

People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project

Hohhot and Baotou Environmental Improvement Project (1) (2)

External Evaluator: Jun TOTSUKAWA, Sano Planning Co., Ltd.

1. Project Description



Project Location



Baotou Heat Supply Co.

1.1 Background

In China, while the economy has been rapidly growing since 1980s, air quality in urban areas has been steadily deteriorating due to overdependence on coal for primary energy consumption. Especially with many cases of acid rain damage reported since 1990s, having an equal emphasis on environment and development has become one of the most important tasks for the country.

The cities of Hohhot and Baotou of the Inner Mongolia Autonomous Region, the target areas of this project, are the capital and the biggest industrial city, respectively, of the region. In these cities air pollution has become so serious due to the increasing urban population and industrial development that in early 1990s the dust level (TSP) was 2-4 times higher than the national standard.

As the population and economy of these cities were expected to keep growing, there was a high probability that air pollution would be even more serious with growing demand for coal. Taking effective environmental measures against industrial and domestic emissions was an urgent task.

1.2 Project Outline

To improve air and water quality in the cities of Hohhot and Baotou of the Inner Mongolia Autonomous Region by introducing gas and heating supply facilities with lower environmental impact and contaminant treatment facilities, and therefore to contribute to the improvement of living conditions in these cities.

Approved Amount / Disbursed Amount	10,000 million yen (1), 5,629 million yen (2) / 9,917 million yen (1), 4,987 million yen (2)
Exchange of Notes Date/ Loan Agreement Signing Date	December 1996 (1), September 1997 (2) / December 1996 (1), September 1997 (2)
Terms and Conditions	Interest Rate: 2.1%; Repayment Period: 30 years (Grace Period: 10 years); Conditions for Procurement: General Untied Loan
Borrower/Executing Agencies	The Ministry of Foreign Trade and Economic Cooperation of the People's Republic of China (1) (2) / (1) National Environmental Protection Agency (2) People's Government of Inner Mongolia Autonomous Region
Final Disbursement Date	January 2003 (1), April 2003 (2)
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	Conducted SAPROF: Feasibility study was conducted as environmental SAPROF from August 1995 to March 1996.
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun TOTSUKAWA, Sano Planning Co., Ltd.

2.2 Duration of Evaluation Study

The ex-post evaluation was conducted in the following periods:

Duration of the Study : December 15, 2009 – October 29, 2010

Duration of the Field study : February 28, 2010 – March 23, 2010

May 6, 2010 – May 29, 2010

2.3 Constraints during the Evaluation Study

Out of the 22 entities that carried out the subprojects of this project, 11 had gone bankrupt or closed up operation by the time of ex-post evaluation. We were not able to collect information about these 11 entities as they had already been reorganized or dissolved. Therefore, for the evaluation of the subprojects these deceased companies were involved in, we used information from former officials of the yen loan office and existing documents.

3. Results of the Evaluation (Overall Rating: B)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of China

(1) Policies at the Time of Appraisal

As air pollution caused by coal combustion became very serious, the government of the

city of Hohhot established the “Blue Sky and Green Land Plan” in 1993, with an emphasis on efforts to improve air quality. For comprehensive activities to improve environmental quality, the “Hohhot Comprehensive Urban Environmental Program” was established in 1995 and was considered as an essential part of the city’s policies at the time of appraisal and the start of this project.

Similarly, the city of Baotou, an industrial city, established “Blue Sky, Clean Water and Green Land Plan” for the improvement of environmental quality in its 9th five-year plan (1996-2000), announcing that the city would strengthen efforts for air and water quality improvement, urban greening, and forest and environmental conservation.

As stated above, in mid-1990s these cities presented policies to strengthen efforts for environmental improvement and such activities were considered as part of their important policies. Especially, many of the subprojects composing this project were included as priority projects defined in the environmental protection programs of the cities, which shows that this project was one of the important aspects of the environmental policies of the cities.

(2) Policies at the Time of Ex-Post Evaluation

Compared with the time of appraisal, the environmental quality in Hohhot and Baotou significantly improved at the time of ex-post evaluation. However, environmental improvement is still emphasized as one of the important policy concerns of the municipal governments and the government of the autonomous region.

Currently aiming to be certified as “National Model City for Environmental Protection”, the city of Hohhot mentions “promotion of installation of desulfurization equipment at power plants and such other facilities, control of pollution caused by coal combustion in winter, and improvement of dust control” as special remarks for air pollution measures in its 11th five-year plan for environmental protection (2006-2010). The city of Baotou, also aiming at the same certification of model city for environmental protection, has been tackling concrete goals according to the action plan for contaminant reduction announced in its 11th five-year plan for environmental protection.

As described above, the improvement of environmental quality is still an important task for these cities and the direction of environmental improvement this project aimed at is still highly consistent with the policies of these cities.

3.1.2 Relevance with the Development Needs of China

(1) Development Needs at Project Appraisal

In mid-1990s, air pollution, especially pollution with dust caused by coal combustion, was extremely serious in Hohhot and Baotou and the pollution level was 4.7 times and 2.1 times,

respectively, higher than the Grade 2 standard¹ (daily average TSP value). As further economic growth and urbanization was expected in these cities, the largest economies in Inner Mongolia, air pollution control was an urgent task. Therefore, it is deemed that the aim and details of this project were consistent with the development needs of these cities.

Table 1 Environmental Quality in Hohhot and Baotou (1993)

	Number of days when national ambient air quality Grade 2 standard was achieved (per year)	Average SO ₂ concentration on the ground	Average TSP concentration on the ground
Hohhot	Approx. 100 days	0.329 mg/m ³ (1.3 times higher than the national standard)	1.418 mg/m ³ (4.7 times higher than the national standard)
Baotou	Less than 50 days	0.258 mg/m ³ (1.0 time of the national standard)	0.630 mg/m ³ (2.1 times higher than the national standard)

Source: Hearing with Municipal Environmental Protection Agencies of Hohhot and Baotou and data used for JICA appraisal

(2) Development Needs at the Time of Ex-Post Evaluation

Air pollution in these cities has been significantly improved at the time of ex-post evaluation. Considering the fact that in 2009 the air quality in Hohhot and Baotou met the national ambient air quality Grade 2 on 342 days and 309 days (about 100 days and a little less than 50 days in 1993), respectively, the air quality has obviously improved. However, although these cities have achieved the standard, comprehensive air pollution control is still considered as an important task as they barely meet the grade 2 standard on many days and new types of air pollutants that were not considered important, such as NO_x contained in automobile exhaust, have been rapidly increasing.

3.1.3 Relevance with Japan's ODA Policy

In 1992 environmental conservation was presented as one of the basic ODA principles in the ODA Charter of the time, and the Japanese government announced that it would significantly expand environmental ODA in the five years from 1992 to 1996.

Moreover, the policy for aid to China of the time included "further consideration of providing aids to inland China" and "provision of aids for air pollution control such as smoke and soot removal and for water pollution control with the use of Japan's experience and technologies in the field of environment".

