ADB

Environmental Impact Assessment

Project Number: Loan 3218
April 2016

People's Republic of China: Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region

Prepared by Hohhot City Development Investment and Operation Company and Hohhot Chengfa Heating Company for Asian Development Bank. This is a revised version of the reformatted version originally posted in 8 July 2014 available on http://www.adb.org/projects/documents/low-carbon-district-heating-project-hohhot-inner-mongolia-autonomous-region-jul-2014-rf-eia.

CURRENCY EQUIVALENTS
(as of 08 March 2016)

Currency unit	–	Yuan (CNY)
CNY1.00	=	$ 0. 1535
$1.00	=	CNY 6.5133

ABBREVIATIONS

ADB	Asian Development Bank
AP	Affected Person
ASL	Above Sea Level
CEMS	Continuous Emissions Monitoring System
CHP	Combined Heat and Power
CNY	Chinese Yuan
CSEMP	Construction Site Environmental Management Plan
EA	Executing Agency
EHS	Environment, Health and Safety
EHSS	Environment, Health and Safety Specialist
EHSU	Environment, Health and Safety Unit
EIA	Environmental Impact Assessment
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EMS	Environmental Monitoring Station
EPB	Environmental Protection Bureau
FGD	Flue-Gas Desulfurization
FSR	Feasibility Study Report
GDP	Gross Domestic Product
GHG	Green House Gas
GIMAR	Government of Inner Mongolia Autonomous Region
GIP	Good International Practice
GRM	Grievance Redress Mechanism
HCDIO	Hohhot City Development Investment and Operation Company
HDPE	High Density Polyethylene
HES	Heat Exchange Station
HH	Household
HSP	Heat Supply Plant
IA	Implementing Agency
IEE	Initial Environmental Examination
IMAR	Inner Mongolia Autonomous Region
IT	Interim Target
LIC	Loan Implementation Consultant
MEP	Ministry of Environmental Protection

MSDS	Material Safety Data Sheet
NG	Natural Gas
OM	Operations Manual, ADB
PCR	Physical Cultural Resources
PPCU	Project Public Complaint Unit
PPE	Personnel Protective Equipment
PPTA	Project Preparatory Technical Assistance
PRC	People's Republic of China
PUR	Polyurethane
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SPS	Safeguard Policy Statement, ADB
TA	Technical Assistance
UPS	Uninterrupted Power Supply
WB	World Bank
WHO	World Health Organization
WWTP	Wastewater Treatment Plant

WEIGHTS AND MEASURES

BOD_5	Biochemical Oxygen Demand, five days
$CaCO_3$	Calcium Carbonate
cm	Centimeter
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
dB(A)	A-weighted sound pressure level in decibels
DO	Dissolved Oxygen
GJ	Gigajoules
GWh	Gigawatt Hour
ha	Hectare
kg	Kilogram
km	Kilometer
kV	Kilovolt
kWh	Kilowatt Hour
Leq	Equivalent Continuous Noise Level
m	Meter
m/s	Meters per Second
m^3	Cubic Meters
mg/l	Milligrams per Liter
mg/m^3	Milligrams per Cubic Meter
MW	Megawatt
NO_2	Nitrogen Dioxide

NO_x	Nitrogen Oxides
^oC	Degrees Celsius
pH	A measure of the acidity or alkalinity of a solution
PM_{10}	Particulate Matter smaller than 10 micrometers
$PM_{2.5}$	Particulate Matter smaller than 2.5 micrometers
SO_2	Sulfur Dioxide
t/h	Tons per Hour
TSP	Total Suspended Particulates

NOTE

In this report, “$” refers to US dollars.

TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

A. Introduction

1. This is the Environmental Impact Assessment (EIA) report for the proposed Low-Carbon District HeatingProject (the Project) in Inner Mongolia Autonomous Region (IMAR) of the People's Republic of China (PRC). The Project consists of the Haoqingying, Xinjiaying and Jinqiao district heating zones located in eastern Hohhot City. The Project was initially designed incorporating coal-fired heat supply plants (HSPs) and pilot testing of a 25 MW wind powered electrode boiler. To address concerns about the environmental impacts of coal as a heating source, the design was subsequently revised to utilize low nitrogen oxides (NO_x) natural gas-fired HSPs, and the wind powered electrode boiler capacity was increased to 50 MW.

B. Policy, Legal and Administrative Framework for Environmental Impact Assessment

2. Environmental impact assessment (EIA) procedures have been established in the PRC for over 20 years. Domestic EIA studies are required to be undertaken by relevant PRC environmental laws and regulations. National and local legal and institutional frameworks for EIA review and approval have been established to ensure that proposed projects are environmentally sound, designed to operate in line with applicable regulatory requirements, and are not likely to cause significant environment, health, social, or safety hazards. The domestic EIA reportsfor the Project were prepared by a qualified EIA consultant and were approved on 28 March 2014 by the HohhotEnvironmental Protection Bureau (EPB).

3. ADB's Safeguard Policy Statement (SPS, 2009) has also been carefully considered. The Project has been classified by ADB as environment category A, requiring the preparation of an EIA(this report). All applicable requirements of the SPS have been addressed in the EIA.

C. Project Scope

4. The Project scope includes: (i) 21 boilers with a heating capacity of 1,610 MW, comprising 19 low NO_x natural gas-fired boilers and two 25 MW wind powered demonstration 10 kV electrode boilers; (ii) 73.76 km of primary heating network; (iii) 180 Heat Exchange Stations (HESs), 11 of which will be building-level HESs; and (iv) SCADA systems installed in all three heating zones. In addition, once the Project is operational,50 inefficient and polluting small coal-fired boilers in the Jinqiao heating zonewill be decommissioned by the Hohhot municipal government.

D. Implementation Arrangements

5. The Government of IMAR (GIMAR) will be the executing agency (EA) and the Hohhot City Development Investment and Operation Company (HCDIO) will be the implementing agency (IA). HCDIO has appointed three Branches which will have direct responsibility for each heating zone.

E. Budget and Time Schedule

6. The Project cost is estimated at 2.389 billion CNY ($391.86 million). The ADB loan will finance 38.3% (914.54 million CNY or $150 million) from ordinary capital resources, the

IA will finance 20.3% (484.600 million CNY or $79.482 million), and the China Everbright Bank will finance 41.4% (990.700 million CNY or $162.377 million). The total construction period for the Project will be approximately 5 years.

F. Description of the Environment

Location and Topography

7. The Project consists of three heating zones located in the eastern part of Hohhot City:

- The Haoqingyingheating zone is located in Xincheng District in northeastern Hohhot. This is a relatively undeveloped district, which was previously farmland, and is the main area for Hohhot's future urban development.

- The Xinjiaying heating zone is located in Saihan District in central eastern Hohhot, adjacent to the site of the existing HSP owned by HCDIO. This area was also previously farmland, and is also designated for future urban expansion.

- The Jinqiao heating zone is located in the Jinqiao in Saihan District in southeastern Hohhot. The site consists of an abandoned brick and tile factory and unused land, and is considered waste land.

8. Hohhot is on the northern edge of the Hetao Plateau (upper reaches of the Yellow River) and the southern edge of the Gobi Desert. It has an elevation of 1,065 masl. The urban topography is flat, though the Daqing Shan Mountains are immediately to the north and the Man Han range is to the southeast. All three heating zones have flat topography.

Meteorology and Climate

9. Hohhot has a temperate continental monsoon climate with long cold dry winters, short hot summers, and dry windy springs. The annual average temperature is 8.7 ^{0}C, the maximum temperature in July is 38.5 ^{0}C, and the minimum temperature in December is -27.6 ^{0}C. Annual average precipitation is 393.2 mm, with April to October accounting for about 94% of the total rainfall throughout the year. The area receives an annual average of 2,662.7 hours sunlight. All three HSPs have been sited to take into account the predominant NW wind direction during the heating season, with sparsely populated areas to the SE.

Water Resources

10. Rivers in the Hohhot area belong to the Yellow, Daheihe and Hunhe river systems. However, there are no rivers, creeks or streams on any of three HSPs. There are a series of fish ponds to the northwest of the Jinqiao HSP site, and care will need to be taken during construction to avoid pond contamination.

Ecological and Sensitive Resources

11. Hohhot is located in a mid-temperate semi-arid climatic zone. The surrounding area includes forest (limited), shrubs, grasslands and steppe meadows. However, the three heating zones are all located within urban or semi-rural environments within the city limits, and are either ex-farmland in areas slated for urban development, or disturbed and unused "waste" land. Existing vegetation cover is typically grass or shrubs, or disturbed soilwith little or no vegetation cover. There are no known rare or endangered flora or fauna, parks, nature reserves or areas with special ecological significance within or adjacent to any of the sites. The project sites are considered as modified habitat under ADB's SPS (2009) definition.

Socioeconomic Conditions

12. Hohhot has a total area of 17,224 km^2. The land area of the rural portion of Hohhot is 15,170 km^2 (88.1% of the total land area), while the urban area is 2,054.0 km^2 (11.9% of the total land area). The urban area includes a built-up (city) area of 79.2 km^2. Hohhot has a population of 2.9488 million (2012), including the urban area with a population of 1.9233 million and the rural area with a population of 1.0255 million.

13. The beneficiaries of the Project include both current and potential future heat users. It is estimated that by 2020 the Project will benefit a population of 883,500.

Physical Cultural Resources

14. The heating zones are located within urban landscapes. They are not on or near any tourism sites, and there are no know Physical Cultural Resources (PCRs) within or adjacent to the sites. However, there is a tomb approximately 100 m south of the Jinqiao heating zone boundary near the existing access road, and care will need to be taken during construction to protect the tomb.

G. Environmental Baseline

15. Air quality data provided by the Hohhot EPB for the 2000 to 2012 period shows that air quality in Hohhot was generally in compliance with relevant standards for SO_2 although there was a peak in 2007, and that NO_2 levels have been well below the applicable standards. Both pollutants are showing a downward trend in annual average concentrations from peak levels in 2007.

16. Site specific baseline environmental monitoring was conducted by a certified environmental monitoring station during the 2013/14 heating season. The results indicate that air quality at the heating zones is good, and all results for TSP, $PM_{10,}$ $SO_{2,}$ and NO_2 were in compliance with the relevant standard, Class II of *GB3095—2012Ambient Air Quality Standards*. However $PM_{2.5}$ levels exceeded the 24-hour standards at all three heating zones. The most likely causes are vehicle exhaust and coal-fired flue emissions.

17. Annual average groundwater quality data (2010) was sourced from the Hohhot Groundwater Quality Monitoring Station. Monitoring data indicates that groundwater quality in Hohhot is relatively good and is in compliance with the relevant standard, Class III of *GB/T14848-93 Quality Standards for Ground Water.*

18. Noise monitoring indicates that daytime and nighttime noise levels at the at the site boundaries of all three heating zones meet the applicable Class II standards (60 dB(A) daytime, 50 dB(A) nighttime) of *GB12348-2008Noise Standards for Industrial Enterprises at Site Boundary*. The results also indicate that daytime and nighttime noise levels at the adjacent sensitive locations for all three heating zones meet the applicable Class II standards (60 dB(A) daytime, 50 dB(A) nighttime) in *GB3096-2008Environmental Quality Standards for Noise*.

H. Anticipated Impacts and Mitigation Measures

19. Anticipated positive and negative environmental impacts of the proposed Project were assessed during the EIA preparation based on the findings of the domestic heating zoneEIAsand feasibilitystudy reports, supported by site visits, stakeholder consultations, additional surveys undertaken by national and international environmental consultants, and additional atmospheric modeling undertaken in 2014.

20. Pre-construction, construction phase and operation phases were each considered separately. The results of the assessment analysis indicates that during the pre-construction phase issues are very limited, and are mostly associated with siting and ensuring appropriate incorporation of mitigation measures into the project design. Potential negative construction phase environmental impacts are short-term and localized, and are associated with soil erosion, construction noise and fugitive dust, disruption of traffic and community services, and risks to worker health and safety. Potential negative operation phase impacts are associated with boiler emissions, waste and wastewater, noise, and health and safety risks to workers. Air dispersion modelling modeling results indicate that even the worst case cumulative operation phase pollutant ground level concentrations (GLCs), which occur only a few times per year at a few specific locations, are fully in compliance with PRC ambient air quality standards. Overall, negative impacts can be minimized with the application of appropriate mitigation measures.

21. Potential positive operation phase impacts are significant and long-term, and are associated with emissions reductions compared to equivalent heat production from coal-fired boilers.

I. Alternative Analysis

22. The district heating area in Hohhot increased from 14.74 million m^2 in 2004 to 86.81 million m^2in 2012, an annual growth rate of 24.81%. With rapid urban expansion heat demand increases dramatically, leading to an urgent need to construct new heating infrastructure.If the Project is not implemented heat from traditional coal-fired HSPs will be required to meet the increasing demand for district heating in Hohhot, and existing polluting small coal-fired boilers may continue to be used. Based on an overall analysis of alternatives, the Project has selected the most appropriate heat source, fuel type, low NOx burner, electric boiler, heat system connection, pipeline type and installation method, and HES type.

J. Information Disclosure and Public Consultations

23. HCDIO has undertaken extensive public consultation and information disclosure. The two phase process began when the Project design still incorporated coal-fired HSPs, and continued when the design was revised to natural gas-fired HSPs. The process has included information disclosure in newspaper articles, two beneficiary surveys with over 190 surveys completed and returned, web-posting of the heating zone EIAs, and a recent public meeting where participants expressed unanimous support for the Project.

K. Grievance Redress Mechanism

24. A project-level grievance redress mechanism (GRM) has been established to receive and facilitate resolution of complaints about the Project's environmental performance during construction and operation phase. The GRM includes procedures for receiving grievances, recording/ documenting key information, and evaluating and responding to the complainants in a reasonable period of time. Any concerns raised through the GRM will need to be addressed quickly and transparently, and without retribution to the affected person.

L. Environmental Management Plan

25. A comprehensive EMP wasdeveloped to ensure (i) implementation of identified mitigation and management measures to avoid, reduce, mitigate, and compensate for anticipated adverse environment impacts; (ii) implementation of monitoring and reporting against the performance indicators; and (iii) Project compliance with the PRC's relevant environmental laws, standards and regulations and ADB's SPS. The EMP includes an environment monitoring plan (EMoP) to monitor the environmental impacts of the Project

and assess the effectiveness of mitigation measures, and a capacity building and training program focused on health, safety and environment. Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting. The EMP is presented in Appendix I.

M. Conclusion

26. The Project environmental assessment process has (i) selected an appropriate technology to reduce the emission of pollutants; (ii) identified negative environment impacts and appropriately established mitigation measures; (iii) received public support from the majority of Project beneficiaries and affected people; (iv) established effective Project GRM procedures; (v) assessed the capacity of the EA and the IA; and (vi) prepared a comprehensive EMP including environmental management and supervision structure, environmental mitigation and monitoring plans, and capacity building and training.

27. Based on the analysis conducted it is concluded that overall the Project will result in significant positive socioeconomic and environmental benefits, and will not result in significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Air quality dispersion modelling results indicate that even the worst case cumulative operation phase pollutant ground level concentrations (GLCs),which occur only a few times per year at a few specific locations, are fully in compliance with relevant standards. When compared to the equivalent production of heat through traditional coal-fired sources, once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,500 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2; and (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons. By 2020 the Project will provide low-emission high efficiency district heating to an estimated 294,500 households with a population of 883,500.

28. Overall, any minimal adverse environmental impacts associated with the Project can be prevented, reduced, or minimized through the appropriate application of mitigation measures. It is therefore recommended that: (i) the Project's categorization as ADB environment category A is confirmed; (ii) this EIA is considered sufficient to meet ADB's environmental safeguard requirements for the Project, and no additional studies are required; and (iii)the Project be supported by ADB, subject to the implementation of the commitments contained in the EMP and allocation of appropriate technical, financial and human resources by the EA and IA to ensure these commitments are effectively and expediently implemented.

I. INTRODUCTION

A. The Project

1. The proposed Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region, (the Project), will upgrade and expand district heating in three heating zonesin Hohhot city. The Project will provide 1,560 megawatts (MW) of clean-burning natural gas-fired heating capacity and 50 MW of demonstration wind powered electrode heating capacity, which in combination will heat approximately 30 million m^2 of public and residential building space.

2. The Project consists of the Haoqingying, Xinjiaying and Jinqiao district heating zones located in eastern Hohhot city, in central Inner Mongolia Autonomous Region (IMAR) (**Figure 1** and **Figure 2**). The Project was initially designed incorporating coal-fired heat supply plants (HSPs) and pilot testing of a 25 MW wind powered electrode boiler. To address concerns about the environmental impacts of coal as a heating source, the design was subsequently revised to utilize low NO_X natural gas-fired HSPs, and the wind powered electrodeboilercapacity was increased to 50 MW.

3. The Government of IMAR (GIMAR) is the executing agency (EA) and the HohhotChengfa Heating Company (HCHC)is the implementing agency (IA), which is responsible for day to day project management, including contractor management, operation and maintenance, and social and environment safeguard monitoring and assurance. The HCDIO[1]is engaged to provide management oversight to the HCHC; to liaise with the GIMAR, and Hohhot municipal government; to provide support and supervision in the project procurement; and to provide timely managerial and technical support to the IA to ensure the timely project implementation as well as good governance of the project. The HCDIO and HCHC will jointly establish a project management office (PMO).

4. The Project cost is estimated at $403 million. The Asian Development Bank (ADB) is considering providing a loan of $150 million from ADB's ordinary capital resources to help finance the Project.

5. When compared to the equivalent production of heat through traditional coal-fired sources, once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,500 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2; and (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons.

B. Report Purpose

6. ADB's environmental safeguard requirements are specified in the Safeguard Policy Statement (SPS 2009). The Project has been screened and classified by ADB as Environment Category A, requiring the preparation of an Environmental Impact Assessment (EIA) including an environmental management plan (EMP).This EIA for the Project has been

[1] The HCDIO will sign onlending agreements with the GIMAR, through Hohhot municipal government, and will onlend to the HCHC. The HCDIO is directly responsible for making equity contributions amounting to 23% of the total project cost.

prepared in compliance with the ADB's SPSrequirements.

C. Approach to EIA Preparation

7. This EIAreport has been prepared based on domestic Feasibility Study Reports (FSRs) for three heating zones, domestic Environmental Impact Assessment (EIA) reports for three heating zones, technical due diligence reviews of the FSRs undertaken by district heating specialists, andadditional surveys, modelling and consultations undertaken by national and international environmental consultants. Key data sources are presented below:

Figure 1: Project Location, Inner Mongolia Autonomous Region

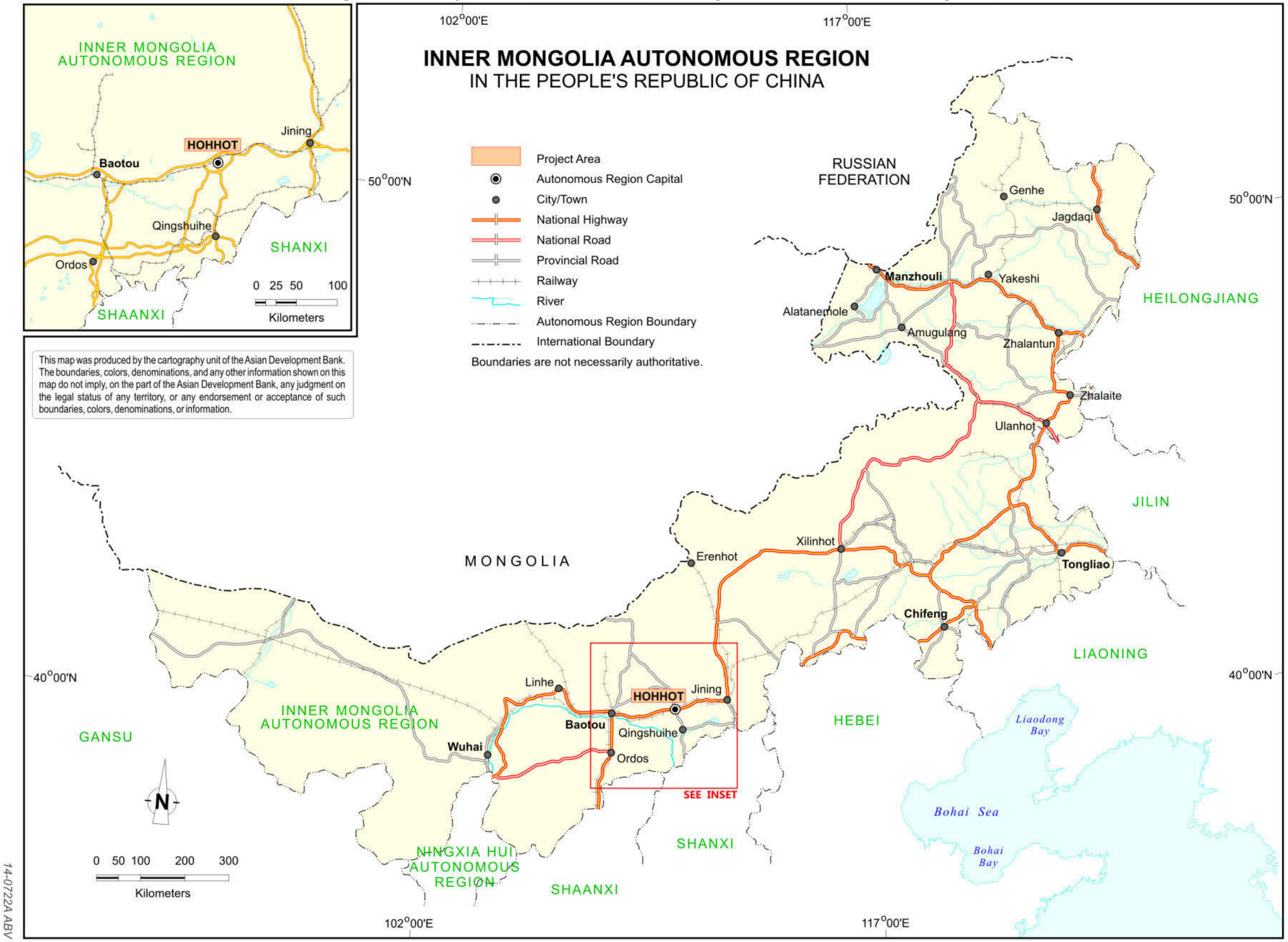
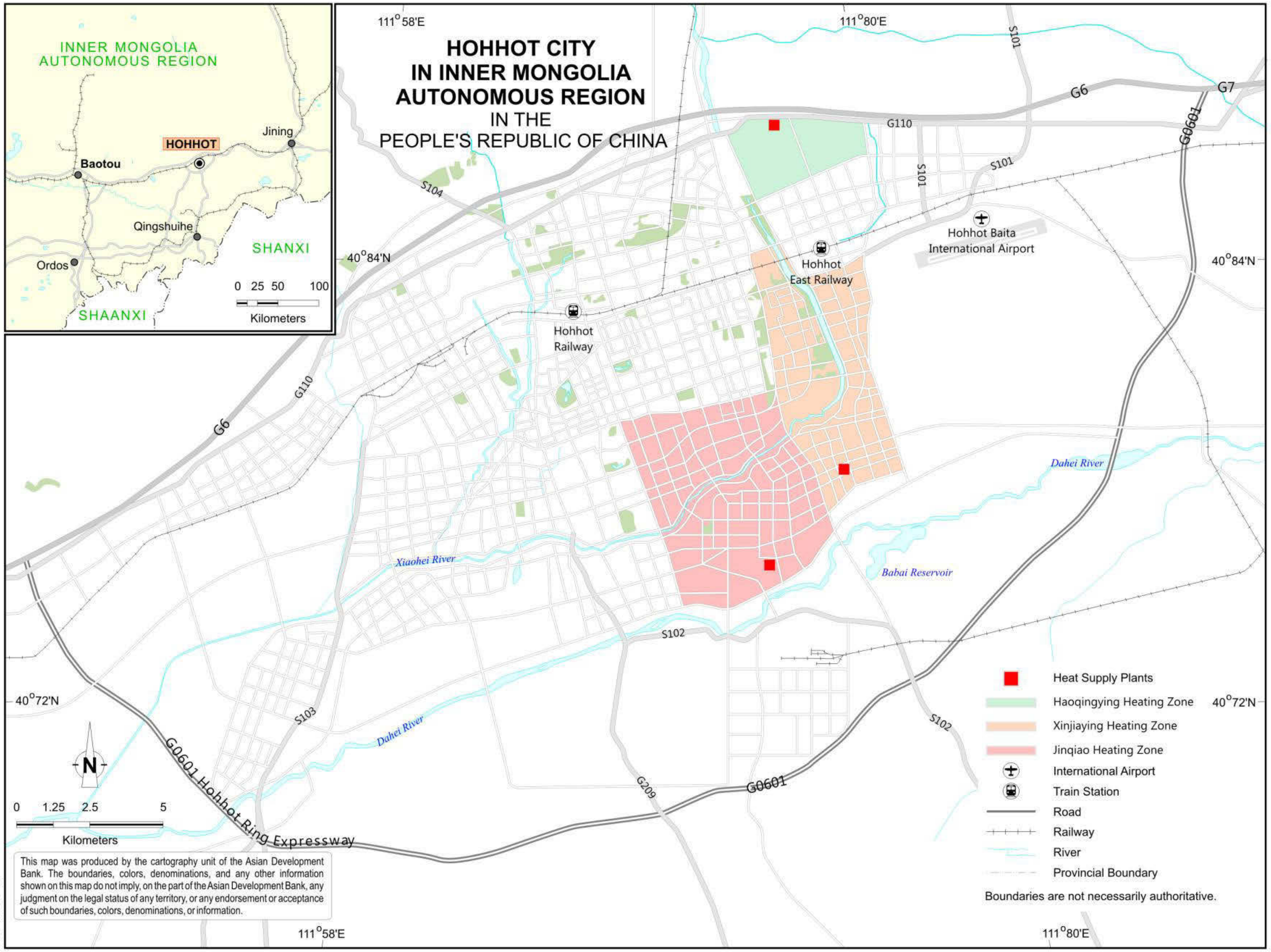


Figure 2: Three Heating Zones under the Project in Hohhot City



Project Description - Data sources include: (i) FSRs prepared by qualified consultants from a certified domesticfeasibility study institute, theNorth China Municipal Engineering Design Research Institute;[2](ii) domestic EIA reports for three heating zones prepared in compliance with the PRC's environmental assessment requirements and regulatoryframework at the national and local levels by a certified EIA institute, Zhong Ye Dong Fang Ltd. in Baotou(see Chapter II for additional information on the domestic EIA process);[3]and (iii) Project due diligencework (site visits, surveys, consultations) undertaken by ADB national and international technical assistance (TA) consultants, including district heating, environment, social and financial technical specialists.[4]

Climate - Data sources for local climate include the IMAR Atmospheric Sounding Technical Support Center and the China Metrological Administration.

Topography, Geology, Soil - Data sources include: (i) field surveys conducted by the domestic EIA consultants in 2012 and2013; and (ii) site visits conducted by ADB environmental consultants in February and April 2014.

Terrestrial Ecological Resources - Data sources include: (i) ecological field surveys conducted by the domestic EIA consultants in2012 to 2013; and (ii) site visits conducted by ADB environmental consultants in February and April 2014.

Air Quality Baseline - Data sources include: (i) publicly available ambient air monitoring data; (ii) site specific air quality monitoring for particulate matter less than 2.5 micrometer in diameter ($PM_{2.5}$), particulate matter less than ten micrometer in diameter (PM_{10}), total suspended particulates (TSP), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) undertaken in January 2014 by a certified organization on behalf of the EIA institute, Lv Se Jing Cheng (Beijing) Physical and Chemical Inspection Technology Ltd., and additional air quality monitoring undertaken in April 2014 by the EIA institute; and (iii) data collected by the domestic EIA consultants from available existing databases.

Background Noise - Data for background noise levels came from noise monitoring at heating zone boundaries and adjacent sensitive points, undertaken by a certified organization on behalf of the EIA institute, Lv Se Jing Cheng (Beijing) Physical and Chemical Inspection Technology Ltd., in January 2014.

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[2] The three FSRs are:
- Feasibility Study Report for Jinqiao peak shaving heat source plant heating supply area in district heating project by HCDIOlow-carbon heat supply project in Hohhot, Inner Mongolia, 2014. Prepared by the North China Municipal Engineering Design Research Institute.
- Feasibility Study Report for Haoqingying heat source plant heating supply area in district heating project by HCDIO, low-carbon heat supply project in Hohhot, Inner Mongolia, 2014.Prepared by the North China Municipal Engineering Design Research Institute.
- Feasibility Study Report for Xinjiaying heat source plant heating supply area in district heating project by HCDIO, low-carbon heat supply project in Hohhot, Inner Mongolia, 2014. Prepared by the North China Municipal Engineering Design Research Institute.

[3] The three EIAs are:
- EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, January 25 2014. Prepared by Zhong Ye Dong Fang Ltd.
- EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.
- EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Peak Adjustment Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

[4] Consultant services provided through ADB PPTA-8403 PRC: Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region.

Water Resources–Baseline underground water quality data came from annual groundwater monitoring data of Hohhot in 2010.

Socioeconomic Status - Socioeconomic surveys and data were collected by the domestic EIA consultants andthe social TA consultant.

Public Consultation and Information Disclosure - Project information was disclosed by HCDIO with assistance from the domestic EIA consultants in 2011 and 2012, when the Project design still incorporated coal-fired HSPs. Public consultations were undertaken by the EIA consultants through field based questionnaire surveys in October 2011. When the design was revised to natural gas-fired HSPs, project information was disclosed by HCDIO with the assistance from the domestic EIA consultants in February 2014 and March and April, 2014. A public information meeting was also held on 10 April, 2014.

Energy Efficiency and Emissions Reduction - Coal saving data was calculated based on the domestic FSR and EIAreports and information from ADB's district heating technical consultants.Analyses on air pollutant emission reductionswere undertakenthe PPTAenvironmental consultants.

D. Report Structure

8. This EIA report consists of an executive summary, nine chapters and appendixes. The report is structured as follows:

Executive Summary
Summarizes critical facts, significant findings, and recommended actions.

I Introduction
Introduces the proposed Project, report purpose, approach to EIA preparation andEIA structure.

II Policy, Legal, and Administrative Framework
Discusses PRC's and ADB's environmental assessment legal and institutional frameworks, status of approval of the domestic EIA reports, and applicable environmental guidelines and standards.

III Description of the Project
Describes the Project rationale, scope, components, location, key features, implementation arrangements, budget and time schedule.

IV Description of the Environment
Describes relevant physical, biological, and socioeconomic conditions within the Project area, and presents results of baseline environmental monitoring.

V Anticipated Environmental Impacts and Mitigation Measures
Describes impacts predicted to occur as a result of the Project, and identifies the mitigation measures which will be implemented. .

VI Analysis of Alternatives
Presents an analysis of Project alternatives undertaken to determine the best way of achieving the Project objectives while minimizing environmental and social impacts.

VII Information Disclosure, Consultation, and Participation
Describes the process undertaken for engaging stakeholders and carrying out EIA disclosure and public consultation.

VIII Grievance Redress Mechanism
Describes the Project grievance redress mechanism (GRM) for resolving complaints.

IX Conclusion and Recommendation
Presents conclusions drawn from the assessment and recommendations.

Appendixes
Appendix I presents the environmental management plan (EMP), including required construction and operation phase environmental mitigation measures, an environmental monitoring plan (EMoP), reporting requirements, and capacity building. Other appendices present supporting documentation and approvals, data on small coal-fired boilers to be decommissioned, and coal and emission reduction factors, assumptions and calculations.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

9. This EIA and the domestic EIAs upon which it is based have been prepared in accordance with PRC's national and local environmental legal and institutional framework and environmental assessment requirements. This EIA has also been prepared in accordance with applicable ADB policies, regulations, requirements, and procedures.

A. PRC Environmental Legal Framework

10. The environmental protection and management system in the PRC consists of a well-defined hierarchyof regulatory, administrative and technical institutions. At the top level the People'sCongress of the PRC has the authority to pass and revise national environmental laws; the Ministry of Environmental Protection(MEP) under the State Council promulgates national environmental regulations; and the MEP either separately or jointly with the Administration of Quality Supervision, Inspection and Quarantine issues national environmental standards. The provincial and local governments can also issueprovincial and local environmental regulations and guidelines in accordance with the nationalones. In addition, national and local five-yearenvironmental protection plans form an important part of the legal framework.

