



Environmental Due Diligence Report

Project Number: 40634-013
July 2016

PRC: Inner Mongolia Autonomous Region Environment Improvement Project (Phase II)

Environmental Due Diligence Report

Prepared by IMAR Project Management Office and Energy and Environmental
Development Research Center

Inner Mongolia Autonomous Region, PRC

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Asian Development Bank

Project Number: 2658-PRC

People's Republic of China: Inner Mongolia Environment Improvement Project
(Phase II)

Environmental Due Diligence Report on the new Second Heat Source Plant
Expansion Project in Zhalaite Banner and Update the Heating Network and the
Boiler Room Expansion Project in Hohhot City

Submit to the Asian Development Bank

Submit by: the Project Leading Group Office of the ADB Loan Inner Mongolia
Environment Improvement Project, and Energy and Environmental Development
Research Center

Date: July 2016

ABBREVIATIONS

ADB	-	Asian Development Bank
CQS	-	Consultants Qualification Selection
DMF	-	Design and Monitoring Framework
DRC	-	Development and Reform Commission
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
GDP	-	Gross National Product
IMPMO	-	Project Management Office of the ADB Loan Inner Mongolia Autonomous Region
GIMAR	-	Inner Mongolia Autonomous Region Government
IA	-	Implementing Agency
ICB	-	International Competitive Bidding
LA	-	Loan Agreement
LAR	-	Land Acquisition and Resettlement
LIBOR	-	London Interbank Offered Rate
NCB	-	National Competitive Bidding
PA	-	Project Agreement
PIAs	-	Project Implement Agency
PPMS	-	Project Performance Monitoring System
PRC	-	People's Republic of China
QCBS		Quality Cost Based Selection
IMFB		Inner Mongolia Autonomous Region Finance Bureau
TOR		Term of Reference

NOTE

- (i) In this report, "\$" refers to US dollars.
- (ii) This due diligence report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "terms of use" section of this website.
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1. INTRODUCTION

1.1 Background

1. The Inner Mongolia autonomous region is one of most pollutants discharge area in our country, also it relies heavily on coal resources, so the current situation of coal resources makes urban areas of Inner Mongolia autonomous region has suffered huge environmental cost. Due to economy strong growth, higher income, and the rapid development of the private residence in recent years, the rapid growing demands for central heating. The present central heating system in Inner Mongolia autonomous region has a larger part of small boiler heating, small capacity, low efficiency, due to the longer service life of thermal insulation pipe, the heat loss is serious in the process of heating. Inner Mongolia Environment Improvement Project (Phase II) (hereinafter referred to as "Loan Project") aims to upgrade the central heating infrastructure, improve energy efficiency, and provide heating for the new building, and will provide assistance in terms of new efficient boilers and transmission and distribution pipeline.

2. The Asian Development Bank (ADB) approved the project \$150 million loan in August 2010, including two parts of the central heating and gas. The aim of loan project is to improve the energy efficiency and environment in the Inner Mongolia autonomous region, main effect is to improve the air quality both in autonomous region and urban construction project district.

3. The project loan agreement signed on September 20, 2010, the effective date is on February 21, 2011. The project was handed over to the ADB Resident Mission in the PRC on October 31, 2013, the former loan closing date is on December 31, 2014, due to the project adjustment and extension, now closing date is adjusted for December 31, 2016.

4. The original project include Hohhot, Baotou, Chifeng Downtown, Kelaqin Banner, Xingan League Zhalaite and Keyouqian central heating projects and Xingan League Keyouqian gas project. In July 2013, project adjustment scheme was approved by the ADB, the original 2 heating projects in Kelaqin Banner and Keyouqian Banner and a gas project in Keyouqian Banner withdrew from the ADB loan project, added three central heating subprojects correspondingly in Xingan League Aershan City, Tuquan County and Wengniute Banner.

5. In July 2016, the project cancelled the Wengniute Component and was replaced by two new subprojects: (i) Second Heat Source Plant Expansion Project in Xingan League Zhalaite; and (ii) Heating Network and the Boiler Room Expansion Project in Hohhot City.

1.2 Goals and Objectives

6. Based on the MOU evaluated by ADB mission, after the evaluation of the Inner Mongolia proposed changes from July 4 to 8 in 2016, in accordance with requirements of ADB Safeguards Policy Statement (2009), there is a need to conduct the environment due diligence on environmental monitoring and management for the proposed changes projects: new Zhalaite expansion project and update the heating network and the boiler room expansion project in Hohhot city, and fulfill the relevant procedures.

7. This environment due diligence was prepared by the Project Leading Group Office of the ADB Loan Inner Mongolia Environment Improvement Project, and Environmental Specialist of Energy and Environmental Development Research Center, in accordance with the ADB Safeguards Policy Statement (2009). This due diligence report was prepared based on: i) *Xingan League Zhalaite Second Heat resource Plant Expansion Project Environmental Impact Assessment Report* which was prepared by Inner Mongolia Basiba Environmental Technology Consulting co., LTD.; ii) *Xingan League Zhalaite Second Heat resource Plant Expansion Project Feasibility Study Report* which was prepared by the NCME; iii) Beijing Gas and Heating Engineering Design Institute prepared "*Hohhot City Coal-fired Boilers From Coal to Gas Feasibility Study Report*" (2013, 2014); iv) Hohhot City Institute of Environmental Science & Research Ltd prepared "*Environmental Impact Report of Hohhot Futai District Heating Corp. Tuanjiehu District Heating Boiler Room Dust Desulfurization Construction Project*"; v) Zhejiang Jingwei Engineering Project Management Co., Ltd. Prepared "*Feasibility Study Report of Hohhot Futai District Heating Corp. Tuanjiehu District Heating Boiler Room Dust Desulfurization Construction Project*" and vi) the site inspection.

8. This report contains (i) the findings from environment due diligence, (ii) the updated EMP; and (iii) summary and conclusions of the environment due diligence.

2. NEWLY BUILT SECOND HEAT SOURCE PLANT EXPANSION PROJECT IN ZHALAITE BANNER

9. In 2008, Zhalaite People's Government applied for the ADB Loan of Inner Mongolia Environment Improvement Project (Phase II), formed the Xingan League Zhalaite Inder Town Central Heating Project (hereinafter referred to as: First Heat), the project owner is Heilongjiang Province Xingda Group Zhalaite Xingda Heating Power Company; The project uses a loan of \$11 million, the construction content is: to build a new boiler room and four heat exchange stations and relevant pipeline. So far, all the construction have been completed and put into operation.

10. By the end of 2015, the project owners proposed to add Second Heat Source Plant Expansion Project in Xingan League Zhalaite Banner (hereinafter, called "Second Heat"). The project will improve the heating capacity through new sources of heat and relevant heating stations and pipelines. Currently the main plant and $1 \times 58 + 1 \times 29$ MW chain grate hot water boiler were built by the domestic funds, but this section is not put into operation, yet. The project owners proposed to use the balance of 7.5 million due to the quit of Wengniute Subject of Inner Mongolia Autonomous Region Environment Improvement Project (Phase II) to complete the remaining part of the construction. The project due diligence report for this part of change has been completed and submitted to ADB for approval.

11. Zhalaite is located in the Xingan League Northeast of Inner Mongolia autonomous region, south of the GreatXing'anMountain, right bank of the Nenjiang River, belongs to the transitionalbeltfromthe GreatXing'an Mountain to Songnen Plain. The second heat construction scope is the southwest side of Zhalaite (Inder Town), west of the Zhalaite Inder Town city center, mainly planning to the heating for use of all kinds of buildings within loop, south of sea road, west of Inder road, east of Zhenxing road. Specific construction contents are as follows:

- (i) Heat source plant: build a new $3 \times 58 + 1 \times 29$ MW chain discharge hot water boiler room.
- (ii) Pipe network: build new Class I hot water pipe network of 14.6km (tube length).
- (iii) Thermal sub-station: build new 22 thermal sub-stations (32 units).

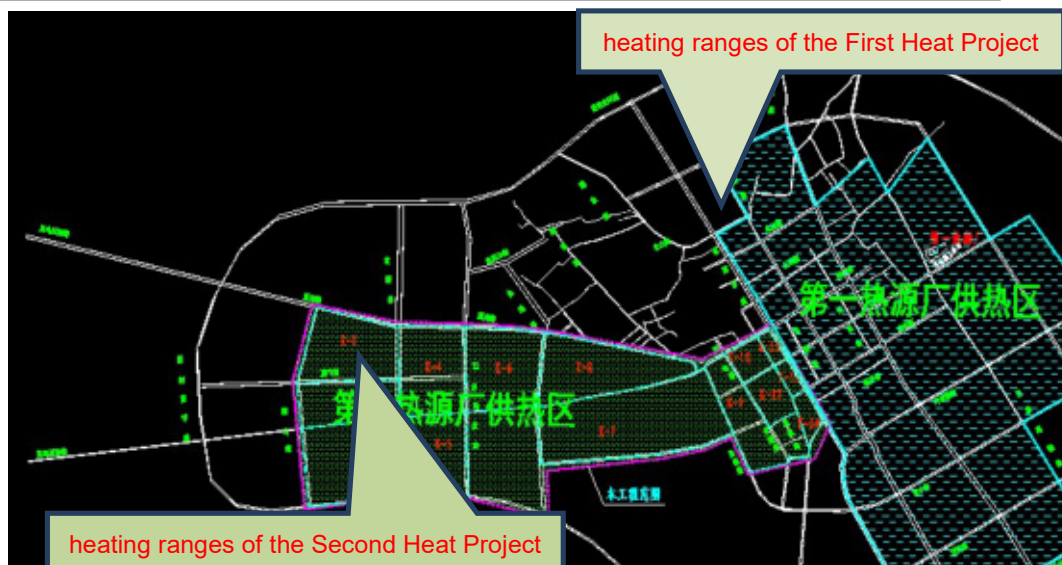
12. For fuel selection, the three kinds of selectable fuel are: natural gas, fuel oil, coal. Because the price of natural gas and fuel oil is about 4 times higher than coal in the same heat value, the cost of heat supply through fuel oil and natural gas is about 3 times of coal even after considering equipment, construction and other general expenses. Residents cannot afford such a high heating fee, so the choice of fuel is coal. Zhalaite Banner is a county-level city, the current government does not plan to phase out coal-fired boilers, the completion of the Second Heat will phase out many small boilers and decentralized heating facilities and will greatly reduce local greenhouse gas emissions.

13. Boiler room coal supply is from coal to Heilongjiang Tailaiby rail, then transported to boiler room by cars, coal sources from the Heilongjiang Dragon Coal Group.

14. Project total investment is CNY 292.2361 million. The realized central heating area is 3.415 million m^2 , of which the new central heating area is 2.715 million m^2 , existing heating area is 0.7 million m^2 , the project adopts the high efficiency, environmental protection area of central heating boiler room to heat; after the project implementation, the existing small boilers located in different locations in Zhalaite Banner will be replaced, including: Xishan boiler room and the traffic police group boiler room, and a few scattered small boiler rooms, and social benefit, economic benefit and environmental benefit are remarkable. The demolition of these boiler rooms is not within the scope of the project.

15. The project owner is Heilongjiang Province Xingda Group Zhalaite Xingda Heating Power Company.

16. The locations and heating ranges of the First Heat Project and Second Heat Project are showing below:



2.1 Introduction of First Heat

17. The project construction scope is the city center of Zhalaite Inder Town, south of Wulan Street, and within the east of Minzu Road. In 2015, 1.5 million m² of new public buildings and civil buildings for heating, and transformed the original central heating area of 0.5 million m². Specific construction contents are as follows:

- (i) Heat source plant: build a new 4×29MW of chain discharge hot water boiler room.
- (ii) Pipe network and Thermal sub-station: build new Class I hot water pipe network of 9.252km (tube length).
- (iii) Build new 20 thermal sub-stations (27 units).

18. Project total investment is CNY 139.5057 million. The realized central heating area is 1.5 million m², rebuilt central heating area is 0.5 million m², the project adopts the high efficiency, environmental protection area of central heating boiler room to heat; after the project implementation, social benefit, economic benefit and environmental benefit are remarkable.

19. Up to now, 1 boiler room and 4 heat transfer stations and their pipelines have been built and put into operation. On March 19, 2016, carried out monitoring on plant boundary air and noise of First Heat Project, monitoring results were satisfactory. Carried out monitoring on the emissions and concentrations of soot, sulfur dioxide, nitrogen oxide of the flue, in addition to monitoring results of dust concentration exceeding 3 mg / m³, the others are all qualified.



Appearance of Heat Source Plant

Desulfurizing Tower



Modification of Bag - type Dust Remover

Warning Sign



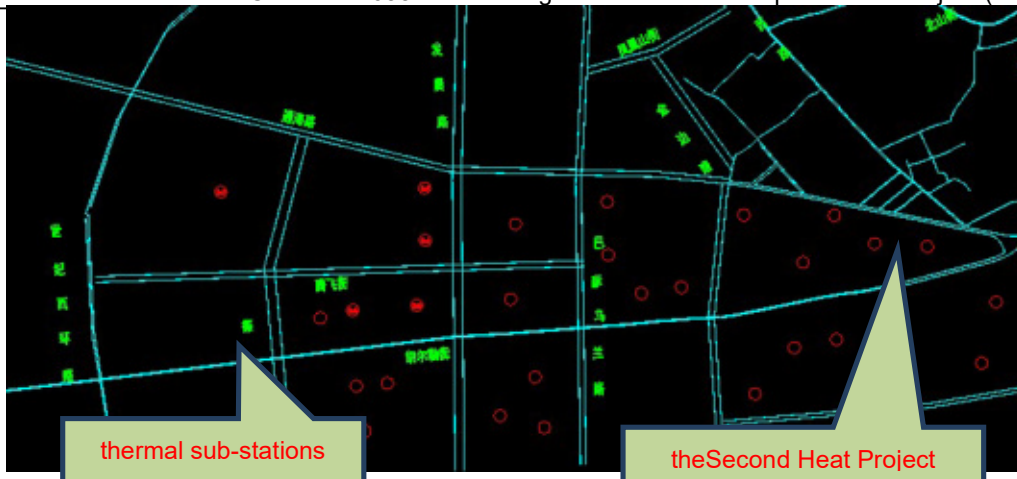
Coal Yard of Heat Source Plant

Landscape Construction

2.2 Introduction of Second Heat

20. Construction contents of second heat are as follows:

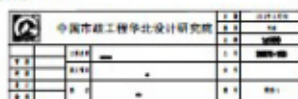
- (i) Heat source plant: build a new 3 x 58 + 1 x 29 MW of chain discharge hot water boiler room.
- (ii) Pipe network: build new Class I hot water pipe network of 14.6km (tube length). The segment of pipe is on an open space and is not near residential areas and roads.
- (iii) Thermal sub-station: build new 22 thermal sub-stations (32 units). The red circles in the figure below are representative of the locations of thermal sub-stations. One station in 100-250 thousand square meters, locations of thermal sub-stations may be adjusted appropriately according to the actual project situation.



