCM Japan Fund (JFJCM)<br>Mr. Teshima, Asian Development Bank<br>(3) Green Climate Fund (GCF)<br>Mr. Maruyama, Mitsubishi UFJ Morgan Stanley</td></tr>
</table>

Afternoon (open seminar)

| | |
|---|---|
| 14:00-14:10 | Opening remarks from the organizers Mr. Kajiwara, Vice-Minister for Global Environmental Affairs, Ministry of the Environment |
| 14:10-14:25 | Promoting Low Carbon Initiatives in Asia's Cities that utilize City to City Collaboration (Ministry of the Environment Japan) |
| 14:25-15:00 | Introduction to the Funding Support Scheme to promote Low Carbon Initiatives in Asia's Cities and Case Studies<br>(1) Projects to fund facilities<br>(2) JCM Japan Fund (JFJCM)<br>(3) Green Climate Fund (GCF) |
| 14:25-15:50 | Part 1 – "Introduction to Initiatives undertaken by Participating Cities in the City to City Collaboration Project<br>(1) Bali Province, Indonesia (Tokyo Metropolis)<br>(2) Rayong Province, Thailand (Yokohama City)<br>(3) Ayeyarwady Region, Myanmar (Fukushima City)<br>(4) Haiphong City, Vietnam |
| 15:50-16:00 | Coffee Break |
| 16:00-17:20 | Part 2 – "Panel Discussion"<br>Japanese municipalities: Hokkaido Government/Sapporo City, Kawasaki City, Kanagawa Prefecture, Kitakyushu City<br>Overseas municipalities: Ulaanbaatar City, Rayong Province |
| 17:20 | Closing remarks |

(2) Presentation

Morning

The content of the explanations provided by OECC is as follows.

- Content of the most recent surveys (surveys and interviews)
- Proposals made under 3 sectors (renewable energy, energy saving and waste disposal)
- Status of the proposals and future initiatives

Afternoon

The participants in this afternoon session included Hokkaido Government and Sapporo City from among Japanese municipalities and Ulaanbaatar City's Bureau for the Natural Environment from among overseas municipalities. They discussed the following points during their talks.

- Status of Joint Crediting Mechanism (JCM) Formation Feasibility Investigation Work in municipal policies
- Matters that had become apparent upon reflection on the activities conducted as part of Joint Crediting Mechanism (JCM) Formation Feasibility Investigation Work for the current fiscal year

- The significance of City to City Collaboration, its merits for municipalities, and its issues and solutions

(3) Results of the seminar and impression

(Results)

During this workshop, we were able to hear about the following directly from the municipalities of the countries concerned, thus proving a useful point of reference for future proposals.

- Ways of thinking concerning support through City to City Collaboration
- Words of caution for when creating plans (not to set goals that are too high)
- Support organizations and activities for local private businesses

We were able to understand the status of initiatives for the JCM Project among the various municipalities.

(Impression)

This seminar consisted mainly of introductions to specific cases and the majority of presentations were conducted from the Japanese side. The content was relatively easy to understand, but the scripts for the talks were too long and had to be cut due to time constraints.

The presentation scripts contained too much content and it was difficult to get a total understanding to the content through a casual reading. In order to understand what was being said fully, it was necessary to reread the scripts later on.

We were able to sympathize with the opinions of Mr. Mizutani, Ministry of the Environment, in the following ways.

- The municipalities and other concerned parties are involved in this project from the standpoint of avoiding a repeat of the kind of environmental situation experienced by Japan 40 – 50 years ago.
- Improvements to the environment are not something which can be achieved easily in the short term. They require ongoing support


View of the morning session



View of the afternoon session


View of the panel discussion