11. Key PRC environmentallaws are listed in**Table1**. The implementation of environmental laws is supported by a series of associated management and technical guidelines issued by the MEP summarized in **Table 2**.

Table1: Applicable PRC environmental laws.

No.	Title of the Law	Year Issued/Updated
1	Environmental Protection Law	1989
2	National Environmental Impact Assessment Law	2003
3	Water Law	2002
4	Water Pollution Prevention and Control Law	2008
5	Air Pollution Prevention and Control Law	2000
6	Noise Pollution Control Law	1999
7	Solid Waste Pollution Prevention and Control Law	2005
8	Water and Soil Conservation Law	2011
9	Forest Law	1998
10	Wild Fauna Protection Law	2004
11	Energy Conservation Law	2008
12	Cleaner Production Promotion Law	2012
13	Urban and Rural Planning Law	2008
14	Land Administration Law	1999

Source: TA Consultants.

Table 2: Applicable PRC environmental management and assessment guidelines.

No.	Guideline	Code and/or Year Issued/Updated
1	Guideline for Technical Review of EIA on Construction Projects	HJ 616-2011
2	Management Guideline on EIA Categories of Construction Projects	2008
3	Further Enhance the Management of EIA and Preventing Environmental Risks	2012
4	Guideline on Jurisdictional Division of Review and Approval of EIAs for Construction Projects	2009
5	Guideline on EIA Categories of Construction Projects	2008
6	Interim Guideline on Public Consultation for EIA	2006
7	Technical Guidelines for EIA – General Program	HJ 2.1-2011
8	Technical Guideline for EIA – Atmospheric Environment	HJ 2.2-2008
9	Technical Guideline for EIA – Surface Water	HJ/T 2.3-1993
10	Technical Guideline for EIA – Acoustic Environment	HJ 2.4-2009
11	Technical Guideline for EIA – Groundwater Environment	HJ 610-2011
12	Technical Guideline for EIA – Ecological Impact	HJ 19-2011
13	Technical Guidelines for Environmental Risk Assessment for Construction Projects	HJ/T 169-2004

Source: TA Consultants.

12. In addition to environmental laws and regulations, there are occupational health and safety laws and regulations the IA must comply with, including the *PRC Safety Production Law (2002), State Administrative Regulations of Safety Production (2004),* and *PRC Prevention and Control of Occupational Diseases Law(2011).*

B. PRC Environmental Impact Assessment Framework

13. EIA procedures have been established in the PRC for over 20 years. Article 16 of the PRC *Law on Environmental Impact Assessment* (2003) stipulates that an EIA document is required for any capital construction project producing significant environmental impacts. Projects are classified into three categories[5]:

(i) **Category A:** Projects with significant adverse environmental impacts, for which a full EIA report is required;

(ii) **Category B:** Projects with adverse environmental impacts which are of a lesser degree and/or significance than those of Category A, for which a simplified tabular EIA report is required; and

(iii) **Category C:** Projects unlikely to have adverse environmental impacts, for which an EIA registration form is required.

14. A full EIA report and a simplified tabular EIA report for category A and B are similar to ADB's EIA and IEE reports, respectively. The registration form of an EIA is similar to an ADB Category C project (see section II.G for more information on ADB's EIA requirements).

[5] *National Environmental Impact Assessment Law*, published on Oct 28 2002 and implemented in Sep 1, 2003.

15. In 2008 the MEP issued "Management Guideline on EIA Categories of Construction Projects". The MEP guidelines provide detailed EIA requirements for 23 sectors and 198 subsectors based on the project's size, type (e.g., water resources development, agriculture, energy, waste management, etc.), and site environmental sensitivity (e.g., protected nature reserves and cultural heritage sites).

16. The MEP's "Guidelines on Jurisdictional Division of Review and Approval of EIAs for Construction Projects" (2009) defines which construction project EIAs require MEP review and approval, and which EIAs are delegated to the provincial EPBs.

C. Project Domestic EIA Report Approval Status and Conditions

17. The Project was initially conceived as a coal-based district heating system, which was categorized as A under the PRC law on EIA. Category A EIAs were prepared by Zhong Ye Dong Fang Ltd., a qualified and licensed EIA institute, and were approved by the Hohhot Environment Protection Bureau in June, 2012.

18. Due to concerns raised by the PRC Government and the ADB with respect to SO_2, NO_x and PM emissions, the Project was subsequently redesigned to switch fuel from coal to natural gas-fired boilers and to expand wind power capacity from 25 to 50 MW using two high voltage electrode boilers. Given the significantly reduced emission from natural gas and electrode boilers, the revised Project was classified as Category B under the PRC EIA law, and tabular EIAs were prepared by Zhong Ye Dong Fang Ltd.[6] On January 25th 2014 the tabular EIA for each heating zone were submitted to the Hohhot EPB, which had been delegated to undertake the EIA review and approval.The EPB's Construction Project EIA Technical Review Committee reviewed the report. Based on the evaluation's recommendation, the Hohhot EPB approved the EIAs on 28 March 2014 (Appendix II).

19. The Project will source electricity for the electrode boilers from the Datang (Hohhot) Renewable Power Company wind farm. An EIA was prepared for the wind farm and was approved by the IMAR EPB in 2011. In addition, the Jinqiao heat source plant (HSP) will be operated in coordination with the Jinqiao combined heat and power (CHP). An EIA was prepared for the Jinqiao CHP, and was approved by the former State Environmental Protection Agency on December 21, 2004. The CHP is equipped with low NO_Xcombustion technology, limestone wet scrubbing flue-gas desulfurization (FGD), bag-type dust collectors, and a continuousemissionsmonitoring system (CEMS).

D. Relevant International Agreements

20. The PRC has signed a number of international agreements regarding environmental and biological protection. Those which have potential application to the Project are listed in **Table 3.**

[6] The three EIAs are:

- EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, January 25 2014. Prepared by Zhong Ye Dong Fang Ltd.
- EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.
- EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Peak Adjustment Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 3: Applicable international agreements.

No.	Agreement	Year	Purpose
1	United Nations Framework Convention on Climate Change	1994	Stabilization of greenhouse gas concentrations in the atmosphere
2	Kyoto Protocol to the United Nations Framework Convention on Climate Change	2005	Further reduction of greenhouse gas emissions
3	Montreal Protocol on Substances That Deplete the Ozone Layer	1989	Protection of the ozone layer

Source: the ADB PPTA Consultants.

E. Other Relevant Guidelines

21. During the design, construction, and operation of a project the ADB requires the borrower to follow environmental standards consistent with good international practice (GIP), as reflected in internationally recognized standards such as the World Bank Group's *Environment, Health and Safety Guidelines* (hereafter referred to as the *EHS Guidelines*).[7] The *EHS Guidelines*contain discharge effluent, air emissions, and other numerical guidelines and performance indicators as well as prevention and control approaches that are normally acceptable to ADB and are generally considered to be achievable at reasonable costs by existing technology. When host country regulations differ from these levels and measures, the borrower/client is to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client is required to provide justification for any proposed alternatives.

22. The *EHS Guidelines* include *GeneralEHS Guidelines* (covering environment; occupational health and safety; and community health and safety) and *Industry Sector Guidelines*. Relevant guidelines referenced in this report include the *General EHS Guidelines*and the *EHS Guidelines for Thermal Power Plants.*

F. Applicable Standards

23. The environmental quality standard system that supports the implementation of the environmental protection laws and regulations in the PRC is classified into two categories by function:ambient environmental standards and pollutant emission/discharge standards. The main standards applicable to the Project are presented in**Table 4.**

1. Ambient Air Quality

24. Ambient air quality limits are intended to indicate safe exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's lifetime. Limits are given for one or more specific averaging periods, typically one-hour average, 24-hour average, and/or annual average. The PRC's *Ambient Air Quality Standards GB3095—2012*has two classes of limit values; Class 1 standards apply to special areas such as natural reserves and environmentally sensitive areas, and Class 2 standards apply to all other areas, including urban and industrial areas. The PRC standards for Class 2 areas are applicable for the Project.

7 *World Bank Group, Environmental, Health, and Safety Guidelines*, April 30, 2007, Washington, USA.http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

Table 4: Applicable PRC environmental standards.

No.	Standard	Code
1	Ambient Air Quality Standards	GB 3095-2012
2	Groundwater Quality Standard	GB/T 14848-93
3	Surface Water Quality Standards	GB 3838-2002
4	Environmental Quality Standards for Noise	GB 3096-2008
5	Noise Standards for Construction Site Boundary	GB 12523-2011
6	Noise Standards for Industrial Enterprises at Site Boundary	GB 12348-2008
7	Integrated Emission Standard of Air Pollutants	GB 16297-1996
8	Integrated Wastewater Discharge Standard	GB 8978-1996
9	Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers	GB 13271-2001
10	Limits and measurement methods for crankcase pollutants From heavy-duty vehicles equipped with P.I. engines	GB 11340-2005
11	Emission Limits and Measurement Methods for Exhaust Pollutants from Vehicle Compression-Ignition and Gas Fuelled Ignition Engines	GB 17691-2005
12	Limits and measurement methods for exhaust pollutants from vehicles equipped ignition engine under two-speed idle conditions and simple driving mode conditions	GB 18285 -2005
13	Limits and Measurement Methods for Emissions from Light Duty Vehicles	GB 18352-2005

Source: ADB PPTA Consultants.

25. The World Health Organization (WHO) Air Quality Guidelines are recognized as international standards and are adopted in the *EHS Guidelines*. In addition to guideline values, interim targets (IT) are given for each pollutant by the WHO as incremental targets in a progressive reduction of air pollution.The WHO guidelines and corresponding PRC standardsare presented in**Table 5**.

- For TSP, there are PRC standards but no correspondingWHO guidelines.
- For PM_{10} PRC Class 2 annual average and 24-houraverage standards meet WHO IT-1 guidelines (there are no 1-houraverage standards or guidelines for either PRC or WHO).
- For $PM_{2.5}$PRC Class 2 annual and 24-hour standards meet WHO IT-1 guidelines (there are no 1-hourstandards or guidelines for either PRC or WHO).
- For SO_2WHO only has a 24-hour average guideline (.125 mg/m^3), which is slightly lower than the PRC standard (.150 mg/m^3). However, SO_2 levels are low in the Project area, and the Project will only contribute extremely low levels of SO_2, so the very minor difference is inconsequential.
- For NO_2 the PRC standard is equivalent to the WHO annual average guidelines, there is no WHO 24-hour average guideline; and the 1-hour average PRC standard is equivalent to the WHO guideline.

26. Overall the PRC standards show a high degree ofequivalency to the WHO guidelines or IT-1 values, and are adopted for use in the EIA report.

Table 5:PRC ambient air quality standards (*GB3095—2012)* and WHO ambient air quality guidelines, mg/m^3.

Standard	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2
WHO Ambient Air Quality Guidelines					
Annual mean		.020	.010	--	.040
Annual mean IT-1		.070	.035	--	--
24-hr mean		.050	.025	.020	--
24-hr mean IT-1		.150	.075	.125	--
1-hr mean		--	--	--	.200
1-hr mean IT-1		--	--	--	--
PRC Ambient Air Quality Standard					
Annual mean (class 2)	.200	.070	.035	.060	.040
24-hr mean (class 2)	.300	.150	.075	.150	.080
1-hr mean (class 2)	--	--	--	.500	.200

Source: WHO Air Quality Guidelines (2006) in IFC *EHS Guidelines* (2007), and PRC GB3095-2012.

2. Groundwater

27. The *EHS Guidelines* do not provide ambient ground water standards but state that wastewater discharges should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality. Therefore the PRC groundwater water quality standards are utilized in this report.The main useof groundwater water at the monitoring wells is domestic drinking water, and therefore the applicable standard is Class III of *GB/T14848-93 Quality Standard for Ground Water* (**Table 6**).

3. Noise

28. **Table7** presents the relevant PRC Urban Noise Standards compared with relevant international guidelines from the WHO (as presented in the *EHS Guidelines*). The classes within the standards are not directly comparable as their classifications to divide residential, commercial, and industrial zones are different, but PRC Class II standards exceed WHO Class II standards and are within 5 dB(A) of WHO Class I standards. PRC noise standards are utilized in this report as the project areas are mixed residential, commercial, and industrial areas.

4. Boiler Plant Emissions

29. **Table 8** presents the relevant PRC *Emission Standard of Air Pollutants for Coal-burning, Oil-burning, Gas-fired Boilers* compared with relevant international standards (*EHS Guidelines*) for gas-fired boilers. The NOx emission standard of 400 $mg/Nm^3$is the applicable PRC standard. However, HCDIO has voluntarily agreed to reduce emissions to less than 100 mg/Nm^3, which exceeds both the PRC sensitive area standard (200 mg/Nm^3) and the EHS Guideline (240 mg/Nm^3).

Table 6: Applicable groundwater standard (Class III, *GB/T14848-93 Quality Standard for Ground Water*).

No	Item	Unit	Limit
1	pH	-	6.5-8.5
2	Sulfate	mg/L	≤250
3	Volatile Phenols	mg/L	≤0.002
4	Total hardness ($CaCO_3$)	mg/L	≤450
5	Ammonia nitrogen	mg/L	≤0.2
6	Molybdenum	mg/L	≤0.1
7	Cyanide	mg/L	≤0.05
8	Chloride	mg/L	≤250
9	Cadmium	mg/L	≤0.01
10	Cr VI	mg/L	≤0.05
11	Arsenic	mg/L	≤0.05
12	Zinc	mg/L	≤1.0
13	Fluoride	mg/L	≤1.0
14	Lead	mg/L	0.05
15	Permanganate index	mg/L	3.0
16	Iron	mg/L	0.3
17	Manganese	mg/L	≤0.1
18	Copper	mg/L	≤1.0
19	selenium	mg/L	≤0.01
20	Total coliforms	/L	≤3.0

Source: EIA Table Report: Low-Carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table7: PRC *Environmental Quality Standards for Noise* (GB3096-2008) and relevant international guidelines.

<table>
<tr><th colspan="3">PRC Standards
Leq dB(A)</th><th colspan="2">International Standards
One Hour Leq dB(A)</th><th rowspan="2">Comparison</th></tr>
<tr><th>Class</th><th>Day
06-22h</th><th>Night
22-06h</th><th>Day
07-22h</th><th>Night
22-07h</th></tr>
<tr><td>0: special health zone</td><td>50</td><td>40</td><td rowspan="3">WHO Class I: residential, institutional, educational: 55</td><td rowspan="3">WHO Class I: Residential, institutional, educational: 45</td><td rowspan="5">Classes are not directly comparable, but PRC Class II standards exceed WHO Class II standards. PRC standards are utilized in this report.</td></tr>
<tr><td>I: mixed residential; and education areas</td><td>55</td><td>45</td></tr>
<tr><td>II: mixed residence, commercial and industrial areas</td><td>60</td><td>50</td></tr>
<tr><td>III: industrial areas</td><td>65</td><td>55</td><td rowspan="2">WHO Class II: industrial, commercial: 70</td><td rowspan="2">WHO Class II: Industrial, Commercial: 70</td></tr>
<tr><td>IV: a
B</td><td>70
70</td><td>55
60</td></tr>
</table>

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

Table 8: Relevant PRC *Emission Standards of Air Pollutants for Coal-burning, Oil-burning, Gas-fired Boilers* (GB 13217-2001) and relevant international guidelines.

Parameter	PRC Standard for Gas Burning Boilers for Heating(operational after 1 January 2001)	EHS Guidelines for Boilers	Comparison
Stack Height	Stack height is determined according to the requirements in the approved EIA, and must be >8m.	Design stack height according to Good International Practice (GIP) to avoid excessive ground level concentrations and minimize impacts.	PRC standard meets GIP
Smoke and Dust	50 mg/Nm^3	NA	No EHS guideline.
SO_2	100 mg/Nm^3	NA	No EHS guideline.
NO_x	400 mg/Nm^3 (200 mg/Nm^3 in sensitive areas)	240 mg/Nm^3	PRC standard for sensitive areas is more stringent than the EHS guidelines .

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

5. Industrial Noise Emissions

30. **Table 9**presentsthe relevant PRC and international standards (US EPA, there no such WHO or EHS Guideline standards) for on-site construction noise. The PRC standards are more stringent than international guidelines, andare utilized in this report.

Table 9: PRC *Noise Standard for Construction Site Boundary* (GB12523-2011) and relevant international guidelines.

Day Leq dB(A)	Night Leq dB(A)	International Standards Leq dB(A)	Comparison
70	55	US EPA: 85 (day, 8 hour exposure)	PRC standards meet or exceed international standards

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

31. **Table 10**presents the relevant PRC and international standards for noise at the boundary of an industrial facility during operation.The classes within the standards are not directly comparable, but PRC Class II standards exceed WHO Class II standards and are within 5 dB(A) of WHO Class I standards. Taking into consideration the mixed residential, commercial and industrial characteristics of three heating zones, the PRC noise standards are utilized in this report.

Table 10:*PRC Noise Standards for Industrial Enterprises at Site Boundary*(GB12348-2008) and relevant international guidelines.

PRC Standards	International Standards	Comparison

Class	Leq dB(A) Day 06-22h	Night 22-06h	Leq dB(A) Day 07-22h	Night 22-07h	
0: recuperation areas	50	40	WHO Class I: residential, institutional, educational: 55	WHO Class I: Residential, institutional, educational: 45	Classes are not directly comparable, but PRC Class II standards exceed WHO Class II standards and are very close (within 5 dB (A) to WHO Class I standards). PRC standards are utilized in this report
I: mixed residential; and education areas	55	45			
II: mixed with residence, commercial and industrial areas	60	50			
III: industrial areas	65	55	WHO Class II: industrial, commercial: 70	WHO Class II: Industrial, commercial: 70	
IV: areas within 10 m on both sides of traffic roadways	70	55			

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

6. Wastewater Emissions

32. **Table 11** presents the relevant PRC wastewater emission standards. The *EHS Guidelines* indicate that wastewater discharged to public or private wastewater treatment systems should: meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges; not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact characteristics of residuals from wastewater treatment operations; and be discharged into municipal or centralized wastewater treatment systems that have adequate capacity to meet local regulatory requirements for treatment of wastewater generated from the project. The Projects wastewater discharges will be required to meet Class III *Integrated wastewater discharge standard* (GB8978-1996).[8]

Table 11: PRC *Integrated wastewater discharge standard*(Class III, GB8978-1996).

No	Pollutant	Maximum acceptable concentration mg/L (except pH)
1	pH	6-9
2	SS	400
3	BOD_5	300
4	COD	500
5	Ammonia nitrogen	—

Source: Unofficial translation of Chinese original by the ADB PPTA consultant.

G. Applicable ADB Policies, Regulations and Requirements

33. The major applicable ADB policies, regulations, requirements and procedures for EIA are the *Environmental Safeguards – A Good Practice Sourcebook* (2012), and the

8 Wastewater discharged into city and town sewage systems which have a secondary wastewater treatment plant must meet Class 3 standards. Wastewater discharged into city and town sewage systems which do not have a secondary wastewater treatment plant, will be subject to provisions according to the functional requirements of the water area which receives effluent from the sewage system.

Safeguard Policy Statement (SPS 2009), which provides the basis for this EIA. The SPS promotes good international practice as reflected in internationally recognized standards such as the World Bank Group's *EHS Guidelines*. The policy is underpinned by the ADB Operations Manual for the SPS (OM Section F1, 2010).

34. All projects funded by ADB must comply with the SPS, which establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in line with applicable regulatory requirements, and are not likely to cause significant environment, health, social, or safety hazards.

35. At an early stage in the project cycle, typically the project identification stage, ADB screens and categorizes proposed projects based on the significance of potential project impacts and risks. A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Project screening and categorization are undertaken to:

i) reflect the significance of the project's potential environmental impacts;

ii) identify the type and level of environmental assessment and institutional resources required for the safeguard measures proportionate to the nature, scale, magnitude and sensitivity of the proposed project's potential impacts; and,

iii) determine consultation and disclosure requirements.

36. ADB assigns a proposed project to one of the following categories:

i) **Category A.** Proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.

ii) **Category B**. Proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.

iii) **Category C**. Proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.

iv) **Category FI**. Proposed project involves the investment of ADB funds to, or through, a financial intermediary.

37. The Project has been classified by ADB as environment category A, requiring the preparation of an EIA (this report).

38. The SPS 2009 requires a number of additional considerations, including: (i) project risk and respective mitigation measures and project assurances; (ii) project-level grievance redress mechanism; (iii) definition of the project area of influence; (iv) physical cultural resources damage prevention analysis; (v) climate change mitigation and adaptation; (vi) occupational and community health and safety requirements (including emergency

preparedness and response); (vii) economic displacement that is not part of land acquisition; (viii) biodiversity conservation and natural resources management requirements; (ix) provision of sufficient justification if local standards are used; (x) assurance of adequate consultation and participation; and (xi) assurance that the EMP includes an implementation schedule and measurable performance indicators. These requirements, which may not be covered in the domestic EIAs, have been considered, and all applicable environmental requirements in the SPS 2009 are covered in thisEIA.

III. PROJECT DESCRIPTION

A. The Project

39. The Low-Carbon District Heating Project in Hohhot in IMAR will upgrade and expand district heating in three heating zones: Haoqingying, Xinjiaying and Jinqiao covering 29.72 million m^2 of public and residential building space. The original scope of the project is to provide 1560 MW from natural gas boilers and 50 MW from wind-based electric boilers to be all installed in urban areas of Hohhot City. Due to the policy change in natural gas purchasing price for a district heating company, which became 60% higher than the previous gas purchasing price for the project, the project faced the challenge to maintain financial viability of the project. After thorough assessment of available heat resources in Hohhot, the project went through scope change in heat sources, while still meeting the original project impact, outcomes, and outputs.

40. The project after the scope change will have 1,422 MW heating capacity in total. It will install 7 pieces of new 70MW gas boilers with optimization; and bring surplus heat from existing natural gas boilers located in different heating zones through pipeline integration. In addition, the project will apply (i) two pieces of 25MW wind-powered electric boilers; (ii) use 50MW heat from the existing municipal solid waste (MSW) that will upgrade it from power only to combined heat and power (CHP) plant; and (iii) surplus 444MW heat from existing Jingneng coal based combined cooling, heating, and power (CCHP) plant, which is located 26km south from Hohhot City. In sum, a total of 878 MW heat will come from natural gas (61%); 50 MW from wind (4%); 50 MW from MSW (4%); and 444MW (31%) from CCHP. The project will also close down five small and inefficient 29 MW coal-fired boilers located in urban area.

41. The project component under new scope will improve:

- (i) flexibility and energy efficiency of heating network systems by connecting and integrating with other existing heating networks, which allows full utilization of any surplus heat within wider heating network systems;
- (ii) boiler efficiency of all new natural gas boilers through the use of pre-heaters and economizers; and
- (iii) urban air quality by (i) closing down small, old, inefficient coal-fired boilers in urban areas, (ii) installing long transmission lines to get surplus heat outside of Hohhot urban area; and (iii) adding non-fossil heat source like MSW;

42. As a result, the project with revised component will reduce carbon dioxide (CO_2) emissions of 1.7 million ton/year. Comparing it to the original project scope and its associated CO_2 reduction potential of 1.3 million ton/year, the change will lead to additional 29% reduction.

B. Project Rational

43. The building area of Hohhot has increased rapidly in recent years, from 38.29 million m^2 in 2004 to 91.31 million m^2 in 2012, an annual growth rate of 11.48%. As of 2012, the total builturban area in Hohhot City was 91.31 million m^2 and the total heating area was 86.81 million m^2, of which 81.24 million m^2 was centrally heated (89%). According to the Hohhot Urban Heating Plan (2005 to 2020), by 2015 the total urban heating area will increase to 151.3 million m^2, and by 2020 it will reach 243.1 million m^2. With urban

expansion heat demand increases dramatically, leading to an urgent need to construct additional heating infrastructure.

44. Current heat sources in Hohhot include a combination of coal-fired CHPs, HSPs, small neighborhood boiler houses, and household stoves.There are currently three large CHPs providing heat to four district heating systems, including the Jinqiao CHP owned by Huaneng Group in the Jinqiao heating zone (the other CHPs are jointly owned by the Futai and Kelin Heating Company, and the Shengtai Heating Company). These three CHPs provide heat to 20.7 million m^2, approximately 23.8% of the total Hohhot heating area (**Table 12** and **Figure 3**). These CHPs produce hotwater and sell it to heating companies; the heating companies are responsible for operating and managing the heating systems and providing heat to the end-users. The Hohhot Urban Heating Plan indicates that two additional CHPs shouldbe constructed by 2020, though work has not yet begun on either.

Table 12: Existing CHPs plants in Hohhot.

Name	Heating Company	Heating Area Covered by CHP Million m^2	Power Generation Capacity MW
Huhot CHP	Kelin Heating Company	6.60	4X350
	Futai Heating Company	4.60	2X200
Jinshan CHP	Shengtai Heating Company	2.95	2X300
Jinqiao CHP	CHP is owned by the Huaneng Group, but HCDIOis the heating company	6.55	2X300
Total		20.70	3000

Source: HCDIO, 2014.

There are currently 5 large HSPs in Hohhot heating a total of 29.49 million m^2, 30% of the total heating area. Their total heating capacity is 2,937 MW, which is only 22% of the target planned in the Hohhot Urban Heating Plan (

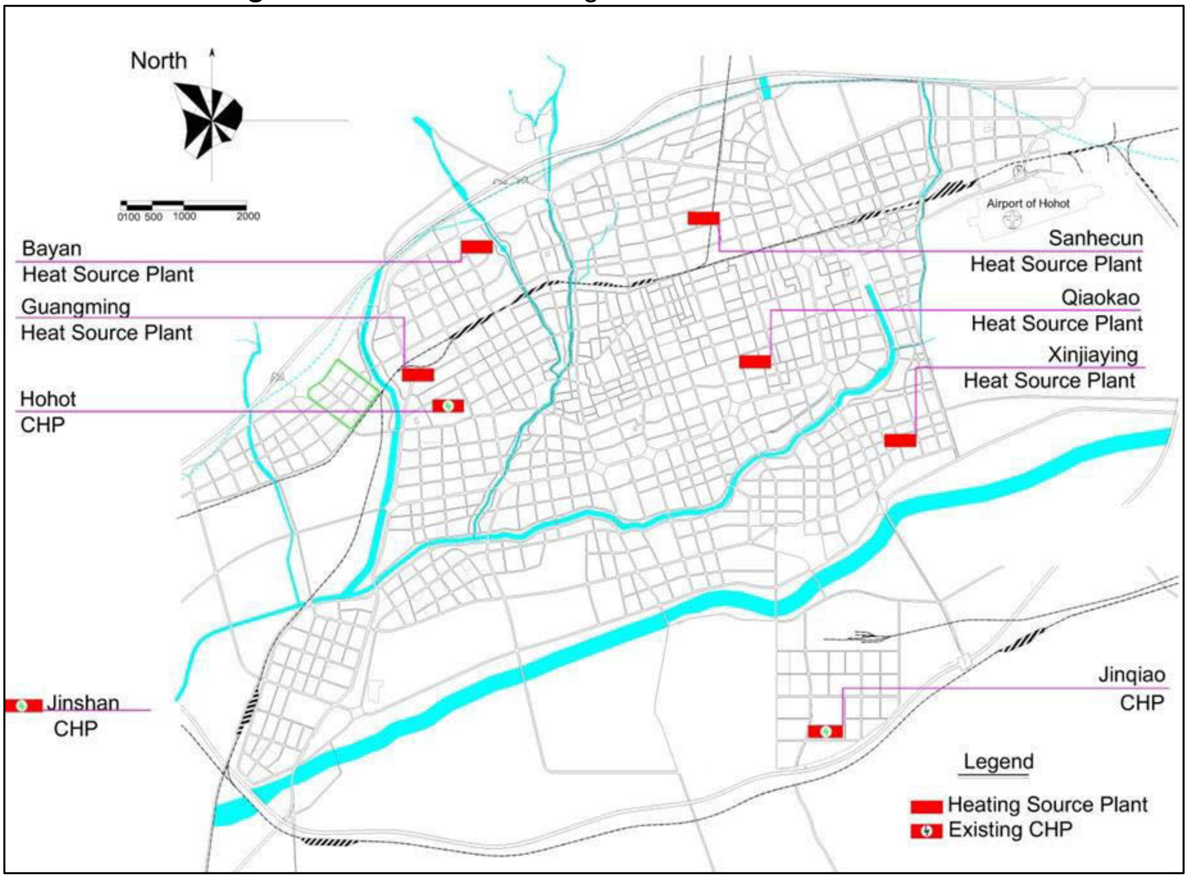
45. **Table 13** and **Figure 3**). Under the Hohhot Urban Heating Plan, an additional 5 HSPs are required to meet the expected demand.

Table 13: Existing Large HSPs in Hohhot.

Name	Owned by	No. Boilers	Heating Capacity MW	Heating Area million m^2
Xinjiaying HSP	HCDIO	8	(5*70)+(3*84) = 602	7.5
Qiaokao HSP	HCDIO	16	(10*58)+(3*70) +(3*70)gas = 1000	11
Sanhecun HSP	HCDIO	14	(5*29)+(6*70)+ (3*70)gas =775	7.8
Guangming HSP	Futai Heating Company	4	(4*70) = 280	2.30
Bayan HSP	Futai Heating Company	4	(4*70) = 280	1.30
Total		46	2,937	29.9

Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2015.

Figure 3: Location of Existing CHPs and HSPs in Hohhot.



Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2014.

46. Currently, there are many small neighborhood coal-fired boiler houses, heating 25.82 million m2, which is 29.7% of the total heating area in Hohhot. These boiler houses are dispersed throughout existing urban areas. To mitigate air pollution caused by these small inefficient boilers, the Hohhot government promotes replacing these boilers with natural gas boilers in cental urban areas. In 2013, 64 small coal-fired boilers were replaced by natural gas boilers, which cover 4.6 million m2 of heating area. In 2014, it is planned to replace 136 small boilers with natural gas boilers, which accounts for 10.7 million m2 coverage.

47. Areas that are not covered by ether district heating or neighborhood boiler houses are still relying on coal-fired house stoves to sustain heating, which cause serious indoor and outdoor air pollution in winter.

48. To meet the anticipated heating demand from an urban heating area of 243.1 million m^2, the Hohhot Urban Heating Plan calls for the development of 2 CHPs and 5 HSPs by 2020.The Hohhot Urban Heating Plan was based on the 2010-2020 Hohhot Urban Development Plan, which was approved in 2011. Based on the 2010-2020 Hohhot Urban Development Plan, the Hohhot municipal government requested to the HCDIO to provide district heating services in three heating zones in Hohhot'seasterngrowth area by providing clean-burning natural gas fired heating to a total area of 29.72 million m^2.

C. Project Scope

49. The original project scope included: (i) 21 boilers with a heating capacity of 1,610 MW, comprising 19 low NOx natural gas-fired boilers and two 25 MW wind powered 10 kV electrode boilers; (ii) 73.76 km of primary heating network; (iii) 180 Heat Exchange Stations (HESs), 11 of which will be building-level HESs; (iv) and SCADA systems installed in all three heating zones located in urban area of Hohhot City.

50. During the assessment and evaluation of new project component for scope change, the project recognized the improvement of building insulation, which was resulted from the PRC building code space heating. Thus, instead of total heat supply capacity has changed from 1610 MW to 1422 MW, which can serve the same heating coverage of 29.72 million m^2.

51. The new project scope will include (i) 9 boilers with a heating capacity of 540 MW, comprising 7 low NOx natural gas-fired boilers and two 25 MW wind powered 10 kV electrode boilers; (ii) 116.63 km of primary heating network; (iii) 192 Heat Exchange Stations (HESs), 11 of which will be building-level HESs; (iv) and SCADA systems installed in all three heating zones. As for the closure of 50 inefficient and polluting small coal-fired boilers in the Jinqiao heating zone, the Hohhot municipal government's Public Utilities Bureau will decommission according to the applicable environmental laws and regulations, as the original plan. Decommissioning five 29MW coal boilers at Sanhecun HSP will be a part of the new project scope. As the Sanhecun HSP belongs to the project IA, the project IA will perform boiler decommission according to the applicable environmental laws and regulations .

52. **Table 14** provides a summary of the revised project scope and its key indicators.

Table 14: Summary of revised project scope and key indicators.