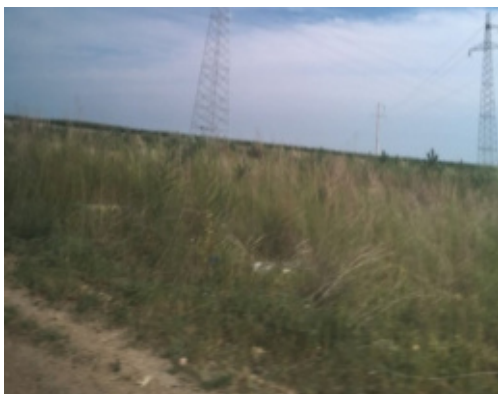
21. This project site is located in the southwest side of the city, is a parallelogram, west–east length of 363m, north – south length of 249m, covers an area of 79000 m², the entire plant district is for gentle slope belt, terrain height difference of 10 meters, geological condition is good, the transportation is convenient, the natural ground elevation is 235-245m within the plant area. The advantages of the site are: the site is near the city thermal load center; the shortest distance from the electrical outlet; convenient transportation, good conditions for fuel and ash transport; convenient land acquisition requirement. It has no need of demolition and no effect on the masses. Plant land is state-owned and land acquisition procedures have been handled. Plant location is ideal, no sensitive points surrounding, no sensitive issues such as pressured overlying deposits, heritage, affecting flood control and drainage, affecting navigation, affecting military installations and security, no cause-related adverse effects.

22. The general layout arrangement scale of Heat source plant is 3 x 58 + 1 x 29 MW of boiler room, for the present, it has been built the boiler room body and 1 x 58 + 1 x 29 MW of boiler through using the domestic funds, plans to use the ADB funds to continue construction 2 x 58 MW boiler, the master plan is not only considered the need of processing of coal, slag, furnace and auxiliary equipment, but also equipped with the production of comprehensive building, bathroom, dining room, garage and other ancillary buildings. Added mechanics, material ancillary buildings, etc., and increased the coal yard.

23. Boiler room induced dust remover, draft fan, desulfurization device and chimneys in sequence from the east to the west. Coaling, coal slag system with coal shed gallery, coal crusher house, slag storage, transfer station, and corridor, etc. The general layout makes full use of the terrain; layout is compact, save covers. Below is the plant layout, figure around the plant.



Plant Layout



New Heat Source Plant East Side
(No Sensitive Site)



New Heat Source Plant South Side
(No Sensitive Site)



New Heat Source Plant West Side
(No Sensitive Site)



New Heat Source Plant North Side
(No Sensitive Site)



Plant Appearance of Second Heat Constructed



Part1x58MW Boiler of Second Heat Constructed



Plan to Build the 1x58MW Boiler

Plan to Build the Location of Desulfurizing Tower

24. After the completion of second heat, the existing main heating boiler room will be replaced within the heating area: Xishan boiler room and the traffic police office boiler room, and using capacity in 0.5 ~ 4 t/h boiler of 27 units with a total of 27 independent small heating boilers. But the demolition of these boiler rooms is not within the scope of the project. All boiler statistics please see the table below.

Table 1. Inder Town Status of Small Boiler Survey Statistics

	Units	BoilerType	BoilerCapacity (T)	Heating Area (m ²)	BoilerMan (No.)
1	NO.6 MiddleSchool	DEW1.4-1.7-95/70	2	3855	4
2	NO.2 MiddleSchool	DEW1.4-0.7-95/70	2	4200	3
3	BP	QXE1.4-0.7-95/70	2	5600	5
4	GrainBureau	DEL2.8-0.7-95/70	4	14000	5
5	Meng Hospital	DEL1.4-0.7-95/70	2	6200	4
6	Transport Company	DEW1.4-0.7-95/70	2	5100	4
7	Shenshan Group DevelopmentBuilding	DEL2.8-0.7-95/70	4	16000	4
8	Yi Grain Depot	WWW60-0.7-95/70	1	2400	3
9	Peoples Hospital	DEW2.8-0.7-95/70	4	15000	6
10	Hotel	DEL1.4-0.7-95/70	2	10000	4
11	Si Mao	DEW0.7-0.7-95/70	1	6000	3
12	NO.3 MiddleSchool	DEW1.4-0.7-95/70	2	10000	4
13	WaterConservancy	DEW1.4-0.7-95/70	2	8500	4
14	Er Mao	DEW1.4-0.7-95/70	2	11000	4
15	Er Grain Depot	WWW60-0.7-95/70	1	2600	3
16	Si Grain Depot	DEW2.8-0.7-95/70	4	12000	4
17	Party School	DEW1.4-0.7-95/70	2	3000	4
18	NO.5 MiddleSchool	DEW0.7-0.7-95/70	1	2600	4
19	NO.1 MiddleSchool	DEW1.4-0.7-95/70	2	9000	4
20	Land Bureau	DEL28-0.7-95/70	4	18000	6
21	Inder Town	DEW1.4-0.7-95/70	2	7000	4
22	BureauofCommerce	WWG0.7-0.7-95/70	1	2600	3

	Units	BoilerType	BoilerCapacity (T)	Heating Area (m ²)	BoilerMan (No.)
23	Petroleum Hotel	WNN0.7-0.7-95/70	0.5	1200	2
24	Prison	DEW0.7-0.7-95/70	1	3500	4
25	Distilling&CattleFeeding	K/QXG0.35-0.7-95/70	0.5	3000	3
26	PlantOilFactory	DEL2.8-0.7-95/70	4	14000	5
27	Winery	WWG0.35-0.7-95/70	0.5	2000	3

2.3 Approval Status

25. Zhalaite Xingda Heating Power co., LTD recommended Zhalaite Development and Reform Commission (NDRC) and the autonomous region development and reform commission to use the surplus funds as application (see **Appendix 1**) in 2015, Inner Mongolia autonomous region development and reform commission approved the Zhalaite heat source plant to use the available surplus funds of the ADB project as application in December 2015,.

26. The project owner, Zhalaite Xingda Power Company, commissioned the Inner Mongolia Basiba Environmental Technology Consulting co., LTD in 2013 to conduct the environmental impact assessment on "Zhalaite Second Heat Source Plant Expansion Project", and compiled the project environmental impact report. In June 2014, "Environmental Impact Assessment Report of the Second Heat Source Plant Zhalaite Expansion Project" was approved by the Xingan League Environmental Protection Bureau. (Please see **Appendix 2**).

27. The main plant, 1 set of 29MW and two sets of 58MW chain grate hot water boilers are already built by domestic funds currently. The remaining two new 58MW chain grate hot water boilers and their pipe network and heating stations are waiting for the approval of using ADB funds urgently.

2.4 Environmental Impact and Mitigation Measures of 2nd heat source plant Project

28. The transition zone between Da Hinggan Mountains and Songnen Plain are mostly seated with low mountains or hills. The terrain is northwest high and southeast low. The northwest region is 1000m above the sea level, while it slopes downward to the southeast about 200m lower. The complex terrain features undulating plain in southeast, hills in middle zone and low relief terrain in northwest, forming highlands in its majority with limited water resources and farmlands. There are over 190 mountains 500m above the sea level, among which 14 are 1000m above the sea level, with Xiesitaigangen in State farm 1126.2m. Zhalaite Banner is situated to the northwest of Xingan League of Inner Mongolia Autonomous Region, south of Da Hinggan Mountains, right bank of Nenjiang River and on the undulating plain between Da Hinggan Mountains and Songnen Plain. It enjoys warm temperate continental monsoon climate, with four distinct seasons. The average temperature of a year is 4.0°C, with January -17.4 °C, extreme minimum temperature -37 °C, July 22.7°C and extreme maximum temperature 41°C (July 22, 1968). The rainfall averages 403.9 mm a year, with extreme precipitation 752.9mm (1988).

29. Objectives of Environmental Protection. The project location is surrounded by farmland, grassland and wasteland. The sensitive point for air quality and noise is Inder Town in northeast.

Table 2. Sensitive Site

Impact element	Sensitive Point	Direction
Air and Noise	Inder Town	EN, 800M

30. The environmental impact of 2nd heat source plant mainly exists in construction and operation period.

A. Environmental impact analysis during construction and relevant mitigation measures.

31. **Air pollution analysis during construction and mitigation measures.** The air pollution is mainly caused by dust and gas emission by machines (diesel engine) and vehicles when flattening the field, excavating ditches and transporting materials. According to approved EIA report in China, the impact would be minimized to the least when adopting the following mitigation measures:

- (i) Contractors set up enclosure around the construction field, the enclosure should be no lower than 1.8m.
- (ii) When excavating ditches, spraying water on the field and piles to keep moisty can prevent dust. Construction waste should be taken away in time to prevent dust and being washed by rain.
- (iii) Transport vehicle should be kept in good condition and should not be overloaded. Transport

- material should be covered and airtight. Dirt or construction materials spilt on the ground should be cleaned up timely to reduce dust.
- (iv) Powder material in construction site of heat source plant and thermal substation should better be placed together. Cement should better be put in nearby storeroom, reduce manual lift, if necessary, avoid the package being torn.
 - (v) In the case of 4 level or stronger wind, contractor should stop earthwork construction, cover the field and material, to minimize dust to the least and increase times of water spraying in windy days.
 - (vi) Closed construction. Contractors should place earthwork in fixed places and spray water on or cover earth and material piles. Transport trucks should be covered by dust cap.
 - (vii) Harden the construction ground. Wheel mud flushing device should be fixed on the exit of construction site, to make sure vehicles won't carry dirt to urban areas. Transport vehicles should avoid environmental sensitive points, namely crowd gathering areas such as residential areas, hospitals, schools and etc. Muck throwing is prohibited when loading or unloading.



Enclosure in the construction site

32. Water environment impact analysis during construction and mitigation measures. Water environment impact in this project mainly include machine washing wastewater, sanitary waste, pipeline cleaning and pressure test wastewater. Machine washing wastewater is a small volume, with major pollutants cement particles and suspended sand matter. The water can be recycled after sedimentation. Sanitary waste can be used to spray the field or plants after simple sedimentation. Pipeline cleaning and pressure test wastewater, with the major pollutants rust and silt, are discharged to temporary sedimentation basin and can be used in next section after sedimentation. The excess sewage is used to water plants on road sides and dust control. The remains would be discharged to Municipal Sewage Network. Pipeline construction sites are mostly located in urban areas, with well-established rain and sewage network. Therefore, wastewater in construction can be discharged to nearby rain and sewage network, causing little influence to local surface water environment.

33. Acoustic environment impact analysis in construction period and mitigation measures. Construction noise alters with the construction contents and machines. Noise source changes with the construction site. The nearest residential sensitive point around heat source plant is 900m away (Xincheng Villiage), so construction work will cause no noise influence. Thermal substation construction would cause certain impact to sensitive points around. In piping construction, excavator was used in a relative longer time, while other machines are used intermittently in shorter time. So the noise is mainly from excavator. According to approved EIA in China, the following mitigation measures can reduce environmental impact to the utmost:

- (i) Select the construction machine and transport vehicle that in line with the national standard. Try to select the low noise machine and skills and set up damping base to violent vibrating machines. Improve the maintenance of all construction facilities and reduce the noise source fundamentally.
- (ii) Stop or reduce construction transport vehicles passing in traffic peak time to reduce noise; set up a temporary detour and warning signs; appoint people to direct traffic.
- (iii) Make reasonable schedule for construction. Especially thermal substation and networks in schools, hospitals and densely populated district are prohibited to carry on construction at night (22:00-06:00) and working time of schools, kindergartens and offices.

- (iv) Make reasonable layout of construction site. Working equipment should be far away from the building; avoid power machinery and equipment being arranged in the same place, to prevent extreme high sound level.
- (v) Make reasonable arrangements for transport routes, try to minimize nighttime traffic; appropriately limit the speed of large trucks, especially when driving in the urban road, high speed and alarms are prohibited; ensure regular maintenance of transport vehicles.
- (vi) Besides the above mitigation measures, contractors should establish good relationship with nearby units and residents. Units and residents vulnerable to noises should be notified before operation is carried out. The contractor should report their construction progress and measures to reduce the noise to achieve the public understanding. In addition, hotline should be set up during the construction period to accept public complaints and positive response should be taken accordingly.

34. Solid waste environmental impact analysis and mitigation measures. There are four kinds of solid waste during construction: i. earth and stone from pipeline excavation and backfill; ii. Household garbage of workers; iii. Waste asphalt from pavement excavation; iv. Construction waste such as cement block and building material during construction of thermal stations and heat source plants. According to the EIA report approved in China, the following mitigation measures could minimize the environmental effect of solid waste during construction.

- (i) Waste soil mainly means surplus earth after backfill. The waste soil can be used to the backfill work of thermal station and heat source plants.
- (ii) Household garbage should be collected and transported to Inder garbage disposal station.
- (iii) Waste asphalt will be processed by Urban development department of Inder town and used to rural road construction.
- (iv) Construction waste in thermal station and heat source plants will be transported to specialized construction waste disposal sites.
- (v) Proper storage of solid waste is necessary. Moisture proofing and erosion control measures should be taken to avoid effect to soil and underground water.
- (vi) Cleaning and restoration should be carried out immediately after construction.

35. Ecological impact analysis during construction and mitigation measures. Pipeline excavation and surface construction may result in vegetation damage in surrounding areas. Pipeline laying are mainly carried out in urban areas in direct burial laying method with a relatively small amount of earthwork in a short period of time. Pipeline laying are designed according to local terrain, location of heating boiler and on the basis of urban construction plan, avoiding passing through the main road and demolition of buildings. Vegetation is rarely influenced by pipeline laying. Temporary piling earthwork under construction or waste earth may cause soil erosion if not taking proper measures in rainy seasons. The project has little influence to the terrain of construction site. When necessary measures preventing soil erosion are taken, the project may cause hardly any influence to the conservation of soil and water in construction site.

36. Social environmental impact analysis and mitigation measures. Ground and underground pipelines of public works such as drain line and communication power line will be inevitably affected during construction. But their regular service won't be cut off. Trees and grassland on the roadside would be affected during pipeline laying. Certain measures should be taken to protect it and restore it once damaged. Road traffic capacity and residents living on both sides of the road would be inevitably influenced during construction. Section work and enclosed operation should be combined to reduce safety risks during construction. With relatively short operation time, no obvious adverse impact would be caused to road traffic. A large number of machines and transport vehicles applied in construction would increase traffic pressure to adjoining roads. So, contractors should avoid operation in rushing hours.

37. During current construction progress, the mitigation measures have been well implemented, and no serious environment pollution occur.

B. Environmental impact analysis in operation period and relevant mitigation measures.

38. Air environmental impact analysis in operation period and mitigation measures. Major elements causing air pollution includes, boiler flue gas, coal yard dust, coal system dust, limestone powder base dust, transport dust, furnace dust and slag storage dust. Boiler flue gas mainly consists of soot, SO₂, and NO_x. The project applies bag-type dust remover to get rid of 95% dust. Alkaline process will be adopted for desulfurization, with the efficiency (η) 80%. In normal situation, air pollutants have little

effect on surrounding environment. But when accidents happen, pollutants of boiler flue gas concentration exceed the standard ratio of 49.16 times at most, causing severe influence to air environment of assessment area. So strict management is needed by enterprises to ensure normal operation and avoid accidental discharge, esp. the breakdown of flue gas scrubber. Wind and dust suppression nets, watering facilities and green belt should be applied around coal yard to minimize dust and its influence to the environment. Coal crushing and transport should be carried out inclosed corridor. Enterprises set up watering facilities and dust-removal devices in blanking site and broken building; so that the environmental influence would be little. The limestone should be bagged and stored in storage. Limestone pneumatic conveying system storage should be tightly capped to reduce air pollution to surrounding areas. The roads condition in this project is poor, with large amount of dust, causing severe damage to the roadside plants. After adopting the measures of hardening the road, regular watering and covering transport materials, the project has rare influence to surrounding environment. Precipitator dusts will be pneumatically conveyed to ash house and transported to building material factory after being moistened. Cooling down slag would be transported away after temporary storage. Ashes storage facilities are closed structures, so little dust would be caused in storage and transport.