¹ National standard Grade 1 is for nature preserves, Grade 2 for residential, commercial and general industrial areas, and Grade 3 for specific industrial areas such as heavy industry areas. Therefore, Grade 2 is usually used for evaluation of air quality in urban areas. (From the ambient air quality standard GB3095-1996 of the People's Republic of China)

In light of the above, this environmental improvement development project is deemed to have been consistent with the Japanese aid policy in terms of its contents and areas.

3.1.4 Relevance of the Selection of Subprojects

It is believed that it was foreseeable at the time of appraisal that one of the business entities involved in subprojects (related to Hohhot Wrought Iron Plant) would be eliminated in the near future according to a national policy. This fell in the category of entities of the business scale and contents that were likely to be eliminated in the long to medium terms, and the business actually went bankrupt in the late 2000s². Considering the above, it is “highly probable” that the selection of entities for subprojects was partially inappropriate.

However, the basis of this argument is an evaluation survey conducted in 2009 (by the Sino-Japan Friendship Centre for Environmental Protection) and the exact name of the policy of the time that specified the targets for business closure could not be identified during the ex-post evaluation. Therefore, such inappropriateness of the selection was described as “highly probable”. In addition, considering that there was only one business unit that fell into the category of inappropriate selection, we would only like to point out this matter as above and do not consider it as a negative factor to give minus point for the evaluation of relevance.

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

3.2 Efficiency (Rating: a)

3.2.1 Project Outputs

Before evaluating the outputs of this project, we would like to mention the following three major changes from the original plan.

- Project implementation by two-step loans that was originally planned for part of the project has been cancelled. The portion was implemented as subprojects by yen loans. (Phase I subprojects no. 6 to 13 in the following table)
- The subproject for refining of oven gas at the Baotou Iron and Steel Co. was cancelled³ and the excess funds went to new subprojects. Therefore, additional five subprojects were created in Baotou (Phase II subprojects no. 9 to 13).
- Many companies went bankrupt or stopped operation. (11 entities of the total 22)

² There was a government policy to close blast furnaces smaller than 400 m³, and the size of the furnace at the Hohhot Wrought Iron Plant was about 170 m³. (Data from the Sino-Japan Friendship Centre for Environmental Protection)

³ Construction of new coke ovens (No. 6 and 7) planned at the time of appraisal was cancelled due to the government notice to decrease iron production. Therefore, there was no need for the installation of treatment facilities and the implementation of this subproject was cancelled.

The table below shows comparison between planned outputs and actual results of the subprojects and includes costs and periods as well. It also shows ratings of inputs. If change in government policies or other event of force majeure had a negative effect on outputs, such case was not considered as a negative factor for evaluation. Moreover, as there was not enough information about deceased businesses, we only evaluated the subprojects where the target businesses are still operating.

Rating “a” was given if the project cost/period was smaller/shorter than planned (100% or below), “b” if higher/longer than planned (above 100% and below 150% of the plan), and “c” if much higher/longer than planned (above 150% of the plan). (Please see the section of “Input” for the approach to comprehensive evaluation based on these ratings.)

Table 2 Comparison between Original Plan and Actual Outputs and Inputs

Phase I		
1) City Gas Supply in Hohhot (executing body: China City Gas Development Company – former Hohhot Gas Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Construction of gas purification equipment (1 dry desulfurization unit and 1 dehumidifier) ② Laying of distribution pipes in the city 59.6 km ③ Construction of a gas tank (1 tank – 50,000 m ³) ④ Construction of gas pressure regulation stations (4 locations) ⑤ Introduction of an operation management system (SCADA)	Some outputs have changed. (Changes are underlined.) ① Construction of gas purification equipment (1 dry desulfurization unit only. <u>A dehumidifier has not been installed.</u>) <u>*Switched to natural gas in Sep. 2008</u> ② Laying of distribution pipes in the city 59.6 km ③ Construction of a gas tank (1 tank – 50,000 m ³) ④ Construction of gas pressure regulation stations (4 locations) ⑤ Introduction of an operation management system (SCADA)	<u>*A dehumidifier has not been installed.</u> As the result of detailed study showed the water content in gas was lower than originally expected, it was decided that the introduction of a dehumidifier was not necessary. <u>* Switched to natural gas in Sep. 08</u> * The project period was extended mainly for design work to respond to changes of dehumidifier installation condition. However, as it was an appropriate and necessary action, it is not considered as a negative factor for the evaluation of the project period. (Thus the evaluation result is described as b→a below. Hereinafter the same.)
Project cost: 54.57 million yuan	Project cost: 40.33 million yuan	(Project cost) a
Project period: Jan. 1998 – Mar. 2000 (27 months)	Project period: Jan. 1998 – Jul. 2000 (31 months)	(Project period) b→a
2) Heat Supply in Hohhot (executing body: Hohhot Urban Development Investment Management Co., Ltd. – former Hohhot Heat Supply Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Construction of water heating plants (29 MW x 4 units in Northeast Plant and 58 MW x 5 units in Southeast Plant,	Some outputs have changed. (Changes are underlined.) ① Construction of water heating plants (29 MW x 4 units in	* Laying of heat distribution pipes <u>45 km</u> * Heat exchange stations in <u>55 locations</u>

total 406 MW) ② Laying of heat distribution pipes 39 km ③ Heat exchange stations in 60 locations ④ Introduction of an operation management system (SCADA)	Northeast Plant and 58 MW x 5 units in Southeast Plant, total 406 MW) ② Laying of heat distribution pipes <u>45 km</u> ③ Heat exchange stations in <u>55 locations</u> ④ Introduction of an operation management system (SCADA)	- With changes of urban planning, routes of distribution pipes and locations of stations were changed. * The project period was extended for procurement processes, e.g. many rebidding processes.
Project cost: 610 million yuan	Project cost: 606 million yuan	(Project cost) a
Project period: Jan. 1998 – Mar. 2000 (27 months)	Project period: Apr. 2001 – Dec. 2003 (33 months)	(Project period) b
3) City Gas Supply in Baotou (executing body: Baotou City Gas Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Construction of a gas plant ② Laying of distribution pipes in the city 167 km ③ Construction of gas tanks (100,000 m ³ x 1 unit and 500,000 m ³ x 1 unit) ④ Gas pressure regulation stations 15 units ⑤ Introduction of an operation management system (SCADA)	Some outputs have changed. (Changes are underlined.) ① Construction of a gas plant ② Laying of distribution pipes in the city <u>133 km</u> ③ Construction of a gas tank (500,000 m ³ x 1 unit only. <u>Another unit – 100,000 m³ – was not constructed.</u>) ④ Gas pressure regulation stations 15 units ⑤ Introduction of an operation management system (SCADA) ⑥ <u>Construction of heating stations</u>	* Laying of distribution pipes in the city <u>133 km</u> - With changes of the urban planning, routes of distribution pipes were changed. * Construction of gas tanks (<u>One of the two tanks, a 100,000 m³ tank, was not constructed.</u>) - Gradual transition to natural gas was decided. * <u>Construction of heating stations</u>
Project cost: 398 million yuan	Project cost: 338 million yuan	(Project cost) a
Project period: Dec. 1997 – Dec. 2001 (49 months)	Project period: Apr. 1999 – Dec. 2002 (45 months)	(Project period) a
4) Heat Supply in Baotou (executing body: Baotou Heat Supply Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Addition of boilers (29 MW x 2 units, and 58 MW x 4 units at Southeast Plant, total 290 MW) ② Laying of heat distribution pipes, primary supply pipes (6 km) and secondary supply pipes ③ Heat exchange stations in 30 locations ④ Introduction of an operation management system (SCADA)	No change in outputs: ① Addition of boilers (29 MW x 2 units, and 58 MW x 4 units at Southeast Plant, total 290 MW) ② Laying of heat distribution pipes, primary supply pipes (6 km) and secondary supply pipes ③ Heat exchange stations in 30 locations ④ Introduction of an operation management system (SCADA)	No change in outputs * As the procurement cost for heat distribution pipes etc. increased, the total project cost became higher than planned.
Project cost: 375.4 million yuan	Project cost: 425.4 million yuan	(Project cost) b