No.	Item	Unit	Jinqiao			Xinjiaying			Haoqinying			Total
			NG	MSW CHP	Coal CHP	NG	Outsourcing (NG)	Coal CHP	NG	Outsourcing (NG)	Wind power	
1.1	Total Heating Areas of the Project	Million m²		9.53			8.83			11.36		29.71
1.1	Total Heating Areas of the Project	Million m²	3.04	1.09	5.40	--	4.57	4.26	4.52	6.84	--	29.71
1.2	Existing District Heating Areas	Million m²		2.8			0			0		17.3
2.1	Maximal Total Heat Load	MW		438			406			528		1372
3.1	Total Heating Capacity	MW		438			406			528		1422
3.2	Available Heating Capacity of Existing Source	MW					210			318		528
3.3	Heat Source Capacity	MW	140	50	248			196	210		50	894
3.4	Boiler Quantity	Piece	2						3		2	7
3.5	Boiler Capacity	MW	70						70		25	
3.6	Length of Primary Heating Network	km		21.06			26.02			32.29		79.37
3.7	HES (district level HES)			47			48			86		192
	(building level HES)									11		
4	Heat Energy Consumption	GJ/a	250,262	786,240	3,549,672		1,249,826	2,996,698	3,247,651	1,882,451	393,120	14,355,920
5.1	Annual Fuel Consumption	m3/a	7,822,391	-			39,065,513		101,511,032	58,839,324		207,238,260
5.2	Heat value of NG/coal	MJ/Nm3	32.65		20.07		32.65	20.07	32.65	32.65		
5.3	Efficiency of Heat Source	%	98		95		98	95	98	98		

Source: Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

D. Project Location

53. The Project is located in eastern Hohhot city. Hohhot is prefecture level city, which consists of four urban districts (Huimin; Xincheng; Yuquan; and Saihan districts), and five rural counties (Toghoh county; Wuchuan county; Horinger county; Qingshuihe county; and Tumed Left banner.) Total area of Hohhot is 17,224 km^2, containing 2,054 km^2 (11.9%) of urban and 15,170 km^2 (88.1%) of rural areas.

54. The Project consists of three mixed residential, commercial and industrial heating zones located inXincheng and Saihan urban districts of Hohhot city:

- The Haoqingying heating zone is located in Xincheng District in northeastern Hohhot.

- The Xinjiaying heating zone is located in Saihan District in central eastern Hohhot. The Xinjiaying HSP will be adjacent to the site of an existing HSP owned by HCDIO.

- The Jinqiao heating zone is located in Saihan District in southeastern Hohhot. The Jinqiao HSP will be located 5.5 km north of the existing Jinqiao CHP.

E. Key Project Features

1. Energy Efficiency and Environmental Improvement

55. The Project will build 7 large and efficient (98% efficiency) low-NO_x gas-fired boilers, optimizing existing 6 large low-NO_x gas-fired boilers efficiency to 98%,and two high voltagehigh efficiency (99.9%) zero emission electrode boilers using curtailed renewable wind power. Once the Project is operational, 50 small existing coal-fired boilers located in 29 existing small decentralized boiler houses will be closed (**Figure 4**) and 5 existing large coal fired CFB boilers in Sanhecun HSP will be closed. These small coal-fired boilers have a total of 303 MW heating capacity and currently service 6.71million m^2 of existing heating area. Theboilers have low thermal efficiency in the range of 55% to 65%, and lack adequate pollution control devices. Detailed information on boiler houses to be closed is presented in Appendix III.

56. Overall, the Project is expected to improve the energy efficiency of the heating sector by approximately 33%. When compared to the equivalent production of heat through traditional coal-fired sources, once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers and 5 large CFB boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,457 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2, a greenhouse gas; and (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons.

Figure 4: Existing low efficiency coal-fired boiler in Jinqiao heating zone. The boiler will be decommissionedand dismantled once the Project becomes operational.

Source: ADB PPTA consultant, 2014.

2. Low NOx Natural Gas Fired Boilers

57. The Project will construct the Jinqiao HSP with two 70 MW low NOx gas-fired boilers and the Haoqingying HSP with three 70 MW low NOx gas-fired boilers, upgrade the Sanhecun HSP with two 70 MW low NOx gas-fired boilers replacing five 29MW CFB boilers. Compared to traditional coal-fired heat sources, natural gas-based heat is cleaner burning with less emissions and higher efficiency (98%), and for these reasons natural gas is the boiler fuel source recommended in the IFC *EHS Guidelines*.

58. The PRC EIAs use a boiler NOx emission of 137.31mg/m^3, based on a 2007 survey of industrial natural gas boilers in PRC. It's important to note that this emission level is in compliance with both the PRC natural gas boiler emission standard of 400 mg/m^3 and 200 mg/m^3 in sensitive areas (*PRC Emission Standards of Air Pollutants for Coal-burning, Oil-burning, Gas-fired Boilers* (GB 13217-2001)), and the 2007 *EHS Guidelines* of 240 mg/m^3 for boilers.However, to in order to maximize environmental benefits, the Projecthas committed to using low NOx natural gas boilers producing less than 100 mg/m^3 NOx emissions.

59. To meet the lass than 100 mg/m^3 commitment, low-NO_Xcombustion technologies will be used. Each boiler will be designed to optimize flame shape. Staged combustion technology will be used, resulting in a cooler flame which suppresses thermal NO_Xformation. The swirl-stabilized primary area will beresponsible for producing a very stable flame. Combustion chambers will be designed to match the low-NO_X burners. In addition, smart fuel-air compound control will generate the optimum conditions for the combustion air through a joint fan with a frequency converter. The combination of low-NO_X combustion, large combustion chambers, smart control systems and efficient combustion technology will benefit the environment as well as the operator, and will ensure that NO_Xemissions are less than 100 mg/m^3. The flue gas will be used to heat incoming fresh air and cool return water

through heat exchangers, and will then vent via 30 m tall chimneys.

60. The HSPs will produce120°C supply water and the return water temperature will be 60°C. Make-up water for the boilers and associated equipment will be filtered, pre-treated, softened and the oxygen content will be reduced. In case of leakage and loss of circulating water, additional water will be added to the systems by variable speed pumps, ensuringa stable operation pressure for the district heating system and make up water.

61. The use of natural gas-fired boilers in the Project will contribute to energy efficiency improvement and emissions reduction in Hohhot. In addition, gas-fired boilers do not require large coal storage sheds or ash storage silos, and do not need water and electricity for coal, fly and bottom ash and slag treatment. Thus, the use of gas-fired HSPs instead of coal-fired HSPs will require less land and will consume less water and electricity. Furthermore, the transmission of natural gas by pipeline will eliminate the negative impacts of coal transportation through urban areas by truck or train.

3. Natural Gas Source, Regulation and Safety

62. Natural gas will be sourced from the Changqing natural gas reserve, located within the Ordos Basin in IMAR.Three major gas fields, the Wushen, Daniudi and Sulige, are operating with proven gas reserves totaling 717.7 billion m^3. The methane content of the natural gas is 96.08%. Its low heat value is 32.646 MJ/Nm^3, and its high heat value is 36.229 MJ/Nm^3. Detailed fuel quality analysis data is presented in **Table 15**.

Table 15: Natural gas fuelcharacteristics.

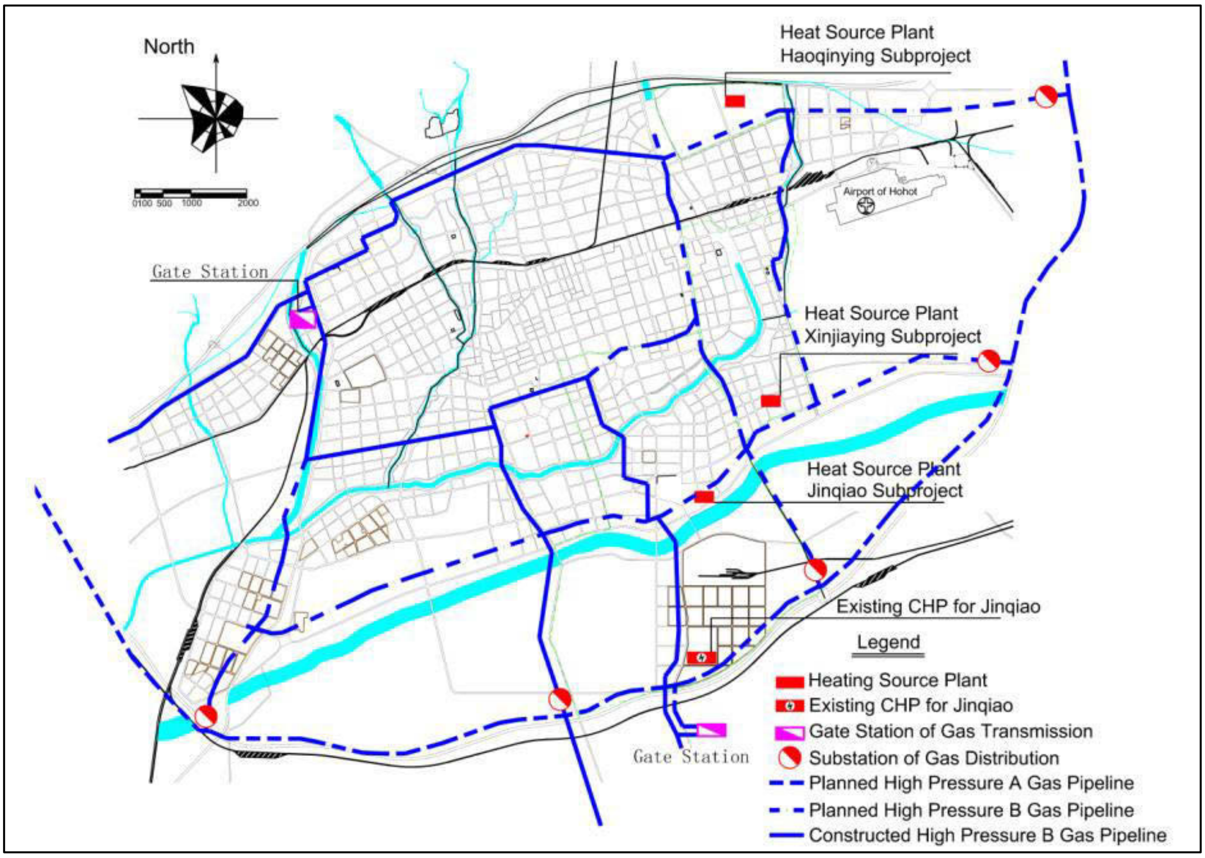
Component	**CH_4**	**C_2H_6**	**C_3H_8**	**iC_4H_{10}**	**nC_4H_{10}**	**iC_5H_{12}**
mol%	96.08	0.614	0.077	0.009	0.008	0.004
Component	**nC_5H_{12}**	**C^+_6**	**CO_2**	**He**	**N_2**	**H_2S**
mol%	0.002	0.125	2.89	0.023	0.162	0.35

Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2014.

63. The West Natural Gas Co. Ltd. is responsible for gas distribution in IMAR, and the China Gas Company ofHohhot is responsible for gas distribution in the urban areas of Hohhot. The China Gas Company has confirmed that there is sufficient capacity to meet the demands of the project and other users. Appendix IV presents the company's letter of commitment to provide gas for the Project's needs.

64. The natural gas will be transported by a 1.6 MPa natural gas network embedded under the east second ring road to gas regulation stations, utilizing DN400 transmission lines (**Figure 5**). Inside the pressure regulation stations the natural gas will be filtered, metered, and its pressure reduced to 0.3 to 0.4 MPa through three parallel filter, meter and regulation assemblies (**Figure 6**).

Figure 5: Existing natural gas network in Hohhot

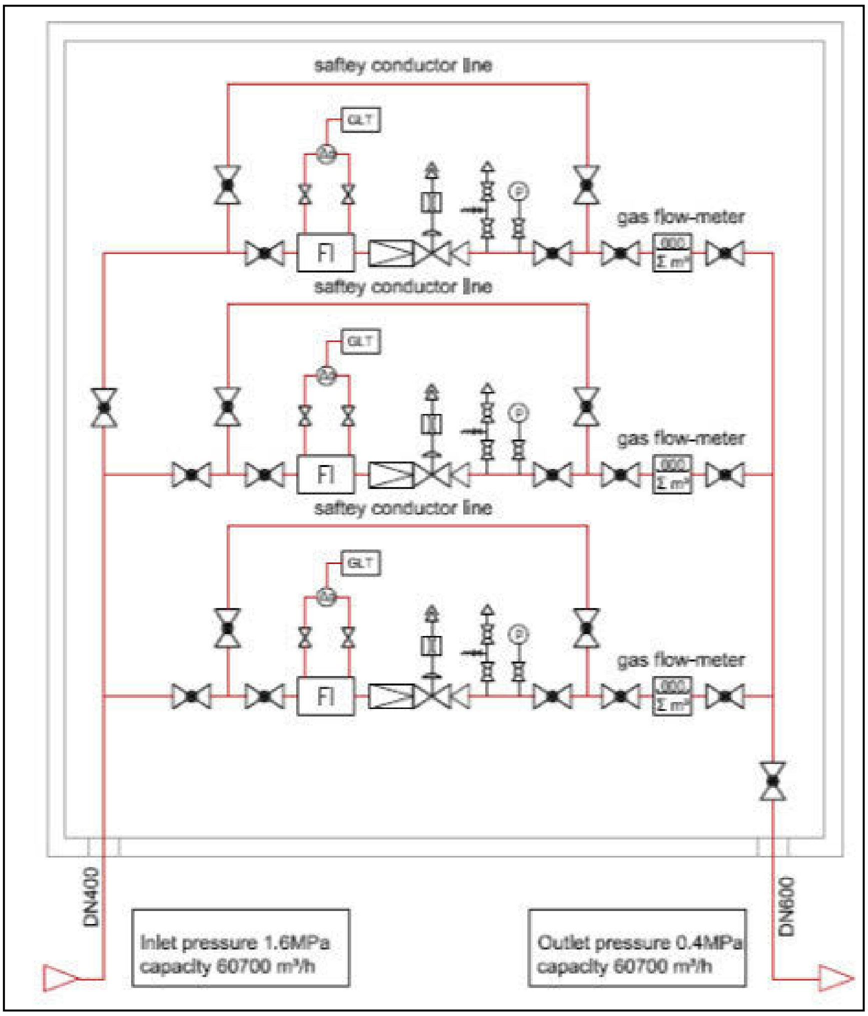


Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2014.

65. Gas regulation stations and boilerspose a fire and explosion hazard due to the potential for gas leaks. All gas works will be in compliance with relevant PRC building code requirements, including *Code for Design of City Gas Engineering* (GB 50028-2006) and *Regulation on Electric Apparatus Design for Explosion and Fire Risk Environment* (GB50058-92). Independent gas regulation station will be constructed 12 meters away from the main HSP buildingsand 30 m from the site boundary, to minimize the risk of explosion damaging other Project facilities or the public. The China Gas Company of Hohhot will construct and operate the gas regulation stations.

66. The gas regulation stations will be specially designed to withstand and contain explosions, and the stations and the connection to the boilers will be equipped with flammable gas detection and alarm systems. In case of a gas leak, automatic shutdown valves will shut down the gas supply, the system will generate audible and visual alarms, and the emergency ventilation system will exhaust gas from the stations so as to protect the building and operators. Normal air change for the stations will be six times per hour, but in emergencies the ventilation system will change the air 12 times per hour.

Figure 6: Schematic of natural gas pressure regulating station.



Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2014.

67. The gas pipelinesfeeding into the pressure regulation stations will be embedded underground, and will be coated with three layers of PE corrosion protection sleeves.The gas lines exiting the gas pressure regulation stations will be suspended overhead, and will be treated with anti-corrosion paint.Pipelines will be grounded and equipped with anti-lightning devices where applicable.

68. All other at risk areas will have flammable gas detection and alarm systems able generate audible and visual alarms, and automatic fire suppression systems. All gas related devices will be brightly colored and equipped with warning signs.

69. During detailed design construction and operation phase emergency risk and response plansfor each heating zone will be established in accordance with the "*National Environmental Emergency Plan*" (24 January 2006) and other relevant PRC laws, regulations and standardsand will include measures in the World Bank EHS guidelines with respect to occupational and community health and safety. Construction and operation phase Environment, Health and Safety (EHS) plans will also be developed by occupational and gas boilers specialists to ensure worker and community safety.

4. Economizer and Air Preheating System for Maximizing Energy Effieicney of Gas Boilers

70. To maximize energy efficiency of gas-boiler, economizer and air preheating system will be used. To make the use of the enthalpy in flue gas that are hot but not hot enough to be used in a boiler, an economizer will be recover energy by using the exhaust gases from the boiler to preheat the cold water that would be supplied to boilers. Air-preheating system will be installed after economizer, which will recover heat from flue gas from economizer for increasing temperature of combustion air.

71. Due to lower return water of heating system, which generate possibility to utilize latent heat of flue gas. Therefore, both economizer and air pre-heating system will be made of stainless steel or aluminium alloy to be condensing economizer and air pre-heater, so that they can recover the residual heat, including sensible heat and latent heat, from the flue gas as much as possible, without suffering condensing corrosion.

72. Efficiency of gas boiler was designed at 93%. With use of economizer and air pre-heating system, energy efficiency of gas-boiler will be ensured to be 98%, which will benefit energy efficiency improvement and emission reduction of the project.

5. Wind Powered Electrode Boilers

73. The Project will construct two 25 MW 10 kV wind powered electrode boilers in the Haoqingyingheating zone. The use of such large scale high voltage electrode boilers is the first time in the PRC.

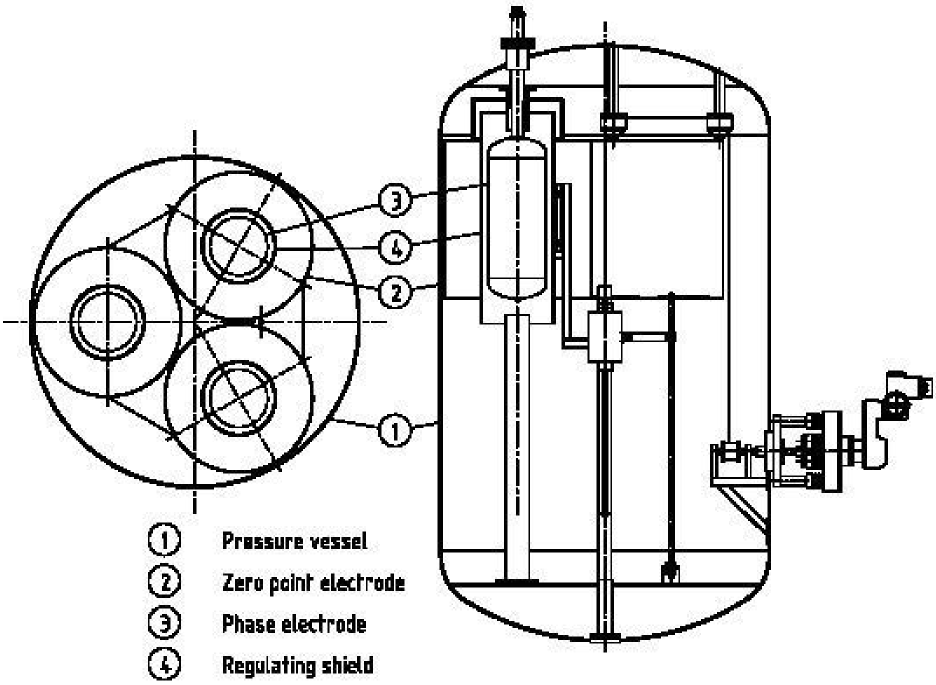
74. Wind power is clean renewable energy, and IMAR has the largest installed wind power capacity in the PRC with more than 18 gigawatt of wind power projects already in operation. However, due to rapid growth of wind farms, consequent over supply of wind generated electricity, and grid priority given to CHPs in winter night time, around 20% of the wind power has been curtailed in IMAR. During the winter time when heating demand rises, reliable coal-based CHP plants are prioritized in the grid operation, forcing many windfarms out of the grid. Wind to heat projects address this problem byutilizingwind power for heating when wind power generated electricity is available. This solution will increase wind power generation and reduce curtailment of wind power, reduce coal or gas consumption for district heating, improve energy conservation, reduce pollutant emissions, and minimize environmental impacts of winter time heating. **Figure 7** shows one of the wind farms from which electricity will be sourced. The Datang (Hohhot) Renewable Power Company wind farm is located on the Inner Mongolia plateau, 90 km northwest of Hohhot. The farm has 58 wind mills and a targeted production capacity of 50 MW

Figure 7: Datang (Hohhot) Renewable Power Company wind farm, northwest of Hohhot.

Source: ADB PPTA consultant, 2015.

75. Electrode boilers work by passing current through the water, between two electrodes, thereby creating heat. It uses conductivity and resistance feasture of water, transmits current and produces heat. The boiler has a 3-phase connection, each phase contains a phse electrode, a zero point electrode, and a regulating shield. The current is conducted directly in the water between the phase electrodes③ and the zero point electrodes②. The power depends on the area of the surface that can conduct the current between phase and zero, which is regulated by the regulating shield ④ that can expand or shrink. If the regulating shield expands, then, the surface area increases. This leads to more boiler power. A zero point electrodeis mounted in a pressurized vessel①. A phase electrode is installed hanging in the ceiling of the pressure vessel. The structure of the electrode hot water boiler is shown in **Figure 8**.

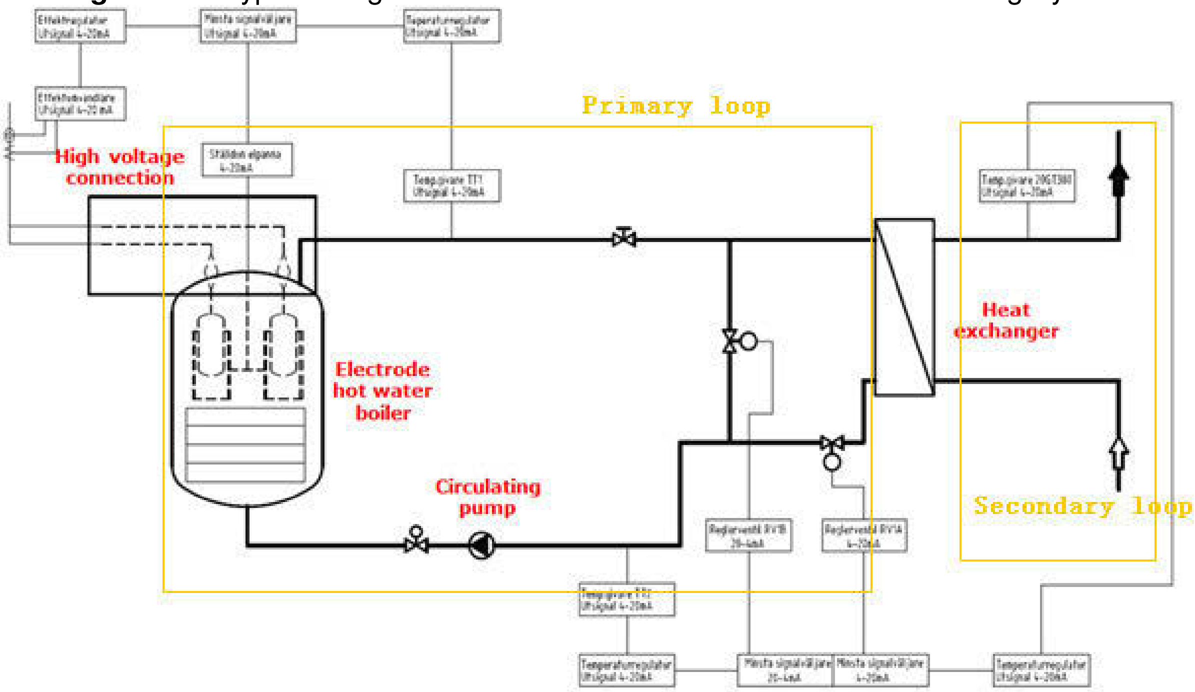
Figure 8.A Typical Structure of an Electrode Hote Water boiler



76. An electrode boiler is usually built in a two-circuit system due to different water quality requirements: primary and secondary loops. A pump circulates the water between

the boiler and the heat exchanger in a primary loop where the boiler water needs high purity. The district heating water at the secondary loop absorbs the thermal energy through the heat exchanger and then, is distributed to the district heating pipe networks. A typical system diagram of electrode boiler hot water heating system is shown in **Figure 9**.

Figure 9. A Typical Diagram for Electrode Boiler-basedHot Water Heating System



77. As there is no combustion, electrode boilers are emission free.They have several key advantages over fossil fuel fired boilers: they have extremely quick response times; they are flexible for cyclical or intermittent operations; they are clean firing and produce no combustion emissions and do not require stacks; they are greater than 99% efficient; and, they are smaller in volume and footprint than fossil fired boilers. **Table 16** presents the key design features for the Haoqingyingelectrodeboilers.

Table 16: Key design features, Haoqingyingelectrode boilers.

No.	Item	Feature
1	Name	High voltage electrode hot water boiler
2	Power	25 MW
3	Diameter of boiler body	2700mm
4	Voltage	10kV
5	Area standing	15m^2（for the boiler body）
6	Weight	12 Ton

Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2015.

78. Each boiler will require 25 m^3 of boiler water at the outset. The boiler circulatory system is closed, and will only require 0.5 m^3 make-up water per heating season. Trisodium phosphate (Na_3PO_4) will be used as an electrolyte to increase the conductivity of the boiler water; approximately 0.3 kg will be required for eachboiler per heating season.

6. Coordination with Existing Jinqiao CHP

79. It is estimated that the Jinqiao heating zone will use around 53% of total heat supply from the existing coal-fired CHP (**Figure 10**) and use around 47% of total heat from the

Project constructed natural gas-fired HSP as heat sources. The existing CHP will cover the heating base load, and the natural gas-fired HSP will cover the peak load. Heat from the Jinqiao CHP will have a priority in order to reduce heat waste. Only when the CHP capacity is insufficient to meet the heat demand, the natural gas-fired HSP will be used to provide heating. This strategy will optimize energy efficiency and improve environment protection.[9] It is estimated that the Jinqiao CHP with 582 MW can sufficiently supply heat to all heating area in Jinqiao heating zone when the outdoor temperature remins avobe -3^{0}C. However, if the temperature drops, the Jinqiao CHP cannot meet the increasing heat demand and the natural gas boiler under the Project will supply heat.

80. A brieft due diligence was conducted for the Jinqiao CHP. The domestic EIA for the Jinqiao CHP was prepared and approved by the former State Environmental Protection Agency on December 21, 2004. The CHP is fully equipped with emission control emasures, including low NOX combustion technology, limestone wet scrubbing flue-gas desulfurization (FGD), and bag-type dust collectors. In addition, a continuous emissions monitoring system (CEMS) is installed to measure emissions at all times. The Jinqiao CHP has been fully complied with the PRC environmental regulations. It is confirmed that there was no record of public complaints.

Figure 10: 582 MW Jinqiao CHP, operated by the state-owned China Huaneng Group.

Source: ADB PPTA consultant, 2015.

7. Primary Distribution Network and HESs

81. The Project will utilize an indirect connection system and will construct heat sources, primary heating networks, heat exchange stations (HESs), and control systems. The Project does not include secondary networks between the HESs and end-users.

82. The Project will construct a total of 192 HESs to transfer heat to the secondary

9 The primary function of the existing CHP is production of electricity. In a stand-alone power plant the heat produced during the electricity production would be waste energy and would have to be cooled in cooling towers, giving a typical plant efficiency of 30-35%. In a CHP this waste heat is captured and used for district heating, thereby increasing the total efficiency of the plant to 80-85% while adding no additional emissions as the coal otherwise would still have been burned to generate electricity. Therefore, use of the CHP will be maximised and the HSP will be used as a peaking plant.

networks. Each HES will service an area ranging from 20,000 to 200,000 $m^{2.}$ A typical HES will be equipped with plate heat exchangers, circulating pumps, and water supply devices. The primary heating network working pressure will be 1.6 MPa, the water supply temperature will be 120°C, and the return water temperature will be 60°C. In the secondary heating network the supply temperature will be 75°C and the return temperature 50°C. A frequency modulating controller will be used for regulating the circulating pump. Measuring and automatic control devices or Remote Terminal Units (RTUs) will be linked to the central control room in the HSPs through the SCADA systems. Primary distribution networks for eachheating zone are presented in Section III.F.

83. The Project will adopt 11 building-level HESs (**Figure 11**). In a building-level HES, all equipment and auxiliary parts will be installed in small prefabricated packages close to the users, typically in the basements of the buildings to be served.[10] This result in cost saving by reducing the size of heating pipes, the reduction of transmission heat losses, the improvement of hydraulic balance and heat efficiency, and energy saving of HESs operation. It also conserves land and space compared to typicalHESs.

Figure 11: Examples of Building Level HES.

(a)Building level HES unit

(b)Building level HES unit-pump

(c)Building level HES unit-Cabinet style

Source: Asian Development Bank, 2014.

Figure 12: Interior of two-unit automated district HES built in 2011.

Source: ADB PPTA consultant, 2014.

[10] Building level HESs will be approximately 2 m long, 1.5 m wide and 2 m high. The final dimensions will be dependent on the manufacturer.

8. Pipelines

84. The Project will install pre-insulated bonded heating pipesutilizingdirect-bury installation. Steel pipes, polyurethane foam (PUR) and high density polyethylene (HDPE) are bonded into one piece in a sandwich-like structure.Non-ozone depleting blowing agents will be utilized for the PUR. Compared to on-site insulation of pipes buried in a tunnel, direct-bury pre-insulated bonded pipes have lower capital costs, reduced heat losses, improved energy efficiency, better anti-corrosive and insulation performance, longer service life, reduced land acquisition requirements,and shorter installation cycles, all of which protect the environment and simplify conditions for construction of municipal facilities.

9. Leak Detection Systems

85. Leak detection systems will be installed in the main pipeline networks to assist operators in detecting and localizing leaks. The systems will provide an alarm and display related data to the pipeline operators in case of leakage, which will help operators detect and accurately locate leakage point by using portable detection equipment. A total of 39.9 km of heating pipeline will be monitored for leakage.

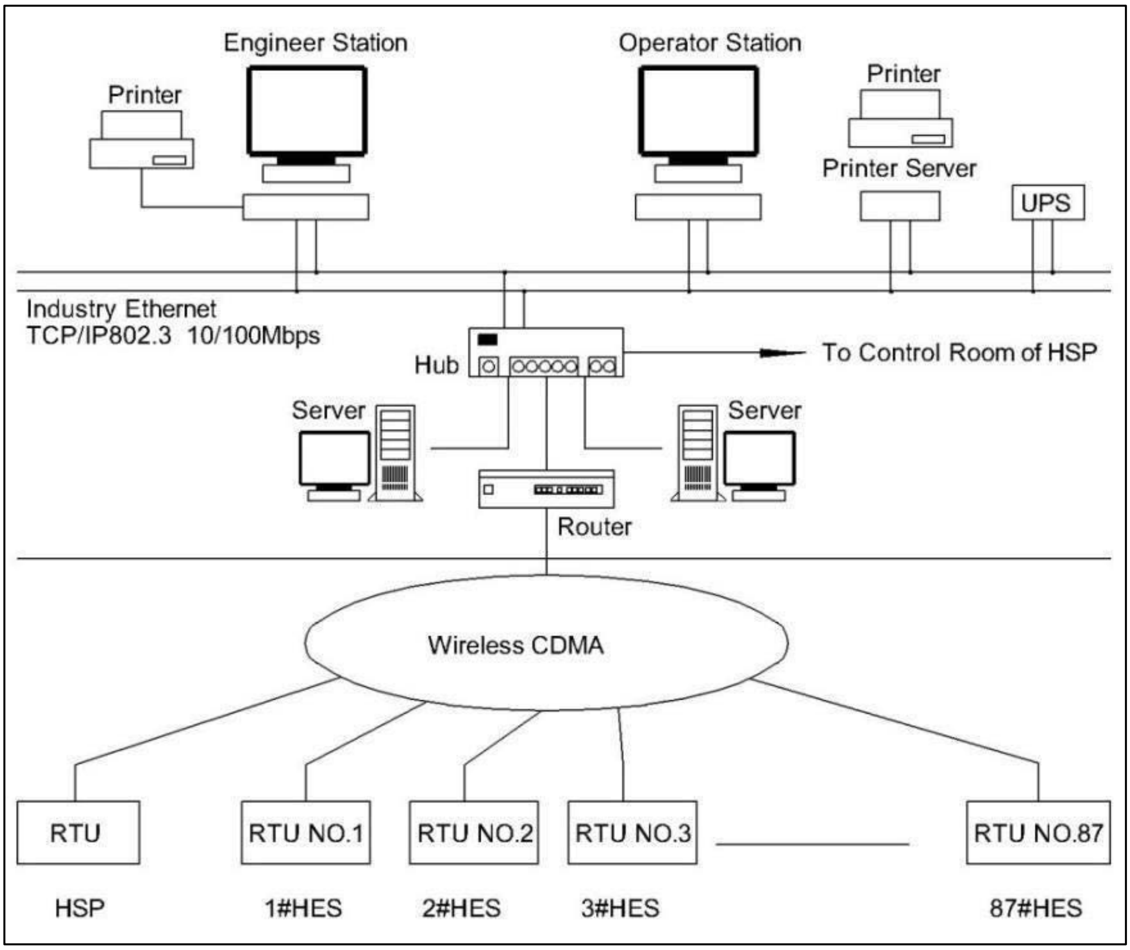
10. SCADA Systems

86. Each HSP will be equipped with a supervisory control and data acquisition (SCADA) system to monitor the main system parameters for the safe and optimal operation of the district heating systems. The SCADA systems will monitor and regulate process heat demand, heat consumption, water consumption and electricity consumption, and will maximize energy saving and ensure efficient and effective heating service.