39. During the operation, major boiler house would be replaced, including Xishan boiler house, traffic police brigade and 31 small independent boiler house with capacity 0.5-4 t/h, to reduce soot, SO₂ and NO_x emissions.

40. Water environmental impact analysis in operation period and mitigation measures.

Wastewater in operation mainly includes household wastewater from heating source plants and wastewater from heat transfer in thermal station. The source of wastewater in heat source plants consist of water softening device, pump cooling water and boiler house. All wastewater would be recycled after collection and cooling down. Household wastewater would be discharged after being processed by septic tank. Wastewater from thermal station is clean and discharged to nearby municipal sewage network.

41. Noise analysis in operation and mitigation measures. Main noise source of heat source plants in operation include blowing machine in boiling house, induced draft fan, pump and relief valve in process pipe line when releasing. Blowing machine and induced draft fan are equipped with low noise fan and installed in closed ventilator room, with air inlet muffler on the wall. Pressure release equipment can control its noise under 110DB(A) by muffler or any other noise snubber. Closed sound insulation door and window are installed in fan house and pump house. The main noise source of thermal station is caused by changing heat-exchanger pump. Regarding the new thermal station, semi-underground setting, independent pump house, double glass seal door and window and low-noise pump are adopted. With the above measures, noise pollution would be minimized.

42. Vibration influence analysis in operation and mitigation measures. When circulating water pump, blowing machine and induced draft fan in heat source plants working on load or without load, 50m long pipeline off heat source plants and thermal station would slightly vibrate, with powerful vibration energy and frequency range basically unchanged. The effect can be maximized at the frequency of 125Hz. There are no residents 500m away from the heat source plants so little effect would be created. But residents living near thermal station would be more or less affected.

43. Solid waste in operation analysis and mitigation measures. Solid waste mainly includes household garbage, slag from boiler house and precipitator dusts. Household garbage should be collected and disposed regularly to local garbage disposal station. Slag and precipitator dust would be sold out for brick making. Regarding the type, storage and disposal method, solid waste in heat source plants could be properly stored and disposed. Anti-penetration method should be applied in solid waste storage to prevent pollution to soil and underground water. When disposed in proper way, solid waste would cause little effect to environment.

44. The construction of second heat source plant has been substantially completed. It is suggested that the construction of desulfurring tower and sedimentation basin should be accelerated to ensure a simultaneous operation period.

2.5 External Environmental Monitoring

45. Currently, the second heat source plant has been under construction with domestic funds. But this section is not put into operation, yet. The project owner entrusted Horqin Right Wing Front Banner

environmental monitoring station to monitor the noise and air in March, 2016. Result shows all the indicators meet the standard, detailed data are as follows:

Table 3. Noise monitoring data

Location	Date	Result[dB (A)]		Standard limit
		Daytime	Nighttime	
East of the plant	Mar.19 2016	47.3	44.5	Daytime 60dB; Nighttime 50dB
South of the plant	Mar. 19 2016	37.6	32.3	
West of the plant	Mar. 19 2016	51.7	47.8	
North of the plant	Mar. 19 2016	39.6	35.5	

Table 4. Air monitoring data

Location	Date	TSP(mg/m ³)	PM10 (mg/m ³)	Standard limit (mg/m ³)
Down wind	Mar. 19, 2016	0.117	0.098	TSP:0.3mg/m; PM10:0.15mg/m

2.6 Estimated investment of environmental mitigation measures

46. The proposed investment of environmental mitigation measures for the second heat source plant is shown in following table.

Table 5. The proposed investment of environmental mitigation measures for the second heat source plant

(Unit: 10000 yuan)

Project			Mitigation measure	Environmental protection investment	Annual cost
During construction	Wastewater		Watering the road to remove dust	0.5	—
	Air pollutant	Construction dust	5.0	—	—
		Vehicle emission	—	—	—
	Noise		Select low noise facilities	—	—
	Solid waste		Collect, timely clean up or transport to specific place	0.5	—
	Supervision		Environmental supervising	62.5	—
	Total		/	68.5	—
During operation	Air pollutant	Boiler house dust	250	100	1000
			100	180	1800
		Coal yard dust	120	—	—
		Transport dust	10	—	—
	Solid waste		Closed storage	12	—
	Noise		Blowing machine in heat source plant to reduce noise	15	—
			Induced draft fan in heat source plant to reduce noise	15	—
			Water pump in heat source plant to reduce noise	10	—
			Water pump in thermal station to reduce noise	20	—
	Greening		Green area 5662.8m2	35	—
	Monitoring		Flue gas on-line automatic monitoring instrument; daily inspection hole and monitoring platform in boiler flue	75	30
	Total		/	662	310
Grand total			730.5	/	
Percentage to total investment			2.5%	/	

Source: The second heat source plant in Zhalaite Banner, Xinggan League construction and expansion project Environmental Impact Assessment Report

2.7 Public participation

47. In June 2016, Environmental specialist from EED visited nearby villages and enterprises around the

48. The questionnaire briefly introduces the location of the contractor, construction content and plan. Choosing the questions closely related to public relationship, the questionnaire both represents the basic attitude to construction project but shows some suggestions and requirements. Following is the content of public participation questionnaire.

Table 6. Public participation investigation on the second heat source plant project

Name	Gender	Age	Education	Contact number	Home add.	Distance to the project/km
Project Overview	Extension project of the second heat source plant in Zhalaite Banner, Xingan League is situated in the southwest of the city. The construction site forms a parallelogram, 363 from east to west and 249m from south to north, occupying an area of 79000 m ² . The project is located in a gentle slope zone, with 10m elevation. The project location boasts of good geological condition and convenient transportation. The natural ground is 235-245m high on average. The project is an extension project.					
			Air	Surface water	Underground water	Noise
	1. How do you evaluate the environment of the area?		Excellent			
			Normal			
			Bad			
2. Have you ever known the project before?		Yes				
		No				
3. How do you evaluate the effect of the project to regional economic development?		Promote economy; Provide employment---Positive effect				
		Polluting environment, Affect life ---Negative effect				
		Negative effect, but bearable				
		No effect				
4. The project will bring about environmental impact. Which one do you think is the major influence?		Waste gas		5. How are you and local residents influenced by the project?		Unbearable severe influence
		Wastewater				Bearable slight influence
		Noise				Good influence
		Solid waste				No influence
6. Which question do you concern most after the construction?		Influence during construction		7. What is the element that influence the most to the interest of you and local residents?		Waste gas
		Landscape, public service facility				Waste water
		Living environment				Noise
		Beautify the environment and promote the image of the city				Solid waste
8. The project would minimize the environmental influence by adopting effective environmental protection measures, establish and improve relevant systems. If those measures taken, would you accept the environmental influence?				Yes		
				No		
9. From the perspective of economic development and environmental protection, what is your attitude to the project? Do you approve of the construction?				Approval		
				Objection		
10. What is your attitude or suggestion to the project? (You can write on the back of the paper)						

49. 50 questionnaires were distributed and 50 effective ones were collected, the response rate is 100%. Result shows the project was basically approved by investigation participants. Local residents have long expectations to the project. The result is as follows:

Table 7. Statistics on investigation result

No.	Major content		Result	Participants	Percentage to overall participants (%)
1	How do you evaluate the environment of the area?	Air	excellent	43	86
			Normal	7	14
			Bad	0	0
		Surface water	excellent	43	86

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No.	Major content		Result	Participant numbers	Percentage to overall participants (%)
		Underground water	Normal	7	14
			Bad	0	0
			excellent	32	64
			Normal	17	34
	Noise	Bad	1	2	
		excellent	34	68	
		Normal	14	28	
		Bad	2	4	
2	Have you ever known the project before?	Yes	35	70	
		No	15	30	
3	How do you evaluate the effect of the project to regional economic development?	Promote economy; Provide employment---Positive effect	35	70	
		Polluting environment, Affect life ---Negative effect	0	0	
		Negative effect, but bearable	11	22	
		No effect	4	8	
4	The project will bring about environmental impact. Which one do you think is the major influence?	Waste gas	9	18	
		Wastewater	28	56	
		Noise	8	16	
		Solid waste	10	20	
5	5.How are you and local residents influenced by the project?	Unbearable severe influence	7	14	
		Bearable slightinfluence	26	52	
		Good influence	13	26	
		No influence	4	8	
6	6.which question do you concern most after the construction?	Influence during construction	3	6	
		Landscape, public service facility	14	28	
		Living environment	28	56	
		Beautify the environment and promote the image of the city	5	10	
7	7、What is the element that influence the most to the interest of you and local residents?	Waste gas	15	30	
		Waste water	26	52	
		Noise	7	14	
		Solid waste	2	4	
8	8. The project would minimize the environmental influence by adopting effective environmental protection measures, establish and improve relevant systems. If those measures taken, would you accept the environmental influence?	Yes	50	100	
		No	0	0	
9	9. From the perspective of economic development and environmental protection, what is your attitude to the project? Do you approve of the construction?	Approval	50	100	
		Objection	0	0	
10	Other opinions or suggestions?		None		

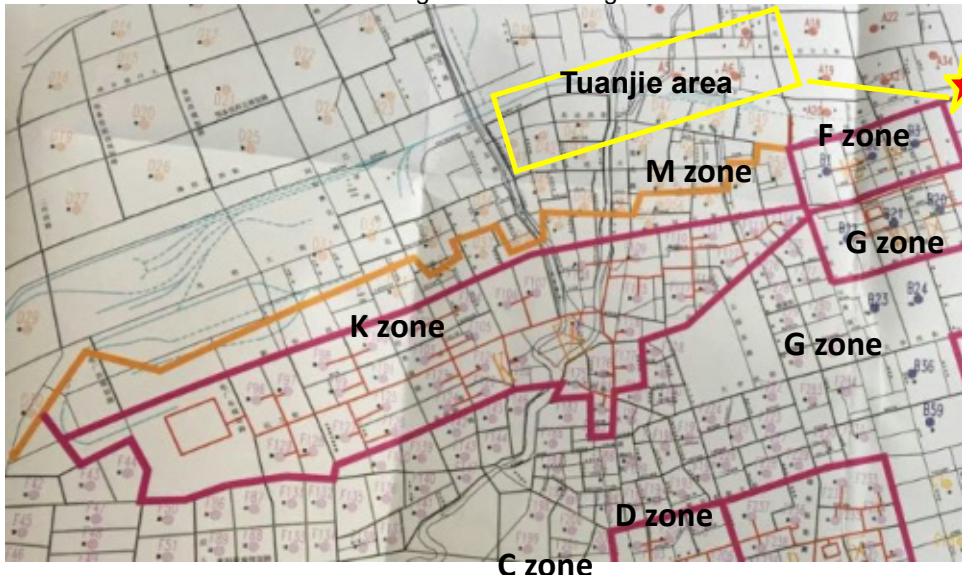
3. UPDATE HOHHOT BOILER AND HEATING NETWORK EXPANSION PROJECT

50.ADB loan to Inner Mongolia Environment Improvement Project (Phase II) and Heating Network and the Boiler Room Expansion Project in Hohhot City were approved in 2009, the unit owners is Hohhot Futai District Heating Company, heating users are mainly the region's announcement of building and civil construction heating. The main construction contents are:

- (i) New 4 chain hot water discharge boiler rooms (3 × 58MW1 seat, 3 × 29MW2 seat, 4 × 29MW1 seats) and ancillary works. This part of boiler was planned to adopt coal-fired boiler in 2009 but will be replaced by gas-fired boilers according to the planning and requirements of Hohhot City Government;

- (ii) New Class I hot water pipe network of 41.13km (tube length), renovation of 303 km.
- (iii) New 94 thermal sub-stations.

51. Project area consists of six regions, namely Nanchafang region (C zone), general machinery plant area (D zone), and the electric machine area (F zone), rely on the bridge area (G zone), Futai thermoelectric area (K zone), Gulou area (M zone). K area is heating by the Fengtai power plant cogeneration, and other areas are heating by the boiler room of heat source plant. The project uses ADB loan of \$ 50 million. The locations of the six regions are showing below:



52. In November 2012, according to the Hohhot Heating Master Plan (2010-2020), conducted local adjustments of urban heating enterprise, Nanchafang region (C region) and general machinery plant area (D zone) was adjusted to the Tuanjie area.

53. In early 2013, Hohhot implemented air pollution control plan, issued the "Hohhot People's Government on the Implementation of Coal-fired Heating Boilers Gas Transformation of the Notice" (call Zheng Fa [2013] No. 142) and a number of documents, all the city's burning coal boiler are the gas boiler. Awarded contracts (HH-EP-03,405 million dollars) related to the coal-fired boilers are unable to perform, it will be canceled.

54. Currently, the electric machine area (F zone), rely on the bridge area (G zone), Gulou area (M zone) using domestic supporting funds for coal-to-gas, form coal-fired boilers to gas boilers. Arranged the deployment by Hohhot Gas Development Co., Ltd, which commissioned Hohhot city.

55. The original $2 \times 29\text{MW}$ (ie, $2 \times 40\text{t/h}$) coal-fired hot-water boiler in Tuanjie area is not within the scope of the Hohhot existing coal-to-gas. However, due to the dust removal system of original boiler room is behind, dust and SO_2 emissions exceeded, Two sets of new bag filter are built for dust and smoke elimination and two sets of new double alkali desulfurization systems for flue gas desulphurization now, while the 1250 m^2 coal yard of boiler room plant and 30 m^2 slag yard will be transformed.

3.1 Changes Status of Hohhot Boiler Room and Heating Network Expansion Project

56. The project will have the following changes:

- (i) Currently, the electric machine area (F zone), rely on the bridge area (G zone), and Gulou area (M zone) are replaced by gas boiler. Gas boiler of rely on the bridge area (G zone) $1 \times 29\text{MW}$ has been completed, $2 \times 29\text{MW}$ gas boiler is in the construction; a gas boiler of the electric machine area (F zone) $1 \times 29\text{MW} + 2 \times 46\text{MW}$ has been completed; Gas boiler of Gulou area (M zone) $4 \times 29\text{MW}$ is in the construction. These gas-fired boilers that have been built and are building all used domestic funds.
- (ii) Project area C, D zone change for the Tuanjie community, the Tuanjie community continues to use the original coal-fired hot water boiler of $2 \times 29\text{MW}$ (ie, $2 \times 40\text{t/h}$) (Boiler Type DZL29-1.25-135 / 70-AII), now 2 new sets of bag filters and two sets of double alkali desulfurization system, and the 1250 m^2 coal yard of coal yard and 30 m^2 slag yard will be

transformed.