Project period: Sep. 1998 – Dec. 2002 (52 months)	Project period: Jul. 1998 – Oct. 2002 (52 months)	(Project period) a
5) Purchase of Monitoring Equipment in Baotou (executing body: Baotou Municipal Environmental Protection Agency)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Purchase of monitoring equipment	No change in outputs: Monitoring equipment	No change in outputs:
Project cost: 13.4 million yuan	Project cost: 12.49 million yuan	(Project cost) a
Project period: Apr. 1999 – Jul. 2000 (16 months)	Project period: Apr. 1999 – Jun. 2000 (15 months)	(Project period) a
6) Wastewater Treatment at Calcium Carbonate Plant in Hohhot (executing body: Inner Mongolia Sanlian Chemical Industry Co., Ltd. – former Hohhot Chemical Industry)		
Original Plan	Actual Outputs	Difference and Input Evaluation
New construction of a closed furnace	No change in outputs: New construction of a closed carbide furnace	No change in outputs: * Due to the delay of appraisal, the total project period became longer. * As the project period was extended, the procurement cost slightly increased.
Project cost: 58.19 million yuan	Project cost: 61.85 million yuan	(Project cost) b
Project period: Jan. 1999 – Feb. 2002 (38 months)	Project period: May 2000 – Dec. 2003 (44 months)	(Project period) b
7) Wastewater Treatment at Chemical Fiber Plant in Hohhot (executing body: Inner Mongolia Chemical Fiber Plant)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of wastewater treatment equipment	No change in outputs: Installation of wastewater treatment equipment (capacity 4,500 m ³ /day)	No change in outputs: Company in bankruptcy
Project cost: 17 million yuan	Project cost: Unknown	
Project period: May 2000 – Jul 2004 (51 months)	Project period: Unknown	
8) Replacement of Boilers at Rubber Chemical Plant in Hohhot (executing body: Hohhot Rubber Plant)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Installation of 3 circulating fluidized bed boilers (20 t/h x 1 boiler and 10 t/h x 2 boilers) ② Generator (1.5 MW turbine generator x 1 unit)	No change in outputs: ① Installation of 3 circulating fluidized bed boilers (20 t/h x 1 boiler and 10 t/h x 2 boilers) ② Generator (1.5 MW turbine generator x 1 unit)	No change in outputs: Company in bankruptcy
Project cost: 15 million yuan	Project cost: Unknown	
Project period: Jan. 1999 – Dec. 2001 (36 months)	Project period: Unknown	

9) Wastewater Treatment at Sugar Factory in Hohhot (executing body: Hohhot Sugar Factory)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of water film dust removers etc. (change of coal combustion method)	Cancelled	Cancelled
Project cost: Unknown		
Project period: Unknown		
10) Treatment of Emission Gas Containing Fluorine from Aluminum Plant in Baotou (executing body: Baotou Aluminum Co., Ltd. – former state-owned Baotou Aluminum Refinery)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Improvement and extension of existing electrolytic cells ② Measures against smoke and dust including installation of bag filters	Some outputs have changed. (Changes are underlined.) ① <u>New</u> installation of electrolytic cells ② Measures against smoke and dust including installation of bag filters	* <u>New</u> installation of electrolytic cells As originally planned extension of existing electrolytic cells was not approved based on a new environmental control standard, new equipment was installed. Since this change was made according to a new environment policy, this extension of project period is not considered as a negative factor.
Project cost: 494.3 million yuan (Budget after redesign)	Project cost: 490 million yuan	(Project cost) a
Project period: Dec. 1999 – Dec. 2000 (13 months)	Project period: May 2001 – Aug. 2002 (16 months)	(Project period) b→a
11) Relocation of Rare Earth Metal Plant in Baotou (executing body: Baotou Rare Earth Metal Plant)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Construction of a new plant with new technologies in the suburbs	Changes in outputs unknown (Company in bankruptcy)	Unknown (bankrupt)
Project cost: Unknown		
Project period: Unknown		
12) Utilization of Coal Ash at First Thermal Power Plant in Baotou (executing body: Baotou First Thermal Power Co., Ltd.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Construction of a brick factory with the use of coal ash	No change in outputs: Construction of a brick factory with the use of coal ash	No change in outputs: * The actual project cost was higher than planned because the procurement cost was estimated low at the time of feasibility study and design. * The project period was extended due to delay of procurement procedures etc.
Project cost: 21.5 million yuan	Project cost: 30 million yuan	(Project cost) b
Project period: May 1999 – Jun. 2001 (26 months)	Project period: Aug. 1999 – Dec. 2002 (41 months)	(Project period) c

13) CO Gas Collection at Ironworks in Baotou (executing body: Baotou Iron and Steel Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of converter emission gas treatment equipment	No change in outputs: Installation of converter emission gas treatment equipment (gas blower pressure regulation system, gas tanks and electric dust collectors)	No change in outputs:
Project cost: 98.92 million yuan	Project cost: 98.92 million yuan	(Project cost) a
Project period: Oct. 1999 – May 2001 (20 months)	Project period: Apr. 1999 – Sep. 2000 (18 months)	(Project period) a
Phase II		
1) Construction of Sewerage Treatment Plant in Baotou (executing body: Baotou Wastewater Industry Co., Ltd. – former Baotou Municipal Engineering Administration Department)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Expansion of a sewerage treatment plant (Sewerage treatment plant in the northern suburbs) 15,000 m ³ /day → 70,000 m ³ /day ② New construction of sewerage treatment plants (Donghe west sewerage treatment plant) 30,000 m ³ /day (Donghe east sewerage treatment plant) 20,000 m ³ /day	No change in outputs: ① Expansion of a sewerage treatment plant (Sewerage treatment plant in the northern suburbs) 15,000 m ³ /day → 70,000 m ³ /day New construction of sewerage treatment plants (Donghe west sewerage treatment plant) 30,000 m ³ /day (Donghe east sewerage treatment plant) 20,000 m ³ /day	No change in outputs:
Project cost: 268 million yuan	Project cost: 266 million yuan	(Project cost) a
Project period: Nov. 1998 – Sep. 2003 (59 months)	Project period: Nov. 1998 – Jul. 2003 (57 months)	(Project period) a
2) Purification of Coke Oven Gas from Ironworks in Baotou (executing body: Baotou Iron and Steel Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of coke gas purification equipment Purification capacity: 50,000 m ³ /hour	Cancelled	Cancelled
Project cost: 408 million yuan		
Project period: Cancellation decided before detailed design		
3) Comprehensive Wastewater Treatment at Ironworks in Baotou (executing body: Baotou Iron & Steel Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Construction of a comprehensive wastewater treatment plant Capacity → 80,000 m ³ /hour	Some outputs have changed. (Changes are underlined.) Construction of a comprehensive wastewater treatment plant Capacity → 60,000 m ³ /hour	* Construction of a comprehensive wastewater treatment plant Capacity → <u>60,000 m³/hour</u> - With advances in technology, the quantity of wastewater decreased and the planned capacity was not required any more.