87. Each SCADA will consist of a control centerlocated at the regulation center building, regional control center, and local control and monitoring units. The control center will be responsible for the comprehensive data collection and processing, issuing control orders to the regional control center, coordinating the whole heating system, and communicating with external units. The regional control center will collect data from the local control units and submit to the central control center, and accept and execute orders from the central control center. The local control centers will be responsible for monitoring and control of the HESs.

88. Equipment in the control center such as host computer, communication controller, operator stations, engineer stations and printerswill be connected with an industrial Ethernet. Communication between the central control center, regional control centers and local control units will be controlled by a communication controller and will pass through an interface connected to general packet radio service (GPRS) network or the Integrated Services for Digital Network (ISDN). A schematic diagram of a SCADA system for the Haoqingyingheating zone, which is similar to other heating zones, is presented in **Figure 13**.

Figure 13: Schematic diagram of SCADA System (HaoqingyingHSP).



Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2015.

11. Electrical Design

89. The HSP and HESs need a secure electricity supply to meet the demands of electric equipment such as boiler pumps, lighting, control panels, etc. In accordance with national regulations, the central control centers will be equipped with Uninterrupted Power Supplies (UPSs) to ensure the control systems can work continuously.Double 10 kV circuits and 800KVA and 200KVA transformers will be used in the boiler houses. In addition, high voltage and low voltage switch cabinets, direct current (DC) cabinet, and lightingsystems have been designed for the HSPs.The HESs will have 380V/220V electric lines to power pumps, lighting, and control panels.

12. Water Supply, Wastewater

90. The Project will utilize an estimated 2,006,200 m³ of municipal water during the 182 day heating season for domestic and production water and fire protection systems.This is equivalent to 1.1% of Hohhot's annual water supply capacityof 168.9 million m³/year. Appendix V presents letters from the Hohhot Municipal Water Supply Company confirming the ability to supply the required water.

91. The Project will generate both domestic and production wastewater. Production

wastewater includes wastewater from the HSP water treatment plants and boiler blowdown. Domestic wastewater will be produced from worker sanitation facilities. Domestic wastewater will be treated in digestion tanks, and then in combination with the production wastewater, will be discharged to the Hohhot municipal sewerage system for treatment at the Jinqiao wastewater treatment plant (WWTP), located west of Hangkai Road.All emission concentration of SS, COD, BOD_5 and ammonia nitrogen will be in compliance with Class III standard requirements of *Integrated Wastewater Discharge Standard* (GB8978-1996), which sets the emission standards for wastewater discharged to a municipal sewerage system.

92. The HSPs will require typical connections to the municipal water system and to the municipal sewerage system:

Haoqingying HSP
- Approximately 100m of water supply pipeline, connecting to the municipal water supply network under East Station road.
- Approximately 100m of wastewater discharge pipeline, connecting to the municipal wastewater drainage network under East Station road.

Jinqiao HSP
- Approximately 2000m of water supply pipeline, connecting to the municipal water supply network under Huyang road from the west wall of the HSP.
- Approximately 80m of wastewater discharge pipeline, connecting to the municipal wastewater drainage network under Fengzhou road from the west wall of the HSP.

Xinjiaying HSP
- Approximately 10m of water supply pipeline, connecting to the municipal water supply network through the plant gate.
- Approximately 10m wastewater discharge pipeline, connecting to the municipal wastewater drainage networkthrough the plant gate.

13. Fire Protection

93. All natural gas works will be in compliance with relevant PRC building code requirements, including the *Code for Design of City Gas Engineering* (GB 50028-2006) and *Regulation on Electric Apparatus Design for Explosion and Fire Risk Environment* (GB50058-92).Independent gas regulation stations will be constructed at least 14 meters away from other buildings and 30 m from the site boundary, to minimize the risk of explosion damaging other Project facilities or the public.The China Gas Company of Hohhot will construct and operate the gas regulation stations.

94. The gas regulation stations will be specially designed to withstand and contain explosions, and the connection to the boilers will be equipped with flammable gas detection, alarm and fire suppression systems. In case of a gas leak, automatic shutdown valves will shut down the gas supply, the system will generate audible and visual alarms, and the emergency ventilation system will exhaust gas from the stations so as to protect the building and operators. Normal air change for the stations will be six times per hour, but in emergencies the ventilation system will change the air 12 times per hour. Electrical devices within the explosion risk area will be safety equipped.

95. The gas pipelines feeding into the pressure regulation stations will be embedded underground, and will be coated with three layers of PE corrosion protection sleeves. The gas lines exiting the gas pressure regulation stations will be suspended overhead, and will

be treated 4 times with anti-corrosion paint. Pipelines will be grounded and equipped with anti-lightning devices where applicable.

96. All other at risk areas will have flammable gas detection and alarm systems able generate audible and visual alarms, and automatic fire suppression systems. All gas related devices will be brightly colored and equipped with warning signs.The risk of fire in HESs is low due to less flammable equipment and materials, so only manual dry fire extinguishers will be used for fire protection purposes.

97. An emergency risk and response plan for each heating zone will be established in accordance with the "*National Environmental Emergency Plan*" (24 January 2006) and other relevant PRC laws, regulations and standards. In addition construction and operation phase environment, health and safety (EHS) plans will be developed by specialists in occupational health and safety and gas-fired boilers to ensure protection of workers and the surrounding community.

14. Heating and Ventilation

98. Facilities will be equipped with cast-iron radiators for space heating. The design room temperature of the complexes, control rooms, and gatehouses is 18°C; pump rooms, heat exchanger rooms, and garages is 10°C; and chemical testing rooms and bathrooms is 16°C. The feed and return water temperatures at HES will be 80 and 65°C respectively.

99. The control room and electric rooms will be mechanically ventilated by fans. Other rooms will be naturally ventilated.

15. Landscaping

100. The HSP sites will be vegetated with appropriately selected native trees and shrubs.

16. Temporary Worker's Camps

101. During the project construction, a temporary workers' camp will be installed at each heat source plant within the premise of the heat source plants. No workers' camp is needed for pipeline construction as it is done in phases and a very limited number of workers will be needed for each phase of pipe installation.

F. Specific Design Details

1. HaoqingyingHeating Zone (to be connected to the existing Sanhecun Heating zone)

a) Location and Scope

102. The proposed HSP is located in the northern portion of the Haoqingyingheating zone in northeastern Hohhot. It will serve 11.36 million m^2 of heating area. In the original product scope, Haoqingying heating zone would have its own heating source plant to supply all heat using seven 70 MW low NOx natural gas-fired boilers and two wind power 25MW 10 kV electrode boilers. However, the revised scope will reduce the number of boilers at its own HSP but get surplus heat from existing HSP in Sanhecun, which was not a part of the original scope.

103. The revised scope in Haoqingying, thus, includes construction of (i) one HSP with 260 MW heating capacity, including three 70 MW low NOx natural gas-fired boilers and two wind power 25MW 10 kV electrode boilers in Haoqingying HSP; (ii) 97 HESs, of which 11

will be building-level HESs; (iii) 32.29 km of primary network; and (iv) one SCADA system control center.Key parameters are presented in **Error! Reference source not found.**.

104. The Haoqingying Heating zone will be connected to the existing Sanhecun heating zone, located west side of Haoqingying (see **Figure 5**). At the Sanhecun HSP, five inefficient 29MW coal boilers will be dismantled and two 70 MW low NOx natural gas-fired boilers including two air preheaters and two economizers will be installed as a part of the revised project scope. At present Sanhecun HSP, 178 MW of surplus heat exists. Thus, a total of 318 MW heat from Sanhecun HSP and 260 MW from Haoqingying HSP will be supplied to the Haoqingying heating zone. The Sanhecun HSP environmental due diligence is provided in Appendix VII.

b) Main Works and Equipment

105. The main equipment includes five 70 MW low NOx natural gas-fired boilers and two 25 MW 10 kV electrode boilers, described below:

Natural Gas Boiler

Type	Low NOxnatural gas hot water boiler
Model	QXS70-1.6/120/60-Q
Rated heat supply	70MW
Rated water supply pressure	1.6 MPa
Rated supply/ return water temperature	120/60 ^{0}C
Ratedwater circulation capacity	1000 t/h
Boiler efficiency	98%
NOx emissions:	< 100 mg/Nm^3
SO_2 emissions:	29.36 mg/Nm^3

Electrode Boiler

Name	High pressure electrode hot water boiler
Type	DJR-35-1.6
Max power	25 MW
Operating Voltage	10 kV

106. **Table 17** presents the main project works.

c) Site Layout and Buildings at Haoqingying HSP

107. Three 70MW Haoqyinying HSP low NOx natural gas-fired boilers will be buit in Haoqingying HSP.The general layout consists of five areas: the main plant area, gas pressure regulation station, water supply facility, electrical substation, and complex and office area. The total HSP building area is 10,257 m^2. The Project will construct the main plant and gas pressure regulation, and it will share other auxiliary facilities such as water supply, storage, electric substation, and office complex including mechanic workshop, dispatching center, etc., with the phase 2 HSP. All buildings will be designed for energy efficiency and noise mitigations will be incorporated into the pumping station. The detailed layout of the plant is shown in **Figure 14**, while **Table 18** provides data on HSP buildings. The HSP location and chimney height would be unchanged.

Table 17: Main Works in Haoqingying Heating Zone

Project Works			Description
Main Works	1	Boiler Room at Haoqinying HSP	3×70 MW low NOx natural gas-fired boilers 2×25 MW 10 kV wind power electrode boilers

	2.	Boiler installation at Sanhecun HSP	2x70 MW low NOx natural gas-fired boilers including two air preheaters and two economizers will be installed
	3	Primary Heat Supply Network	32.29 km
	4	HESs	97 substations, including 11 building level HESs
Ancillary Works	1	Burning system	Each gas boiler is installed with one blower. Boiler flue gas is discharged to atmosphere via funnel and chimney.
	2	Water Treatment Facility	Circulating water pump, make-up pump, softwater preparation equipment, deaerator, etc.
	3	Thermal System	Return water of primary network is sent back to boiler room through deaerator and circulating water pump. Heat supply network is constant pressure by make-up pump. Make-up water is sent to circulating water pump inlet by softening process and deaerator and send back to boiler combined with return water of primary network.
	4	Gas Pressure Regulating Station	After the natural gas pressure is reduced to 0.3-0.4 MPa, the gas is sent to the burner in the boiler room by DN 600 pipeline.
	5	Wind Power Thermal system	Wind power thermal system will connect to primary pipe network directly. Supply temperature is 120^{0}C, returntemperature is 60^{0}C.
Public Utilities	1	Water Supply	Production and domestic water source is municipal water.
	2	Wastewater	Production and domestic wastewater will be discharged to the municipal sewage pipeline network
	3	Power Supply	Power will be supplied by 110kV Haoqingying transformer substation.
	4	Office	Comprehensive administration building, canteen and living quarters.
Environmental Protection	1	Boiler Emissions	Low NOx natural gas fired burners will be used (NOx content in flue gas will be < 100 mg/Nm^3)[11]. Flue gas will be vented via five 2.5 m diameter 30 m tall chimneys.
	2	Noise Control	Low-noise equipment with noise reduction measures like noise elimination, damping, sound insulation and enclosures will be used.

Source: EIA Table Report: Low-Carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd. and Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

Table 18: Haoqingying HSP Buildings

Name	Footprint (m^2)	Building Area (m^2)	BuildingHeight (m)	Notes
Boiler House	9064	9064	22	3 Chimneys 30m High Φ＝2000mm
Gas Station	1093	------		
Total	10257	9064		

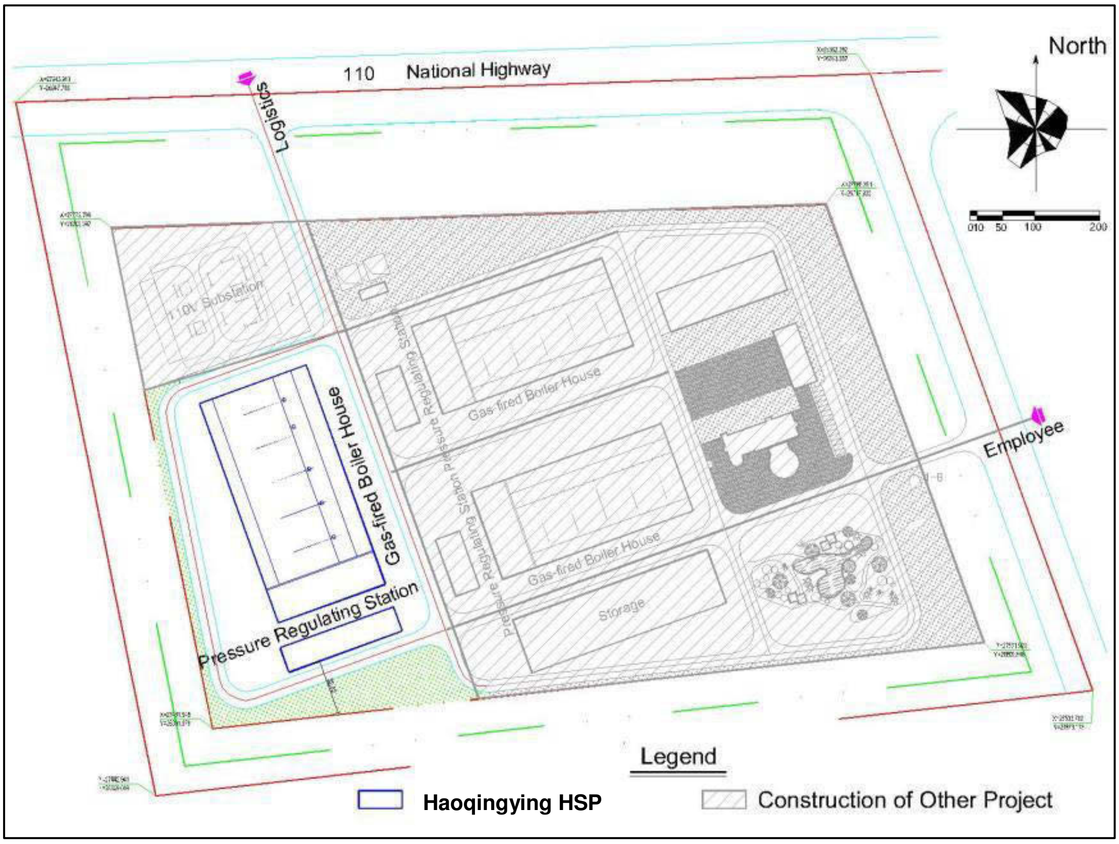
Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

[11] The PRC heating zone EIAs use a boiler NOx emission of 137.31mg/m^3, based on a 2007 survey of industrial boilers in PRC. However, HCDIO has committed to using low NOx boilers producing less than 100 mg/m^3 NOx emissions.

d) Primary Transmission Network and HESs

108. The primary network will be 32.29 km of direct-bury pre-insulated bonded pipe with diameters ranging from DN 150 to DN 1200 mm. A total of 97 HESs will be constructed, including eleven 4 MW building level HESs (**Figure 15** and **Table 19**).

Figure 14: Haoqingying HSP Site Layout.



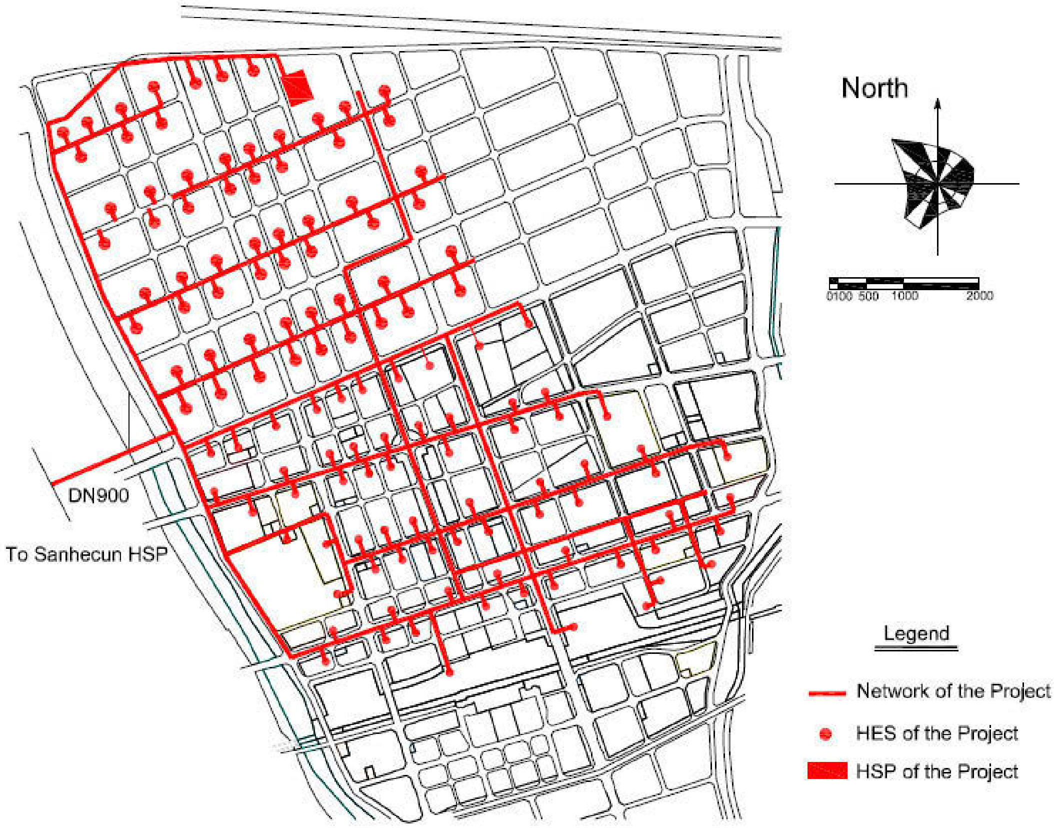
Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

Table 19: HESs in Haoqingying heating zone.

Capacity	3MW	4MW	5MW	6MW	7MW	8MW	2×4MW
Quantity		14	27	12	17	8	
Capacity	2×5MW	2×6MW	2×7MW	2×8MW	3×4MW	3×5MW	3×6MW
Quantity	18	1					

Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

Figure 15: Haoqingying primary network (including connecting pipeline to Sanhecun primary network).



Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

3. Xinjiaying Heating Zone

a) Rationale

109. The Xinjiaying heating zone is mixed residential, commercial, and public buildings (IMAR and Hohhot municipal governments) area.It has an existing district heating system, heat of which is supplied by a HCHC-owned coal-fired 602 MW HSP (five 70 MW coal-fired boilers and three 84 MW coal-fired boilers), serving 7.5 million m^2 of heating area (**Figure 16**).Due to housing and other developments, the heating area of the district is expected to be 26.8 million m^2 by 2020, requiring additonal heating capacity.

110. The original Project scope is to expand the existing Xinjiaying HSP to install additional gas boilers. However, under the revised scope, there will be no expansion at Xinjiaying HSP. Instead, the Xinjianying heating network will be connected to the existing Qiaokao heating network, located west of Xinjianying heating zone to get surplus heat from the existing Qiaokao HSP. In addition, pipelines will be constructed to get surplus heat from Jingneng CCHP located 26 km south of urban Hohhot City. From surplus heat from two exisiting sources will be sufficient to cover heat demand in Xinjiaying heating zone. The environmental due diligence on Qiaokao HSP and the Jingneng CCHP is provided in Appendix VII.

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Figure 16: Existing Xinjiaying HSP.

Source: ADB PPTA consultant, 2015.

b) Location and Scope

111. In Xinjianying heating zone, the project will construct (i) 48 HESs; (ii) 43.79 km of heating pipelines, including 26.02 km of urban network and 17.7 km of long transmission network; and (iii) one central control centre of SCADA system.

112. **Table 20**presents the main project works.

Table 20: Main works in Xinjiaying heating zone.

Project Works			Description
Main Works	1	Primary Heat Supply Network	43.79 (urban network: 26.02 km, long transmission: 17.7 km)
	2	HESs	48 substations

Source: Due Diligence Review of Low-Carbon District Heating Project in IMAR Feasibility Study Report, 2016.

c) Primary Transmission Network and HESs

113. The primary network will be 26.02 km of direct-bury pre-insulated bonded pipe with diameters ranging from DN 150 to DN 1200 mm. A total of 48 HESs will be constructed, ranging in service area size from 20,000 to 180,000 m^2(and**Figure 17**).

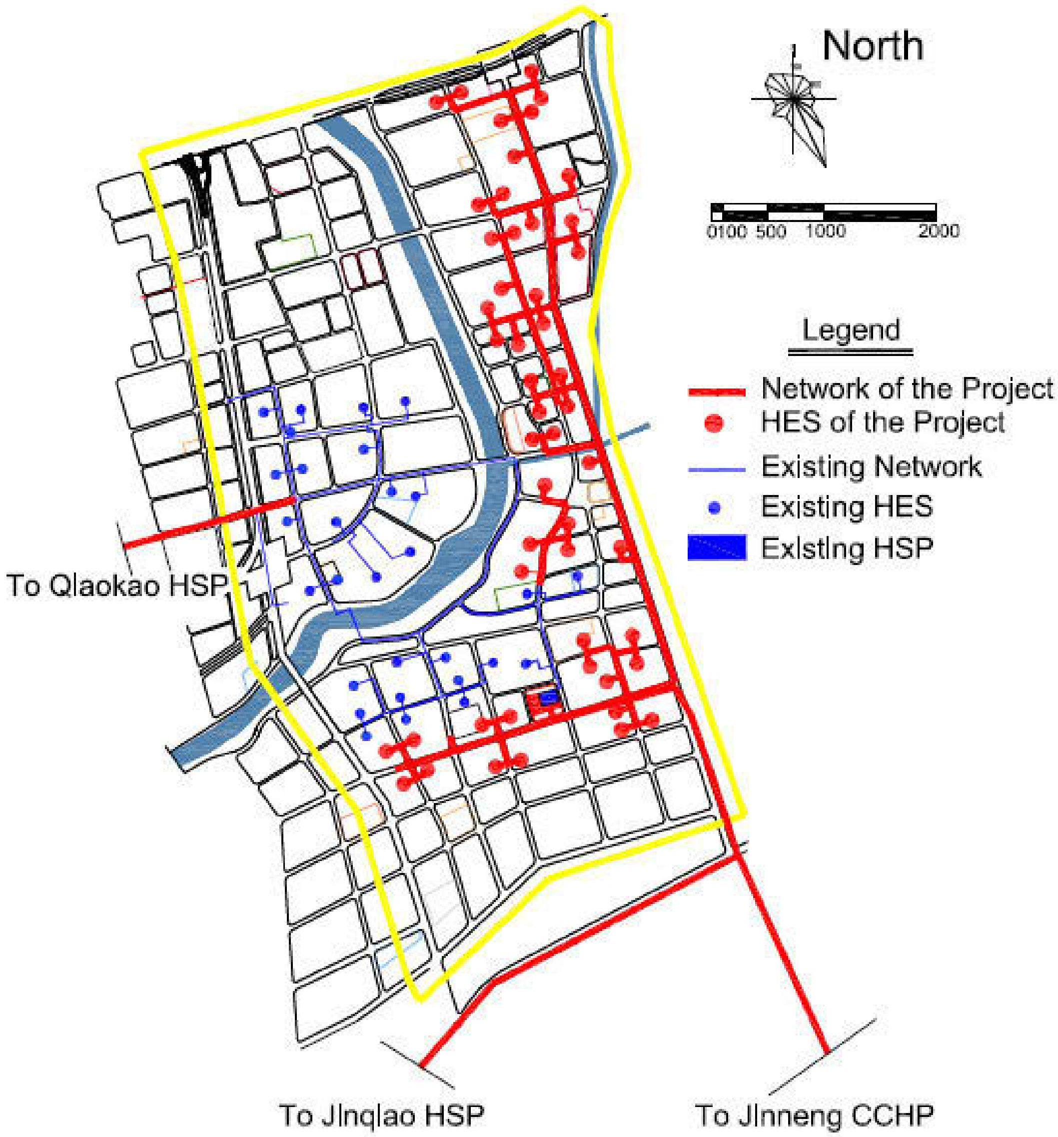
Table 21: HESs in Xinjiaying heating zone

Capacity	3MW	4MW	5MW	6MW	7MW	8MW	2×4MW

Quantity		2	2	1	2	3	3
Capacity	2×5MW	2×6MW	2×7MW	2×8MW	3×4MW	3×5MW	3×6MW
Quantity	4	1			30		

Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

Figure 17: Primary network in Xinjiaying heating zone.



Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

4. **Jinqiao Heating zone**

a) Rationale

114. The Jinqiao heating zone is located in southeastern Hohhot. The HCHC are responsible for urban district heating system operation and provides heat to 9.8 million m^2 from the existing coal-fired 582 MW Jinqiao CHP, operated by the state-owned China Huaneng Group (**Figure 10**).

115. Under the Hohhot Urban Heating Plan, the heating area of the district is expected to be 33.4 million m^2 by 2020, while the district heating area served by the HCHC is expected to 19.23 million m^2 by 2020. In order to meet the demand of 9.53 million m^2 of new heating area by 2020, a new HSP is required.[12] Within these new heat demand areas, currently 29 small decentralized boiler houses with a total of 50 small coal-fired boilers exist (**Figure 4**). Once the project is operational, these old and inefficient coal boilers will be removed by the HMG in accordance with the PRC environmental lasws and regulations.

116. In the original project scope, one HSP with a total of 490 MW gas boilers (7x 70 MW) will be constructed to fulfill all the heat demand. In the revised project scope, a number of gas boilers will be reduced to two and surplus heat from other existing heat sources – Jingcheng SWT and Jingneng CCHP will be utilized to meet the demand in Jinqiao heating zone. The environmental due diligence on the Jingcheng SWT is provided in Appendix VII.

b) Location and Scope

117. The proposed HSP is located at an abandoned brick and tile factory and unused land in southeastern Hohhot, 5.5 km northeast of the existing CHP.The revised project scope will construct (i) one HSP with 140 MW heating capacity, including two 70 MW gas-fired boilers with air-preheaters and economizers to maximize boiler efficiency; (ii) 47 HESs, one of which is main station inside waste to energy CHP; (iii) construction of 40.55 km heating pipe network; (iv) construction of one central control center of SCADA system. Key parameters are presented in **Error! Reference source not found.**.

c) Main Works and Equipment

118. **Table 22**presents the main project works. The **main equi**pme**n**t includes two 70 MW natural low NOx natural gas-fired boilers, described below:

Natural Gas Boiler

Type	Low NOx natural gas hot water boiler
Model	QXS70-1.6/120/60-Q
Rated heat supply	70 MW
Rated water supply pressure	1.6 MPa
Rated supply/ return water temperature	120/60 ^{0}C
Ratedwater circulation capacity	1000 t/h
Boiler efficiency	93%
NOx emissions:	< 100 mg/Nm^3
SO_2 emissions:	29.36 mg/Nm^3

[12] The 9.53 million m^2 includes the 1.29 million m^2 currently heated by the 50 small coal-fired boilers.

Table 22: Main works in Jinqiao heating zone.

Project Works			Description
Main Works	1	Boiler Room	2x70 MW low NOx natural gas-fired boilers and two air-preheaters and two economizers
	2	Primary Heat Supply Network	40.55 km
	3	HESs	47 substations
Ancillary Works	1	Burning system	Each gas boiler is installed with one blower. Boiler flue gas is discharged to atmosphere via funnel and chimney.
	2	Water Treatment Facility	Circulating water pump, make-up pump, softwater preparation equipment, deaerator, etc.,
	3	Thermal System	Return water of primary network is sent back to boiler room through deaerator and circulating water pump. Heat supply network is constant pressure by make-up pump. Make-up water is sent to circulating water pump inlet by softening process and deaerator and send back to boiler combined with return water of primary network.
	4	Gas Pressure Regulating Station	After the natural gas pressure is reduced to 0.3-0.4 MPa, the gas is sent to the burner in the boiler room by DN 600 pipeline.
Public Utilities	1	Water Supply	Production and domestic water source is municipal water.
	2	Wastewater	Production and domestic wastewater will be discharged to the municipal sewage pipeline network
	3	Power Supply	Two-circuit power will be supplied by Heihe transformer substation.
	4	Office	Comprehensive administration building, canteen and living quarters.
Environmental Protection	1	Boiler Emissions	Low NOx natural gas fired burners will be used. Flue gas will be vented via seven 2.0 m diameter 30 m tall chimneys.
	2	Noise Control	Low-noise equipment with noise reduction measures like noise elimination, damping, sound insulation and enclosures will be used.

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd., and Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

d) Site Layout and Buildings

119. The general layout of the site includes five areas: the main plant area, gas pressure regulation station, water supply facility, electrical substation, and complex and office area. In addition, there are three unoccupied areas reserved for future use. Within the main plant area, the units or facilities are installed successively from west to east: gas-fired boiler house → blowing fans → chimney. Auxiliary operations and services will be installed around the main plant, including the office and administration center, water service facility, electrical substations, etc. The detailed layout of the plant is shown in **Figure 18**, while **Table 23** provides data on HSP buildings. The HSP location and chimney height would be unchanged.

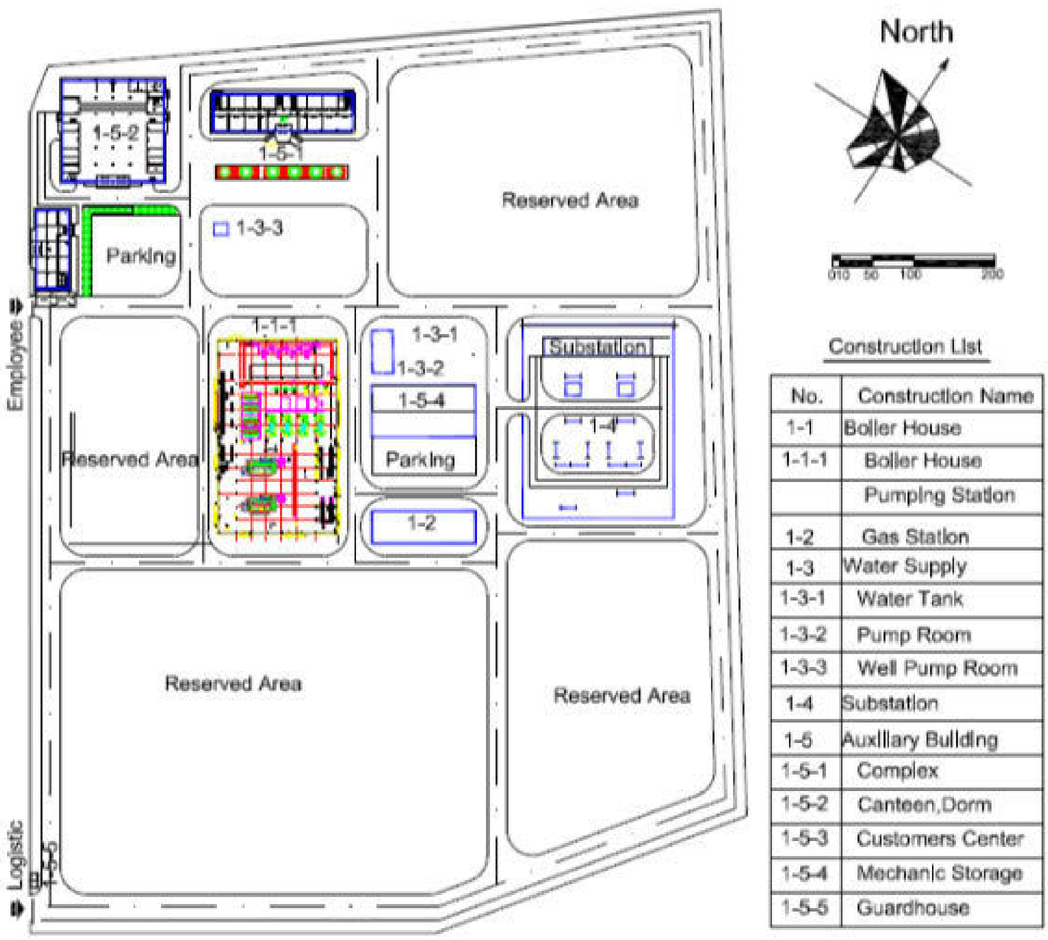


Figure 18: Jinqiao HSP site layout.

Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

e) Primary Transmission Network and HESs

120. The primary network will be 40.55 km of direct-bury pre-insulated bonded pipe with diameters ranging from DN 150 to DN 1200 mm. A total of 44 HESs will be constructed, ranging in service area size from 20,000 to 180,000 m^2 (**Figure 19** and **Table 24**).

Table 23: Jinqiao HSP buildings.

No.	Name	Footprint (m^2)	Building Area (m^2)	Building Height (m)	Notes
1	1# Boiler House	5462.73	5462.73	12	4 Chimneys 30m High Φ＝2000mm
2	Gas Station	720	------		
3	Water Tank	260	------		
4	Pump Room	480	480	3.5	
5	Well Pump Room	35.64	35.64	3.5	
6	Substation	6300	420	5	
7	Complex	1136.4	5683.2	13.5	
8	Canteen and Dorm	2246.7	4383.2	8	
9	Customers Center	571	571	3.5	
10	Mechanic and Storage	1152	1152	6	
11	Guardhouse	21.8	21.8	3	
	Total	23849	23672.3		

Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

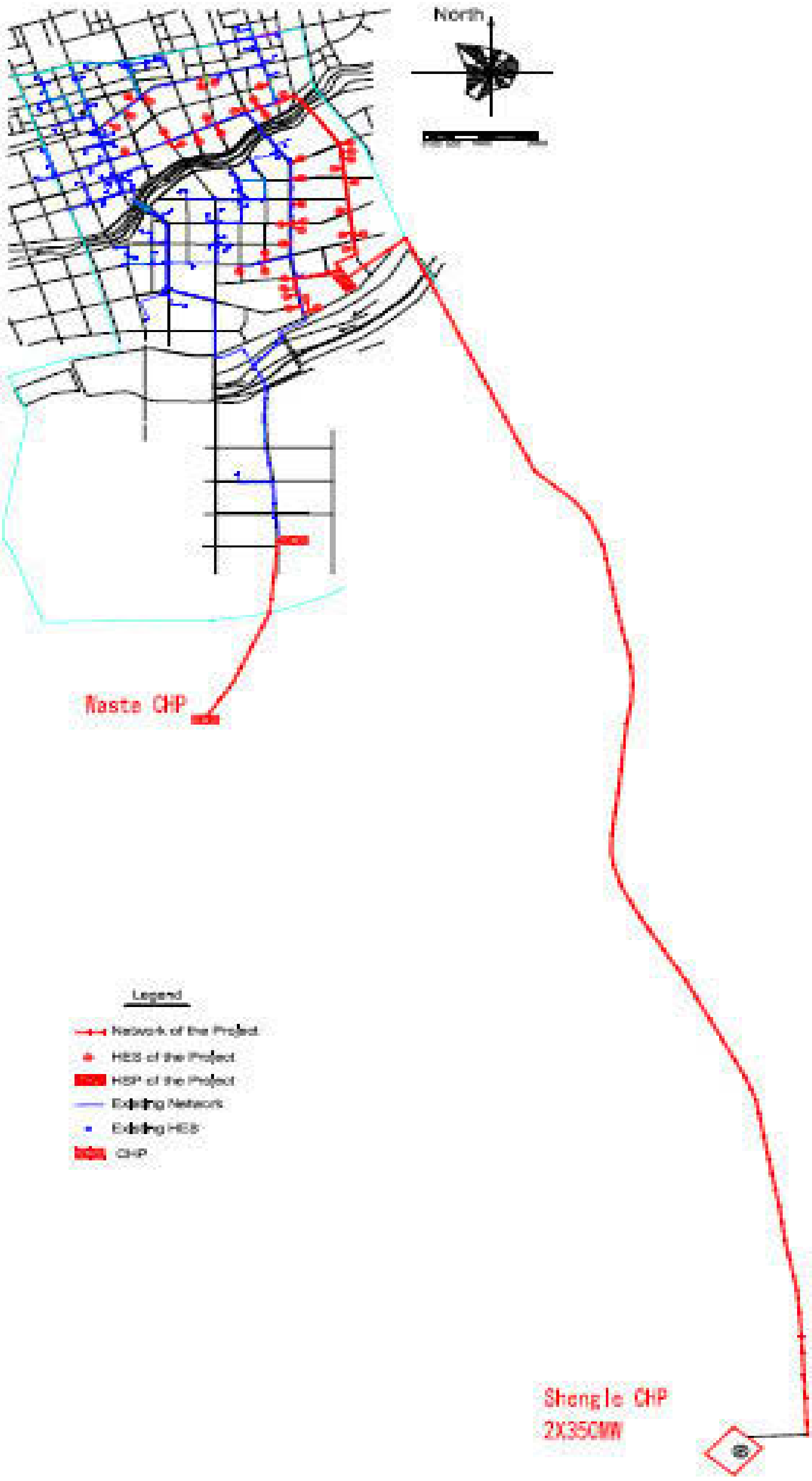
Table 24: HESs in Jinqiao heating zone.

Capacity	3MW	4MW	5MW	6MW	7MW	8MW	2×4MW
Quantity	2				1	2	8
Capacity	2×5MW	2×6MW	2×7MW	2×8MW	3×4MW	3×5MW	3×6MW
Quantity	16		**3**	**2**		**4**	**8**

Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

121. **Long transmission line:** To utilize energy of Jingneng CCHP, located 26 km away from the urban area of Hohhot., a long transmission line from Jingneng CCHP will be built to connect Xinjiayin heating zone and Jinqiao heating zone. The proposed routine from Jingneng CCHP to area was carefully surveyed. To ensure reliability and sustainability of long transmission line, specific technical requirement for insulation material will be selected. Detailed stress analysis will be done during the detailed engineering design to mitigate stress fatigue failure of some components. Right compensator shall be selected in accordance with stress analysis and technical application of various compensators. Corrugated stainless steel compensator which is well isolated for waterproof will be used for the project.

Figure 19: Jinqiao primary network.



Source: Due Diligence Review of Low-carbon District Heating Project in IMAR Feasibility Study Report, 2016.

G. Implementation Arrangements

122. The Government of IMAR (GIMAR) is the executing agency (EA) and the Hohhot Chengfa Heating Company (HCHC) is the implementing agency (IA), which is responsible for day to day project management, including contractor management, operation and maintenance, and social and environment safeguard monitoring and assurance. The HCDIO[13]is engaged to provide management oversight to the HCHC; to liaise with the GIMAR, and Hohhot municipal government; to provide support and supervision in the project procurement; and to provide timely managerial and technical support to the IA to ensure the timely project implementation as well as good governance of the project. The HCDIO and HCHC will jointly establish a project management office (PMO).The HCHC has appointed three Branches which will have direct responsibility for each heating zone.The HCHC's Production Safety Office has primary responsibility for environmental, health and safety and has a staff of 22. Each Branch also has a corresponding Production Safety Office, typically with a staff of 10.

H. Budget and Time Schedule

123. The Project cost is estimated at 2.389 billion CNY ($391.86million).The ADB loan will finance38.3% (914.54 million CNY or $150 million) from ordinary capital resources, the IA will finance 20.3% (484.600 million CNY or $79.482 million), and the Shanghai Pudong Development Bank will finance 41.4% (990.7000 million CNY or $162.377 million).

124. The total construction period for the Project will be approximately 5years. Construction will be undertaken in a phased approach, with detailed design, construction, equipment installation and trial operation expected to take about 50 months for each heating zone:

Feasibility research phase	8 months
Preliminary design phase	4 months
Detail design phase	6 months
Construction	16 months
Equipment and pipeline installation	12 months
Combined trial operation	4 months

125. The Project expected lifetime is 25 years.

[13] The HCDIO will sign onlending agreements with the GIMAR, through Hohhot municipal government, and will onlend to the HCHC. The HCDIO is directly responsible for making equity contributions amounting to 23% of the total project cost.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Location

126. The Project is located in eastern Hohhot City, Inner Mongolia Autonomous Region (IMAR), in north-central PRC. IMAR borders Mongolia, and Russia to the north; Gansu and Ningxia provinces to the southwest; Ningxia, Shaanxi, Shanxi and Hebei provinces to the south; and Liaoning, Jilin and Heilongjiangprovinces to the southeast and east (**Figure 1).** Hohhot is a prefecture level city, located on the northern edge of Hetao Plateau, south of Gobi desert. It consists of four urban districts, which are Huimin; Xincheng; Yuquan; and Saihan districts; and five rural counties, which are Toghoh county; Wuchuan county; Horinger county; Qingshuihe county; and Tumed Left banner. Total area of Hohhot is 17,224 km^2, containing 2,054 km^2 (11.9%) of urban and 15,170 km^2 (88.1%) of rural areas.

127. The Project consists of three heating zones, which aremixed residential, commercial and industrial areas, located in the northeastern, eastern and southeasternparts of Hohhot City.

- The Haoqingyingheating zone is located in Xincheng District in northeastern Hohhot (geographic coordinates 40°53'9.80"N 111°44'42.73"E). The 202,060 m^2 trapezoidal shaped HSP site is west of Shaliang village and south of national road 110.This relatively undeveloped area is agrowth area for Hohhot's future urban and commercial development, and has recently seen housing and other developments.

- The Xinjiaying heating zone is located in Saihan District in central eastern Hohhot, adjacent to the site of the existing HSP owned by HCDIO (40°47'32.55"N, 111°46'8.35"E). The 105,087.86 m^{2}HSP site is south of the Ruyi River, north of Guihua 7 Street and East of Guihua 3 Street.This area was previously farmland, and is designated for future urban expansion.

- The Jinqiao heating zone is also located in Saihan District in southeastern Hohhot, 5.5 km north of the existing Jinqiao CHP.The 131,701 m^{2}HSP site is east of Fengzhou road, west of Labaying road, north of South Third Ring Road and south of Shijiedajie (40°45'21.54"N, 111°44'46.21"E). The site consists of an abandoned brick and tile factory and unused land, and is considered waste land.

B. Physical Resources

1. Geography

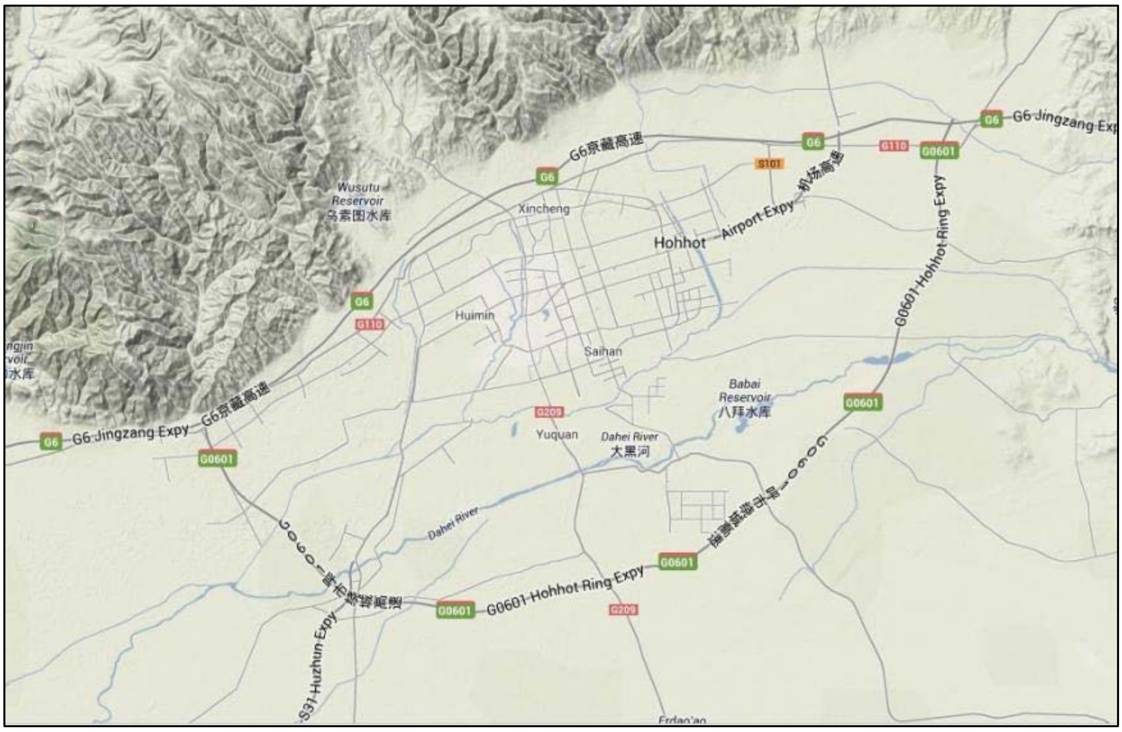
128. Hohhot is on the northern edge of the Hetao Plateau (upper reaches of the Yellow River) and the southern edge of the Gobi Desert. It has an elevation of 1,065 masl. It is located on an alluvial fan with mainly sandy or sandy clay soils. The urban topography is flat, though the Daqing Shan Mountains are immediately to the north (**Figure 20**) and the Man Han range is to the southeast. All three heating zone sites have flat topography.

129. According to the PRC *Earthquake Parameter Map* (GB 18306-2001) Hohhot is in Earthquake Intensity Zone VIII, a zone where the peak ground acceleration is 0.20 g.[14]All buildings will be designed in accordance with Earthquake Intensity Zone VIII requirements in *Code for Seismic Design of Buildings* (GB 50011-2010). However, the PRC EIA reports

[14] g= acceleration due to gravity at the Earth's surface (9.8 m/s^2); 10 % probability of being exceeded within 50 years.

that all three heating zone sites are geologically stable and there is no risk of soil liquefaction. The Hohhot Land and Resources Bureau has confirmed that there are no geologicalrisks at any of the sites.[15]

Figure 20: Hohhot topography.



Source: Google Maps, 2014.

2. Meteorology and Climate

130. Hohhot has a temperate continental monsoon climate, with long cold dry winters, short hot summers, and dry windy springs. The PRC EIAs indicate that region's annual average temperature is 8.7 ^{0}C, the maximum temperature in July is 38.5 ^{0}C, and theminimum temperature in Decemberis -27.6 ^{0}C. Annual average atmospheric pressure is 896.2 hPa; annual average relative humidity is 52%; annual precipitation is 393.2 mm, with April to October accounting for about 94.0% of the total rainfall throughout the year. Annual evaporation is 1,361.5 mm, and the area receives an annual average of 2,662.7 hours sunlight.**Table 25** presents a summary of climatic data from 1971 to 2000, provided by the China Metrological Administration.

131. Hohhot is under the Mongolian high pressure zone in winter, and the atmospheric structure is stable and wind speedsare relatively low. Annual average wind speed is 1.8 m/s. Maximum wind speeds are in the spring in April and May at 2.65 m/s (April). Minimum wind speed are in January and December at 1.35 m/s (December). Wind speeds tend to be higher during the daytime than at night, and minimum wind speed occurs at around 8 am. Based on 30 years of weather data, the most frequent wind directions in each month are northwest (NW), east (E) and southwest (SW). The predominant wind direction from October to May is NW. This includes the winter heating season, and thus has a direct

[15] Based on meeting with Mr. Xie Heping of the Hohhot Land and Resources Bureau Feb 12, 2014.

influence on pollution dispersion from heating plants. The predominant wind direction in summer and autumn (June, July and September) is E, while the most frequent wind direction in August is SW (**Figure 21**). All three HSPs have been sited to take into account the predominant NW wind direction during the heating season, with sparsely populated areas to the SE.

Table 25: Climate data for Hohhot, 1971-2000.

Climate data for Hohhot (1971−2000)													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average high °C	−5	−0.4	7	16.3	23.2	27.3	28.5	26.4)	21.2)	14.1	4.4	−3.2	13.32
Average low °C	−16.8	−12.8	−5.5	1.6	8.2	13.3	16.4	14.8	8.3	1	−7	−14.2	0.61
Precipit-ation mm	2.6	5.2	10.2	13.5	27.6	47.2	106.5	109.1	47.4	20.7	6.2	1.8	398
Avg. precipit-ation days (≥ 0.1 mm)	2.5	2.8	3.4	3.7	6	8.9	12.9	12.7	8.3	4.5	2.4	1.8	69.9
% humidity	58	52	46	37	39	47	61	66	62	59	59	59	53.8
Mean monthly sunshine hours	180.7	198.3	245.5	268.6	294.5	291.3	264.9	255.2	252.1	244.8	195.3	171	2,862.20

Source: China Meteorological Administration, 2009.

3. Water Resources

a) Surface Water Resources

132. Rivers in the Hohhot area belong to the Yellow, Daheihe and Hunhe river systems (**Figure 22**).

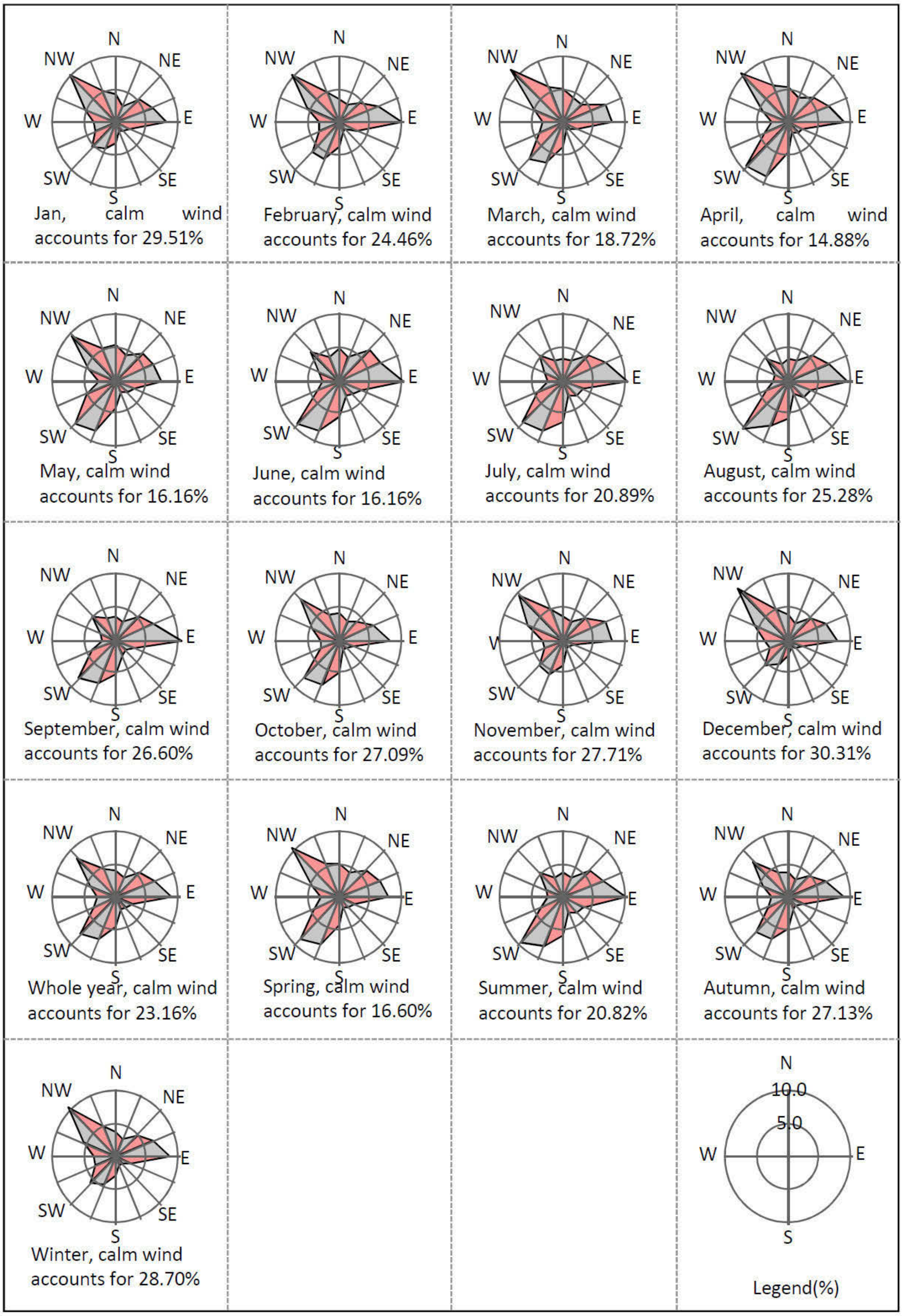
133. Hohhot is on the northern edge of the Hetao Plateau (upper reaches of the Yellow River). In the Hohhot region the Yellow River flows from Shisifenzi village southwest of Hohhot to Dantaizi Village in Qingshuihe County, and has a total length 109.5 km.

134. The Daheihe River is a level one tributary of the Yellow River, originating in mountains to the east of Hohhot and flowing from northeast to southwest, passing south of the urban center of Hohhot. It has a basin area of 17,673 k m^2 and a main stem length of 236 km. Its main tributaries include the Guaijiaofuhe River, Hasuhaitui canal, the Xiaoheihe River and the Shilawusuhe River. The Daheihe River is characterized by short duration peak flood flows during the wet season.

135. The Xiaoheihe River is a level one tributary of the Daheihe River, originating in Wuchuan County and flowing from the northeast to southwest, joining the Daheihe River at North Hunjin Bridge in Hohhot. The river has a basin area of 2,182 km^2 and a main stem length of 104.8 km. According to data from the Erdaohe hydrological station, the Xiaoheihe annual average runoff is 67.8 million m^3, and its average flow rate is 2.15 m^3/s. Maximum wet season flow in July and August is 87.5 $m^3/$ s, and minimum dry season flow is 0.92 m^3/s.

136. Huozhai Creek is a level one tributary of Xiaoheihe River, originating from Jingerliang, Youyouban village and flowing southeast into the Xiaoheihe.

Figure 21: Wind direction frequency and wind rose diagram by month (based on 30 years data).



Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 22: Hohhot surface water resources.

Source: Google Maps, 2014.

137. There are no rivers, creeks or streams or other surface water resources on any of the HSPs in three heating zones. The Hohhot Water Affairs Bureau reviewed the HSP locations and confirmed that there are no sensitive surface water resources at or near the sites.[16]However, site visits by national and international environmental specialists noted that there are a series of fish ponds to the northwest of the Jinqiao HSPsite, and care will need to be taken during construction to avoid pond contamination.

b) Ground Water Resources

138. Groundwater resources in Hohhot include both shallow and deep aquifers. The aquifers are young (Quaternary) sediments of fluvial and lacustrine origin. Groundwater from shallow aquifers is accessed using traditional open dug wells and more recent hand-pumped boreholes, usually less than 30 m deep. Boreholes deeper than 100 m tap into the deeper aquifera, which are often artesian. Within the city limits shallow groundwater recharge is 9.87 x $10^8 m^3$,and annual developed reserves is 10 x 10^8 m^3.

139. The Hohhot Water Affairs Bureau reviewed all three HSP locations and confirmed that there are no sensitive groundwater resources at or near the sites.[17]

C. Ecological and Sensitive Resources

140. Hohhot is located in a mid-temperate semi-arid climatic zone. The surrounding area includes forest (limited), shrubs, grasslandsand steppe meadows. However, the three HSP sites are all located within urban or semi-rural environments within the city limits with

[16] Based on meeting with Wu Li, Section Chief of Water Administration and Water Resources Department, Hohhot Water Affairs Bureau, Feb 12, 2014.
[17] Ibid.

surrounding landuse including mixed commercial, residential, agricultural and industrial. Original vegetation cover has been previously removed, and existing site vegetation is typically grass or shrubs, or disturbed dirt with little or no vegetation cover (**Figure 23**). Based on site visits by national and international environmental specialists, there are no known rare or endangered flora or fauna, parks, nature reserves or areas with special national, regional or local ecological significance within or adjacent to any of the sites. In addition, the Hohhot Forestry Bureau confirmed there are no rare or endangered flora or fauna at or near the HSP sites.[18]The project sites are considered as modified habitat under ADB's SPS (2009) definition.

Figure 23: Vegetation coverage at the proposed HSP sites in three heating zones.

(i) Jinqiao HSP site, looking to the north.

(ii)Xinjiaying HSP site, looking from the southern boundary to the north.

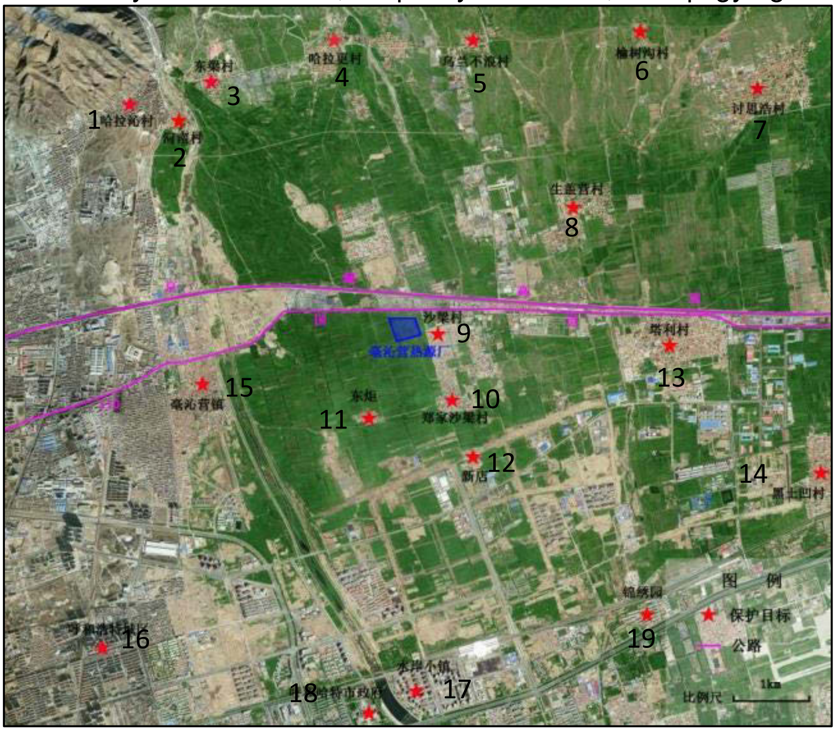
(iii)HaoqingyingHSP site, looking from the northern boundary to the south.

Source: ADB PPTA consultants

141. Sensitive locations for air quality and noise impacts in the heating zone areas were determined in the domestic EIAs utilizing remote sensing and ground surveys. **Figure 24** show sensitive areas for air quality and noise impacts for Haoqingying HSP. There are no schools, hospital or temples within 3km of the HSP. **Figure 25** show sensitive areas for air quality and noise impacts for the Xinjiaying HSP. The closest school is in Xinjiaying Village, approximately 0.5 km northwest of the HSP. **Figure 26**show sensitive areas for air quality and noise impacts for the Jinqiao HSP. The closest school is approximately 1.4 km west of the HSP, while the closest hospital is 1.1 km to the west. **Table 26**, **Table 27** and **Table 28** present corresponding data on sensitive areas for air quality and noise impacts for the three HSPs.

18 Based on meeting with Mr. Wang Hao, Chief Engineer, Hohhot Forestry Bureau, Feb 12, 2014.

Figure 24: Potentially sensitive sites,air quality and noise, HaoqingyingHeating zone.



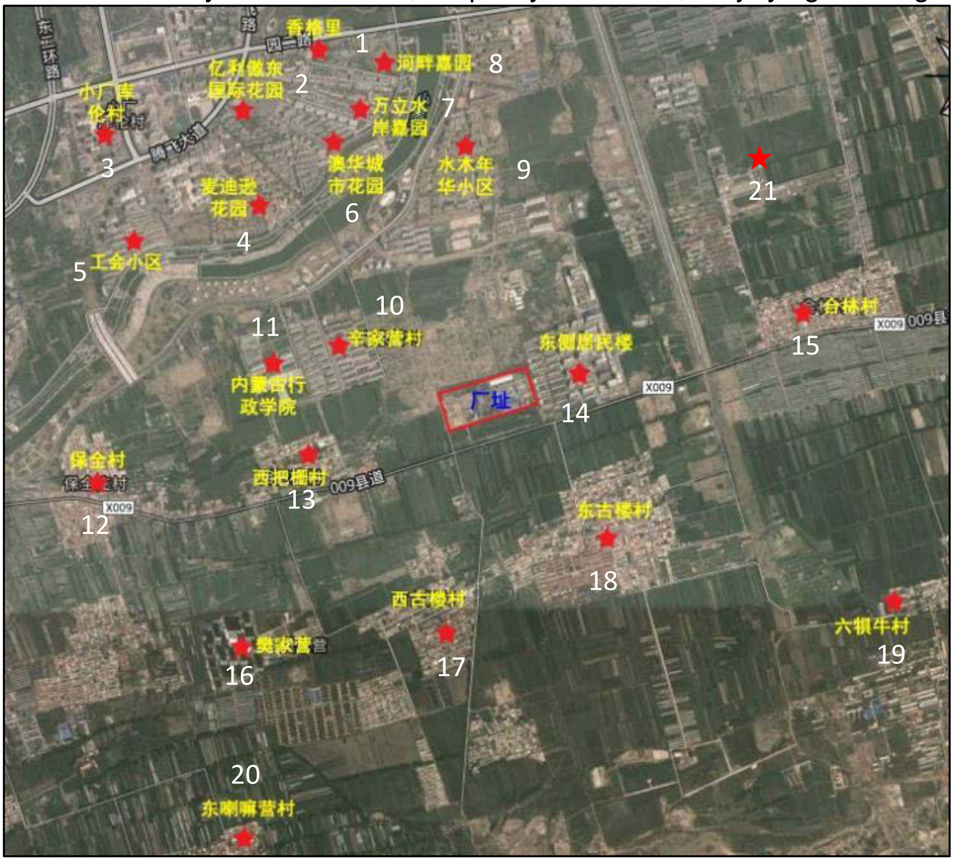
Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia,Haoqingying Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 26: Sensitive areas (air quality, noise), HaoqingyingHeating zone.

Sensitivity	No	Area	Direction	Distance	Function	Protection
Air quality	1	Halaqin	NW	4.2km	Residential Area	Class II
	2	Henan	NW	3.7km	Residential Area	Class II
	3	Dongliang	NW	3.8km	Residential Area	Class II
	4	Halageng	N	3.3km	Residential Area	Class II
	5	Wulanbulang	N	3.6km	Residential Area	Class II
	6	Yushugou	NNE	4.6km	Residential Area	Class II
	7	Taosihao	NE	4.9km	Residential Area	Class II
	8	Shenggaiying	NE	2.3km	Residential Area	Class II
	9	Shaliang village	SE	83m	Residential Area	Class II
	10	Zhengjiashaliang	SSE	0.8km	Residential Area	Class II
	11	Dongju village	SE	0.9km	Residential Area	Class II
	12	Xindian village	SSE	1.6km	Residential Area	Class II
	13	Tali village	ESE	2.5km	Residential Area	Class II
	14	Heituao village	SE	5.3km	Residential Area	Class II
	15	Haoqingying town	WSW	2.3km	Residential Area	Class II
	16	Hohhot urban area	SW	4.5km	Residential Area	Class II
	17	Waterbank town	S	4.2km	Residential Area	Class II
	18	Municipal government	SSW	4.8km	Office Area	Class II
	19	Jinxiuyuan	SE	4.5km	Residential Area	Class II
Noise	9	Shaliang (east of project site)	E	83m	Residential Area	Class II

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia, Haoqingying Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 25: Potentially sensitive sites,air quality and noise, Xinjiaying Heating zone.