3.2 Domestic Approval Status

57. On July 20, 2009, Inner Mongolia Autonomous Region Development and Reform Commission approved the Feasibility Study Report of Hohhot Boiler and Heating Network and Expansion Project.

58. On August 31, 2009, Hohhot, Inner Mongolia Autonomous Region Environmental Protection Department approved the Environmental Impact Report of the Heating Network Transformation and Boiler Room of Integration Project (ie Boiler and Heating Network and Expansion Project) was approved (see **Appendix 3**).

59. On November 29, 2012, Inner Mongolia Autonomous Region Development and Reform Commission conducted the adjustment of the sub-projects on Hohhot Boiler and Heating Network and Expansion Project, and the plant address was approved from Nanchafang region (C zone) and general machinery plant area (D zone) to Tuanjie community (see **Appendix 4**).

60. Tuanjiehu Community Boiler Room Heating Boiler Dust Desulfurization Projects of Hohhot Futai Thermal Heating Corp was approved by Hohhot Economic and Information Bureau in 2015.

61. On June 24, 2015, environmental impact report of Tuanjiehu Community Boiler Room Heating Boiler Dust Desulfurization Projects was approved by the Hohhot Xincheng District Environmental Protection Bureau. (see **Appendix 5**).

3.3 Changes Status of Hohhot Boiler Room and Heating Network Expansion Project and Positive Effect Analysis on the Environment

62. Hohhot Boiler Room and Heating Network Expansion Project has less impact on environmental than before, especially on the environmental impact of the atmosphere, and significant environmental benefits.

A. The electric machine area (F zone), rely on the bridge area (G zone), and Gulou area (M zone) are replaced by gas boiler.

63. The biggest source of pollution is coal-fired heating boilers in Hohhot, natural gas as a clean energy to replace the coal, to conduct heating, can be much more effective to reduce air pollution, and therefore Hohhot government vigorously implements the "Gasification Hohhot."

64. According to "*Hohhot City Coal-fired Boilers From Coal to Gas Feasibility Study Report*" (2013, 2014), Hohhot city project of "coal-to-gas" in 2013 involved 51 scattered coal-fired boilers, heating area of 6.113 million m², coal-fired boiler 78, with a total tonnage of 812.5t/h, gas boiler reconstruction totaling 88 units with a total installed capacity of 797t/h; 137 scattered coal-fired boilers in 2014, heating area of 8,108,600 m², 202 sets of coal-fired boilers, the total tonnage of 1626t/h, gas boiler reconstruction totaling 269 units with a total installed capacity of 904.5t/h, it will bring better environmental benefits after implementation of the project:

- (i) Improve energy utilization efficiency, save a lot of energy, reduce dust, SO₂, NO_x and CO₂ emissions, see the table below:

Table 8. Energy and Emission Reduction Capacity of HOHHOT Coal to Gas Subproject

No.	Project	Energy-saving Emission Reduction
1	Switch to coal (million tons)	40
2	Dust reduction (tons)	2128
3	SO ₂ reduction (tons)	938
4	NO _x reduction(tons)	1062
5	CO ₂ reduction (tons)	56

Note: Adopt the second purification plant in Changqing gas composition data as a basis for calculation.

- (ii) Reduce the emissions and traffic carryings of coal and ash, to improve urban sanitation and traffic conditions.
(iii) Reduce the amount of coal and dust pollution, reduce and control the emissions of PM2.5.

65. According to the corresponding proportion of gas boiler installed capacity to conversion, the electric

machine area (F zone), rely on the bridge area (G zone), and Gulou area (M zone) are replaced by the gas boiler, after that, the gas boiler total tonnage of 463t/h (324MW), will bring environmental benefits as follows:

- (i) Improve energy utilization efficiency, save a lot of energy, reduce dust, SO₂, NO_x and CO₂ emissions, see the table below:

Table 9. Energy and Emission Reduction Capacity of this subproject

No.	Project	Energy-saving Emission Reduction
1	Switch to coal (million tons)	11
2	Dust reduction (tons)	579
3	SO ₂ reduction (tons)	255
4	NO _x reduction (tons)	289
5	CO ₂ reduction (tons)	15

Note: Adopt the second purification plant in Changqing gas composition data as a basis for calculation.

- (ii) Reduce the emissions and traffic carryings of coal and ash, to improve urban sanitation and traffic conditions.
 (iii) Reduce the amount of coal and dust pollution, reduce and control the emissions of PM2.5.

B. Project area C, D zone change for the Tuanjie community, new bag filters and double alkali desulfurization system, fully closed transformation on the boiler coal yard and slag yard.

66. Tuanjie community installs the coal-fired hot water boiler of 2 × 29MW (ie, 2 × 40t/h) (Boiler Type DZL29-1.25-135/70-AII), heating boiler room area of 830,000 m², boiler room fitted with two water dust scrubber, and treatment of boiler flue, dust removal efficiency of 80% desulfurization equipment is not installed.

67. The project removed the original water dust scrubber, 2 new bag filters and 2 double alkali desulfurization systems, bag filter of 99%, double alkali desulfurization system design desulfurization efficiency of 70%, can guarantee boiler exhaust emission standards so that emissions of pollutants, see the table below.

Table 10. Pollution Discharge Reduction

Pollutants	Emission Concentration before Transformation mg/m ³	Emission before Transformation t/a	Emission Concentration after Transformation mg/m ³	Emission after Transformation t/a	Emission Reductions t/a
Dust	1185.8	124.8	11.86	6.24	118.56
SO ₂	1135.27	435.2	340.58	130.56	304.64
NO _x	245.42	94.08	243.44	94.08	0

68. The 1250 m² coal yard of boiler room plant and 30 m² slag yard was fully to conduct the closed transformation, avoid the dust pollution in winter windy day, and reduce the adverse effects in the boiler room operation period on the surrounding environment.

3.4 Environmental Impact Analysis and Mitigation Measures of heating pipe network and Boiler House Reconstruction and Expansion Project in Hohhot

69. **Coal-fired chain boiler**(this is part of the New 4 chain hot water discharge boiler rooms including: 3 × 58MW1 seat, 3 × 29MW2 seat, 4 × 29MW1 seats) is replaced by gas fired boiler in Dianji residential area (Location F), Qiaokao area (Location G) and Drum tower area (Location M).

70. **Environmental impact analysis and mitigation measures during construction.** The reform of Coal-fired chain boiler to gas fired boiler in Dianji residential area (Location F), Qiaokao area (Location G) and Drum tower area (Location M) does not involve the construction of housing and other civil engineering. As gas is a cleaner energy than coal, gas fired boiler has less environmental impact than coal-fired chain boiler. The impact would be even less when the following measures are adopted:

- (i) Flyash and slag collection system is not required;
 (ii) Dust removal and desulphurization system are not required;
 (iii) Night construction should be prohibited;
 (iv) Plant green belt and trees around the heat source plant to reduce noise.



Trees in heat source plant

71. **Environmental impact and mitigation measures during operation.** Air pollutants discharged from gas-fired boiler during operation is below the corresponding pollutant emission limit. Household wastewater of workers is the major source of sewage. Public toilet is set up. The sewage would be pretreated through septic-tank before discharged to municipal pipe network. Noise constitutes the major environmental impact. But after adopting the relevant measures of sound insulation and noise reduction, the influence could be minimized. The relevant mitigation measures are as follows:

- (i) install shock absorber and adopt noise reduction measures for fans;
- (ii) set up sound insulation window to reduce noise dissemination;
- (iii) apply gas leak detector to prevent gas leakage that may cause fire;
- (iv) install explosion-proof lights and other explosion-proof equipment;
- (v) post security warning signs;
- (vi) Equip firefighting equipment.



Soft connection of fan



Gas leak detector



Shock absorber of blast tube



Fire extinguisher in boiler house

B. Project location C and D are changed to Tuanjie residential area. Bag filter and double alkaline desulphurization system are equipped and closed reconstruction would be carried out to coal yard and slag disposal pit of boiler house.

72. Following is the Environmental impact analysis and mitigation measures during construction.

73. **Air environmental impact analysis and mitigation measures during construction.** Raise dust is a major air pollutant during construction. They are created mainly in the process of material transport, air storage, loading and mixing. The following measures would minimize its environmental impact:

- (i) harden the road in the construction field including entrance and exit;
- (ii) apply water spraying and dust removal equipment in construction site;
- (iii) set up vehicle washing platform and apply automatic washing facilities to ensure the cleanness of the wheels and body of transport vehicles before they drive out of the construction site;
- (iv) place material orderly; any material easily causing dust should be in closed storage or covered by strainer mesh;
- (v) The outward of scaffold must be sealed with dense mesh safety net;
- (vi) Cement base and mixing station should be designed to be enclosed; appoint a worker specially in charge of material that easily causing dust and pollution, such as cement bags;
- (vii) Waste soil and material should be cleaned timely; Those cannot be transported away should be covered by strainer mesh.
- (viii) When four level of stronger wind occurs, construction easily causing dust should be stopped;
- (ix) Surround the construction site with enclosure.



Moistened ground in construction site



Enclosure of construction site

74. **Water environmental impact analysis and mitigation measures during construction.** Major pollutant of construction wastewater is suspended solid, so most can be recycled after sedimentation. It may cause little impact to environment. Good management of building materials and construction waste

can prevent secondary pollution. Maintenance of machinery and equipments should be done timely in professional factories to prevent oil leakage, which may cause oil pollution and increase the pollutant load of rains.

75. Noise environmental impact analysis and mitigation measures during construction.

Machinery is the major noise source in the construction site. Those machines include concrete mixer, transport vehicles and so on. Relevant measures should be taken to reduce noise influence following the time limit of noise management during construction in Hohhot City. Those following measures would minimize noise influence:

- (i) Construction plans, machinery and schedule should be reasonably arranged. Construction is strictly prohibited at noon (12:00-14:00) or night (22:00-6:00). A large number of powerful machines and equipments should be avoided to be used at the same time.
- (ii) Reasonable construction layout should be made to reduce the influence to nearby residents.
- (iii) Select low noise machines and equipments. For the excavation and transport machines (excavators, bulldozers, and tipping machines, etc), exhaust muffler and isolate engine vibration measures can be adopted to reduce noise. Besides, other vibration parts that cause noise can be partially or totally closed to reduce the amplitude of vibration. Idle machines and equipments should be closed down. Maintenance should be done to all machines, especially those noisy ones with loosing components and those with noise-reduction components easily broken.
- (iv) Noisy machines and facilities should be put far away from sensitive points with isolation and noise-reduction measures being adopted to reduce the influence to sensitive places.
- (v) Strengthen the management to noisy construction vehicles. Transport vehicles should better use low noise horns and any whistle on passing roads is prohibited.

76. Solid waste impact and mitigation measures during construction. Solid waste during construction mainly means waste building material, including excavation waste soil, building waste and household garbage of workers. Solid waste is comparatively in a large amount and concentrated time. So its environmental influence is usually temporary. Timely cleaning up and processing should be done to minimize its impact to environment:

77. Following is the Environmental impact analysis and mitigation measures during operation.

78. Air environmental impact analysis and mitigation measures during operation. The major air pollutant during operation is boiler flue gas. In this project, the original granite water film dust remover will be dismantled, two sets of bag-type dust remover (efficiency 99%) and two sets of double alkaline desulphurization system (efficiency 70%) would be applied to ensure the emission to meet the standard.

79. Water environmental impact analysis and mitigation measures during operation. Wastewater in operation mainly includes desulphurization waste water, boiler drainage and water softening system discharge. According to domestic environmental impact report form, desulphurization waste water flows into mixed flocculation pool, adding CaO for reaction and treated by NaOH, can be recycled. If applied, no wastewater would be discharged from desulphurization system. The only water evaporation occurs in the process of lye regeneration, sedimentation and Gypsum dewatering, can be supplemented by boiler discharge. Boiler discharge is quiet drainage, mainly used for coal, ash humidifying, boiler room ground flush and desulphurization system replenishment. Softening water drains would be recycled without any discharge. Wastewater during operation basically has no discharge, causing rare influence to the environment.

80. Solid waste environmental impact analysis and mitigation measures. Solid waste during operation mainly includes $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ generated from regenerative reaction tank, ash and dust. They would be temporarily stored in ash storehouse, timely transported away and sold to nearby brick factory for reuse.

81. Noise environmental impact analysis and mitigation measures during operation. Noises are mainly generated from double alkaline desulphurization system and facilities of power distribution room, including new fan and pump, slurry pump and lye pump. Those equipments were set within closed houses with noise being reduced by insulation walls. The following measures would minimize the noise influence to environment:

- (i) Select low noise, small vibration equipment.

- (ii) Noisy equipments, such as blowing fan, induced draft fan and pump should be installed within houses. Install sound absorption system to fans and vibration reduction system to pumps to reduce noises.
- (iii) Apply soft connector to fans and water pumps.
- (iv) Install noise muffler to the ignition and exhaust pipe of the boiler.

82. Underground water environment impact analysis and mitigation measures during operation.

Hardening the road of coal storage yard and ash storehouse, and applying anti-penetration treatment to the sidewall and bottom of mixed alkaline pool in desulphurization system, mixed flocculation tank and flow sedimentation tank can ensure the groundwater not contaminated.

3.5 Public participation

83. In June 2016, Environmental specialist from EED visited nearby villages and enterprises around the project and solicited the public opinions in the form of questionnaire.

84. The questionnaire briefly introduces the location of the contractor, construction content and plan. Choosing the questions closely related to public relationship, the questionnaire both represents the basic attitude to construction project but shows some suggestions and requirements. Following is the content of public participation questionnaire.