Project cost: 235.92 million yuan	Project cost: 166.6 million yuan	(Project cost) a
Project period: Sep. 2001 – Jun. 2003 (22 months)	Project period: Jul. 2002 – Jun. 2003 (12 months)	(Project period) a
4) Blast Furnace Gas Power Generation at Ironworks in Hohhot (executing body: Wrought Iron Factory in Hohhot)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Installation of gas boilers (10 t/hour x 2 units) ② Installation of turbine generators (1.5 MW x 2 units)	No change in outputs: ① Installation of gas boilers (10 t/hour x 2 units) ② Installation of turbine generators (1.5 MW x 2 units)	No change in outputs: Company in bankruptcy
Project cost: 18.1 million yuan	Project cost: Unknown	
Project period: Oct. 1999 – Nov. 2001 (26 months)	Project period: Unknown	
5) Caustic Soda Production Process Improvement at Chemical Plant in Hohhot (executing body: Inner Mongolia Sanlian Chemical Industry Co., Ltd. – former Hohhot Chemical Industry)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Emission gas and wastewater treatment equipment (From fusion method to ion diaphragm method) ② Installation of cyclone dust collectors and bag filters	No change in outputs: ① Emission gas and wastewater treatment equipment (From fusion method to ion diaphragm method) ② Installation of cyclone dust collectors and bag filters and chlorine leak absorption towers	No change in outputs: * The project cost exceeded the plan due to the increase of procurement cost.
Project cost: 46.24 million yuan	Project cost: 49.87 million yuan	(Project cost) b
Project period: Oct. 1998 – May 2000 (20 months)	Project period: Oct. 1998 – Jan. 2000 (16 months)	(Project period) a
6) Expansion of City Gas Supply in Hohhot (executing body: City Gas Development Co., Ltd. – former Hohhot Gas Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of 7 gas generators (2 for backup) Gas generation capacity 516,000 m ³ /day	Cancelled	Cancelled
Project cost: 41.5 million yuan		
Project period: Cancellation decided before detailed design		
7) Comprehensive Utilization of Coal Ash in Hohhot (executing body: Hohhot Purple Sand Pottery Resource Development Co.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Construction of a building material production plant Quantity of wastes (coal ash) used → 12,000 t/year	Changes of outputs unknown (bankrupt)	Unknown (bankrupt)
Project cost: 38.4 million yuan		
Project period: May 1995 – 2002 (month unknown)		

8) Dust Control at Cement Factory in Qingshuihe County, Hohhot (executing body: Cement factory in Qingshuihe County, Hohhot)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of electric dust collectors and bag filters	No change in outputs: Installation of electric dust collectors and bag filters	No change in outputs: Company in bankruptcy
Project cost: 7 million yuan	Project cost: Unknown	
Project period: Mar. 1998 – 2004 (month unknown)	Project period: Unknown	
9) Comprehensive Measures for Heat and Electricity Environment at Baotou Jiujiu Group (executing body: Baotou Jiujiu Group)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of boilers (modification of 3 boilers and new installation of 1 boiler)	Changes of outputs unknown (bankrupt)	Unknown (bankrupt)
Project cost: 44.8 million yuan		
Project period: Nov. 1999 – Dec. 2001 (26 months)		
10) Wastewater Control at Baotou Hefa Rare Earth Refinement Plant in Baotou (Implemented at: Hefa Rare Earth Co., Ltd. – former Baotou Hefa Rare Earth Co., Ltd.)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of ammonium chloride wastewater treatment equipment	No change in outputs: Installation of ammonium chloride wastewater treatment equipment	No change in outputs: * Bidding and other procurement procedures required some time.
Project cost: 29.7 million yuan	Project cost: 28.07 million yuan	(Project cost) a
Project period: Jan. 1999 – Dec. 2001 (36 months)	Project period: Aug. 1999 – Dec. 2002 (41 months)	(Project period) b
11) Comprehensive Environmental Measures at Baotou Yellow River Chemical Industry (executing body: Tomorrow Technology Co., Ltd. – former Yellow River Chemical Industry)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of equipment to treat wastewater containing phenol and acid wastewater	No change in outputs: Installation of equipment to treat wastewater containing phenol and acid wastewater	No change in outputs: Company in bankruptcy (in process)
Project cost: 81.7 million yuan	Project cost: 81.7 million yuan	
Project period: Jul. 1998 - (months unknown)	Project period: Jan. 2003 – Jan. 2005 (25 months)	
12) Emission Gas, Smoke and Wastewater Treatment at Insulation Material Factory in Baotou (executing body: Insulation material factory in Baotou)		
Original Plan	Actual Outputs	Difference and Input Evaluation
Installation of equipment to treat wastewater containing phenol and organic gas	Changes of outputs unknown (bankrupt)	Unknown (bankrupt)
Project cost: 33.2 million yuan		
Project period: Feb. 1999 – May 2001 (28 months)		

13) Comprehensive Environmental Measures at Enamel Plant in Baotou (executing body: Enamel plant in Baotou)		
Original Plan	Actual Outputs	Difference and Input Evaluation
① Installation of a boiler SO ₂ control system ② Installation of dust and noise control systems	No change in outputs: ① Installation of a boiler SO ₂ control system ② Installation of dust and noise control systems	No change in outputs: Company in bankruptcy
Project cost: 30.5 million yuan	Project cost: Unknown	
Project period: Dec. 2001 – Dec. 2003 (25 months)	Project period: Unknown	

Note: Information in the table (plan, actual results, project cost and project period) is taken from the replies to the questionnaire sent by the ex-post evaluation team and documents of Sino-Japan Friendship Centre for Environmental Protection.

The following factors caused above-described differences between the original plan and the actual result.

- Project details were changed to meet governmental policy changes. (E.g., city gas supply in Hohhot and Baotou – switch from coke gas to natural gas was encouraged.)
- The government introduced new environmental standards. (E.g., treatment of emission gas containing fluorine from an aluminum plant – new facilities were introduced as the originally planned specifications did not meet tightened environmental standards.)
- Layout and scale of necessary facilities were changed to meet changes in urban planning. (E.g., heat supply in Hohhot – changes including re-routing of distribution pipes.)
- Requirements about scale and details of facilities were changed according to the result of detailed study through basic design survey (B/D) and detail design (D/D). (E.g., city gas supply in Hohhot – it was decided dehumidifiers would not be necessary because the water content in gas found out to be lower than expected.)