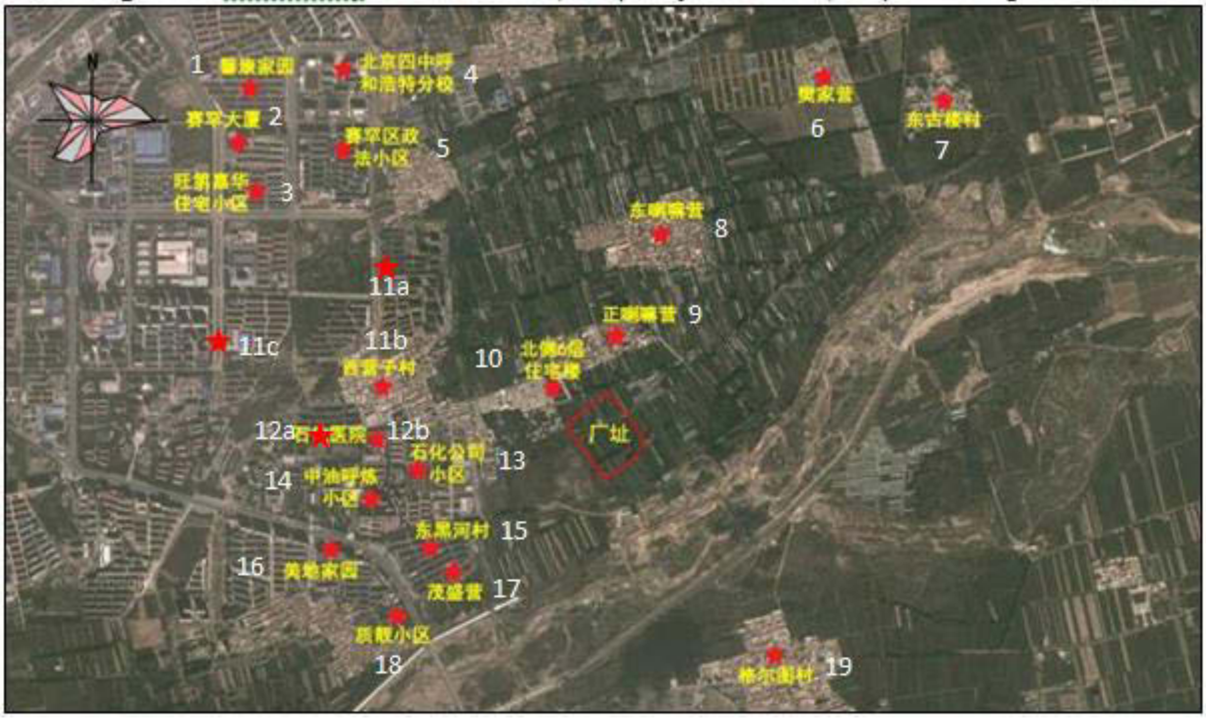
Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia, Xinjiaying Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 27: Sensitive areas (air quality, noise), Xinjiayingheating zone.

Sensitivity	No	Area	Direction	Distance	Function	Protection
Air quality	1	Xianggeli	N	2.2km	Residential Area	Class II
	2	Yiliaodong Guoji Huayuan	NW	2.0km	Residential Area	Class II
	3	Xiaochang Kulun village	NW	2.5km	Residential Area	Class II
	4	Maidixun Huayuan	NW	1.5km	Residential Area	Class II
	5	Gonghui plot	NW	2.0km	Residential Area	Class II
	6	Aohua Chengshi Huayuan	N	1.69km	Residential Area	Class II
	7	Wanlishuian Jiayuan	N	1.7km	Residential Area	Class II
	8	Hepanjiayuan	N	1.9km	Residential Area	Class II
	9	Shuimunianhua plot	N	1.1km	Residential Area	Class II
	10	Xinjiaying village	NW	0.3km	Residential Area	Class II
		Party School of Inner Mongolia	NW	0.5km	School	Class II
	11	Inner Mongolia Administrative College	W	0.9km	School	Class II
	12	Baoquan village	W	1.9km	Residential Area	Class II
	13	Xibazha village	W	0.7 km	Residential Area	Class II
	14	Residential buildings	E	40m	Residential Area	Class II
	15	Helin village	E	1.4 km	Residential Area	Class II
	16	Fanjiaying	SW	1.6 km	Residential Area	Class II
	17	West Gulou village	SW	0.6 km	Residential Area	Class II
	18	East Gulou village	S	0.5 km	Residential Area	Class II
	19	Liujuniu village	SE	2.3 km	Residential Area	Class II
	20	East Labaying village	SW	2.6 km	Residential Area	Class II
	21	Xibazha Center School	NE	21. km	School	Class II
Noise	14	Residential buildings	E	40m	Residential Area	Class II

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia, Xinjiaying Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 26: Potentially sensitive sites,air quality and noise,Jinqiao heating zone.



Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia, Jinqiao Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 28: Sensitive areas (air quality, noise), Jinqiaoheating zone.

Sensitivity	No	Area	Direction	Distance	Function	Protection
Air quality	1	Xinkang Jiayuan	NW	2.5km	Residential Area	Class II
	2	Saihan Dasha	NW	2.4 km	Office	Class II
	3	Wandijiahua	NW	2.1km	Residential Area	Class II
	4	Branch school of Beijing FourthSchool	NW	2.0km	School	Class II
	5	Zhengfa	NW	2.1km	Residential Area	Class II
	6	Fanjiaying	NE	2.3km	Residential Area	Class II
	7	East Gulou village	NE	0.7km	Residential Area	Class II
	8	East Labaying village	N	178m	Residential Area	Class II
	9	Zhenglabaying village	N	21m	Residential Area	Class II
	10	Residential buildings	N	168m	Residential Area	Class II
	11a	Saihan District Hospital	NW	1.5km	Hospital	Class II
	11b	Xiyingzi village	NW	0.8Km	Residential Area	Class II
	11c	Jinqiao Primary School	W	2.1km	School	Class II
	12a	No. 17 Middle School	W	1.4km	School	Class II
	12b	Petrochemical hospital	W	1.1km	Hospital	Class II
	13	Petrochemical company	W	0.9km	Residential Area	Class II
	14	PetroChina Hohhot refinery	W	1.2km	Residential Area	Class II
	15	East Heihe village	SW	1.0km	Residential Area	Class II
	16	Meidi Jiayuan	SW	1.5m	Residential Area	Class II
	17	Maoshengying	SW	1.0km	Residential Area	Class II
	18	Zhiliang plot	SW	1.4km	Residential Area	Class II
	19	Geertu village	S	1.1km	Residential Area	Class II
Noise	10	Zhenglabaying buildings	N	168m	Residential Area	Class II
	10	Zhenglabayings buildings	W	21m	Residential Area	Class II

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia, Jinqiao Heating Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

D. Socio-economic and Cultural Resources

1. Socioeconomic Status

a) IMAR and Hohhot

143. Hohhot, the capital of IMAR, is at the center of the region's politics, economy and culture. Located in south central IMAR, Hohhot is an important land and air hub-city, linking Beijing with northwest China. Hohhot Airport flies over forty air routes to various major domestic cities, and flies two direct routes to Mongolia and Russia.

144. Hohhot city is a prefecture level city, meaning that it administers both itsurbanarea and the rural regions in its vicinity. The administrative area includes 4 urban districts (Huimin District, **Xincheng District**, Yuquan District and **Saihan District**), Hohhot Economic and Technological Development Zone, and 5 rural counties (Togtoh County, Wuchuan County, Horinger County, Qingshuihe County and Tumed Left Banner). They are further divided into 20 urban sub-districts, and 96 townships. The three heating zones under the Project are located in Xincheng and Saihan urban districts.

145. Hohhot has a total area of 17,224 km^2. The land area of the rural portion of Hohhot is 15,170 km^2 (88.1% of the total land area), while the urban area is 2,054.0 km^2 (11.9% of the total land area). The urban area includes a built-up (city) area of 79.2 km^2.Hohhot has a population of 2.9488 million (2012), including the urban area with a population of 1.9233 million and the rural area with a population of 1.0255million.

146. Hohhot has 12 ordinary universities with over 200,000 students; 63 vocational schools with 33,000 students; 140 hospitals and health centers; 13 health epidemic prevention stations; and 21 maternity and child health centers.

147. General socio-economic data for IMAR and Hohhot is presented in **Table 29**.

Table 29: General socio-economic data of Hohhot and IMAR (2011).

Indicator	Unit	Hohhot	IMAR
Population	person	2,948,000	24,817,000
Urban	%	65.2	56.6
Ethnic minority	%	13.4	21.8
GDP	CNY billion	217.7	1,436.0
Primary sector	%	5.0	9.1
Secondary sector	%	36.3	56.0
Tertiary sector	%	58.7	34.9
Per capita GDP	CNY	75,266	57,974
Rural per capita income	CNY	10,038	6,642
Urban per capita income	CNY	28,877	20,408
Urban poor (Dibao)	%	6.5	8.0

Source: IMAR and Hohhot Statistical Yearbooks, in Social Analysis Report, IMAR District Heating Supply Project, Dec 2013.

b) Heating Zone Areas

148. General socioeconomic data for the two districts where the heating zones are to be implemented is presented are given in **Table 30**. The socioeconomic conditions of the two project districts are superior to that of Hohhot as a whole.

Table 30: Socioeconomic profiles of project districts (2012).

Indicator	Unit	Xincheng District (Haoqingyingheating zone)	Saihan District (Xinjiaying and Jinqiao heating zones)
Population	person	367,522	416,897
Male	%	49.8	50.4
Female	%	50.2	49.6
Urban	%	86.3	63.3
Ethnic minority	%	20.4	17.5
Households	No.	128,464	143,078
Urban per capita income	CNY	31,741	30,808
Urban poor (Dibao)	person	8,543	11,637
Urban poor (Dibao)	%	2.7	4.4
HH size[19]	person	2.86	2.91
Employed per HH	person	1.26	1.35
Employment rate	%	49.4	49.4
Average per capita income	CNY	31,741	31,741

Source: Hohhot Statistical Yearbook (2012), in Social Analysis Report, IMAR District Heating Supply Project, Dec 2013.

c) Project Beneficiaries

149. The beneficiaries of the Project include both current and potential future heat users (**Table 31**). The potential future users include current residents with heating from small boilers and home stoves and residents who will settle in the heating zone areas. Using an average household (HH) size of 3.0 persons, by 2020 the Project will benefit an estimated 294,500 user HHs with a population of 883,500:

i) The Haoqingyingheating zone will benefit 87,000 HHs with 261,000 residents.

ii) The Xinjiaying Heating zone will benefit 68,000 HHs with 204,000 residents.

iii) The Jinqiao Heating zonewill benefit its current users of 66,500 HHs with 199,500 residents through peak regulation, and will benefit an additional 73,000 HHs with 219,000 residents as a result of increased capacity.

Table 31: Project beneficiary HHs (2020).

Heating zone	CurrentBeneficiaries		PotentialBeneficiaries		Total	
	No. of HHs	No. of residents	No. of HHs	No. of residents	No. of HHs	No. of residents
Jinqiao	66,500	199,500	73,000	219,000	139,500	418,500
Xinjiaying			68,000	204,000	68,000	204,000
Haoqingying			87,000	261,000	87,000	261,000
Total	66,500	199,500	228,000	684,000	294,500	883,500
	22.6%		77.4%		100%	

Source: IA and consultants' estimations in Social Analysis Report, IMAR District Heating Supply Project, Dec 2013.

[19] Acording to the socioeconomic survey, average HH size is 3.11 and 3.02 for rural and urban HHs respectively.

2. Industry

150. Hohhot is a major industrial center within IMAR. It has the third-largest economy in the province, with a GDP of RMB 247.56 billion in 2012, accounting for approximately 15.5% of the province's total.

151. The city's six pillar-industries are dairy processing, electricity, electrical information, biopharmaceuticals, chemical metallurgy and machinery manufacturing. Hohhot is renowned as the “Home Town of Milk” in China, andits milk products are distributed to all of the major domestic markets.

152. As aneconomic center in IMAR, Hohhot has been expanding its urban area since the 1990s. The completion of a new office tower for the Hohhot Municipal Government in eastern Hohhot marked a shift of the city center to the eastern growth areas. Major economicindicators for Hohhot are presented in **Table 32**.

Table 32: Major economic indicators (2012).

Indicator	Value
Population (million)	2.95
GDP (RMB billion)	247.56
GDP Composition	
Primary Industry	4.90%
Secondary Industry (Industry &Construction)	36.40%
Tertiary Industry (Service)	58.70%
GDP Per Capita (RMB)	83,952
Unemployment Rate	3.63%
Fixed Asset Investment (RMB billion)	130.14
Utilized FDI (USD million)	616.94
Total Import & Export (USD million)	1,701.28
Export (USD million)	832.92
Import (USD million)	868.36
Sales of Consumer Goods (RMB billion)	102.23

Source: Hohhot Economic and Social Development Report 2012 (http://china-trade-research.hktdc.com).

3. Tourism and Physical Cultural Resources

153. Hohhot has only been capital of IMAR since 1947, and as a new capital historical and tourist sites are somewhat limited. Tourist attractions include cultural sites such as WanbuhuayanPagoda, Da Zhao Temple, Zhaojun Tomb, Wusutuzhao Temple, Xilituzhao Palace, and the Great Mosque, as well as natural sites such as Wusutu National Forest Park, the Hasu Sea, Da Qingshan Safari Park, and the plateau grasslands.

154. The Projectsites are not on or near any tourism sites, and there are no know Physical Cultural Resources (PCRs) within or adjacent to the sites other than a tomb approximately 100 m south of the Jinqiao HSP boundary near the existing access road.[20]Care will need to be taken during construction to protect the tomb.

[20] Physical cultural resources (PCRs): movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above or below ground or under water. Their cultural interest may be at the local,

Figure 27: Tomb located south of the Jinqiao HSP site.

Source: The ADB PPTA consultant, 2014.

E. Environmental Baseline Monitoring

1. Overall Hohhot Air Quality

155. **Table 33** and **Figure 28** present summary air quality data for SO_2 and NO_2, the two primary pollutants of concern in natural gas fired boilers. The data was provided by the Hohhot EPB, and is drawn from a total of 8 automated continuous air quality monitoring stations (**Figure 29**). The data shows that air quality in Hohhot was generally in compliance with relevantstandards for SO_2 although there was a peak in 2007, and that NO_2 levels have been well below the applicable standards. Both pollutants are showing a downward trend in annual average concentrations from peak levels in 2007.

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provincial, national, or international level. Within the Project area these could include:

- Funeral site: graves, cemeteries, shrines, stupas.
- Religious buildings: Temples or Pagodas, complete or ruins.
- Religious objects: Buddhist images or sculpture.
- Sacred sites: sacred caves, forest, hills or cliffs.
- Historical sites or objects: artifacts, tools, relics, memorials.
- Spirit sites: sites residents believe are occupied by a spirit (house, tree, stone, etc.).

Table 33: Air Quality Monitoring Data of Hohhot City from 2000 to 2012, (Annual Average Air Quality in mg/m^3)

Year	SO_2	NO_2
2000	0.034	0.031
2001	0.029	0.039
2002	0.030	0.036
2003	0.031	0.043
2004	0.027	0.044
2005	0.036	0.037
2006	0.039	0.043
2007	**0.064**	0.048
2008	0.049	0.046
2009	0.049	0.040
2010	0.045	0.033
2011	0.054	0.039
2012	0.049	0.035
PRC Standard (Class II, GB3095-1996)	0.060	0.080

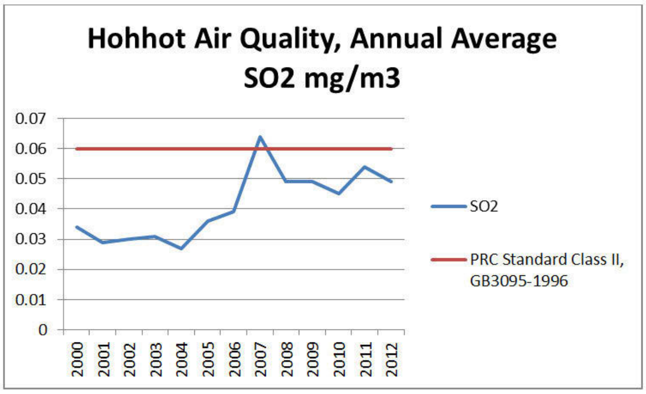
Source: Hohhot Municipal EPB, 2014

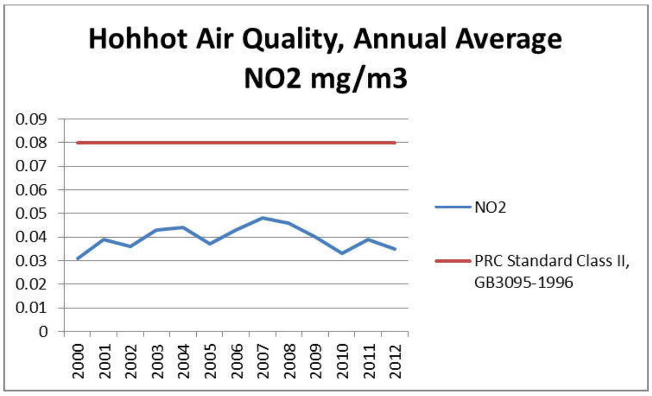
Notes:

1) Prior to 2001 monitoring was undertaken manually. Data from 2001 and on is averaged from 8 automated continuous monitoring stations (see Figure 3).

2) **Bold** denotes a standard exceedance. Please note that the above table, provided by EPB, refers to the previous PRC ambient air quality standards (GB3095-1996). In the new PRC ambient air quality standards (GB 3095-2012), the Class 2 annual average NO_2 standard is 0.04 mg/ m^3 while the Class 2 annual average SO_2 standard remains 0.060 mg/ m^3. These standards are phased-in beginning in 2012 for some cities and by 2016 for all cities nationwide.

Figure 28: Air Quality Monitoring Data of Hohhot City from 2000 to 2012, (Annual Average Air Quality in mg/m^3).





Source: Hohhot Municipal EPB, 2014.

Figure 29: Location ofHohhot EPB Automated Continuous Air Quality Monitoring Stations in Relation to Approximate Location of HSP Sites

Source: Hohhot Municipal EPB, 2014.

2. Site Specific Ambient Air Quality – Initial Assessment, January 2014

As part of the domestic EIA process, baseline environmental monitoring was conducted by Lvsejingcheng (Beijing) Physical and Chemical Testing Technology Ltd. at two locations at each heating zone site. Monitoring was undertaken continuously over a 7 day period from January 15 to 21, 2014 (e.g. during the heating season) for SO_2 and NO_2 (1-hour average concentrations) and TSP, PM_{10}, $PM_{2.5}$, SO_2 and NO_2 (24-hour average concentration). Wind direction, wind speed, air temperature, barometric pressure, cloud cover and other meteorological parameterswere also monitored.

156. **Table 34**presents data forthe monitoring sites, while **Figure 30, Figure 31 and Figure 32**show their locations.**Table 35**to **Table 40**presents summaries of the ambient monitoring results for all three heating zones. The results indicate that the overall air quality at the heating zone sites is good, and all results for TSP, PM_{10}, SO_2, and NO_2 were in compliance with Class II PRC standards. However $PM_{2.5}$ levels exceeded the 24-hour standards at all three heating zones. The most likely causes are vehicle exhaust and coal-fired flue emissions.

Table 34: Ambient air quality monitoring station locations and parameters monitored.

No	Heating Zone/ Monitoring Site	Direction from HSP	Distance from HSP (km)	Site Function	Standard (GB3095—2012)	ParametersMonitored
HaoqingyingHeating Zone						
1	HSP site	--	--	--	Class II	SO_2, NO_2: 1-Hour Average
2	Xindian village	SSE	1.6	Residential area	Class II	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2: 24-Hour Average
Xinjiaying Heating Zone						
1	HSPsite	--	--	--	Class II	SO_2, NO_2: 1-Hour Average
2	East Gulou village	S	0.5	Residential area	Class II	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2: 24-Hour Average
Jinqiao Heating Zone						
1	HSP site	--	--	--	Class II	SO_2, NO_2: 1-Hour Average
2	Geertu Village	S	1.1	Residential area	Class II	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2: 24-Hour Average

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia,Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

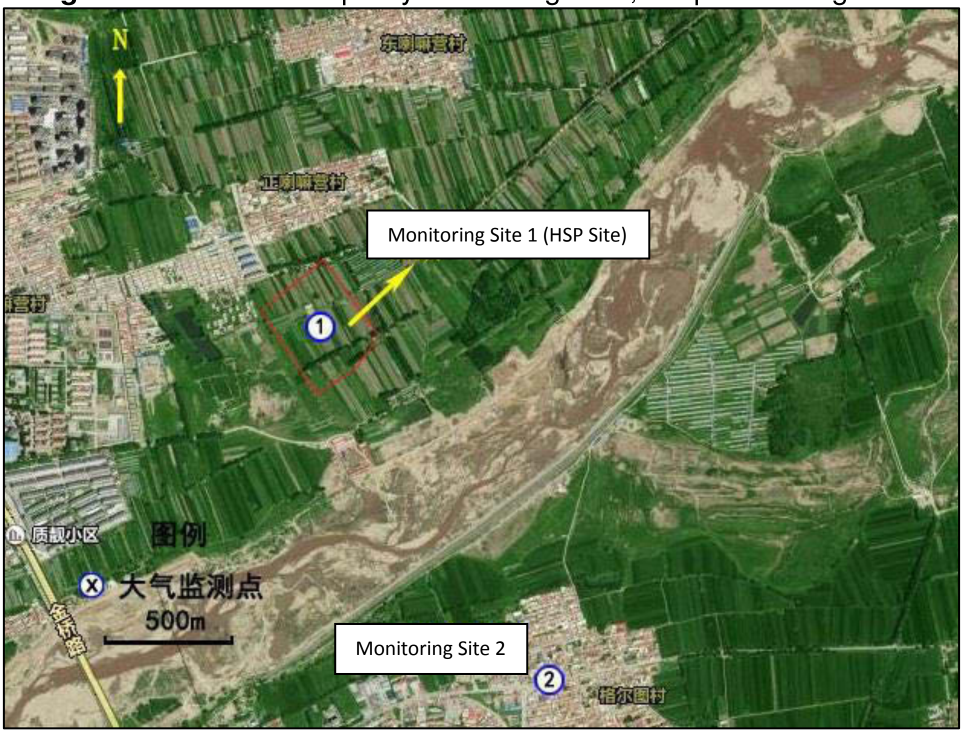
Figure 30: Ambient air quality monitoring sites, HaoqingyingHeating zone.

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 31: Ambient air quality monitoring sites, Xinjiaying Heating zone.

Source: EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 32: Ambient air quality monitoring sites, Jinqiao Heating zone.



Source: EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Peak Adjustment Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 35: Haoqingyingambient air quality monitoring results, TSP, PM_{10}, $PM_{2.5}$ 24-Hour Average.

No	Monitoring Site	TSP 24-Hour Average			
		Concentration Range (mg/m³)	Standard mg/m³ (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	HSP site	0.267--0.269	0.300	0	-
2	Xindian Village	0.266--0.272		0	-
		PM_{10} 24-Hour Average			
No	Name	**Concentration Range (mg/m³)**	**Standard mg/m³ (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**
1	HSP site	0.130--0.136	.150	0	-
2	Xindian Village	0.131--0.136		0	-
		$PM_{2.5}$ 24-Hour Average			
No	Name	**Concentration Range (mg/m³)**	**Standard mg/m³ (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**
1	HSP site	0.081--0.092	.075	100	23
2	Xindian Village	0.083--0.094		100	25

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 36: Haoqingyingambient air quality monitoring results, SO_2 and NO_2, 1-Hour and 24-Hour Averages.

No	Site	SO_2 1-Hour Average				SO_2 24-Hour Average			
		Concentration Range (mg/m³)	Standard mg/m³ (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)	Concentration Range (mg/m³)	Standard mg/m³ (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	Sub-project	0.034--0.043	.500	0	-	0.038--0.039	.150	0	-
2	Xindian Village	0.033--0.046		0	-	0.038--0.039		0	-
		NO_2 1-hour average concentration				**NO_2 24-Hour Average**			
No	**Name**	**Concentration Range (mg/m³)**	**Standard mg/m³ (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**	**Concentration Range (mg/m³)**	**Standard mg/m³ (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**
1	Sub-project	0.034--0.044	.200	0	-	0.036--0.037	.080	0	-
2	Xindian Village	0.034--0.042		0	-	0.036--0.037		0	-

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 37: Xinjiaying ambient air quality monitoring results, TSP, PM_{10}, $PM_{2.5}$ 24-Hour Average.

No	Monitoring Site	TSP 24-Hour Average			
		Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Averaging Periods Exceeding Standard (%)
1	HSP site	0.281--0.291	0.030	0	-
2	East Gulou Village	0.281--0.283		0	-
		PM_{10} 24-Hour Average			
No	Name	**Concentration Range (mg/m^3)**	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Averaging Periods Exceeding Standard (%)**
1	HSP site	0.129--0.139	.150	0	-
2	East Gulou Village	0.130--0.137		0	-
		$PM_{2.5}$ 24-Hour Average			
No	Name	**Concentration Range (mg/m^3)**	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Averaging Periods Exceeding Standard (%)**
1	HSP site	0.086--0.097	.075	100	29
2	East Gulou Village	0.084--0.095		100	27

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 38: Xinjiaying ambient air quality monitoring results, SO_2 and NO_2, 1-Hour and 24-Hour Averages.

No	Site	SO_2 1-Hour Average				SO_2 24-Hour Average			
		Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)	Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	Sub-project	0.034--0.048	.500	0	-	0.039--0.040	.150	0	-
2	East Gulou	0.033--0.047		0	-	0.038--0.039		0	-
		NO_2 1-hour average concentration				**NO_2 24-Hour Average**			
No	**Name**	**Concentration Range (mg/m^3)**	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**	**Concentration Range (mg/m^3)**	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**
1	Sub-project	0.035--0.045	.200	0	-	0.037--0.039	.080	0	-
2	East Gulou	0.034--0.044		0	-	0.037--0.038		0	-

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 39: Jinqiao ambient air quality monitoring results, TSP, PM_{10}, $PM_{2.5}$ 24-Hour Average.

No	Monitoring Site	TSP 24-Hour Average			
		Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Averaging Periods Exceeding Standard (%)
1	HSP site	0.272--0.277	0.030	0	-
2	Geertu Village	0.244--0.263		0	-
No	**Name**	**PM_{10} 24-Hour Average**			
		Concentration Range (mg/m^3)	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Averaging Periods Exceeding Standard (%)**
1	HSP site	0.126--0.136	.150	0	-
2	Geertu Village	0.125--0.135		0	-
No	**Name**	**$PM_{2.5}$ 24-Hour Average**			
		Concentration Range (mg/m^3)	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Averaging Periods Exceeding Standard (%)**
1	HSP site	0.083--0.091	.075	100	21
2	Geertu Village	0.085--0.094		100	25

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 40: Jinqiao ambient air quality monitoring results, SO_2 and NO_2, 1-Hour and 24-Hour Averages.

No	Site	SO_2 1-Hour Average				SO_2 24-Hour Average			
		Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)	Concentration Range (mg/m^3)	Standard mg/m^3 (Class II, GB3095-2012)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	Sub-project	0.033--0.043	.500	0	-	0.037--0.039	.150	0	-
2	Geertu Village	0.034--0.043		0	-	0.038--0.038		0	-
No	**Name**	**NO_2 1-hour average concentration**				**NO_2 24-Hour Average**			
		Concentration Range (mg/m^3)	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**	**Concentration Range (mg/m^3)**	**Standard mg/m^3 (Class II, GB3095-2012)**	**Averaging Periods Exceeding Standard (%)**	**Worst Case Exceedance of Standard (%)**
1	Sub-project	0.033--0.043	.200	0	-	0.036--0.037	.080	0	-
2	Geertu Village	0.034--0.042		0	-	0.035--0.037		0	-

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

3. Ambient Air Quality – Additional NO_2 and SO_2 Monitoring

157. The ambient air quality monitoring undertaken in January 2014 by the EIA institute

was sufficient for the atmospheric dispersion modeling of SO_2 and NOx undertaken in the PRC EIAs using SCREEN3, a US EPA approved screening model. However, additional modeling was subsequently undertaken using AERMOD, a US EPA and PRC approved steady-state plume model, and this required additional and more comprehensive monitoring for NO_2 and SO_2, the two primary pollutants of concern in natural gas fired boilers (see Section V.C for additional information on dispersion modeling).

158. Monitoring was undertaken at 10 sites (**Table 41** and **Figure 33**). The sites were selected based on proximity to the HSPs, prevailing wind directions, and site sensitivity. Monitoring of NO_2 and SO_2 was undertaken continuously from Apr 12, 2014 to Apr 18, 2014. Sampling frequencyand periods is presented in **Table 42**.Wind direction, wind speed, air temperature, barometric pressure, cloud cover and other meteorological elements were also monitored.

Table 41: Ambient air quality monitoring sites, SO_2 and NO_2.

No	**Name**	**Function**	**Applicable Air Quality Standard** (GB3095-2012)	**Parameters Monitored**
1	Halaqin village	Rural residential area	Class II	SO_2, NO_2
2	Tali village	Rural residential area	Class II	SO_2, NO_2
3	Shilandai village	Rural residential area	Class II	SO_2, NO_2
4	Inner Mongolia Museum	Mixed zone (commercial, transportation and residential)	Class II	SO_2, NO_2
5	Liujuniu village	Rural residential area	Class II	SO_2, NO_2
6	Babai village	Rural residential area	Class II	SO_2, NO_2
7	Qianbaimiao village	Rural residential area	Class II	SO_2, NO_2
8	Houqiaobao village	Rural residential area	Class II	SO_2, NO_2
9	Xiashitouxinying village	Rural residential area	Class II	SO_2, NO_2
10	West Dahei River village	Rural residential area	Class II	SO_2, NO_2

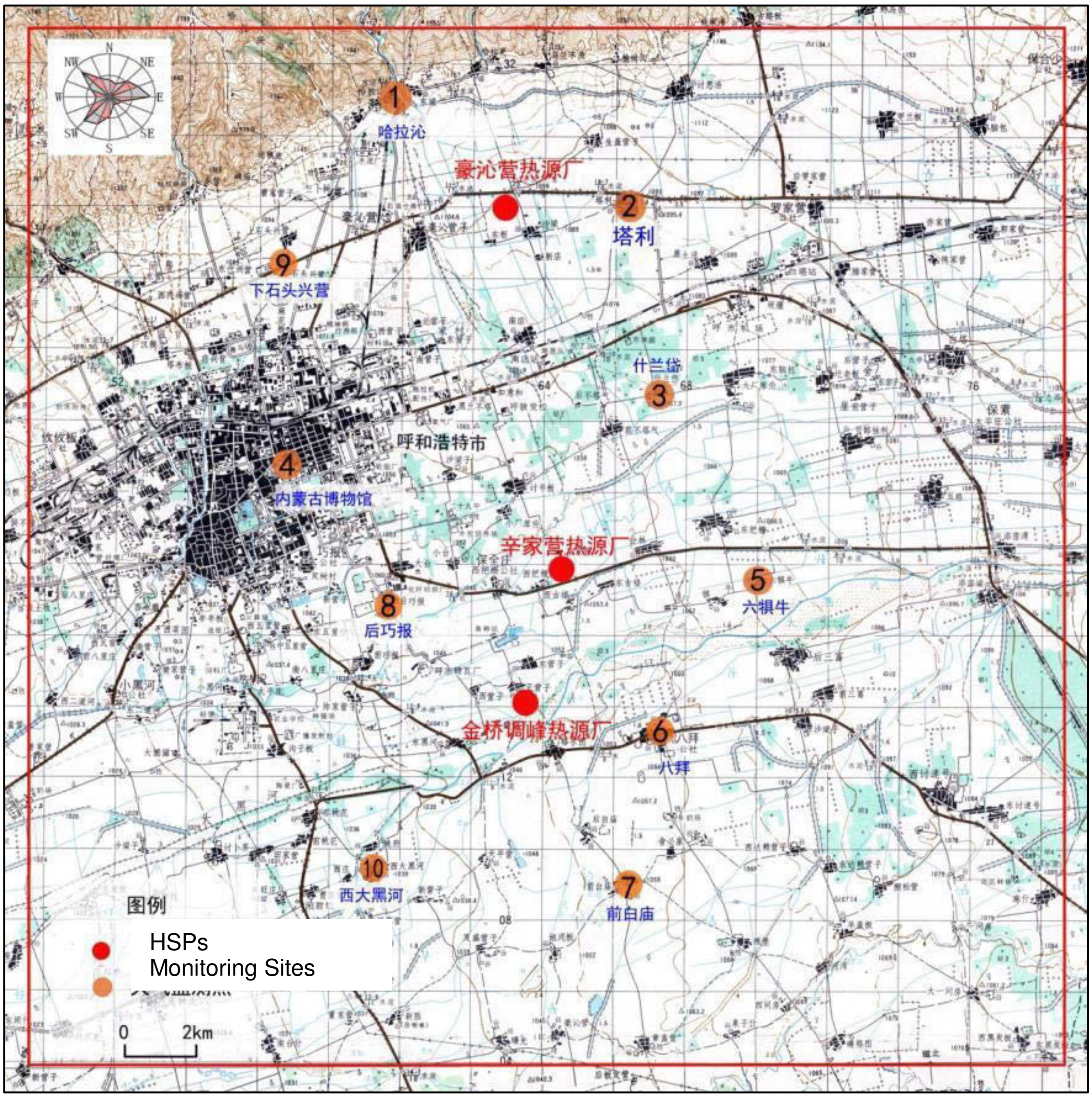
Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 42: Ambient air quality monitoring sampling frequency, time and periods.