Table 11.Public participation investigation

Table 11.1 Public participation investigation							
Name		Gender	Age	Education	Contact number	Home adds.	Distance to the project/km
Project Overview	Inner Mongolia Environment Improvement Project (Phase II) and Heating Network and the Boiler Room Expansion Project in Hohhot City were approved in 2009, the unit owners is Hohhot Futai District Heating Company, heating users are mainly the region's announcement of building and civil construction heating. The main construction contents are: New 4 chain hot water discharge boiler rooms (3 × 58MW1 seat, 3 × 29MW2 seat, 4 × 29MW1 seats) and ancillary works;(ii) New Class I hot water pipe network of 41.13km (tube length), renovation of 303 km.(iii) New 94thermal sub-stations. Project area consists of six regions, namely Nanchafang region (C zone), general machinery plant area (D zone), the electric machine area (F zone), rely on the bridge area (G zone), Futai thermoelectric area (K zone), Gulou area (M zone). K area is heating by the Fengtai power plant cogeneration, and other areas are heating by the boiler room of heat source plant. The project will have the following changes: Currently, the electric machine area (F zone), rely on the bridge area (G zone), and Gulou area (M zone) are replaced by gas boiler. Project area C, D zone change for the Tuanjie community, the Tuanjie community continues to use the original coal-fired hot water boiler of 2 × 29MW (ie, 2 × 40t/h) (Boiler Type DZL29-1.25-135 / 70-A II), now 2 new sets of bag filters and two sets of double alkali desulfurization system, and the 1250 m2 coal yard of coal yard and 30 m² slag yard will be transformed.						
	1. How do you evaluate the environment of the area?			Air	Surface water	Underground water	Noise
			Excellent				
			Normal				
Bad							
2. Have you ever known the project before?		Yes					
		No					
3. How do you evaluate the effect of the project to regional economic development?		Promote economy; Provide employment---Positive effect					
		Polluting environment, Affect life ---Negative effect					
		Negative effect, but bearable					
		No effect					
4. The project will bring about environmental impact. Which one do you think is the major influence?		Waste gas		5.How are you and local residents influenced by the project?	Unbearable severe influence		
		Wastewater			Bearable slight influence		
		Noise			Good influence		
		Solid waste			No influence		
6. Which question do you concern most after the construction?		Influence during construction		7. What is the element that influence the most to the interest of you and local residents?	Waste gas		
		Landscape, public service facility			Waste water		
		Living environment			Noise		

Environmental Due Diligence Report

PRC Loan – 2658: Inner Mongolia Environment Improvement Project (Phase II)

	Beautify the environment and promote the image of the city			Solid waste	
8. The project would minimize the environmental influence by adopting effective environmental protection measures, establish and improve relevant systems. If those measures taken, would you accept the environmental influence?			Yes		
			No		
9. From the perspective of economic development and environmental protection, what is your attitude to the project? Do you approve of the construction?			Approval		
			Objection		
10. What is your attitude or suggestion to the project? (You can write on the back of the paper)					

Table 12. Statistics on investigation result

No.	Major content		Result	Participator numbers	Percentage to overall participators (%)
1	How do you evaluate the environment of the area?	Air	excellent	2	10
			Normal	15	75
			Bad	3	15
		Surface water	excellent	2	10
			Normal	10	50
			Bad	8	40
		Underground water	excellent	4	20
			Normal	12	60
			Bad	4	20
		Noise	excellent	10	50
			Normal	5	25
			Bad	5	25
2	Have you ever known the project before?	Yes		12	60
		No		8	40
3	How do you evaluate the effect of the project to regional economic development?	Promote economy; Provide employment---Positive effect		18	90
		Polluting environment, Affect life ---Negative effect		0	0
		Negative effect, but bearable		2	10
		No effect		4	20
4	The project will bring about environmental impact. Which one do you think is the major influence?	Waste gas		13	65
		Wastewater		4	20
		Noise		2	10
		Solid waste		1	5
5	How are you and local residents influenced by the project?	Unbearable severe influence		0	0
		Bearable slight influence		10	50
		Good influence		9	45
		No influence		1	5
6	Which question do you concern most after the construction?	Influence during construction		14	70
		Landscape, public service facility		2	10
		Living environment		2	10
		Beautify the environment and promote the image of the city		2	10
7	What is the element that influence the most to the interest of you and local residents?	Waste gas		7	35
		Waste water		5	25
		Noise		4	20
		Solid waste		4	20
8	The project would minimize the environmental influence by adopting effective environmental protection measures, establish and improve relevant systems. If those measures taken, would you accept the environmental influence?	Yes		20	100
		No		0	0
9	From the perspective of economic development and	Approval		20	100
		Objection		0	0

No.	Major content	Result	Participator numbers	Percentage to overall participators (%)
	environmental protection, what is your attitude to the project? Do you approve of the construction?			
10	Other opinions or suggestions?	None		

4. REVISION PROPOSAL ON ENVIRONMENTAL MANAGEMENT PLAN

85. The environmental management plan is revised according to the revision of two projects, including the second heat source plant expansion project in Zhalaite Banner, Xingan League and heating network and boiler housing reform and expansion project in Hohhot city. The revision aims to meet with the changes in the execution of sub-items and environmental monitoring. The revision parts mainly represents in environmental monitoring plan, monitoring elements and measures. The detailed revisions are listed in attachment 6.

5. CONCLUSIONS

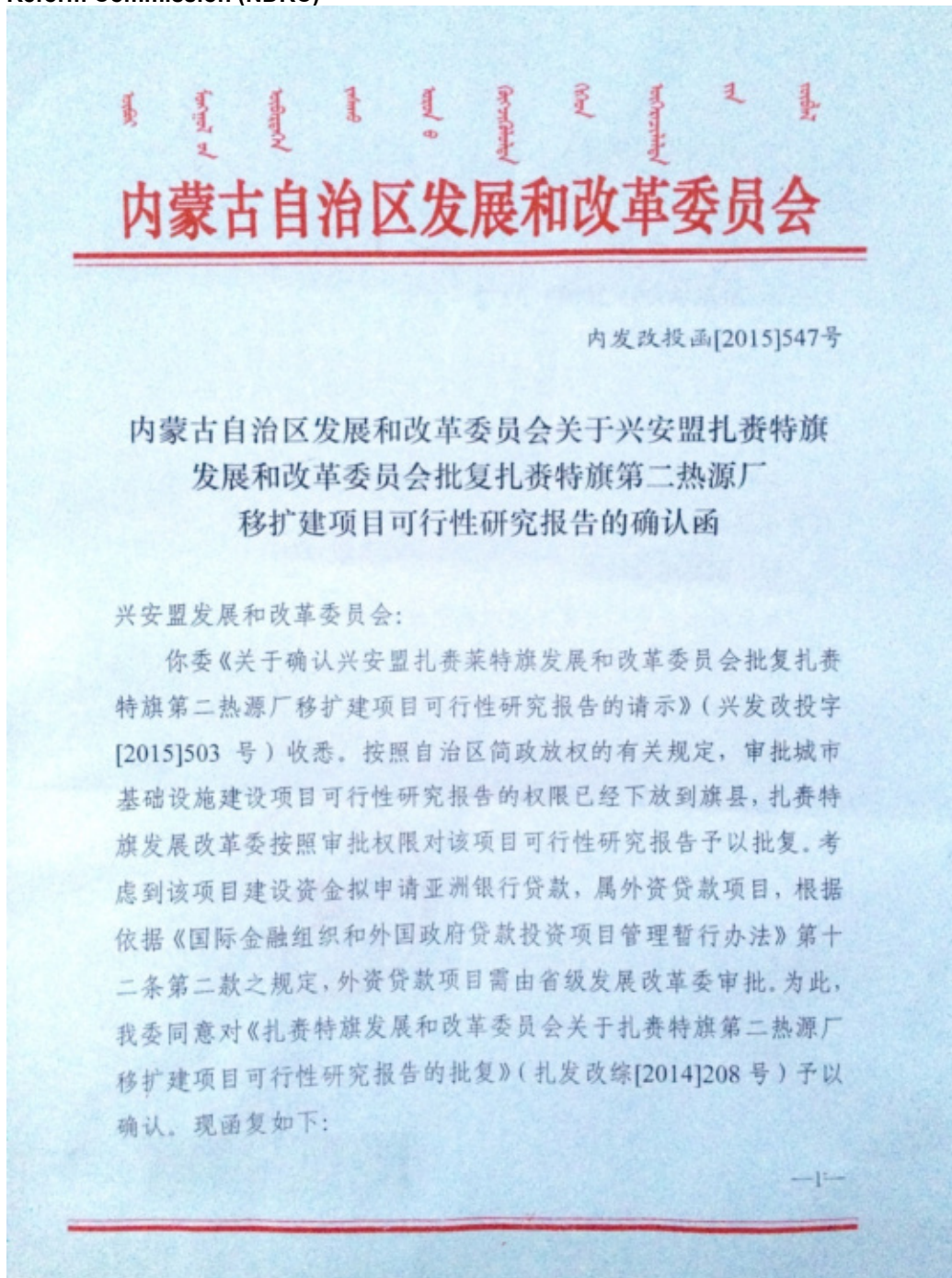
86. The second heat source plant expansion project in Zhalaite Banner, Xingan League will replace small boilers, including small scale, backward equipment in Xishan boiler house and traffic police brigade boiler house to reduce pollutants emissions in this region. After adopting relevant environmental mitigation measures, the environmental influence during construction would be under control.

87. In heating network and boiler housing reform and expansion project in Hohhot city, the replacement of coal to cleaner gas as heating source energy in Dianji residential area (Location F), Qiaokao area (Location G) and Drum tower area (Location M) will cause less influence to environment. Project location C and D are changed to Tuanjie residential area. The area are equipped with new bag-type dust collector and double alkaline desulphurization system and reconstruction to coal yard and slag field of boiler house are carried out. Those changes would reduce environmental influence. After adopting relevant mitigation measures, the environmental influence during construction would be under control.

88. The update of environmental management plan will effectively reduce environmental impact during project revision and the execution of other sub-items, reduce or eliminate environmental impact during project operation and ensure the effective implementation of environmental management plan.

6. APPENDIX

Appendix 1 Variation Approval from the Inner Mongolia Autonomous Region Development and Reform Commission (NDRC)



一、项目建设规模及内容

- 1、热源厂：新建一座 3×58+1×29MW 链条炉排热水锅炉房。
- 2、管网及热力站：新建一级热水管网 14.6km（管槽长）。
- 3、新建热力站 22 座（32 套）机组。

二、项目责任单位

齐齐哈尔市兴达投资集团扎赉特旗兴达热力有限责任公司。

三、项目总投资及资金来源

工程总投资 29223.61 万元。资金来源为申请亚洲银行贷款、自筹等方式解决。

四、项目建设地点

兴安盟扎赉特旗音德尔镇城区西侧。

请你委切实加强项目和资金管理，认真履行基本建设程序，确保项目早日建成发挥效益。

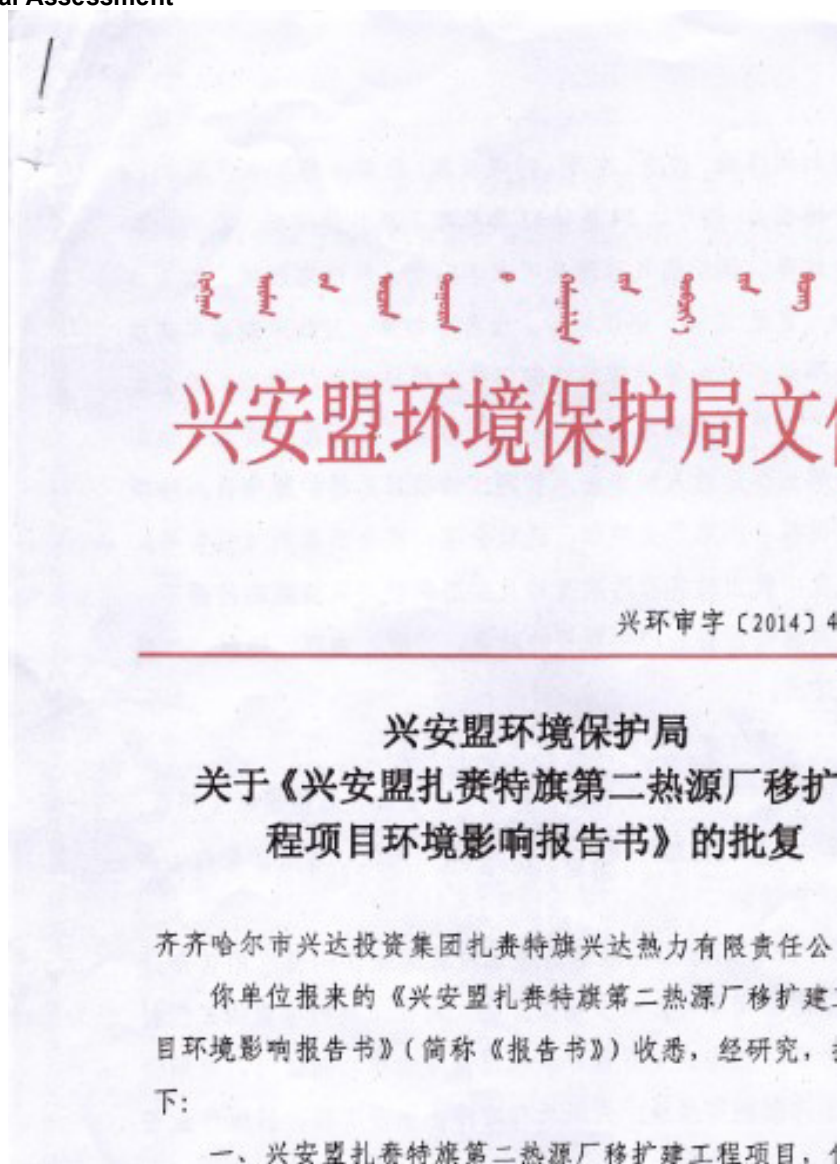
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内蒙古自治区发展和改革委员会

2015 年 12 月 2 日



Appendix 2 Official Reply from Xingan League Environment Protection Agency for the Environmental Assessment



预审意见:	
公司	
经办人:	年 月
下一级环境保护行政主管部门审查意见:	
<p>兴安盟扎赉特旗第二热源厂移扩建工程项目，位于扎赉特旗音德尔镇，该项目符合当地发展规划。建设区域及周边无环境敏感点或制约因素。生产过程 COD 和氨氮排放量为零，二氧化硫排放量为 94.64 吨/年、氮氧化物为 269 吨/年，二氧化硫排放指标将从 2009 年扎赉特旗兴达热力公司管理 270 吨中调剂解决，氮氧化物排放指标已申请盟环保局调剂解决。建设单环境违法行为。该项目为扩建项目，经研究，我局同意该项目建设。</p>	
公章	

Appendix 3 Official Reply from the Inner Mongolia Autonomous Region Environmental Protection Bureau for the Environmental Impact Assessment of the Hohhot Boiler Room and Heating Network Expansion Project

内蒙古自治区环境保护厅

内环审〔2009〕65号

内蒙古自治区环境保护厅
关于亚洲开发银行贷款内蒙古环境改善
二期项目—呼和浩特市供热管网改造及
锅炉房整合工程环境影响报告书的批复

呼和浩特市富泰热力股份有限公司：

你公司报送的《亚洲开发银行贷款内蒙古环境改善二期项目—呼和浩特市供热管网改造及锅炉房整合工程环境影响报告书》（以下简称《报告书》）收悉。我厅组织有关专家和地方环境保护行政主管部门对《报告书》进行了审查。经研究，批复如下：

一、该工程拟维持《呼和浩特市城市供热规划（2005-2020年）》中C+D区、F区、G区和M区现有818.2万m³供热能力不变，拆除上述供热区域内的123台分散锅炉，分别在原三里营南路制锁厂供热站改建3×58MW、原十四中北供热站改建3×29MW、原市委供暖所八车间供热站改建3×29MW、驰誉西侧桥靠供热站改建4×29MW等供热锅炉，新建一级热水管网41.13Km、换热站94座，更新管网303Km，同步配套储运等公辅设施和除尘脱硫装置。工程总投资75452.88万元，其中环保投资5282万元。

本期工程为改建，为当地城市供热规划的过渡方案，通过此次锅炉房整合与管网改造，可有效削减二氧化硫排放量324.5t/a。在落实《报告书》提出的各项污染防治措施，确保达标排放满足总量控制基础上，我厅原则同意本工程按照《报告书》中所列性质、规模、地点、运营方式、环境保护对策措施和下述要求进行建设。

二、该工程在设计和建设、运营过程中还应重点做好以下工作：

（一）应严格遵循本项目建设原则，在本项目试运行前按时拆除服务区域内的 123 台分散供热锅炉，对废弃供热站进行环境功能整治。上述内容纳入本期工程竣工环境保护验收范围，接受当地环保部门的监督。