3.2.2 3.2.2 Project Inputs

3.2.2.1 Project Period

At the time of appraisal, Phase I period was planned to be December 1996 to December 2001 (61 months) and Phase II to be July 1997 to December 2001 (54 months). However, we evaluated the project period only with the ongoing subprojects, as we did for the project cost, as there is not enough information about deceased businesses. 2 points was given to subprojects with rating “a”, 1 point to rating “b” and 0 point to rating “c”. The subprojects whose total score exceeded 80% of the highest score were evaluated as (a), from 50% to 80% as (b), and less than 50% as (c). As a result of calculation based on this, the project period is deemed to be mostly as planned.

Table 3 Evaluation of Project Period

	(a) Same as or shorter than planned [up to 100%]	(b) Longer than planned [above 100% and below 150%]	(c) Much longer than planned [150% or more]	Total	Evaluation
Subproject Quantity	9	3	1	13	
Point	18	3	0	21	81% = (a)

As for the project period, some subprojects were delayed. In addition to governmental approval processes and procurement, redesign and reinvestigation to respond to new environmental standards introduced by the government and review of urban planning also had influence.

3.2.2.2 Project Cost

The planned and actual costs of this project are as shown in the following table.

Table 4 Comparison of Planned and Actual Project Costs (Unit: million yen)

	Planned Cost		Actual Cost	
	Phase I	Phase II	Phase I	Phase II
Foreign currency (yen loan)	10,000	5,629	9,917	4,987
Domestic currency	7,680	8,761	Unknown	Unknown
Total	17,680	14,390	Unknown	Unknown

Many of the companies involved in this project are now in bankruptcy and the actual cost in the local currency portion is unknown. Therefore, we also evaluated the project cost only with 13 ongoing subprojects. The rating method is the same as the one for project period evaluation described above, and scores were given according to the ratings of subproject cost. (2 points for “a”, 1 point for “b” and 0 point for “c”. The sub-project cost is rated as (a) if the total score exceeds 80% of the highest score, (b) if it is from 50% up to 80%, and (c) if it is less than 50%.) As a result of this calculation, the project cost is deemed to be mostly as planned. The following table shows the rating calculation of sub-projects.

Table 5 Evaluation of Project Cost

	(a) Same as or smaller than planned [up to 100%]	(b) Larger than planned [above 100% and below 150%]	(c) Much larger than planned [150% or more]	Total	Evaluation
Subproject Quantity	9	4	0	13	
Point	18	4	0	22	85% = (a)

For the reasons stated above, both project cost and period are mostly as planned if the scope is limited to the businesses that are still operating; therefore the efficiency of this project is high.

3.3 Effectiveness (Rating: b)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

The achievement level of operation and effect indicators of each project is as shown in the following table.

All the entities that are still operating have achieved the original goals as the facilities and equipment constructed by this project have been effectively utilized. As for the deceased businesses, analysis of the causes will be described later.

The table shows ratings (a, b and c, in the order of highest to lowest) in the right column. Subprojects whose achievement level is 80% or more receive rating “a”, from 50% to 80% “b”, and if the achievement level is less than 50% or the entity is in bankruptcy, the subproject received rating “c”. The ratings are based on the achievement level as of 2009.

Table 6 Targets and Actual Results of Operation and Effect Indicators

Phase I			
Subproject	Target values (2000)*	Actual results (2009)	Achievement level
1) City gas supply in Hohhot	Reduction of coal consumption: 59,897 t/year Reduction of SO ₂ emission: 2,000 t/year Reduction of TSP emission: 3,007 t/year Gas supply → Supply of 164,000 m ³ /day newly created	Reduction of coal consumption: 838,214 t/year Reduction of SO ₂ emission: 27,989 t/year Reduction of TSP emission: 42,081 t/year Gas supply: 60,000 m ³ /day → 1,156,000 m ³ /day	a
2) Heat supply in Hohhot	Reduction of coal consumption: 167,940 t/year Reduction of SO ₂ emission: 5,896 t/year Reduction of TSP emission: 9,812 t/year	Reduction of coal consumption: 167,980 t/year Reduction of SO ₂ emission: 5,964 t/year Reduction of TSP emission: 9,862 t/year	a

3) City gas supply in Baotou	Reduction of coal consumption: 99,000 t/year Reduction of SO ₂ emission: 1,584 t/year Reduction of TSP emission: 3,713 t/year Gas supply → Supply of 146,400 m ³ /day newly created	Reduction of coal consumption: 424,914 t/year Reduction of SO ₂ emission: 14,061 t/year Reduction of TSP emission: 150,141 t/year Gas supply → Supply of 547,900 m ³ /day newly created	a
4) Heat supply in Baotou	Reduction of coal consumption: 56,042 t/year Reduction of SO ₂ emission: 1,062 t/year Reduction of TSP emission: 4,206 t/year	Reduction of coal consumption: 67,795 t/year Reduction of SO ₂ emission: 1,285 t/year Reduction of TSP emission: 5,088 t/year	a
5) Purchase of monitoring equipment in Baotou	More than 150 items can be monitored.	More than 200 items can be monitored.	a
6) Wastewater treatment at calcium carbonate plant in Hohhot	TSP: 1,805 t/year → 435 t/year CO: 9,460 t/year → 0 t/year	TSP: 31 t/year CO: 0 t/year	a
7) Wastewater treatment at chemical fiber plant in Hohhot	COD: 235 → 120 mg/L S2-: 2.4 → 1 mg/L Zn2+: 27 → 3.2 mg/L	Bankrupt	c
8) Replacement of boilers at rubber chemical plant in Hohhot	SO ₂ : 1,031 → 237 mg/Nm ³ TSP: 5,835 → 225 mg/Nm ³	Bankrupt	c
9) Wastewater treatment at sugar factory in Hohhot	TSP: 879 → 250 mg/Nm ³ COD: 6,837 → 6,000 mg/L BOD: 3,026 → 3,000 mg/L SS: 2,815 → 312 mg/L	Cancelled	-
10) Treatment of emission gas containing fluorine from aluminum plant in Baotou	TSP: 3,303 → 494 kg/year Fluorinated compounds: 480 → 85 t/year	TSP: 145 kg/year Fluorinated compounds: 48 t/year	a
11) Relocation of rare earth metal plant in Baotou	SO ₃ : 13,000 → 0 mg/Nm ³ Chlorine: 2,420 → 480 mg/Nm ³ Hydrogen fluoride: 520 → 10mg/L	Bankrupt	c
12) Utilization of coal ash at First Thermal Power Plant in Baotou	Utilization of wastes (coal ash): 50,000 t/year	Utilization of wastes (coal ash): 55,000 t/year	a
13) CO gas collection at ironworks in Baotou	TSP: 100 → 10 mg/Nm ³ CO: 160,000 t/year → 0 t/year	TSP: 10 mg/Nm ³ or lower CO: 0 t/year	a

Note: The year for the base data described in the columns for targets (to the left of the arrow) in the columns of targets is unknown. (This table contains data from 1996 summary of appraisal items, but the summary does not specify the years.)