Pollutant	**Sampling Frequency**	**Sampling Times**	**Sampling Period**
SO_2, NO_2	4 times/day	One hour average: 02:00, 08:00, 14:00, 20:00	45minutes sampling time for one hour concentration
SO_2, NO_2	1time/day	Daily average: 4:00-24:00	20 hours sampling time for daily concentration

Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 33: Ambient air quality monitoring sites, SO_2 and NO_2.



Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

159. The monitoring results are presented in **Table 43** and **Table 44**. The results confirm the findings of the more limited monitoring undertaken in January 2014; SO_2 and NO_2 pollution levels in Hohhot are low. 1-hour hour average concentrations of SO_2ranged from 12 to 54μg/m^{3}while 24-hour average concentrationsranged from 13 to 24μg/m^3. All concentrations were in compliance with the PRC standards (GB3095-2012). 1-hour average concentration of NO_2ranged from 17 to 65μg/m^3, while 24-hour average concentrationsranged from 23-34μg/m^3. Again, all concentrations were in compliance with the PRC standards (GB3095-2012).

Table 43: Ambient air quality monitoring results, SO_2.

No	Site	1- hour Average # of Averaging Periods	Concentration Range (μg/m^3)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)	24-hourAverage # of Averaging Periods	Concentration Range (μg/m^3)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	Halaqin village	28	12-38	0	0	7	16-22	0	0
2	Tali village	28	14-43	0	0	7	18-23	0	0
3	Shilandai village	28	14-44	0	0	7	15-23	0	0
4	Inner Mongolia museum	28	18-52	0	0	7	13-24	0	0
5	Liujuniu village	28	14-54	0	0	7	17-23	0	0
6	Babai village	28	14-54	0	0	7	15-23	0	0
7	Qianbaimiao village	28	15-54	0	0	7	18-23	0	0
8	Houqiaobao village	28	16-52	0	0	7	18-24	0	0
9	Xiashitouxinying village	28	15-52	0	0	7	18-24	0	0
10	West Dahei River village	28	13-54	0	0	7	16-22	0	0

Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 44: Ambient air quality monitoring results, NO_2.

No	Site	1- hour Average # of Averaging Periods	Concentration Range (μg/m^3)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)	24-hourAverage # of Averaging Periods	Concentration Range (μg/m^3)	Averaging Periods Exceeding Standard (%)	Worst Case Exceedance of Standard (%)
1	Halaqin village	28	21-56	0	0	7	23-26	0	0
2	Tali village	28	21-63	0	0	7	24-30	0	0
3	Shilandai village	28	21-63	0	0	7	25-34	0	0
4	Inner Mongolia museum	28	20-62	0	0	7	24-30	0	0
5	Liujuniu village	28	17-65	0	0	7	24-32	0	0
6	Babai village	28	18-65	0	0	7	24-32	0	0
7	Qianbaimiao village	28	17-65	0	0	7	25-33	0	0
8	Houqiaobao village	28	20-62	0	0	7	25-33	0	0
9	Xiashitouxinying village	28	19-62	0	0	7	25-30	0	0
10	West Dahei River village	28	17-65	0	0	7	26-29	0	0

Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

4. Groundwater Quality

160. Annual average groundwater quality data (2010) was sourced from the Hohhot Groundwater Quality Monitoring Station for wells at the following water supply plants: No 1-5 plants, the plant outside the east gate, the Jinchuan plant and the Ruyi plant (**Figure 34**).Of the 23 pollutants monitored, 8 are monitored on a monthly basis (pH, Total hardness, sulphate, chloride, potassium permanganate index, ammonia, fluoride and total coliforms), and 15 are monitored in January and July (volatile phenols, nitrate nitrogen, nitrite nitrogen, iron, manganese, copper, zinc, anionic surfactants, cyanide, mercury, arsenic, selenium, cadmium, chromium V and lead).

161. Annual average monitoring results are presented in **Table 45**. The results indicate that groundwater quality in Hohhot is relatively good and is in compliance with the relevant standard, Class III of *GB/T14848-93 Quality Standards for Ground Water.*

Figure 34: Location of Hohhot groundwater monitoring wells.

Source: HCDIO, 2014.

Table 45: Groundwater monitoring data from Hohhot water supply plants, 2010 (annual averages, units in mg/L except pH).

Parameter	No 1 plant	No 2 plant	No 3 plant	No 4 plant	No 5 plant	East gate plant	Jinchuan plant	Ruyi plant	Standard
pH	7.4	7.38	7.48	7.37	7.44	7.32	7.55	7.38	6.5-8.5
total hardness	193	208	181	248	195	296	226	211	≤450
ammonia nitrogen	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	≤0.2
permanganate index	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	≤3.0
sulfate,	15	17	10	28	14	25	21	15	≤250
nitrite	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	≤0.02
nitrate nitrogen	1.26	2.76	0.83	4.36	0.58	4.39	1.72	3.7	≤20
chloride	7.71	8.73	5.56	20	6.26	12.6	13.7	10	≤250
fluoride	0.35	0.32	0.31	0.3	0.3	0.28	0.29	0.3	≤1.0
arsenic	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	≤0.05
selenium	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	0.2×10^{-3}	≤0.01
mercury	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	0.005×10^{-3}	≤0.001
chromium VI	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	≤0.05
iron	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	≤0.3
manganese	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	≤0.1
copper	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	≤1.0
cadmium	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	0.05×10^{-3}	≤0.01
lead	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	0.5×10^{-3}	≤0.05
zinc	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	≤1.0
volatile phenols	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	≤0.002
cyanide	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	≤0.05
total dissolved solids	260	285	235	340	242	420	318	244	≤1000
total coliform	<3	<3	<3	<3	<3	<3	<3	<3	≤3

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

5. Ambient Noise

162. Lvsejingcheng (Beijing) Physical and Chemical Testing Technology Ltd. was hired to undertake noise monitoring at the HSP boundaries and adjacent sensitive sites. The monitoring was carried out at over a 24-hour period on January 19, 2014. Weather conditions were sunny and cloudless with wind speed less than 5.0m/s, which is in compliance with relevant PRC meteorological requirementsfor noise monitoring.

163. Monitoring was undertaken with HS 6298 and Aiwa AWA6218 multi-functional ambient noise detectors. Monitoring at the HSP site boundaries was undertaken in accordance with the relevant requirements in *PRC Noise Standards for Industrial Enterprises at Site Boundary*(GB12348-2008). Noise monitoring at adjacent sensitive sites was undertaken in accordance with the relevant requirements in PRC *Environmental Quality Standards for Noise* (GB3096-2008).**Table 46**presents the location of the monitoring

points (site boundaries and adjacent sensitive locations) for the three HSPs, while **Figure 35, Figure 36, and Figure 37**show their locations.

Table 46: Location of ambient noise monitoring sites.

Heating zone	Monitoring Sites at HSP Boundary	Monitoring at Adjacent Sensitive Areas	
		Location	Monitoring Sites
Haoqingying	Sites 1 to 6 around site boundary	Shaliang Village (southeast of project site), 2 story building	Site 1, outdoor monitoring point at 1st floor
Xinjiaying	Sites 1 to 9 around site boundary	Residential area to the east of the site, 6 story buildings	Site 1, 3 outdoor monitoring points at 1st, 3rd and 6th floors Site 2, 3 outdoor monitoring points at 1st, 3rd and 6th floors
Jinqiao	Sites 1 to 4 around site boundary	Zhenglabaying (north of project site), 2 story buildings	Site 1, outdoor monitoring point at 1st floor Site 3, outdoor monitoring point at 1st floor
		Zhenglabaying (northwest of project site), 6 story building	Site 2, 3 outdoor monitoring points at 1st, 3rd and 6th floors
		Zhenglabaying (northwest of project site), 2 story building	Site 4, outdoor monitoring point at 1st floor

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

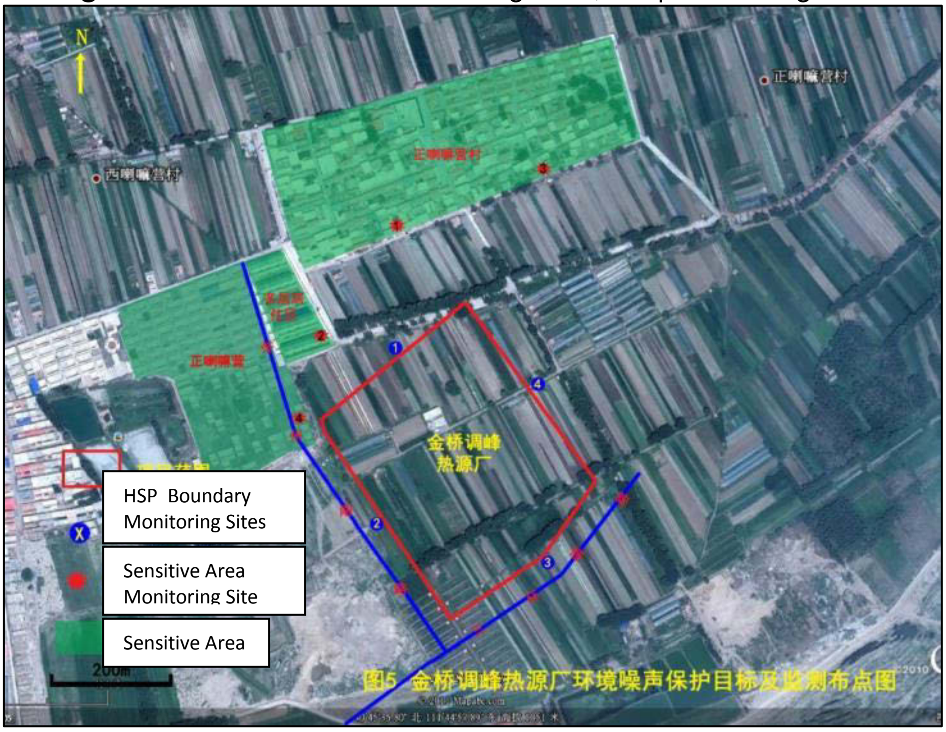
Figure 35: Ambient noise monitoring sites, HaoqingyingHeating Zone.

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 36: Ambient noise monitoring sites, Xinjiaying Heating Zone.

Source: EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Xinjiaying Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 37: Ambient noise monitoring sites, Jinqiao Heating zone.



Source: EIA Tabular Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Heating Resource Plant of Hohhot City Development Company, January 25, 2014. Prepared by Zhong Ye Dong Fang Ltd.

164. The ambient noise monitoring results are presented in **Table 47**. The results indicate that daytime and nighttime noise levels at the at the site boundaries of all three heating zones meet the applicable Class II standards(60dB(A) daytime, 50dB(A) nighttime) in *PRC Noise Standards for Industrial Enterprises at Site Boundary* (GB12348-2008). The results also indicate that daytime and nighttime noise levels at the adjacent sensitive locations for all three heating zones meet the applicable Class II standards (60 dB(A) daytime, 50 dB(A) nighttime) in *PRCEnvironmental Quality Standards for Noise* (GB3096-2008).

Table 47: Ambient noise monitoring results.

Heating zone	Monitoring Location	Monitoring Site No. and Floor Location		Daytime Average Leq dB(A) (06:00 – 22:00)	Nighttime Average Leq dB(A) (22:00 – 06:00)
Haoqingying	HSP Boundary	1		54.1	48.7
		2		54.9	48.1
		3		53.2	47.3
		4		51.2	47.1
		5		52.1	47.0
		6		51.2	47.4
	Sensitive Area	1	1st floor	53.7	49.2
Xinjiaying	HSP Boundary	1		50.1	48.3
		2		51.2	47.7
		3		52.3	48.5
		4		52.7	49.2
		5		50.6	48.9
		6		51.3	49.8
		7		50.9	49.0
		8		51.8	48.5
		9		51.2	48.0
	Sensitive Areas	1	1st floor	49.8	49.1
			3rd floor	50.5	49.8
			3rd floor	50.2	49.6
		2	1st floor	52.4	49.8
			3rd floor	51.8	49.7
			3rd floor	50.9	49.5
Jinqiao	HSP Boundary	1		45.6	44.4
		2		47.9	45.8
		3		48.4	44.3
		4		47.0	44.8
	Sensitive Areas	1	1st floor	49.2	45.8
		3	1st floor	46.9	45.1
		4	1st floor	51.0	44.7
		2	1st floor	47.4	46.0
			3rd floor	46.3	45.2
			3rd floor	51.3	47.3

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

165. Anticipated positive and negative environmental impacts of the proposed Project were assessedbased on the findings of the approved domestic EIA reports,supported by site visits, stakeholder consultations, additional surveys undertaken by national and international environmentalconsultants in 2014, and additional atmospheric modeling undertaken in 2014.Applicable and specific requirements of the PRC EIA regulations and the ADB's SPS (2009), and experiences from existing district heating projects in the PRC and elsewhere were considered carefully in assessing the environmental impacts.

166. Pre-construction, construction phase and operation phases were each considered separately. The results of the assessment analysisindicates that during the pre-construction phase issues are very limited, and are mostly associated with siting and ensuring appropriate incorporation of mitigation measures into the project design.

167. Potential negative construction phaseenvironmental impacts are short-term and localized, and are associated with soil erosion, construction noise and fugitive dust, disruption of traffic and community services, and risks to worker health and safety.Potential negative operation phase impacts are associated with boiler emissions, waste and wastewater, noise, and health and safety risks to workers.

168. Potential positive operation phase impacts are significant and long-term, and are associated with emissions reductions compared to equivalent heat production from coal-fired boilers for district heating.

A. AnticipatedPre-construction Phase Impacts and Mitigation Measures

1. Siting and Land Acquisition

169. The social safeguards due diligence undertaken for the Project (natural gas-fired design) describe the land that wasacquired for the three HSPsites:[21]

- HaoqingyingHSP: 303 mu (20.2 ha) of land was acquired from the Shaliang Village in Xincheng District.

- Jinqiao HSP: 329.7 mu (22 ha) of waste land (a brick and tile factory abandoned over 15 years ago and other unused land) wasacquired from Zhenglamaying Village in Saihan District.

170. Pipelines will be built with existing road right-of-ways, and will not require land acquisition. The HESs will be built on existing local government owned land that has been reserved for construction and also will not require land acquisition or resettlement.

171. Overall, the social safeguards due diligence indicates that the Project will not result in any involuntary land acquisition, resettlement or economic or physical displacement, and there will be no loss of personal property, structures, crops, trees or other assets. There are also no potential adverse impacts on disadvantaged or vulnerable groups, including the poor, women and children, and Indigenous Peoples.

2. Mitigation Measures and Monitoring during Detailed Design

[21] Inner Mongolia Autonomous Region District Heating Supply Project, Social Analysis Report. December, 2013.

172. Mitigation measures to be adopted during detailed design to minimize the impacts are as follows:

(i) **DetailedDesign.** Environmental mitigation measures indicated in this EIA, the EMP and the domestic EIAs will be incorporated into the detailed design.

(ii) **Bidding Documents and Contracts.** Environmental mitigation measures indicated in this EIA, the EMP and the domestic EIAs will be included in contracts for civil constructions and equipment installations. All contractors will be required to strictly comply with the EMP.

(iii) **Environmental monitoring.** The environmental monitoring program (EMoP, see **Table A-4**in **Appendix I**) will be incorporated into the design to ensure that environmental impacts are closely monitored and activities of the Project construction and operating are closely supervised against the PRC environmental laws, regulations and standards, ADB SPS, and the Project EMP and approved domestic EIAs.

3. Grievance Redress Mechanism

173. In accordance with the Grievance Redress Mechanism (GRM) presented in Chapter VIII of the EIA, a Project Public Complaints Unit (PPCU) will be establishedwithin the Project Management Office (PMO); GRM training will be provided for PPCU members and GRM access points; and the PPCU's phone number, fax, address, and email will be disclosed to the public.

4. Training and Capacity Building

174. An institutional strengthening and training program will be delivered by loan implementation environmental consultants (LIEC)(see **Table A-2** in EMP). The program will include the development of construction and operation phase EHS plans for each heating zone. The training will focus on ADB's and PRC's environmental, health and safety laws, regulations and policies; implementation of the EMoP; the GRM; and international good EHSpractices in natural gas-fired HSP operation. Training will be provided to the IA, relevant PMO staff, relevant three branch staff, contractors and Saihan District EPB that is responsible for environmental compliance issues at three heating zones.

175. The IA shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks. No operator shall be permitted to operate critical mechanical equipment without having proper certification.

B. Anticipated Construction Phase Impacts and Mitigation Measures

176. The following mitigation measures apply to all HSP sites, pipeline constructionand HES construction sites, unless otherwise specified.

1. Erosion and Spoil

177. Construction activities such as land leveling, excavation and filling activities may lead to surface erosion. The most vulnerable soil erosion areas in the construction site include excavation sites, leveling sites, spoil sites, temporary construction sites, and other areas where surface soil is disturbed. Soil erosion can also occur after completion of construction in areas if site restoration is inadequate. However, the HSP sites are generally flat and there are no rivers, streams, lakes that are likely to be affected, other than fish ponds to the northwest of the Jinqiao HSP site. Pipeline excavation and burial may also cause localized erosion and mudding of adjacent road. Construction activities may also

generate surplus spoil.

178. These impacts can be mitigated through typical good practice construction erosion controls and site maintenance:

(i) HSP site storm water runoff will be assessed and estimated and appropriate storm water drainage systems to minimize soil erosion will be implemented, including perimeter bunds and establishment of temporary detention andsettling ponds to control topsoil runoff.

(ii) Fish ponds along the northwestern boundary of the JinqiaoHSPwill be protected by silt fences when nearby construction activities are underway.

(iii) Spoil will be reuse of on-site to the maximum extent feasibleas fill to rehabilitate disturbed areas or for landscaping.

(iv) Temporary spoil storage sites will be identified, designed, and operated to minimize impacts. Sites will be restored at the conclusion of storage activities.

(v) Excess spoil that cannot be used on-site will be transported to an approved spoil disposal site.

(vi) Spoil and aggregate piles will be covered with landscape material.

(vii) During earthworks the area of soil is exposed to potential erosion at any one time will be minimized.

(viii) Construction and material handling activities during periods of rains and high winds will be limited or halted.

(ix) Pipelineswill be installed and backfilled in a sequenced section-by-section approach, with sections not exceeding 300 m in length. Open excavation areas during trenching activities will be minimized, and appropriate construction compaction techniquesutilized.

(x) Any planned paving or vegetating of areas will be done as soon as practical after the materials are removed to protect and stabilize the soil.

(xi) Once construction is completedisturbed surfaces will be properly sloped and revegetated with native trees and grass(see greening plan, below).

2. Wastewater

179. There areno surface water bodies around the construction sites other than the fishponds northwest of the Jinqiao HSP. However, inappropriatedisposal of domestic wastewater (from construction worker camps and/or workers) or construction wastewater (from washing aggregates, washing construction equipment and vehicles, pouring and curing concrete, and oil-containing wastewater from machinery repairs) may cause soil or groundwater resources contamination.

180. These impacts can be mitigated through typical good wastewater management practices:

(i) Adequate temporary sanitary facilities and ablutions will be provided for construction workers.Toilets will be equipped with septic tanks in accordance with PRC standards.

(ii) Septic tanks will be pumped out on an as needed basis, and the effluent will be transported to the nearest sewage treatment plant for treatment by the local sanitation department.

(iii) Wastewater from the canteen should be treated in an oil-water separator, and then discharged into the municipal sewer for final treatment at the Jinqiao wastewater treatment plant.

(iv) Construction wastewater will be directed to temporary detention andsettling pondsprior to discharge to urban storm sewers.

(v) Areas where construction equipment is being washed will be equipped with water collection basins and sediment traps.

3. Air Pollution

181. Anticipated sources of air pollution from HSP construction activities include: (i) dust generated from demolition, earth excavation, filling, loading, hauling and unloading; (ii) dust generated from disturbed and uncovered construction areas, especially on windy days; (iii) dust generated by the movement of vehicles and heavy machinery on unpaved access and haul roads; (iv) dust from aggregate preparation and concrete-mixing; and (v) emissions from construction vehicles (gaseous CO and NO_2) and heavy diesel machinery and equipment. Similarly, dust and air pollution will also be generated during the installation of the heat supply pipelines from (i) excavation, piling of materials; (ii) raw material transport and unloading; (iii) cement mortar preparation; (iv) pipeline backfilling; and, (v) emissions from construction vehicles and heavy diesel machinery and equipment.

182. Based onprevious domestic project experience, worst case predicted TSP concentrations in clear weather conditions without watering are presented in **Table 48**. Dust impacts from pipeline and HES construction will be more limited in scope, and are expected to be within approximately a 20 m radius of both sides of the roads or HES sites.

Table 48: Worst case predicted TSP concentrations, clear weather without mitigations.

Construction Activity	Dust Sources	Wind speed(m/s)	Distance (m)	Concentration (mg/m3)
Earthworks	Excavation, backfilling, loading and unloading, transportation, site operation	2.4	50	11.7
			100	8.8
			150	5.0

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd. Based on experience with previous projects.

183. To reduce air quality impacts during the construction period the following air quality management measure will be implemented:

(i) HSP sites, HES sites and pipeline sections under construction will be fully enclosed by a 3 m high fence prior to the commencement of construction.Fence heightwill be increased near sensitive locations (residential areas, schools, clinics and hospitals).

(ii) Water will be sprayed on active construction sites where fugitive dust is being generated on a daily basis, and more frequently during windy days.

(iii) Construction activities will be halted during high wind events.

(iv) All construction piles with the potential to generate dust will be covered and/or regularly watered.

(v) Transport vehicles will be limited to low speeds in construction sites.

(vi) Loads will be covered during truck transportation to avoid spillage or fugitive dust generation. Fine materials will be transported in fully contained trucks.

(vii) Construction site roads will be well maintained, and watered and swept on an as-needed basis.Construction site road entry points will be equipped with truck drive through wash ponds.

(viii) Transport routes will avoid residential neighborhoods and other sensitive areas to the maximum extent practical.

(ix) Vehicles and construction machineries will be maintained to a high standard (to be done off-site) to ensure efficient operating and fuel-burning and compliance with the PRC emission standards GB 11340-2005, GB 17691-2005, GB 18285 -2005 and GB 18352-2005.

(x) The use of coal for cooking on site, heating and hot water is prohibited.

(xi) Non-ozone depleting blowing agents will be utilized for the polyurethane foam (PUR) during the construction of pre-insulated bonded heating pipes.

4. Noise Impacts

a) Noise Intensity

184. A significant increase in localized noise is expected during construction. HSP construction activities will involve excavators, bulldozers, concrete-mixing plants, loaders, graders, rollers, and other heavy machinery, as well as noise from goods transportation. Noise during pipeline construction will be generated by trench excavators, rollers and other compaction machinery. Though noise levels may be high, the impacts will be temporary and localized, and with the exception of the pipelinesand HESs, will be focused on the uninhabitedHSP siteareas. The major anticipated noise sources at each construction stage are presented in **Table 49**, while transportation noise sources are presented in**Table 50**.

Table 49: Primary noise sources at each construction stage.

Construction Stage	Primary Noise Source	Sound Level dB(A)
Demolition	Bulldozer	95
	Excavating machinery	90-96
Land Forming	Bulldozer	95
	Excavating machinery	90-96
	Loader	90
Foundation and earthworks	Loader	90
	Excavating machinery	78-96
Floor and Structure	Vibrator	90-100
	Reinforcement cutting shears	90-95
	Welder	90-95

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 50: Transportation vehicle noise sources, construction phase.

Noise Source	Large Truck	Light Truck
Sound level dB（A）	95	75

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

b) Noise Prediction

185. Construction equipment is considered a point noise source, and the predictive model is as follows:

$$L_2 = L_1 - 20\lg(r_2/r_1) \quad (r_2 > r_1)$$

Where, L_1 and L_2 are equipment noise sound levels at locations R_1 and R_2, respectively.

186. Peak construction noise levels at different distances from the source at each constructionstageare presented in**Table 51**. This assumes a worst case scenario: high noise equipment is operating without noise barriers or mitigations, and sound absorption in air is not included.

187. The worst case peak construction noise prediction results show that during the day some high noise activities within 20 m of the site boundaries in the daytime, and 100 m at nighttime, could be close to being in non-compliance with GB 12523－2011 which specifies the noise limit at construction site boundaries for Class II areas as 75 dB (A) during the daytime and 55 dB (A) during the nighttime. These impacts will be localized and short-term during the construction process, and the highest noise impacts will be within the HSP sites. However, mitigation measures to protect communities will nonetheless be implemented.

Table 51: Predicted noise levels of construction equipment by distance.

Construction Stage	**Primary Noise Source**	**Noise value dB(A) at distance (m) from source**							
		10 m	20 m	30 m	40 m	50 m	100 m	200 m	300 m
Foundation and Earthworks	Loader	70	64	60.5	58	56	50	44	38
	Excavating Machinery	67	61	57.5	55	53	47	41	34
	Piling Machines	80	74	70	68	66	60	54	47
Structure Construction	Vibrator	75	69	65.5	63	58.7	55	49	43
	Concrete pump	72.5	66.5	63	60.5	58.5	52.5	46.5	40.5
	Reinforcement cutting shears	73	67	63.5	61	59	53	47	41
	Chainsaw	69	63	59.5	57	55	49	43	37
	Lift	74	68	64	62	60	54	48	42

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

c) Mitigation Measures for Noise Impacts

188. To ensure construction activities meet PRC noise standards (*Noise Standards for Construction Site Boundary*, GB 12523-2011) and protect workers and adjacent residents, the following mitigation measures will be implemented:

(i) Construction activitieswill be restricted to 6:00-12:00 h and 14:00-22:00 h. Construction activities will be prohibited during the nighttime (22:00 h to 07:00 h). Exceptions will only be allowed in special cases, and only after getting approval of the surrounding residents, EPB and other relevant departments.

(ii) When undertaking construction planning, simultaneous high-noise activities will be avoided, and high noise activities will be scheduled during that day rather than evening hours. Similarly, construction sites will be planned to avoid multiple high noise activities or equipment from operating at the same location.

(iii) Low-noise equipment will be selected as much as possible.

(iv) Noise levels from equipment and machinery must conform to the PRC standard GB 12523-2011, will be equipped with mufflers, and will be properly maintained to minimize noise.

(v) Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum.

(vi) Noise personnel protective equipment (PPE) will be provided to workers.

(vii) Transportation routes and delivery schedules will be planned during detailed design to avoid densely populated and sensitive areas and high traffic times.

(viii) Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and hospitals.

(ix) Given their location within residential areas, special attention will be paid to protect sensitive sites near HESs and along the pipeline routes:

- High noise construction activities will be positioned as far away from sensitive sites as possible.
- Low noise equipment will be utilized to the extent possible.
- Temporary or permanent noise barriers will be installed to protect sensitive sites.

5. Solid Waste

a) Waste Sources

189. Solid waste generated in the construction phase will include construction waste, waste from boiler dismantling, and domestic waste. Construction wastes include fill, various building materials such as steel, timbers, rubble, and other types of waste. At Sanhecun HSP, five 29MW coal boilers will be dismantled, which will generate waste. An estimated of 0.5 kg/day per worker of domestic waste will be generated from construction workers. Inappropriate waste storage and disposal could affect soil, groundwater, and surface water resources, and hence, public health and sanitation.

b) Mitigation Measures

190. The following solid waste management measure will be implemented:

(i) Wastes will be reused or recycled to the extent possible.

(ii) Littering by workers will be prohibited.

(iii) Domestic waste containers will be provided at all work sites. Domestic waste will be collected on a regular basis by the local sanitation departments and transported for recycling, reuse, or disposal at a licensed landfill, in accordance with relevant PRC regulations and requirements.

(iv) Construction waste dumpsters will be provided at all work sites. Construction waste, including boiler demolition waste, will be collected on a regular basis by a licensedwaste collection company and transported for recycling, reuse, or disposal at a licensed landfill, in accordance with relevant PRC regulations and requirements.

(v) Dismantled boilers will be properly disposed or recycled in accordance with relevalant PRC regulations and requirements.

(vi) Coal ash will be properly collected, stored, transported for recycling (coal ash can be sold to make construction materials)

(vii) Excavated soil will be backfilled onsite to the extent possible. Excess spoil that cannot be used on-site will be transported to an approved spoil disposal site.

(viii) There should be no final waste disposal on site.Waste incineration at or near the site is strictly prohibited.

(ix) Contractors will be held responsible for proper removal and disposal of any significant residual materials, wastes, and contaminated soils that remain on the site after construction.

6. Hazardous and Polluting Materials

191. Inappropriate transportation, storage, use and spills of petroleum products and hazardous materials can cause soil, surface and groundwater contamination. To prevent this, the following mitigation measures will be implemented:

(i) A hazardous materials handling and disposal protocol that includes spill emergency response will be prepared and implemented by contractors.

(ii) Storage facilities for fuels, oil, chemicals and other hazardous materials will be within secured areas on impermeable surfacesprovided with dikes, and at least 300 m from drainage structures and important water bodies. A standalone site within the storage facility will be designated for hazardous wastes.

(iii) Suppliers of chemicals and hazardous materials must hold proper licenses. They will follow all relevant protocolsin "Operation Procedures for Transportation, Loading and Unloading of Dangerous or Harmful Goods" (JT 3145-91).

(iv) A licensed company will be hired to collect, transport, and dispose of hazardous materials, including coal boiler demolition waste in accordance with relevant PRC regulations and requirements.

(v) Vehicles and equipment will be properly maintained and refueled in designated service areas on impermeable surfaces provided with oil traps, at least 300 m from drainage structures and important water bodies.

7. Dismantling Coal Boilers Dismantle

192. Inappropriate transportation, storage, use and spills of petroleum products and hazardous materials can cause soil, surface and groundwater contamination. To prevent this, the following mitigation measures will be implemented:

(vi) A hazardous materials handling and disposal protocol that includes spill emergency response will be prepared and implemented by contractors.

(vii) Storage facilities for fuels, oil, chemicals and other hazardous materials will be within secured areas on impermeable surfacesprovided with dikes, and at least 300 m from drainage structures and important water bodies. A standalone site within the storage facility will be designated for hazardous wastes.

(viii) Suppliers of chemicals and hazardous materials must hold proper licenses. They will follow all relevant protocolsin “Operation Procedures for Transportation, Loading and Unloading of Dangerous or Harmful Goods” (JT 3145-91).

8. Impacts to Flora and Fauna

193. Typical construction impacts on flora and fauna include removal of vegetation and disruption of the ecosystem during construction. If present, rare or endangered flora or fauna may also be impacted. However, the Project HSP sites are located in urban or semi-rural environments within the city limits, which have little or no vegetation cover other than recently establishedgrasses and shrubs. Similarly, pipeline routes and HES sites are within urbanenvironments. There are no known rare or endangered flora or fauna, parks, nature reserves or areas with special ecological significance which will be impacted by the Project. This conclusion has been confirmed by the Hohhot Forestry Bureau. Impacts on flora or fauna are thus expected to be minimal and short-term. Nonetheless, to address potential impacts:

(i) A greening plan will be implemented in each HSP:

a. HSP site vegetation plans will be developed, using appropriate native species. According to the domestic EIAs, the approximate area to be vegetated for each HSP is:
   - Haoqingying greening area: 34,486 m^2
   - Xinjiaying greening area: 27,226 m^2.
   - Jinqiao greening area: 34,375 m^2.

b. Any vegetated areas impacted by pipeline works or construction of HESs will be restored post-construction using appropriate native species.