（二）严格控制入炉煤质（年需用量 282690 吨，含硫率 $< 0.72\%$ ），强化除尘脱硫设施（除尘效率 $> 95\%$ ，脱硫效率 $> 70\%$ ）的运行管理，锅炉烟气污染物排放应达到《锅炉大气污染物排放标准》（GB13271-2001）II 时段二类区标准限值要求，二氧化硫年排放量控制在 977 吨以内。

煤场应采取妥善的抑尘措施，锅炉灰渣及时清运，供热站厂界无组织排放要满足《大气污染物综合排放标准》（GB16297-2001）无组织排放限值要求。

（三）依托原有工程水源，须做好给水工程内容的衔接。严禁开采地下水。生产废水和生活污水预处理后，出水满足《污水综合排放标准》（GB8978-1996）三级标准方可排入辛辛板城市污水处理厂。

（四）选用低噪声设备，采取减振、隔声、消声等降噪措施，确保所有供热站和换热站厂界噪声满足《工业企业厂界环境噪声排放标准》（GB12348-2008）2 类标准限值。

（五）应进一步落实锅炉灰渣、脱硫石膏的综合利用途径，厂内临时堆存须按《一般工业固体废物贮存、处置场污染控制标准》（GB18599-2001）II 类场要求做好防渗处理。

（六）按照国家规定设置规范的污染物排放口，预留永久性烟囱监测口。

三、本项目的污染防治设施必须与主体工程同时设计、同时施工、同时投入使用，在项目建设中应开展环境监理工作，并将环境监理报告作为项目建设过程中环境管理依据之一。项目竣工后，须在试运行前向我厅书面提交试运行申请，经检查同意后方可进行试生产。在项目试生产期间必须按规定程序向我厅申请环境保护竣工验收，验收合格后，项目方可正式投入生产。

四、我厅委托呼和浩特市环境保护局负责该项目施工期间的环境保护监督检查工作。

(此页无正文)

二〇〇九年八月三十一日

主题词：环保 项目 报告书 批复

抄送：呼和浩特市环境保护局，内蒙古自治区环境监察总队，
内蒙古自治区环境工程评估中心，内蒙古煤炭建设生态研
究院有限责任公司。

内蒙古自治区环境保护厅办公室 2009年9月3日印发

共印 20 份

Appendix 4 Official Reply from the Inner Mongolia Autonomous Region Development and Reform Commission for the Site Changes of the Hohhot Boiler Room and Heating Network Expansion Project

内蒙古自治区发展和改革委员会文件

内发改投字[2012]2642号

关于呼和浩特市供热管网及锅炉房
改扩建工程部分分项工程变更厂址的批复

呼和浩特市发展改革委：

你委《关于亚行内蒙古环境改善二期项目呼市供热管网及锅炉房改扩建工程项目变更热源厂厂址的请示》（呼发改外字[2012]109号）收悉。经研究，批复如下：

2011年4月26日，我委以内发改投字[2011] 984号文件批复该项目初步设计。工程范围包括六个区域：南茶房区域（C）、通用机械厂区域（D）、昭君新村区域（包括电机小区）（F）、桥靠区域（G）、鼓楼南马神庙区域（M）和富泰热电区域（K）。

—1—

近期，呼和浩特市供热总体规划（2010-2020年）对城区供热企业供热范围进行了局部调整，其中，南茶房区域（C）和通用机械厂区域（D）已经调整由其它热源覆盖。此外，近几年，新城区团结小区附近城区建设速度较快，供热需求快速增长，供热能力严重不足。为适应变化的新情况，进一步完善外资项目建设程序，确保资金使用安全，提高投资效益，我委同意将原批复中的拟供南茶房区域和通用机械厂区域的热源厂调整至团结小区，用地在团结小区现有锅炉房厂区内。建设规模（3×58MW 链条炉排热水锅炉房一座）和项目总投资保持原批复不变。

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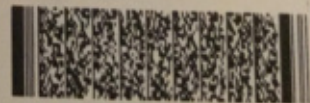
内蒙古自治区发展和改革委员会

2012年11月29日

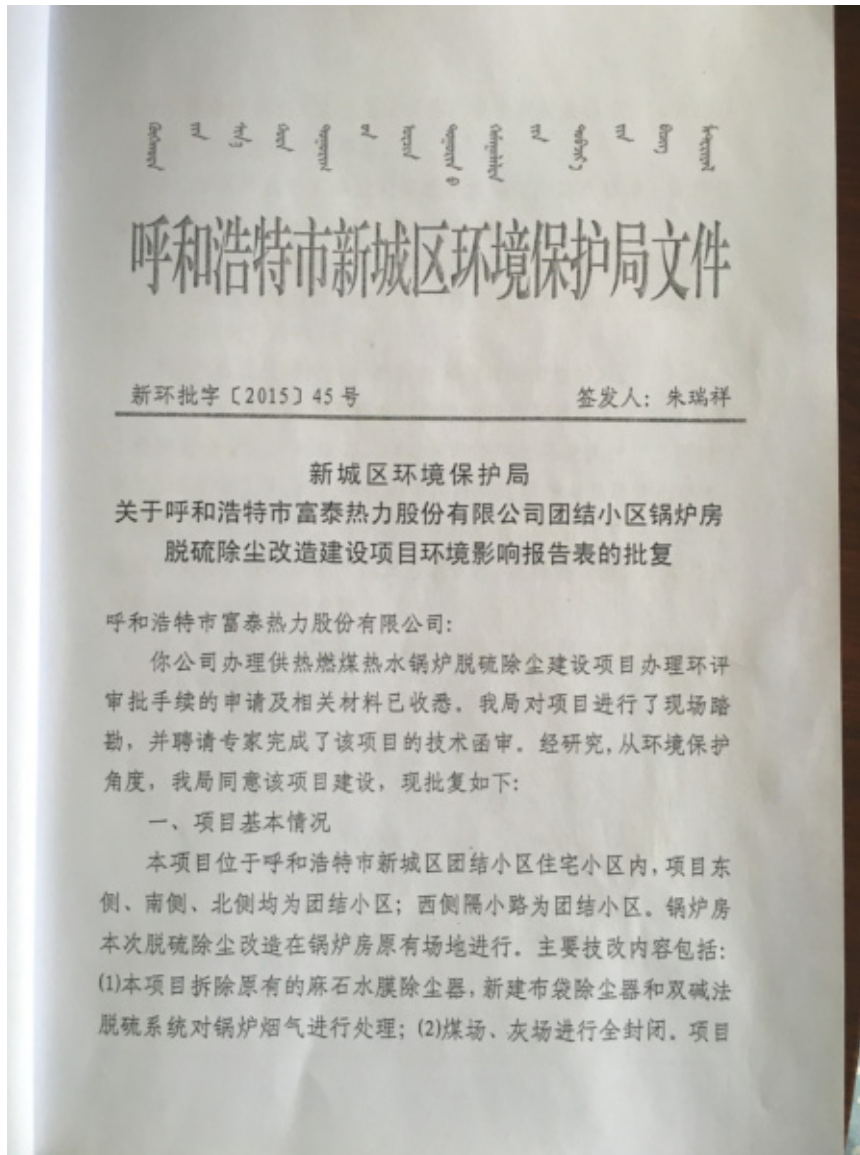
内蒙古自治区发展和改革委员会办公室

2012年11月29日印发

—2—



Appendix 5 Official Reply from HohhotXincheng District Environment Protection Agency for the Environmental Assessment of the Tuanjiehu Neighborhood Heating Boiler Desulfurization and Dust Removal Project



确保厂界噪声满足《工业企业厂界环境噪声排放标准》(GB 12348-2008) 2类标准限值要求。

6、项目产生的生活垃圾实现分类管理，日产日清，垃圾转运站；锅炉灰渣及脱硫废渣及时清运。

7、项目施工期间须委托有资质的环境监理单位对工程扬尘、废水、废气、噪声、烟气治理等建设工程进行全过程监理，并提供规范化管理用于“三同时”验收。

8、严格履行环评文件提出的其他污染防治措施。

三、项目建设必须严格执行配套建设的环境保护设施与主体工程同时设计、同时施工、同时投产使用的环境保护“三同时”制度。项目竣工后，建设单位必须按照规定程序向我局提交竣工环境保护验收申请，以便进行环境保护竣工验收。验收合格后，项目方可投入试生产及正式运营的，我局将依据国家法律法规对你公司进行处罚。

四、新城区环境监察大队负责该项目施工期、运营期环境保护监督检查工作。

2015年6月24日

Appendix 6 Updated Environmental Management Plan

A. Objectives

1. The objectives of the EMP are to (i) ensure implementation of identified mitigation and management measures to avoid, reduce, mitigate, and compensate for anticipated adverse environment impacts, and (ii) monitor and report against the performance indicators, while ensuring that the project complies with the PRC's environmental laws, standards and regulations and to ADB's Safeguard Policy Statement (SPS 2009). Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

B. Implementation Arrangements

2. This project is the scope change to the ADB financed Inner Mongolia Autonomous Region Environment Improvement Project (Phase II), which has seven district heating subprojects including four of the under implementation and three of them are new ones. IMAR Government is the executing agency for the project. A project leading group was established and is responsible for directing the project and providing policy guidance during project implementation. The IMAR PMO was established years ago and is responsible for coordinating the implementation of project activities on behalf of the IMAR Government.

3. IMAR PMO is overall responsible for implementing EMP. IMAR PMO will nominate a qualified environment officer to undertake effective environmental management activities specified in the EMP. Environmental engineers of a construction supervision company (CSC) contracted by each IA will be responsible for the daily inspection, monitoring, and evaluation of mitigation measures at each construction site.

4. Each IA will form an environmental management unit (EMU), which consists of a leader and an appropriate number of staff to coordinate environmental issues with the contractor, CSC and IMAR PMO. The EMU will be supported by the loan implementation environment consultant and supervised by the local EPBs. Contractors are responsible for implementing relevant mitigation measures and EMP monitoring during construction specified in the EMP supported by the CSC. Each IA is responsible for mitigation measures and EMP monitoring during project operation.

5. The local EPBs and Environment Monitoring Stations (EMS) under EPBs in each subproject city will ensure compliance with the PRC's environmental standards and regulations through regular and random environmental compliance monitoring and inspection during construction and operation. The EPBs will conduct the PRC's environmental compliance monitoring and inspection and local ambient air quality monitoring according to PRC regulations on behalf of each municipal EPB.

6. ADB is responsible for monitoring and supervising the overall environmental performance of the project. ADB will also disclose the project monitoring reports on its website. ADB will review the semiannual environment performance reports submitted by IMAR PMO, and conduct due diligence of environment issues during the project review missions. If the EA and IA fail to meet safeguards requirements described in the IE and the EMP, ADB will seek corrective measures and advise the EA and IMAR PMO on items in need of follow-up actions. The institutions and their responsibilities are summarized in Table A-1.

Table A-1 Summary of Institutions and Responsibilities for EMP

Name of Institution	Responsibilities
Project Leading Group	Direct the project and provide policy guidance during project implementation; Review project implementation progress and take additional measures if necessary.
ADB	Monitor and supervise the overall environmental performance of the project; Review the semiannual environment reports and disclose the project monitoring reports on its website; conduct due diligence of environment issues during the project review missions.
IMAR PMO	Responsible for overall implementation of the EMP with the support from consultants and IAs; Coordinate with IM Finance Bureau, IAs, the tender companies, consultants, and other governmental agencies.
Six IAs	Establish EMU; Provide supervision to CSCs and submit monthly reports to the PMO; Work with design institutes and the tender companies in preparing bidding documents

	to ensure environmental protection provisions are included in them.
Local EPBs and EMSs	Conduct environmental monitoring according to the monitoring plan and inspect the facilities during construction and operation to ensure compliance; Enforce applicable environmental laws and regulations.
Construction Supervision Company	Responsible for the daily inspection, monitoring, and evaluation of mitigation measures at each construction site.
Environmental consultant	Provide technical assistance to PMO and IAs for implementing the EMP; Provide training to the staff of the PMO, IAs and CSC. Prepare the semi-annual environmental reports.

7. **Institutional Strengthening and Capacity Building.** The provincial EPB and environment consultants will offer series of trainings to strengthen the capacity of IMAR PMO and implementation agencies concerned for EMP implementation. The training topics, approach, budgets and number of participants are listed in Table A-2. Environmental consultants will be responsible for developing training materials and providing training.

Table A-2 Institutional Strengthening and Training Program

Training	Attendees	Contents	Times	Period (days)	Number of Persons	Budget (CNY 10,000)	Source of fund
ADB's and PRC's environmental laws, regulations and policies	PMO, IAs, contractors	ADB's safeguard policy statement and other environmental regulations; Project applicable PRC's environmental laws, policies, standards and regulations; International environmental management practice in civil constructions.	2	1	30	4	Included in the loan implementation consulting package
Grievance Redress Mechanism	PMO, PPCU, IAs, Local EPBs, residential communities, and Stakeholders	GRM structure, responsibilities, and time frame; Types of grievances and eligibility assessment	2	1	30	4	
Implementation of environment monitoring plan	PMO, IAs, contractors, CSCs	Impacts and mitigation measures during construction and operation; Monitoring and auditing mechanism Reporting requirements; Corrective actions for EMP	4	1	40	10	
International	IAs	Best practice of	2	2	30	6	

Environmental Due Diligence Report

PRC Loan – 2658: Inner Mongolia Environment Improvement Project (Phase II)

good practices and technologies in district heating	and PMO	operation and maintenance of district heating systems; New heating technologies					
Total			10	5	130	24	

C. Potential Impacts and Mitigation Measures

8. The potential impacts of the project during construction and operation have been identified and appropriate mitigation measures have been proposed (see Chapter V for details) and will be implemented during the project implementation. The effectiveness of mitigation measures will be evaluated through environmental inspections and monitoring. Detailed impacts mitigation measures are presented in Table A-6.

D. Environment Monitoring Plan

9. An environment monitoring plan has been developed which is included in Table A-7. The monitoring plan covers air quality, wastewater, and solid waste parameters during construction as well as operation of each subproject. Monitor frequencies, responsible parties and estimated costs are identified in the plan.

10. The contractors and CSCs will be responsible for onsite routine environmental monitoring during construction. The IAs will be responsible for supervising the contractors under the guidance from IMAR PMO and the local EPBs and with the assistance from the loan implementation environment consultant. The IAs will be responsible for ensuring that the proposed environmental mitigation measures in the EMP to be properly implemented. The EMU under each IA will be responsible for their internal monitoring during operation.

11. The local EPB environmental monitoring stations will be responsible for monitoring the project to ensure that they comply with applicable regulations and requirements specified in the domestic EIA reports approved by the local EPBs.

12. **Standard Monitoring Methods.** The monitoring methods, detection limits, and the standard code for each monitoring parameter are shown in Table A-3. The data and results of environmental inspection and monitoring activities will be used to assess: (i) the extent and severity of actual environmental impacts against the predicted impacts and baseline data collected before the project implementation; (ii) performance or effectiveness of environmental mitigation measures or compliance with pertinent environmental rules and regulations; (iii) trends in impacts; (iv) overall effectiveness of EMP implementation; and (v) the need for additional mitigation measures and corrective actions if non-compliance is observed.