Phase II			
Subproject	Target values (2000)*	Actual results (2009)	Achievement level
1) Construction of sewerage treatment plant in Baotou	① Expansion of a sewerage plant (Sewerage plant in the northern suburbs) 15,000 m ³ /day → 70,000 m ³ /day ② New construction of sewerage plants (Donghe west sewerage treatment plant) 30,000 m ³ /day (Donghe east sewerage treatment plant) 20,000 m ³ /day	① Expansion of a sewerage plant (Sewerage plant in the northern suburbs) 15,000 m ³ /day → 70,000 m ³ /day ② New construction of sewerage plants (Donghe west sewerage treatment plant) 30,000 m ³ /day (Donghe east sewerage treatment plant) 20,000 m ³ /day ③ COD: 200 mg/L → 50 mg/L (National standard Grade 2 achieved)	a
2) Purification of coke oven gas from ironworks in Baotou	Installation of coke oven gas purification equipment Purification capacity: 50,000 m ³ /hour	Cancelled	-
3) Comprehensive wastewater treatment at ironworks in Baotou	Construction of a comprehensive wastewater treatment plant Treatment capacity: 80,000 m ³ /hour	Construction of a comprehensive wastewater treatment plant Treatment capacity: <u>60,000 m³/hour</u> - As the scale of the wastewater treatment plant was reduced according to the needs, the planned capacity was modified at the time of basic design. The plant was constructed according to the modified plan; therefore this is not considered as a negative factor for achievement evaluation.	b → a
4) Blast furnace gas power generation at ironworks in Hohhot	No concrete target specified	Bankrupt	c
5) Caustic soda production process improvement at chemical plant in Hohhot	Reduction of coal consumption: 10,000 t/year	Reduction of coal consumption: 10,000 t/year - Coal consumption reduced to 1/5	a
6) Expansion of city gas supply in Hohhot	Installation of 7 gas generators (2 for backup) Gas generation capacity: 516,000 m ³ /day	Cancelled	-
7) Comprehensive utilization of coal ash in Hohhot	Construction of a building material plant Quantity of wastes (coal ash) used: 12,000 t/year	Bankrupt	c
8) Dust control at cement factory in Qingshuihe County, Hohhot	No concrete target specified	Bankrupt	c

9) Comprehensive measures for heat and electricity environment at Baotou Jiujiu Group	No concrete target specified	Bankrupt	c
10) Wastewater control at Baotou Hefa Rare Earth Refinement Plant in Baotou	No concrete target specified	NH3-N: 25mg/L National industrial wastewater standard achieved - The standard was not met before the implementation of this project, but it has been achieved now. Therefore the achievement level is evaluated as “a”.	a
11) Comprehensive environmental measures at Baotou Yellow River Chemical Industry	No concrete target specified	Bankrupt (in process)	c
12) Emission gas, smoke and wastewater treatment at insulation material factory in Baotou	No concrete target specified	Bankrupt	c
13) Comprehensive environmental measures at enamel plant in Baotou	No concrete target specified	Bankrupt	c

For evaluation of effectiveness, total rating is given based on the total scores of subprojects. 2 points is given for “a”, 1 point for “b” and 0 point for “c”. Then the project is evaluated as (a) if the total score exceeds 80% of the highest score, (b) if it is between 50% and 80%, and (c) if it is less than 50%. The evaluation result based on this method is as seen in the following table. As the total score is 56% of the highest score, the effectiveness of this project is evaluated as (b).

Table 7 Evaluation of Operation and Effect Indicators

	Rating (a) Achievement level over 80%	Rating (b) Achievement level 50% to 80%	Rating (c) Achievement level less than 50% or the company is in bankruptcy	Cancelled (-)	Total
Subproject Quantity	13	0	10	3	23
Point	26	0	0	—	26 (56% of the highest score 46 points)

Note: The three cancelled subprojects are not included in the total evaluation.

One of the characteristics of the effectiveness of this project is that many of the companies involved have gone bankrupt. Therefore, the total effectiveness is evaluated to be moderate although all the companies that are still operating have produced results exceeding targets.

[Deceased companies]

The background factors behind these bankruptcies were two major policies of the Chinese government, “reform of state enterprises” and “promotion of shakeout of companies with high environmental load (low productivity)”.

The first policy, “reform of state enterprises”, was quickly spread across the country with backing from the “Report on Ownership Reform of State-Owned Enterprises”⁴ etc. It also happened in the Inner Mongolia. According to the “Progress Report on Restructuring the Economic System in the Autonomous Region” by the Economic Development Committee of the Inner Mongolia Autonomous Region, “ownership reform of enterprises owned by the autonomous region or the state have been progressing smoothly since the start in 2003, (snip) pending issues regarding 10 enterprises are expected to be solved by the end of the year”. Although it is unknown how many state-owned enterprises in Inner Mongolia that were reorganized in the 4-5 years of the time, the report shows that the reform of state enterprises had been rapidly carried out during those 4-5 years.

Moreover, for the “promotion of shakeout of companies with high environmental load”, the “Implementation Plan for the Shakeout of Companies with High Environmental Load in Inner Mongolia” was also established according to the 11th five-year plan, presenting the plan to “eliminate companies with a low production capacity and high environmental load” in 10 industries including cement, cokes, iron alloy and carbide industries in the autonomous region”. As a result, many businesses have been eliminated as shown in the following table.

Table 8 Number of Companies Eliminated in Inner Mongolia according to the Company Shakeout Plan (2003-2007)

Industry	Iron and steel	Carbide	Cement	Coke refinement
Number of companies eliminated	57	5	17	75

Source: Inner Mongolia Development and Reform Commission and International Coal Network

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

Financial Internal Rate of Return (FIRR) was calculated for Hohhot and Baotou city gas supply subprojects and Hohhot and Baotou heat supply subprojects at the time of appraisal. However, we cannot calculate FIRR for the gas supply subprojects at the time of this ex-post

⁴ Report by the State-owned Assets Supervision and Administration Commission of the State Council (November 2003)

evaluation, because, unlike the original plan, natural gas is now fully used instead of coke gas, and the basis for the calculation is totally different.

Moreover, the benefits of the heat supply subprojects cannot be identified, either, because the boilers installed through this project are now used with other boilers with higher heat efficiency that have been installed separately from this project in response to recent jumps in electricity and other material prices. Therefore, FIRR is not calculated in this evaluation.

Economic Internal Rate of Return (EIRR) was not calculated at the time of project appraisal and therefore the comparison of similar benefit indicators is not possible. Although we tried to use the data of reduction of patients with bronchial diseases, as an indicator to show the benefit of air quality improvement, EIRR calculation is difficult as data of the time cannot be obtained. Therefore, EIRR is not calculated in this evaluation.

3.3.2 Qualitative Effects

The primary qualitative effect of this project is that “the local people has become aware of the improvement of environmental quality and are now able to have comfortable daily lives”. The result of the beneficiary survey (Hohhot) also shows that 75% of the residents were aware of the improvement of environmental quality and many said that they “do not use antidust masks in everyday life as often as before”. This can be seen not only in the beneficiary survey result but in the “Survey of Satisfaction of Residents with Environment”, conducted by the Chinese government on its own.