TableA-3:Monitoring Parameters and Methods

Media	Monitoring Period	Monitoring Parameter	Method (Standard No.)	Detection Limit(mg/m ³)	Standard Limit(mg/m ³)
Air	Construction Period	TSP	Gravimetric GB/T 15432-1995	0.001	300
		PM10	Gravimetric HJ618 -2011	0.001	150
		PM2.5	Gravimetric HJ618 -2011	0.001	75
	Operation Period (coal fired boiler)	SO ₂	Formaldehyde absorption by pararosaniline - spectrophotometric method HJ 482-2009	0.007	900
		NO _x	Hydrochloric acid naphthalene ethylenediamine spectrophotometry HJ 479	0.002	900
		SOOT	Gravimetric GB/T 16157-1996	0.001	200
		TSP	Gravimetric	0.001	300

	Operation Period (gas fired boiler)		GB/T 15432-1995		
		PM10	Gravimetric HJ618 -2011	0.001	150
		PM2.5	Gravimetric HJ618 -2011	0.001	75
		SO ₂	Formaldehyde absorption by pararosaniline - spectrophotometric method HJ 482-2009	0.007	100
		NO _x	Hydrochloric acid naphthalene ethylenediamine spectrophotometry HJ 479	0.002	100
		SOOT	Gravimetric GB/T 16157-1996	0.001	50
		TSP	Gravimetric GB/T 15432-1995	0.001	300
		PM10	Gravimetric HJ618 -2011	0.001	150
		PM2.5	Gravimetric HJ618 -2011	0.001	75

13. **Quality assurance (QA) and quality control (QC) for compliance monitoring.** To ensure monitoring accuracy and data integrity, the QA and QC procedures are established in accordance with the following regulations:

- (i) Regulations of QA/QC Management for Environmental Monitoring (SEPA, July 2006);
- (ii) QA/Q Manual for Environmental Water Monitoring, the State Environmental Monitoring Centre in 2001;
- (iii) QA/QC Manual for Environmental Air Monitoring, the State Environmental Monitoring Centre in 2001.

E. Reporting Requirements

14. The IAs supported by the CSCs will submit the monthly environment monitoring report to IMAR PMO, who will prepare and submit environment monitoring reports to ADB semiannually during construction and annually during operation. The environmental specialists of the loan implementation consultants will provide technical assistance and training to the staff of the PMO, IAs and CSCs.

15. The local EPB's EMS will conduct required measurements according the EMP environmental monitoring plan and submit the monitoring reports to IMAR PMO. A consolidated monitoring report will be prepared by IMAR PMO with the assistance from the implementation environment consultant.

16. No later than two months after completion of the construction work, the IAs shall collect data from all contractors and CSCs, and submit construction completion report to IMAR PMO and the local EPBs in order to comply with the PRC regulations. Within two months after project completion, environmental acceptance monitoring and audit reports of project completions shall be (i) prepared by the local EMSs; (ii) reviewed for approval by the local EPBs, and (iii) submitted to IMAR PMO. ADB can request to PMO a copy of the construction completion report for the project record.

17. The environmental reporting requirements during the implementation of the project are summarized in the Table A-4.

TableA-4: Reporting Requirements

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Report	Prepared by	Submitted to	Frequency
A. Construction Phase Monthly environment monitoring report	Contractors, IAs supported by CSCs	IMAR PMO	Monthly
EMP monitoring report	IMAR PMO supported by loan consultants	ADB	Semiannually
B. Operation Phase Subproject EMP monitoring report	IAs	IMAR PMO	Annually
EMP monitoring report	IMAR PMO supported by loan consultants	ADB	Annually

F. Performance Indicators

18. Performance indicators (Table A-5) have been developed to assess the implementation of the EMP. These indicators will be responsive to changes in project design, such as a major change in boilers and their auxiliary facilities, or in technology, unforeseen events, and monitoring results.

Table A-5: Performance Indicators

No.	Description	Indicators
1	Staffing	(i) Qualified environment officer was assigned in IMAR PMO before project implementation (ii) Local EMS is hired by the IA before construction (iii) EMU is established with appropriate number of staff in each IA before project implementation
2	Budgeting	(i) Environmental mitigation cost during construction and operation is timely allocated (ii) Environmental monitoring cost is timely allocated (iii) Budget for capacity building is timely allocated
3	Monitoring	(i) Internal environmental inspection and monitoring during construction period is included in the contracts between the IAs and CSCs (ii) Compliance monitoring is conducted by the local EMS semiannually (iii) EMP monitoring is conducted by contractors, CSCs, IAs and EMSs
4	Supervision	(i) IMAR PMO supervises environmental inspection and monitoring done by CSCs (ii) ADB mission review EMP implementation at least once a year during project implementation period
5	Reporting	(i) Monthly environment monitoring reports prepared by IAs and CMSs are submitted to IMAR PMO (ii) Compliance environment monitoring reports prepared by EMS are submitted to local EPBs and IM PMO semiannually (iii) Semiannual and annual EMP monitoring reports prepared by IMAR PMO are submitted to ADB (iv) Construction completion report prepared by IAs is submitted to IMAR PMO
6	Capacity Building	(i) Training on ADB safeguard policy is provided to IMAR PMO and IAs at the beginning of project implementation (ii) Training on grievance redress mechanism (GRM) is provided at least once during the project implementation (iii) Training on EMP is provided at least once a year during the (iv) project implementation
7	Grievance Redress Mechanism	(i) Project public complaints unit (PPCU) is established in each IA before project implementation (ii) Contact persons of PPCU are assigned and disclosed to the public before construction (iii) Complaints are recorded and processed within the set time framework in the GRM of this CIEE
8	Compliance with the PRC	All subprojects comply with the PRC's environmental laws and regulations and meet all the required standards.

	standards	
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G. Estimated Budget for Mitigation and Monitoring

19. The estimated budgets for environmental mitigation and monitoring for all three subprojects are summarized as follows. Mitigation cost during construction is estimated at CNY11.06 million or \$1.78 million, and annual operating cost is CNY9.46 million or \$1.53 million. The estimated budget for pollution control equipment for SO₂, NO_x and TSP is CNY22.48 million or \$ 3.62 million.

20. Monitoring cost during construction is estimated at CNY 1.06 million or \$170,000, while the estimated annual monitoring cost during operation is CNY 285,000 or \$46,000, respectively. The estimated budget for capacity building is CNY380,000 or \$61,300.

H. Mechanisms for Feedback and Adjustment

21. Based on environmental inspection and monitoring results, the local EPBs will decide whether (i) further mitigation measures are required as corrective actions, or (ii) some improvements are required for environmental management practices.

22. The effectiveness of mitigation measures and monitoring plans will be evaluated through a feedback reporting system. IMAR PMO with assistance from EPBs and the loan consultants will assess the results of environmental monitoring and then propose any changes to EMP monitoring and mitigation plan. If necessary, adjustments can be proposed to the EMP. However, any major adjustments will be subject to ADB review and approval.

23. If, during inspection, substantial deviation from the EMP is observed or any changes are made to the project that may cause substantial adverse environmental impacts or significant increase in the number of affected people, then IMAR PMO should consult with the IMAR EPB, the local EPBs, and ADB and form an environmental assessment team to conduct additional environmental assessment and, if necessary, further public consultation. The EMP can be revised based on the changes of the project activities and the revised EMP will be passed to the contractor(s) and the IAs for implementation.

24. Any revised EMP should be sent to ADB's review. The revised EMP with ADB confirmation is subject to reposting on the ADB's website as the ADB public communications policy (PCP) requires. The mechanism for feedback and adjustment of the EMP is shown in Figure A-1.

Figure A-1: Mechanism for Feedback and Adjustment of EMP

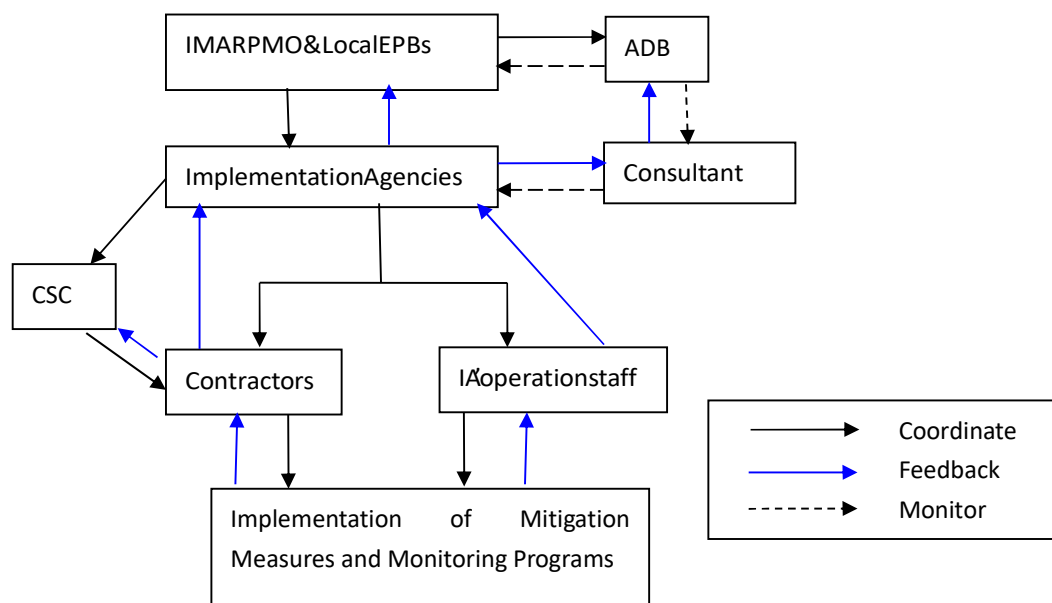


Table A-6 Environment Impacts and Mitigation Measures

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Budget (CNY in 1000)	Source of Funds
			Implemented by	Supervised by		
A. A. Pre-construction Phase						
Design Mitigation facilities and measures	Subproject's sites and routes selection	Sites of heating plants and the heating supply pipeline routes will be reconfirmed to avoid or minimize potential adverse impacts on the surrounding environments and communities; The location of the proposed heat exchange stations, based on the preliminary selection during the feasibility study, will be reconfirmed and designed as far as possible from environmentally sensitive receptors, such as schools, hospitals, residential buildings.	DIs and IAs	IMAR PMO		Included in design contracts
	Including mitigation measures and monitoring program in engineering design	Environmental mitigation measures identified in the IEE and the domestic EIAs will be incorporated in the engineering design documents and bidding documents for all subprojects, and will be included in contract documents for civil constructions and equipment installations. All contractors shall be required to strictly comply with the EMP; Environmental monitoring program will be incorporated into the engineering designs to ensure that environmental impacts are closely monitored and construction and operating activities are closely supervised against the approved EIAs	DIs	IMAR PMO, IAs, local EPBs		Included in design contracts
	Wastes and spoil disposal sites	Appropriate spoil disposal sites will be considered in the engineering design.	DIs	Local EPB, IM PMO		Included in design contracts
Bidding and Contracting	Bidding and contract document preparation	Incorporate environmental mitigation measures indicated in the EMP and EIAs in bidding documents And construction contracts for all subprojects.	DIs and IAs	IMAR PMO, Local EPBs		Included in design contracts
Grievance Redress Mechanism	Establishment of operational GRM	Establish a Project Public Complaints Unit (PPCU) in each IA's office; provide training for PPCU members and GRM access points; Disclose the PPCU's phone number, fax, address, and email to the public.	IAs	IMAR PMO, Local EPBs		Included in IAs' operation budget
B. Construction Phase						
Soil	Soil erosion due to construction activities	Minimize active open excavation areas during pipeline trenching activities and some foundation works and use appropriate compaction techniques for constructions. Limit construction and material handling activities during periods of rains and high winds Stabilize all earthwork disturbance areas as soon as possible but no more than maximum 14 days after earthworks have been completed at the sites Plant grass and trees in the HSPs to minimize soil erosion Properly slope or re-vegetate disturbed surfaces, such as compacted pipeline trenches	Contractors, CSCs	IAs, Local EPB, IMAR PMO	680	Included in construction contract

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		Appropriately set up temporary construction camps and storage areas to minimize land area required and impact on soil erosion				
	Soil contamination	Properly store petroleum products, chemicals, hazardous materials and wastes on impermeable surfaces in secured and covered areas to avoid soil contamination. Use best management practices to prevent spills of oil and chemicals and avoid contact with soil directly. Remove all construction wastes from the site safely and dispose it to approved spoil disposal sites only. Provide spill cleanup measures and equipment at the construction site and require contractors to conduct training in emergency spill response procedures	Contractors, CSCs	IAs, Local EPB, IMAR PMO	340	Included in construction contract
Wastewater	Surface and groundwater contamination from construction wastewater, and domestic water	Construct intercepting ditches and drains to prevent storm water runoff from entering construction sites, and divert run off from sites to existing drainage. Equip with water collection basins and sediment traps tall construction equipment wash areas. Install septic treatment and disposal systems at construction camps and provide proper maintenance protocols and training. Monitor water quality parameters (SS, COD, oil, and grease) in rivers in each subproject city by local environmental monitoring station (EMS) during construction in accordance with the monitoring program	Contractors, CSCs	IAs, Local EPB, IMAR PMO	1000	Included in construction contracts
Noise	Noise from construction, machinery operation, and transportation activities	Ensure that noise levels from equipment and machinery conform to applicable national standards, and properly maintain machinery to minimize noise. Apply noise reduction devices or methods where piling equipment is operating within 500m of sensitive sites such as schools, hospitals, and residential areas. Locate sites for rock crushing, concrete-mixing, and similar activities at least 1km away from sensitive areas. To reduce noise at night, restrict the operation of machinery generating high levels of noise, such as piling, and movement of heavy vehicles along urban roads between 8pm and 7am the next day based on international best/common construction practice. Incorporate noise considerations in public notification of construction operations; disseminate information on procedure of handling complaints through the GRM. Reach an agreement with nearby schools and residents regarding heavy machinery work to avoid any unnecessary disturbances. Place temporary noise barriers around noise sources during construction, if necessary. Monitor noise at sensitive areas at regular intervals. If noise standards are exceeded, equipment and construction conditions will be checked, and mitigation measures will be implemented to rectify the situation. Conduct quarterly interviews with residents living adjacent to the construction sites to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance	Contractors, CSCs	IA, IMAR PMO, local EPBs	1000	Included in construction contracts
Noise	Noise from HSP (coal crusher, draft, air compressor and water feed pumps)	Install acoustic enclosures, barriers, or shields to reduce noise levels Plant greenbelt all along the HSP's boundaries as appropriate for further attenuation of noise. Install mufflers on vents of the boiler and air blowers and sound-proof shields on the power generators to mitigate the noise impact. Installation of sound-proof shield and double window Properly maintain pumps and other equipment to minimize noise	Equipment supply and installation contractors IAs	Local EPB, IMAR PMO, Local EMSs, consultant	1400	Include in the equipment supply and installation contracts

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	Noise from heat exchange stations	Installation of sound-proof shield and double window. Properly maintain pumps and other equipment to minimize noise.	Equipment supply and installation contractors IAs	Local EPB, IMAR PMO	1500	Included in the equipment supply and installation contracts
Vibration	Vibration generating by compacting and rolling	Prohibit heavy vibration operations (i.e. pipeline trench compacting, pilling and road roller operation, etc) at night.	Contractors, CSCs	IAs, IMAR PMO, local EPBs		Included in construction contracts
Ambient Air	Fugitive dust generated by construction activities	Spray water on construction sites and material handling routes where fugitive dust is being generated. Pay particular attention to dust suppression near sensitive receptors such as schools, hospitals, or residential areas. Cover materials during truck transportation, in particular, the fine material, to avoid spillage or dust generation. Store petroleum or other harmful materials in appropriate places and covering to minimize fugitive dust emission.	Contractors, CSCs	IAs, IMAR PMO, local EPBs	850	Included in construction contract
	Air emission from vehicles and construction equipment	Ensure vehicle emissions are in compliance with relevant PRC standards. Maintain vehicles and construction machineries to a high standard to ensure efficient running and fuel-burning and compliance with the PRC emission standards	Contractors, CSCs	IAs, Local EPB, IMAR PMO	800	Included in construction contract
Solid Waste	Solid waste from construction activities	Establish temporary storage for solid wastes away from water bodies or other environmental sensitive areas, and regularly haul solid waste to an approved land fill or designated dumping site. Provide appropriate waste storage containers at construction sites. Hire a qualified contractor to remove all wastes from sites to approved waste disposal sites, according to appropriate domestic procedures. Hold contractors responsible for proper removal and disposal of any significant residual materials, wastes, and contaminated soils that remain on the site after construction. Any planned paving or vegetating of the area will be done as soon as the materials are removed to protect and stabilize the soil. Prohibit waste incineration near construction sites.	Contractors, CSCs	IAs, Local EPB, IMAR PMO	900	Included in construction contract
	Hazardous and polluting materials from construction activities	Prepare and implement the protocol for the handling and disposal of hazardous and pollution construction materials including a spill prevention and emergency plan. Storage facilities for fuels, oil, and other hazardous materials will be within secured areas on impermeable surfaces, and provided with bunds and cleanup installations. Vehicles and equipment will be properly staged in designated areas to prevent contamination of soil and surface water; vehicle, machinery and equipment maintenance and refueling will be properly carried out so that spilled materials do not seep into the soil.	Contractors, CSCs	IAs, Local EPB, IMAR PMO	420	Included in Construction contract

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		Oil traps will be provided for service areas and parking areas; and fuel storage and refilling areas will be located at least 300m from drainage structures and important water bodies. Contractors' fuel suppliers shall be properly licensed. They shall follow proper protocol for transferring fuel and the Operation Procedures for Transportation, Loading and Unloading of Dangerous or Harmful Goods of JT3145-91.				
	Small boiler site	Before demolishing small boilers, a survey and investigation for the small boiler sites will be conducted by the IA and/or the local EMS under supervision of the local EPBs. The assessment will include contamination status of soil, groundwater, structures and surface water bodies if nearby. If the environment is contaminated, the site restoration plan shall be developed taking into account the World Bank's Group General EHS Guidelines on Construction and Decommissioning and follow up activities will be conducted by the IA under the supervision of the local EPB. Dispose demolition debris in municipal solid waste landfills or special construction and demolition debris landfills subject to approval by the municipal EPBs. Dispose waste into the river or other water bodies will be strictly prohibited.			300	
Flora and Fauna	Protection of vegetation, revegetation of disturbed areas; planting and compensatory planting trees and grass	Preserve existing vegetation where no construction activity is planned, or temporarily preserve vegetation where activity is planned for a later date; Properly backfill, compact, and re-vegetate pipeline trenches after heating pipeline installation; Protect existing trees and grassland during construction; when a tree has to be removed or to an area of grassland disturbed, replant trees and re-vegetate the area after construction; Remove trees or shrub only as a last resort if they impinge directly on permanent structures; and Undertake compensatory planting of an equivalent or larger area of affected trees and vegetation in compliance with the PRC's forestry law and regulations	Contractors, CSCs	IA, Local EPB, IMAR PMO	220	Included in construction Contract
Community Disturbance and Safety	Traffic congestion and accident, and interruption in public utilities	Contractors will consider the impact on traffic in construction scheduling. A traffic control and operation plan will be prepared and it shall be approved by local traffic management administration before commencing construction. The plan will include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings, building temporary roads, selecting transport routes to reduce disturbance to regular traffic, reinstating roads, and opening the road to traffic as soon as the construction is completed. The plan will also include coordination with other utility providers, when necessary, to ensure the construction activities will not interfere or interrupt with their services. Plan construction activities so as to minimize disturbances to utility services. Public notices will be placed to inform construction and any disturbances to utility services to the affected people. Temporary land occupation will be planned well ahead of construction to minimize its impact. Land will be reinstated to its original condition after construction. Implement safety measures around the construction sites to protect the public, including warning signs to alert the public to potential safety hazards, and barriers to prevent public access to construction sites.	Contractors, CSCs	IA, Local Public Transportation Bureau, IMAR PMO	660	Included in Construction contract
Occupational health and safety	Health damage and accidents during construction activities	Identify and minimize the causes of potential hazards to workers. Provide preventive and protective measures, including modification, substitution, or elimination of hazardous conditions. Provide appropriate personal protective equipment (PPE) to workers to minimize risks, including ear protection, hardhats and safety boots. Provide adequate safety protection equipment including firefighting systems.	Contractors, CSCs	IA, Local EPB, IMAR PMO	600	Included in construction contract

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		<p>Provide adequate signage in risk areas.</p> <p>Provide procedures for limiting exposure to high noise or heat working environments in compliance with PRC noise standards for construction sites (GB12523-2011) and relevant international guidelines.</p> <p>Provide training to workers, and establish appropriate incentives to use and comply with health and safety procedures and utilize PPE.</p> <p>Provide training to workers on the storage, handling and disposal of hazardous wastes.</p> <p>Provide procedures for documenting and reporting occupational accidents, diseases, and incidents.</p> <p>Provide emergency prevention, preparedness, and response arrangements.</p> <p>Hold safety meetings with staff before each shift.</p>				
Physical Cultural Resources		<p>Establish and conduct chance-find procedures for physical cultural resources</p> <p>Relics destroying, damaging, defacing, concealing or otherwise interfering shall be strictly prohibited in accordance with PRC regulations.</p> <p>If a new site is unearthed, work should be stopped immediately and the IA and local cultural relic bureau will be promptly notified; construction will resume only after a thorough investigation and with the permission of the appropriate authority.</p>	Contractors, CSCs	IAs, IMAR PMO	90	In case of cultural relic discovered, the direct cost for compensation to contractor will be covered by special fund for cultural relic protection
Subtotal of Construction Phase					11060	
C Operation Phase						
Air Quality	Emissions need to be monitored to ensure compliance	Conduct emission testing for environmental acceptance. Calibrate continuous emission monitoring (CEM) system.	Local EMS	Local EPBs	150	Include in IAs' operation budget
	Air pollution from heat source needs to be controlled	Properly operate and maintain emission control devices (desulfurization, denitrification, dust removal equipment). Properly operate and maintain CEM systems.	IAs	Local EPBs	3000	
	Dust from coal and ash handling	<p>Spray water on haul road to suppress dust during transporting and unloading coal;</p> <p>Spray water on coal stockpiles, especially on windy days;</p> <p>Compact coal stockpiles as required to minimize air ingress and the potential for auto ignition and loss of volatiles;</p> <p>Spray water on ash storage piles to minimize fugitive dust emissions during temporary storage; and</p> <p>Use enclosed trucks or cover up the ash when transporting ash from HSP to ash users for construction</p>	IAs	Local EPBs	2200	Included in IAs' operation budget

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		material.				
Noise	Noise from coal crusher, draft fan, air compressor and water feed pumps may impact workers' hearing	HSPs and HESs will have proper building insulation to avoid noise pollution; Implement restricted access, and provide PPEs such as earmuffs and earplugs to personnel who works in high noise generating areas;	IAs	Local EPB	10	Include in the IAs' operation budget
Solid Wastes	Fly ash and slag could affect soil and water quality if not properly managed Boiler decommissioning could affect soil, air and water quality if not managed proper	All fly-ash and slag will be temporarily stored on site and then transported to the local construction industry as a raw building material or road construction material. No permanent on site ash disposal will be allowed. All demolition wastes will be routinely collected by appropriately licensed waste management companies for reuse, recycling (e.g. equipment; steel, iron and other metals; salvage able wood and building materials; etc.) or final disposal in a licensed waste facility (e.g. for non-recyclable materials). Waste management will be undertaken in consultation with local authorities. No on-site landfills are permitted at any demolition site. No burning of wastes will be permitted at demolition sites. A site contamination investigation will be undertaken in consultation with the local EPB, and if necessary site specific plans will be developed to address any site contamination. Contaminated spoil will be transported to approved disposal sites, and clean fill provided. The site will be rehabilitated to a level suitable for its proposed future use; the local EPB will approve the rehabilitation, and will require additional rehabilitation actions if necessary. Family stove owners who choose to dispose their stoves will be given access to the services of the waste management companies.	IAs	Local EPB	300	Include in the IAs' operation budget
Wastewater	Water pollution and reuse in HSP	Waste water from HSPs will be treated and recycled within the HSPs; All HSPs' sanitation facilities will discharge to municipal sewer net works that meet relevant PRC standards; Runoffs from HSPs will be directed to sedimentation basins, and wastewater will be reused if possible, for dust suppression. Solid waste residue in the basins will be cleared as required and transported to approved landfills; For areas with oily wastewater discharges, oil-water separators will be installed before discharging to the sedimentation basins; and Leach ate and drainage from the coal storage yard will be collected and drained into the storage pond for reuse in spraying the coal storage yard. Any oil and grease sludge skimmed out from the treatment process will be collected and handed over to recycler as per PRC standards	IAs	Local EPBs	1330	IA's operation budget
	Wastewater from heat exchange stations	Regularly clean the sedimentation tank, dispose accumulated sludge and sediments in the municipal IAs landfill.	IAs	Local EPBs, local EMS	690	Include in the equipment supply and installation contracts
	Backwash effluent from	Build an equalization and sedimentation tank in each HES for pH adjustment and sedimentation	Equipme	Local	670	Include in

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	heat exchange stations	(SS≤400mg/L) before the back was heffluentis discharged into the municipal sewer.	nt supply and installatio n contracto rs, IAs	EPB, IMAR PMO		the equipme nt supply and installatio n contracts
Community Disturbance and Safety	Occupational and community health and safety	Conduct regular inspections of the district heating network, and repair defects promptly; Minimize community disturbance during repairing of HES and heating pipelines; and Comply with applicable workers safety laws and regulations.	IAs	Local EPBs, local LB,	120	IA's operation budget
Boiler Demolition	Economic displacement	Implementthelaborretrenchmentplan(LRP)andalsocomplywithapplicablePRClawsandregulations	IAs	IMAR PMO	990	IA's operation budget
Subtotal of Part C (per year)					9460	
D. Emissions Mitigation Technical Measures						
Ambient Air	Pollutants emission from heating plants	Build tall stacks to disperse pollutant emitted from HSPs and minimize the direct impact of emissions on adjacent areas; Install and operate electro static precipitation (ESP),fabric filter or other particulate control device to control particulate matter (PM) emissions; Use desulfurization technology inside the circulated fluidized bed (CFB) boiler. Wet scrubber will be used for additional SO ₂ reduction for bigger CFB boilers; Using CFB technology as denitrification control technology due to low combustion temperature and less thermal NOx formation; and Install CEMs on the smoke stack of the HSPs to monitor SO ₂ andfluedustemissions.CEM data will be sent to local and provincial EPBs directly for monitoring purpose.	Equipme nt supply and installatio n contracto rs, IAs	Local EPB and provinci al EPB	224 76.8	Include in the equipme nt supply and installatio n contracts
		Subtotal of Part D:			22476.8	
		Grand total (B+C+D)			42,996.8	

TableA-7:Environmental Monitoring Plan

Subject	Parameter	Location	Frequency	Implemented by	Supervised by	Source of Fund
Construction Period						
Waste water generated from construction	Inspection of wastewater mitigation measures (water collection basins and sediment traps, etc.)	All construction sites	Waste water effluent sites, Monthly	Contractors, CSCs,	IAs, IMAR PMO	Included in CSC's Contract
	COD、SS、Oil	All construction sites	Semiannually	Environmental Monitoring Stations	IMAR PMO, Local EPBs	Included in Construction Contract
Ambient Air	Inspection of dust mitigation measures (water spraying, cover transport vehicles, etc);and Inspection of maintenance and condition of vehicles and construction equipment.	All construction sites and nearby areas	Monthly	Contractors, CSCs,	IAs, Local EPBs, IMAR PMO	Included in CSC's Contract
	SO ₂ 、NO _x and SOOT	Stacks of HSPs	Environmental performance test before commercial operation	Environmental Monitoring Stations	EPB	Included in equipment installation Contract
	TSP、PM10and PM2.5	All construction sites and sensitive spots	Semiannually	Environmental Monitoring Stations	Local EPBs, IMAR PMO	Included in Construction Contract
	SO ₂ 、NO _x and SOOT	Continuous emission inspection at stacks of HSPs	Online	IAs	Local and Municipal EPBs	Included in IAs' operationbudgets
Noise	Leq dB (A)	All sensitive spots around construction sites	Semiannually , monitoring noise during daytime and nighttime	Environmental Monitoring Stations	Local EPBs, IMAR PMO	Included in Construction Contract
Construction spoil disposal	Spoil Waste	Construction wastes disposal sites.	Annually after waste disposal	Local EPBs	IMAR PMO	Included in Construction Contract
Small boiler demolition	Solid Waste	Small boiler houses	Whenever a small boiler is demolished.	Local EPBs	IMAR PMO	IAs
B. Operation						
Emission from HSP	SO ₂ 、NO _x and SOOT	Compliance monitoring of samples at the HSPs stacks	Monthly during heating season	IAs	Local EPBs	Included in IAs' operation budgets
Dust from	TSP、PM10and PM2.5	1m outside of the	Once during	Environmental	Local EPBs	Included in IAs' operation

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storages of coal and ash		HSP's boundary	heating season	Monitoring Stations		budgets
Heating network safety and reliability	Conduct regular inspections of the district heating network and repair defects promptly	Heating pipeline network	Before and after heating season for once each.	IAs	IMAR PMO	Included in IAs' operation budgets
Noise from HSPs	Leq dB (A)	1m outside of the HSP's boundary	Once during heating season, monitoring noise during daytime and nighttime	Environmental Monitoring Stations	Local EPBs, IMAR PMO	Included in IAs' operation budgets
Noise from heat exchange station	Leq dB (A)	1m outside of the buildings of the heat exchange station	Once during heating season, monitoring noise during daytime and nighttime	Environmental Monitoring Stations	Local EPBs, IAs, IMAR PMO	Included in IAs' operation budgets
Domestic Sewage	SS、COD	Domestic sewage outlets	Once during heating season	IAs	Local EPBs, IMAR PMO	Included in IAs' operation budgets
Wastewater from Heating Stations	pH、sulfate、phosphate	Heating Stations Sewage outlets	Once during heating season	IAs	Local EPBs, IMAR PMO	Included in IAs' operation budgets