Such benefits have been produced through effective cooperation and complementary relationship between this project and the efforts for environmental improvement that the Chinese government has been making on its own. Therefore, these effects were not brought about by this project alone, but we would like to add that the general contribution of this project is deemed to be significant.

Table 9 Residents’ Recognition of Air Quality Improvement
(Beneficiary survey result)

Change in air quality (in comparison with 10 years ago)	Total (%)		Beneficial effects pointed out by the respondents who selected “improved” or “generally improved” [multiple answers allowed]	Total (%)
Improved very much	36	➔	Reduction of clothing contamination by dust	55
Rather improved	39		Able to hang laundry outside	56
Not changed much	7		No need to use masks and sunglasses for dust protection any more	60
Rather deteriorated	13		Reduction of cough and soreness in the eyes	47
Deteriorated very much	5		Other	5

Note: Result of a beneficiary survey conducted during the ex-post evaluation (survey of 100 residents of the city in April 2010)

Table 10 Result of Survey on Residents' Satisfaction with Environment
 (Rate of respondents who answered "satisfied": %)
 (Conducted by the Chinese government)

		2006	2007	2008
Hohhot	Air quality	79.4	70.4	86.5
	Water quality	80.9	73.1	87.9
Baotou	Air quality	72.0	79.4	81.2
	Water quality	71.3	80.8	81.5

Source: Survey on Residents' Satisfaction with Environment⁵, conducted by the Chinese government

In light of the above, this project has somewhat achieved its objectives, therefore its effectiveness is fair..

3.4 Impact

3.4.1 Intended Impacts

The implementation of this project has the following impacts.

(1) Improvement of Air Quality in Both Cities

As seen in the table below, the air quality in Hohhot and Baotou has significantly improved since the implementation of this project. This is a synergetic effect of the implementation of this project and various other environmental projects and regulations that the Chinese government has been enforcing and promoting⁶.

The ratio of investment amounts is one of the factors that imply the significance of the role of this project. For example, the investment amount for the subprojects of this project accounts for about 28% of the total investment amount for major projects for "urban environmental infrastructures and pollution source control" defined in the Hohhot 10th five-year plan (2000-2005).⁷ Although the investment amount is not directly linked with environmental effect, the significance of the role/influence of this project is inferable.

⁵ Survey on the residents' awareness conducted in selected major cities. Hohhot and Baotou have been covered since 2006. However, the number of samples is unknown.

⁶ Neither of the cities received aids in the environmental field from other donors during the period of this project.

⁷ The predicted SO₂ reduction caused by the subprojects of this project accounts for about 16% of the total amount of SO₂ reduction predicted. Electric power plants emit a particularly large amount of SO₂. Therefore, this project, which does not have subproject directly involved with electric power plants, has a slightly smaller impact on the reduction of SO₂ emission.

Table 11 Indicators of Air Quality in Hohhot

Indicator (unit)	Base value at the time of appraisal (1993)	Original target (2000 target)	Actual result (2008)
• Total SO ₂ emission (t)	52,500	56,872	94,800
• Average SO ₂ concentration on the ground (mg/Nm ³)	0.110	0.128	0.049
• Total TSP emission (t)	72,240	81,661	21,976
• Average TSP concentration on the ground (mg/Nm ³)	0.421	0.444	0.364 (2006)
• Number of days national air quality standard Grade 2 was achieved (per year)	Approx. 100	-	342 (2009)

Source: Hohhot Municipal Environmental Protection Agency

Note: SO₂ emission has largely increased due to the construction of a power plant in the suburbs of Hohhot. However, as it is in the suburbs, the SO₂ concentrate measured at monitoring points in the city is not affected so much.

Table 12 Air Quality Indicators in Baotou

Indicator (unit)	Base value (1993)	Predicted value (2000)	Actual value (2008)
• Average SO ₂ concentration on the ground (mg/Nm ³)	0.110	0.128	-
• Average TSP concentration on the ground (mg/Nm ³)	0.421	0.444	-
• Number of days national air quality standard Grade 2 was achieved (per year)	Less than 50		309 (2009)

Source: Website of China Information Statistics and Baotou Municipal Environmental Protection Agency

Note: We were not able to obtain data of environmental indicators (SO₂ and TSP) of Baotou because Baotou Environmental Protection Agency did not disclose the information.

(2) Improvement of Infrastructures

The gas and heat supplied population is significantly larger than originally planned and it contributes the improvement of the local people's lives. Moreover, it is said that the infrastructures for stable supply of gas and heat have increased the values in the real estate market, especially in the new urban development districts⁸.

Table 13 Changes in the Number of Households Supplied with Gas through Hohhot and Baotou Gas Supply Subprojects

	1998	2009
Hohhot gas supply subproject	70,000	313,000
Baotou gas supply subproject	57,000	140,000

Source: Responses to questionnaire

⁸ From the responds to the questionnaire of Hohhot Heat Supply Co. and Baotou Gas Co.

(3) Decrease of Respiratory Diseases

Although it was expected at the time of project appraisal that this project would contribute to the decrease of respiratory diseases, it is difficult to determine the causal link with this project. However, 1/3 of the respondents to the beneficiary survey said respiratory diseases “have decreased”. Therefore, the local people are aware that this project has a positive impact.

3.4.2 Other Impacts

There has been no relocation of residents for the implementation of this project. As for the land acquisition, land for heat exchange stations (55 locations in Hohhot and 30 locations in Baotou) for heat supply subprojects and land for a new sewerage treatment plant for the subproject for the construction of a sewerage treatment plant in Baotou have been acquired. However, there has been no particular problem with such land acquisition and there is no negative impact.

In light of the above, this project has significantly improved the environmental quality of the cities of Hohhot and Baotou and has a positive impact on the daily life and infrastructures of the local residents. Therefore the impact of this project is large.

3.5 Sustainability (Rating: b)

3.5.1 Structural Aspects of Operation and Maintenance

It is deemed that the business units that are currently operating have certain sustainability in terms of the operation and maintenance system. Many businesses including state enterprises have enhanced the operation system in the last 10 years in the 2000s. This is as a result of the improvement of the organizational structure that has been achieved through 1) downsizing related to the reform of state enterprises (e.g., reduction of the employees of Baotou Iron and Steel to 2/3), 2) consolidation with a Hong Kong company (e.g., Hohhot gas co. – strengthening of the management structure), 3) merger and acquisition by major companies (e.g. Hohhot Chemical Industry and Hefa Rare Earth – instruction and supervision on the management structure by the parent companies) etc.

Moreover, along with changes in the structure, many businesses have also established a comprehensive structure for efficient operation and maintenance covering matters that have not been emphasized before, e.g., a customer service system and a system of security for accountability to outside parties.

3.5.2 Technical Aspects of Operation and Maintenance

For the implementation of this project, all companies provided special technical training to ensure appropriate operation of the new facilities and equipment. After the start of operation,

opportunities like technical training in each company and technology exchange meetings held by the national society of engineers and such other organizations have been positively utilized; therefore, technological sustainability is deemed to be almost assured.

For example, in the case of the Baotou sewerage treatment subproject, some engineers were sent to a wastewater technology school in Baotou for two years and the operation started mainly by the engineers who had completed the course. After that, training is provided to about 40 engineers every year in major cities in the country (such as Shanghai, Tianjin and Suzhou) and the central government has accredited the organization with “Urban Wastewater Control Certificate Class A”. (Only a small number of organizations in the country have Class A certification.)

3.5.3 Financial Aspects of Operation and Maintenance

Before discussing the financial sustainability of this project, we will analyze the going business entities in the following categories.

Table 14 Categories of Going Business Entities

Category of businesses		Name
Highly public enterprises		Heat supply companies, gas companies
Commercial enterprises	Medium-scale	Inner Mongolia Sanlian Chemical Industry, Baotou Hefa Rare Earth
	Large-scale	Baotou Iron and Steel, Baotou Aluminum Co., Ltd, First Thermal Power Co., Ltd.

The highly public enterprises are actually under severe financial condition by their lower profitable business-model on their primary business field, especially heat supply companies. Revenue from heat supply cannot cover the surging material costs and such companies are actually run with financial support from the municipal government. However, the sustainability of these enterprises can be regarded to be high to some extent because such financial support from the municipal government is almost ensured. By contrast, gas companies have been financially healthy in gradual manner with the backing of policies such as the recent decision on mandate use of natural gas for public transportation.

On the other hand, large-scale commercial enterprises have already conducted streamlining of the organization and the financial conditions relating to operation and maintenance have been stable. It is difficult to determine the medium- to long-term stability of medium-scale commercial enterprises because of tough competition of products, carbides and caustic soda as well as large market price movements.

3.5.4 Current Status of Operation and Maintenance

Each company has conducted operation and maintenance of facilities and equipment by appointed engineers according to an annual maintenance plan with almost no problem.

On the other hand, some of the facilities and equipment that have been installed through this project are not in use or not likely to be used in the future, due to recent changes in environmental policies and standards. (Hohhot Gas Co.: there is no need to use the dry desulfurization unit because of the switch to natural gas, Baotou Heat Supply Co.: boilers may not be used in the future because the switch to cogeneration is now considered.)

However, except the above-mentioned facilities, most of the facilities will be continuously utilized and necessary maintenance including replacement of parts of facilities and equipment are likely to be conducted. For example, as a result of the field survey of the ex-post evaluation, it was confirmed that parts for an electrolytic cell (approx. 6 million yen) had been replaced according to the regulation in a manual.

As stated above, high sustainability can be seen in terms of organization, technology and finance of the going businesses. However, there are a total of 11 deceased entities; therefore such deceased companies are considered as a negative factor for the overall evaluation of sustainability.

Therefore, though some problems have been observed in terms of maintenance, sustainability of this project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

With a major purpose of improving air and water quality in the cities of Hohhot and Baotou, Inner Mongolia, this project meets the needs of these cities and has been producing significant environmental effects through complementary relationship with various efforts of the Chinese government. As a result, the environmental quality in these cities has significantly improved. However, there have been some cases where expected effects did not last long, e.g., 11 business units out of 22 that conducted subproject of this project have gone bankrupt, mainly due to reformation of state-owned enterprises that was promoted in parallel with the country's rapid economic growth.

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

4.2 Recommendations

4.2.1 Recommendations for Executing Agencies

The Chinese government has indicated its intention to continue to reorganize or eliminate companies with high environmental load according to the company scale and other criteria. As

this policy might affect some of the companies involved in subprojects, the financial departments of the cities have to constantly monitor such movements. Moreover, executing agencies need to collect appropriate information and conduct monitoring as they need to provide information to JICA as stipulated under the article 6.01 (d) of the General Terms and Conditions in case the business goes bankrupt and sells facilities and equipment installed through this project.

4.2.2 Recommendations to JICA

In order to ensure compliance with the above-mentioned Article 6.01 of the GTC, JICA should keep communication at periodic intervals with the current contacts of the cities, the financial departments.

4.3 Lessons Learned

(1) In case of provision of support for environmental pollution control, the project sustainability will become higher if support is provided to the sectors related to highly sustainable public infrastructures. It is highly possible that, for financial reasons, commercial enterprises with environmental load cannot respond to slight changes in the national environmental policy and such companies are quite likely to be forcibly eliminated under the political system of China.

(2) As the offices that had been promoting project implementation (such as the yen loan office) was closed after the project completion, communication between JICA and executing agencies has become generally more difficult than during the project period. There is rather a high possibility that the structure and status of implementing business units will change in a project like this one, which is in the middle of dramatic changes in environmental policies. Therefore, it is important to maintain the same system and frequency of communication between two parties for a certain period after project completion so that the both parties will collect information and properly deal with it.

(3) When evaluating this project, which consisted of multiple subprojects, we found out that effect/operation indicators for the overall evaluation had not been set properly. Thus we evaluated the whole project with the sum of the scores of individual subprojects, but this method might be easily affected by the score scales. Although there should be some room left for slight changes to meet characteristics of individual projects, it is important to establish a uniform evaluation method.

Comparison of the Original and Actual Scope

Item	Original	Actual
1. Project Outputs	See Table 2 above	See Table 2 above
2. Project Period	Phase I Dec. 1996 – Dec. 2001 (61 months) Phase II Jul. 1997 – Dec. 2001 (54 months)	Jan. 1998 – Dec. 2003 (excluding subprojects for deceased businesses) Oct. 1998 – Jul. 2003 (excluding subprojects for deceased businesses)
3. Project Cost		
Amount paid in Foreign currency	Phase I 10,000 million yen Phase II 5,629 million yen	Phase I 9,917 million yen Phase II 4,987 million yen
Amount paid in Local currency	Phase I 7,680 million yen (Note 1) Phase II 8,761 million yen (Note 2) (Local currency) Phase I 640 million yuan Phase II 645 million yuan	Phase I 20,324 million yen (Note 3) Phase II 2,354 million yen (Local currency) Phase I 1,412 million yuan Phase II 163 million yuan
Total	Phase I 17,680 million yen Phase II 14,390 million yen	Phase I 30,241 million yen (Note 4) Phase II 7,339 million yen (excluding cost in subprojects for deceased businesses, for figures other than foreign currency)
Japanese ODA loan portion	Phase I 10,000 million yen Phase II 5,629 million yen	Phase I 9,917 million yen Phase II 4,987 million yen
Exchange rate	1 yuan = 12.00 yen (1996) 1 yuan = 13.60 yen (1997)	1 yuan = 14.38 yen (1998-2003 average)

Notes 1 and 2: Amount excluding project cost in local currency for two-step loans

Note 3: Amount including project cost in local currency for two-step loans. Two-step loans were planned for more than half of the subprojects, 8 subprojects out of 13. The total cost for Phase I shown in this table is larger than the plan because one of the Phase II subprojects (purification of coke oven gas from ironworks in Baotou – budget 5,948 million yen) was cancelled after the project appraisal and the budget was switched to a Phase I project (treatment of emission gas containing fluorine from an aluminum plant in Baotou) and for other reasons.

Note 4: The cost in local currency increased as described in Note 3; therefore the total amount also increased.