194. The Jinqiao heating zone will require one river crossing. To minimize potential impacts:

(i) Directional drilling will be used to embed the pipeline under the waterway.

(ii) The waterbody will be protected by siltation fences.

9. Impacts on Socio-Economic Resources

a) Community Disturbance and Safety

195. Project construction has the potential to cause significant community disturbance such as traffic congestionor delays, and public safety risks from construction activities, heavy vehicles and machinery traffic. For example, Project construction will require an estimated 212,000 trucks loads: 3,000 trucks of earth fill for HSPs, 300 trucks of steel, 4,500 trucks of concrete, 500 trucks of equipment, 1,300 trucks of pipeline, 200 trucks of fittings, 200 trucks of HES, 200 trucks of electric and control equipment, and 11,000 trucks of earth fill for installing pipelines. In addition, portions of the pipeline network and HESs are often located within sensitive residential or commercial areas. There is also the potential for interruptions in municipal services and utilities resulting from damage to pipelines for water supply, drainage, heating supply, and gas, as well as to underground power cables and communication cables.

196. Existing road access to the HSP sites is good. The Haoqingying HSP is located south of the national road 110, and traffic will not have a significant impact on any residential area. The Xinjiaying HSP will be constructed adjacent to an existing HSP, which owned bythe HCHC. Again there is good existing access via Da Tian Road which does not have an impact on residential areas. The Jinqiao HSP can be accessed by the 3rd Ring Road to the south, Feng Zhou Road to the west, and La Ma Ying Road to the eastwith little or no impact on residential area.Nonetheless, mitigations will be implemented to address traffic and other communitydisturbance issues:

Traffic and Public Safety

(i) Traffic control plans, agreed to by the local traffic control authority, will be developed and implemented for each heating zone in order to minimize community disturbance:

- Local government, using information provided by the PMO, will inform residents, institutions, bossinessand other affected parties as to planned construction activities including schedule and duration of construction works, and expected traffic and other disruptions.
- Transportation routes and delivery schedules will be planned during detailed design to avoid densely populated and sensitive areas and high traffic times.
- Warning signs and cones will be installed along roads to protect workers and people in the neighborhood. Safetyflags will be used if appropriate.
- Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and hospitals.
- During evening construction warning lights will also be used.
- Roadside earthworks should be completed as quickly as possible, and all spoil either backfilled or removed.
- Road crossing will use the pipe-jacking installation method where possible in order to minimize disruption.

(ii) Public access to construction sites and other areas of danger will be restricted and temporary barriers installed.

Access to Public Services, Private Properties and Businesses

(i) Local authorities will be consulted to minimize disruption of public services such as telephone, water, gas and power supply. Contactors will use good construction practices to avoid disruption of other services.

(ii) The Contractor shall take measures to minimize disruption of access to private properties and businesses where possible.

(iii) Temporary access to affected private properties, businesses and public service buildings will be provided including temporary crossings over pipeline trenches, and subsequently good quality permanent access will be provided.

b) Worker Occupational Health and Safety

197. Construction may cause physical hazards to workers from noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, chemical hazards such as toxic fumes and vapors, and others.

198. Contractors will implement adequate precautions to protect the health and safety of their workers.:

(i) Each contractor will implement the relevant construction phase EHS plan developed by the LIEC.

(ii) An EHS officer will be appointed by each contractor to implement and supervise the EHS management plan.

The EHS Plan will:

– Identify and minimize the causes of potential hazards to workers.
– Implement appropriate safety measures.
– Ensure the provision of adequate type and number of fire extinguishers and first aid facilitiesonsite.
– Provide training to workers on occupational health and safety and emergency response, especially with respect to using potentially dangerous equipment.
– Ensure that all equipment is maintained in a safe operating condition.
– Ensure that material stockpiles or stacks, such as, pipes are stable and well secured to avoid collapse and possible injury to workers.
– Provide appropriate personal protective equipment (PPE) to workers to minimize risks, including ear protection, hard hats and safety boots, and post adequate signage in risk areas.
– Provide procedures for limiting exposure to high noise or heat working environments in compliance with PRC noise standards for construction sites (GB12523-2011).
– Provide training to workers on the storage, handling and disposal of hazardous wastes.
– Ensureregularsafety meetings with staff.

10. Physical Culture Resources

199. There are no known cultural heritage or archaeological sites on the Project sites. However, there is a tomb approximately 100 m south of the Jinqiao HSP boundary near the existing access road, and care will need to be taken during construction to protect the tomb. In addition, construction activities may have the potential to disturb as yet unknown underground cultural relics.

200. To addressthese issues:

(i) The tomb south of the JinqiaoHSP(**Figure 27**) will be demarcated by fence and signs as a no-entry area.

(ii) A construction phase chance find procedure will be established and activated if any chance finds of PCRs are encountered:

- construction activities will be immediately suspended if any PCRs are encountered;
- destroying, damaging, defacing, or concealing PCRs will be strictly prohibited in accordance with PRC regulations;
- the local Cultural Heritage Bureau will be promptly informed and consulted; and,
- construction activities will resume only after thorough investigation and with the permission of the local Cultural Heritage Bureau.

C. Anticipated Operation Phase Impacts and Mitigation Measures

201. The Project may cause some adverse environmental impacts during operation including air pollution from natural gas combustion, noise from HESs, wastewaterand solidwastes, and fire and safety hazards.

1. Air Pollution

a) Air Pollution Emissions

202. The primary emissions to air from the combustion of fossil fuels are sulfur dioxide (SO_2), nitrogen oxides (NO_X), particulate matter (PM), carbon monoxide (CO), and greenhouse gases, such as carbon dioxide (CO_2). Natural gas generally produce negligible quantities of particulate matter and sulfur oxides, and levels of nitrogen oxides are about 60% of those from plants using coal (without emission reduction measures). Natural gas-fired plants also release lower quantities of carbon dioxide, a greenhouse gas.To minimize emissions and associated impacts, the Project will utilize low NOx natural gas-fired boilers and zero emission demonstration electrode boilers.

203. The domestic EIAs use a boiler NOx emission concentration of 137.31mg/m^3, based on a 2007 survey of industrial natural gas boilers in the PRC. It's important to note that this emission level is in compliance with both the PRC natural gas boiler emission standard of 400 mg/m^3 and 200 mg/m^3 in sensitive areas (*PRC Emission Standards of Air Pollutants for Coal-burning, Oil-burning, Gas-fired Boilers* (GB 13217-2001)), and the 2007 IFC EHS guidelines of 240 mg/m^3 for natural gas boilers. However, to in order to maximize environmental benefits, the Project has committed to using low NOx natural gas boilers producing less than 100 mg/m^3 NOx emissions.

204. As noted above, the 1,560 MW of clean-burning natural gas-fired heating capacity and 50 MW of wind powered electrode heating capacity generated by the proposed Project

will replace heat that otherwise would have been generated by coal-fired power plants. When compared to the equivalent production of heat through traditional coal-fired sources, once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,500 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2; (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons (**Table 52**).

Table 52: Project emissions / coal use and savings vs coal-fired boilers.

Heating zone	Pollutant / Coal Use	Predicted Project Emissions(gas-fired district heating) ton/a	Predicted Baseline Emissions(equivalent heat production using coal-fired district heating) ton/a	Emissions Reduction ton/a
Haoqingying	CO_2	362,819	803,923	441,104
	NOx	348	3,726	3,378
	PM	-	9,895	9,895
	SO_2	74	4,555	4,481
	Fly Ash and Bottom Ash	-	72,566	72,566
	Standard Coal	-	322,472	322,472
	Raw Coal	-	482,514	482,514
Xinjiaying	CO_2	303,729	647,476	343,746
	NOx	291	3,001	2,710
	PM	-	7,970	7,970
	SO_2	62	3,669	3,606
	Fly Ash and Bottom Ash	-	58,445	58,445
	Standard Coal (1000 ton/a)	-	259,717	259,717
	Raw Coal	-	388,615	388,615
Jinqiao	CO_2	149,359	663,919	514,560
	NOx	143	3,077	2,934
	PM	-	8,172	8,172
	SO_2	31	3,762	3,731
	Fly Ash and Bottom Ash	-	59,929	59,929
	Standard Coal	-	266,313	266,313
	Raw Coal	-	398,483	398,483
Project Total	CO_2	815,907	2,115,318	1,299,411
	NOx	783	9,805	9,023
	PM	-	26,037	26,037
	SO_2	167	11,985	11,818
	Fly Ash and Bottom Ash	-	190,940	190,940
	Standard Coal	-	848,503	848,503
	Raw Coal	-	1,269,614	1,269,614

Sources: Based on EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014 and PPTA consultant calculations. Annex VI presents detailed calculations and assumptions.

b) Air Pollution Dispersion Modelling and Compliance with Air Quality Standards

205. The main pollutants of concern in natural gas-fired boiler emissions are NOx and SO_2. The domestic EIAs undertook preliminary atmospheric dispersion modeling for SO_2 and NOx. The results indicated that the worst case ground level concentrations (GLCs) of SO_2 and NO_2 are 0.88% and 9.96% respectively of the PRC standard, and the location with the maximum concentration is 970 m downwind of the pollution source.However, the modelling utilized SCREEN3, which is a screening model; only one boiler per HSP was modeled, (as opposed to the design of from 5 to 7 boilers); the modeling did not take into account the planned additional HSP at Haoqingying, and there was no "cumulative" modelling assessing impacts of all three HSPs simultaneously against background ambient levels.To address these issues, updated modeling was undertaken in April 2014 by the EIA Institute.[22]

206. It is important to note that there was no additional modelling work conducted to reflect the revised project component. The revised project scope involves significant amount of stack emissions reductions from HSPs located in urban areas of Hohhot City. Therefore, the air quality impact in Hohhot would be significantly less than the expected impact from the original project scope. In addition, the additional heat sources like Jincheng MSW and Jinneng CCHP are located far south from the urban area. Considering the down wind flows during winter, which is south-east, the emissions from these sources would not impact Hohhot air quality.

i. Atmospheric Dispersion Model

207. Atmosphericdispersion modelling was undertaken utilizing AERMOD, a US EPA and PRC approved steady-state short range (up to 50 km) plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of all point, surface and body sources.[23] AERMOD can simulate the concentration distribution in both the short term (1-hour and daily average concentrations) and the long term (annual average concentrations). AERMOD is applicable for rural or urban districts and simple or complicated terrain. The impact of bottom flow of buildings (e.g. plume downwash)is also taken into account. AERMOD uses meteorological data for 1-hour continuous pre-treatment to simulate average concentration distribution in periodsdown to 1 hour. AERMOD includes two preprocessors: AERMET, which accepts surface meteorological data and upper air soundings, and then calculates atmospheric parameters needed by the dispersion model; and AERMAP, a terrain preprocessorwhich provide a physical relationship between terrain features and the behavior of air pollution plumes. It generates location and height data for each receptor location. It also provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills.

ii. Modelling Scenarios

208. Atmospheric dispersion modeling was undertaken for the following scenarios:

Case 1 – HSPs and Cumulative

i) Worst case SO_2 and NO_x GLCs with Haoqingying, Xinjiaying and Jinqiao HSPs running simultaneously.

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22 Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

23 AERMOD is recommended model in Appendix A of *Guidelines for Environmental Impact Assessment of Atmospheric Environment* (HJ2.2-2008).

ii) Worst case SO_2 and NO_x GLCs with Haoqingying, Xinjiaying and Jinqiao HSPs running simultaneously superimposed over worst case background ambient air quality (cumulative assessment taking into account other pollution sources in the airshed).

Case 2 – HSPs, Additional Planned HSPs, and Cumulative

i) Worst case SO_2 and NO_xGLCs with Haoqingying, Xinjiaying and Jinqiao HSPs running simultaneously and with planned HSP expansion also taken into account (e.g. planned additional HSP at Haoqingyingsite).

ii) Worst case SO_2 and NO_x GLCs with Haoqingying, Xinjiaying and Jinqiao HSPs running simultaneously and with planned HSP expansion also taken into account (e.g. planned additional HSP at Haoqingyingsite) superimposed over worst case background ambient air quality (cumulative assessment taking into account other pollution sources in the airshed).

iii) The modelling did not include other planned CHP or heat source plants under the Hohhot development plan due to uncertainty of their locations and timelines.

iii. Input Data

HSP Emission Parameters

209. The HSP emission parameters are presented in **Table 53**.

Table 53: HSP exhaust gas emission parameters.

Project	HSP	Emission height (m)	Inner diameter (m)	Exhaust Quantity (m^3/h)	Exhaust Temp. (^oC)	Emission Rate (kg/h)	
						SO_2	NO_x[24]
Low-carbon District Heating Project	Haoqingying HSP	30	2.5	5×179,045	120	5×5.26	5×17.90
	Xinjiaying HSP	30	2.5	7×107,061	120	7×3.14	7×10.71
	Jinqiao HSP	30	2.5	7×109,591	120	7×3.22	7×10.96
Planned HSP at Project site[a]	Haoqingying Phase II HSP	120	5	1,180,480	80	24.6	308.5

[a]The modelling was done using parameters that was indicated in the approved domestic EIA requirements for the original coal-fired HSP. It is note thatthe heating company already decided to switch from coal to natural gas for the planned Haoqingying Phase II HSP. A revised domestic EIA for gas-based was prepared and submitted for approval. Currently it is under the process of review by relevant authority. It is expected that environmental impact from Phase II HSP at project site would be significantly reduced compared to the expected impacts shown in modelling results.
Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Meteorological Data

[24] Modeling needs to account for the conversion of nitrogen oxides (NO_x) emitted by a source into nitrogen dioxide (NO_2) in ambient air. In accordance with the *Guidelines for Environmental Impact Assessment of the Atmospheric Environment* (HJ2.2-2008), the modeling assumed that for 1-hour and 24-hour average concentrations, 90% of the NO_x is converted to NO_2, and for annual average concentrations 75% is converted to NO_2.

210. Meteorological data from the Hohhot National Basic Meteorological Station was obtained from the IMAR Atmospheric Sounding Technical Support Center. The meteorological station is located at East Hailaer Road in Hohhot, at an elevation of l063 masl. Topographyat the station is similar to the HSP sites, and the station is approximately the same distance from all three heating zones. The meteorological station was established in 1951, and has more than 50 years of continuous observation records.

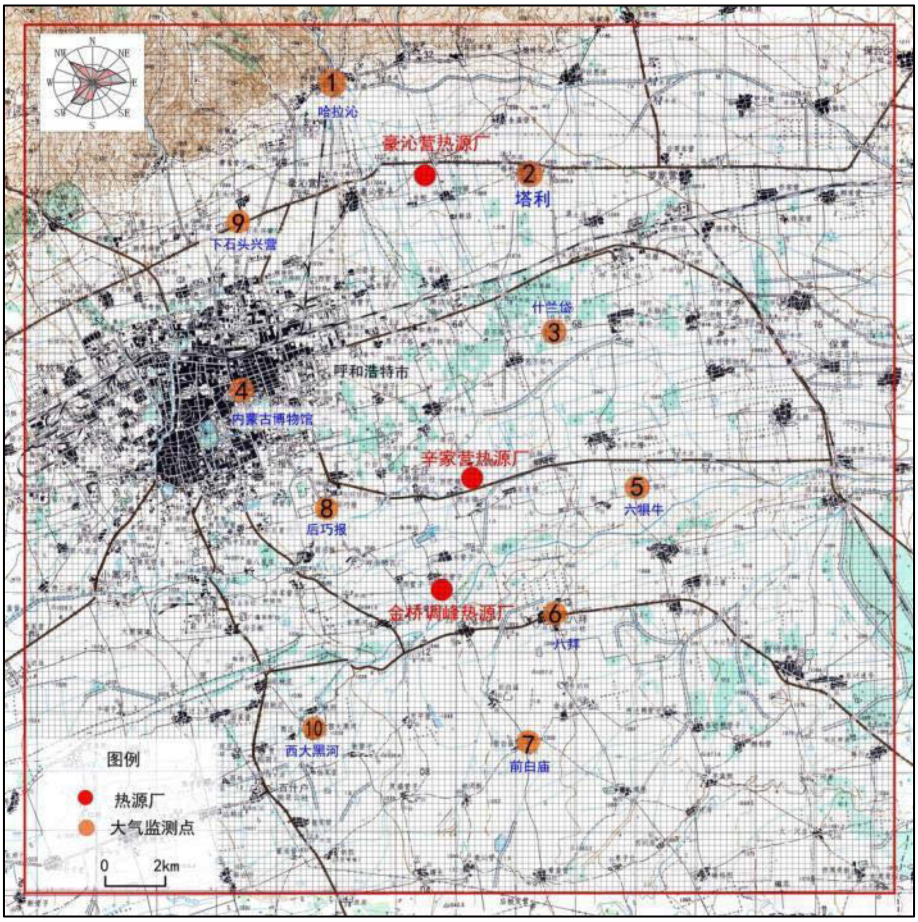
211. The modeling utilized one year of meteorological data for the year 2012, including hourly wind directions and wind speed for each day in 2012, dry-bulb temperature, ground data like cloud cover (total cloud cover and low cloud cover), etc. Daily high altitude data was observed two times per day every 100m from 0-3000m. The AERMET estimate method was used for mixed layer height. The default of 200 calculated layers was utilized with a maximum altitude of 5000m.

212. Ground characteristic parameters required by AERMOD (surface albedo at high noon, Bowen at daytime and ground roughness) were set according to recommended parameters in the reference model suitable for the three heating zones. Atmospheric diffusion parameters mainly use ground meteorological data and sounding meteorological data to generate the predicted meteorological input document.

Receptor Grid System

213. Predictions of concentration were made for a 29km×29km grid with the Xinjiaying HSP at the center. The grid consists of 200m x 200m cells with a total of 21,025 receptors. The southeast corner of the grid is the origin (0m x 0m) (**Figure 38**). Terrain was assumed to be flat.

Figure 38:29 x 29 km AERMOD modelling grid.



Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

GLC Parameters

214. The modelling predicted the following GLCs:

1- hour Average Concentrations
Worst case predicted 1-hour averaging period SO_2 and NO_2 GLCs over the entire 2012 modelling period (4320h); and worst case predicted 1-hour averaging period SO_2 and NO_2 GLCs + worst case ambient concentration at monitoring sites (cumulative assessment).

24-hour Average Concentrations
Worst case predicted 24-hour averaging period SO_2 and NO_2 GLCs over the entire 2012 modelling period (4320h); and worst case predicted 24-hour averaging period SO_2 and NO_2 GLCs + worst case ambient concentration at monitoring sites (cumulative assessment).

Annual Average Concentrations
Annual averaging period SO_2 and NO_2 GLCs over the entire 2012 modelling period (4320h). A cumulative assessment of annual averaging period SO_2 and NO_2 GLCs plus annual average ambient concentration at monitoring sites is not possible as annual average concentration data is not available for the monitoring sites.

iv. Results

Case 1 (Three HSPs; and Three HSPs + Background)

Worst case 1-hour average SO_2 and NO_2 GLCs

215. The ten worst case 1-hour average SO_2 and NO_2 GLCs and corresponding date and position are presented in **Table 54**. **Figure 39**and **Figure 40** show SO_2 and NO_2 concentration contour lines diagrams at the time when the maximum 1-hour average concentration of SO_2 and NO_2occurred. The modelling shows that, under the meteorological conditions of 2012, the worst case 1-hour average GLC of SO_2 and NO_2 from the Project are 26.30μg/m³ and 89.40μg/m^3, equivalent to 5.26% and 44.70% respectively of the standard. The location is 310m from the Haoqingying HSP.

216. The worst case 1-hour average SO_2 GLCs at the monitoring sites range from 2.92 to 5.17μg/m^3, while the worst case 1-hour average NO_2GLCsat the monitoring sites range from 9.96 to 17.60μg/m³. The worst case GLCs occur at Qianbaimiao Village. **Table 55**presents the cumulative Case 1 modelling results (e.g. worst case background concentration value from monitoring + worst case concentration predicted GLC). The results show that the worst case 1-hour GLCs combined with worst case background concentrations for SO_2 range from 42.29-59.17μg/m³ and for NO_2 range from 70.60-82.60μg/m³, which account for 8.46-11.83% and 35.30-41.30% of the corresponding standard, respectively.

Worst case 24-hour average SO_2 and NO_2 GLCs

217. The ten worst case 24-hour average SO_2 and NO_2 GLCs and corresponding date and position are presented in **Table 56**. **Figure 41** and **Figure 42** show SO_2 and NO_2 concentration contour lines diagrams at the time when the maximum 1-hour average concentration of SO_2 and NO_2occurred. The modelling shows that, under the meteorological conditions of 2012, the worst case 1-hour average GLC of SO_2 and NO_2 from the Project are 4.16μg/m³ and 14.20μg/m^3, equivalent to 2.77% and 17.75% respectively of the standard. The location is 346m from the Xinjiaying HSP.

218. The worst case 24-hour average SO_2 GLCs at the monitoring sites range from 0.25 to 0.39 μg/m^3, while the worst case 24-hour average NO_2GLCs at the monitoring sites range from 0.85 to 1.32 μg/m³. The worst case GLCs occur at Shilandai Village. **Table 57** presents the cumulative Case 1 modelling results (e.g. worst case background concentration value from monitoring + worst case concentration predicted GLC). The results show that the worst case 24-hour GLCs combined with worst case background concentrations for SO_2 range from 22.30-24.37 μg/m³ and for NO_2 range from 27.02-35.32 μg/m³, which account for 18.87-16.35% and 33.78-44.15% of the corresponding standard, respectively.

Worst case annual average SO_2 and NO_2 GLCs

219. The ten worst case annual SO_2 and NO_2 GLCs and corresponding date and position are presented in **Table 58**. **Figure 43**and **Figure 44** show SO_2 and NO_2annual average concentration contour line diagrams. The modelling shows that, under the meteorological conditions of 2012, the worst case annual average GLCs of SO_2 and NO_2 from the Project are 0.715 μg/m³ and 2.44 μg/m^3, equivalent to 1.19% and 6.10% respectively of the standard. The locations are 404m from the Jinqiao HSP (SO_2) and 467m from the Xinjiaying HSP (NO_2).

Table 54: Case 1 ten worst case 1-hour SO_2 and NO_2 GLCs and corresponding date and positions.

Pollutant	Time	**Meteorological conditions**(wind direction in degrees, wind speed and temperature)	Worst case GLCs		Grid Position
			Predicted GLC concentration(μg/ m^3)	Ratio of GLC concentration to Standard (%)	
SO_2	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	26.30	5.26	23600, 23800
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	24.70	4.94	25200, 13600
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	24.40	4.88	23600, 23800
	10pm, 15 Apr	308, 7.3m/s, T=14.2℃	24.20	4.84	25200, 13600
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	24.10	4.82	25200, 13600
	9pm, 23 June	305, 6.7m/s, T=20.2℃	22.60	4.52	25200, 13600
	8pm, 30 Apr	315, 7.7m/s, T=18.1℃	22.50	4.50	24200, 9800
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	21.90	4.38	24000, 10000
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	21.00	4.20	24200, 10000
	5pm, 21 Jan	307, 7m/s, T=-6.1℃	20.40	4.08	25200, 13600
NO_2	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	89.40	44.70	23600, 23800
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	84.20	42.10	25200, 13600
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	83.10	41.55	23600, 23800
	10pm, 15 Apr	308, 7.3m/s, T=14.2℃	82.50	41.25	25200, 13600
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	82.10	41.05	25200, 13600
	9pm, 23 June	305, 6.7m/s, T=20.2℃	77.10	38.55	25200, 13600
	8pm, 30 Apr	315, 7.7m/s, T=18.1℃	76.60	38.30	24200, 9800
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	74.50	37.25	24000, 10000
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	71.30	35.65	24200, 10000
	5pm, 21 Jan	307, 7m/s, T=-6.1℃	69.60	34.80	25200, 13600

Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 55: Case 1 worst case 1-hour SO_2 and NO_2cumulative (worst case predicted + background) GLCs at monitoring sites.

Pollutant	Monitoring Site	Worst case background concentration* ($\mu g/m^3$)	Worst case concentration contributed from Project($\mu g/m^3$)	Worst case cumulative concentration ($\mu g/m^3$)	Ratio of cumulative concentration to standard (%)
SO_2	Halaqin village	38	4.29	42.29	8.46
	Tali village	43	3.47	46.47	9.29
	Shilandai village	44	4.00	48.00	9.60
	Inner Mongolia museum	52	2.92	54.92	10.98
	Liujuniu village	54	2.99	56.99	11.40
	Babai village	54	4.39	58.39	11.68
	Qianbaimiao village	54	5.17	59.17	11.83
	Houqiaobao village	52	3.43	55.43	11.09
	Xiashitouxinying village	52	2.98	54.98	11.00
	West Dahei River village	54	4.01	58.01	11.60
NO_2	Halaqin village	56	14.60	70.60	35.30
	Tali village	63	11.80	74.80	37.40
	Shilandai village	63	13.60	76.60	38.30
	Inner Mongolia museum	62	9.96	71.96	35.98
	Liujuniu village	65	10.20	75.20	37.60
	Babai village	65	15.00	80.00	40.00
	Qianbaimiao village	65	17.60	82.60	41.30
	Houqiaobao village	62	11.70	73.70	36.85
	Xiashitouxinying village	62	10.20	72.20	36.10
	West Dahei River village	65	13.70	78.70	39.35

Note: background concentration is the maximum concentration recorded at the site during the ambient air quality monitoring.

Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 56: Case 1 ten worst case 24-hour SO_2 and NO_2 GLCs and corresponding date and positions.

Pollutant	Time	Meteorological conditions (wind direction in degrees, wind speed and temperature)	Worst case GLCs		Grid Position
			Predicted GLC concentration(μg/ m^3)	Ratio of GLC concentration to Standard (%)	
SO_2	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	4.16	2.77	25200, 14000
	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	3.41	2.27	24200, 10400
	12pm, 18 Oct	318, 0.5m/s, T=4.8℃	3.40	2.27	25200, 13600
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	3.34	2.23	24200, 9800
	12pm, 16 Oct	202, 1.7m/s, T=8.2℃	3.24	2.16	25200, 13600
	12pm, 21 Jan	14, 1m/s, T=-5.9℃	3.18	2.12	25200, 13600
	12pm, 17 May	279, 3.1m/s, T=9.6℃	3.15	2.10	24200, 10400
	12pm, 29 Jun	312, 1.5m/s, T=20.8℃	3.13	2.09	25200, 13600
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	2.98	1.99	25200, 13600
	12pm, 17 May	279, 3.1m/s, T=9.6℃	2.93	1.95	25200, 14000
NO_2	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	14.20	17.75	25200, 14000
	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	11.60	14.50	24200, 10400
	12pm, 18 Oct	318, 0.5m/s, T=4.8℃	11.60	14.50	25200, 13600
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	11.40	14.25	24200, 9800
	12pm, 16 Oct	202, 1.7m/s, T=8.2℃	11.00	13.75	25200, 13600
	12pm, 21 Jan	14, 1m/s, T=-5.9℃	10.80	13.50	25200, 13600
	12pm, 17 May	279, 3.1m/s, T=9.6℃	10.70	13.38	24200, 10400
	12pm, 29 Jun	312, 1.5m/s, T=20.8℃	10.70	13.38	25200, 13600
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	10.20	12.75	25200, 13600
	12pm, 17 May	279, 3.1m/s, T=9.6℃	10.00	12.50	25200, 14000

Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 57: Case 1 worst case 24-hour SO_2 and NO_2cumulative (worst case predicted + background) GLCs at monitoring sites.

Pollutant	Monitoring Site	Worst case background concentration* (μg/m^3)	Worst case concentration contributed from Project(μg/m^3)	Worst case cumulative concentration (μg/m^3)	Ratio of cumulative concentration to standard (%)
SO_2	Halaqin village	22	0.30	22.30	14.87
	Tali village	23	0.29	23.29	15.53
	Shilandai village	23	0.39	23.39	15.59
	Inner Mongolia museum	24	0.26	24.26	16.18
	Liujuniu village	23	0.25	23.25	15.50
	Babai village	23	0.31	23.31	15.54
	Qianbaimiao village	23	0.34	23.34	15.56
	Houqiaobao village	24	0.37	24.37	16.25
	Xiashitouxinying village	24	0.31	24.31	16.21
	West Dahei River village	22	0.33	22.33	14.89
NO_2	Halaqin village	26	1.02	27.02	33.78
	Tali village	30	0.99	30.99	38.74
	Shilandai village	34	1.32	35.32	44.15
	Inner Mongolia museum	30	0.90	30.90	38.63
	Liujuniu village	32	0.85	32.85	41.07
	Babai village	32	1.06	33.06	41.33
	Qianbaimiao village	33	1.16	34.16	42.70
	Houqiaobao village	33	1.27	34.27	42.84
	Xiashitouxinying village	30	1.06	31.06	38.83
	West Dahei River village	29	1.12	30.12	37.65

Note: background concentration is the maximum concentration recorded at the site during the ambient air quality monitoring.

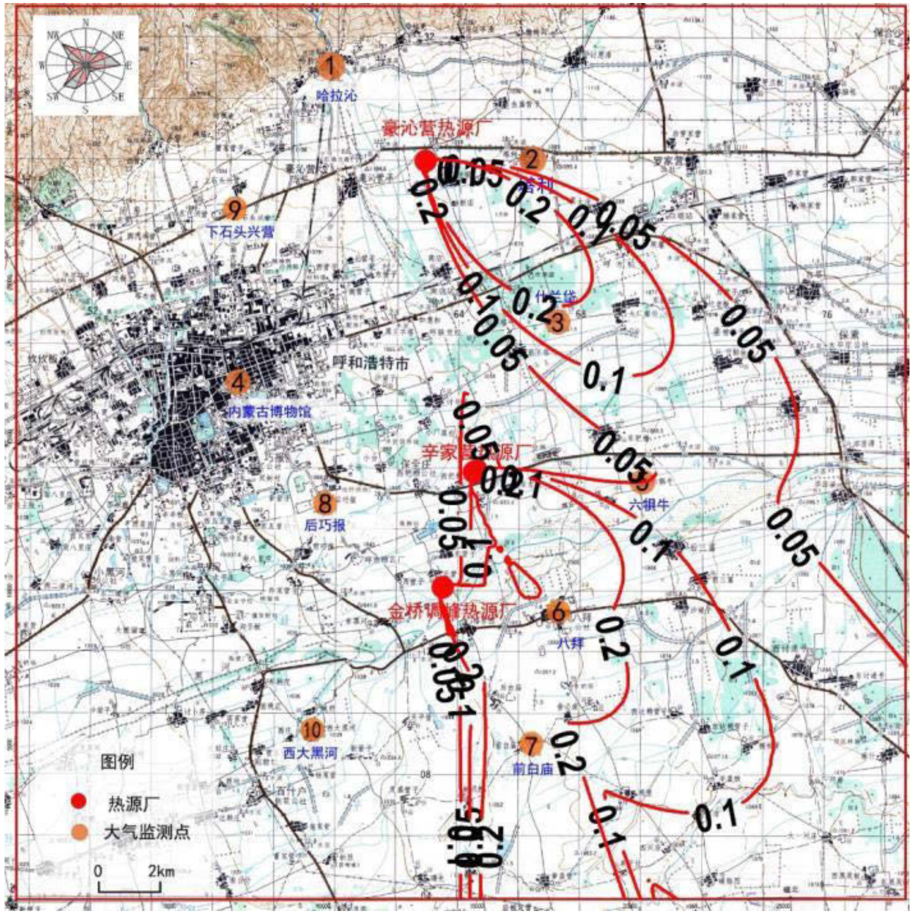
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 58: Case 1 ten worst annual average SO_2 and NO_2GLCs and corresponding positions.

Pollutant	Position	Worst case GLC (μg/m^3)	Ratio of GLC concentration to Class II standard limit (%)
SO_2	14200, 10400	0.715	1.19
	15200, 14200	0.715	1.19
	13600, 24200	0.675	1.13
	13600, 24400	0.638	1.06
	15000, 14200	0.627	1.05
	14000, 10400	0.620	1.03
	14200, 10600	0.614	1.02
	13800, 24400	0.565	0.94
	15200, 14400	0.555	0.93
	15200, 14000	0.552	0.92
NO_2	15200, 14200	2.44	6.10
	14200, 10400	2.44	6.10
	13600, 24200	2.30	5.75
	13600, 24400	2.17	5.43
	15000, 14200	2.14	5.35
	14000, 10400	2.11	5.28
	14200, 10600	2.09	5.23
	13800, 24400	1.92	4.80
	15200, 14400	1.89	4.73
	15200, 14000	1.88	4.70

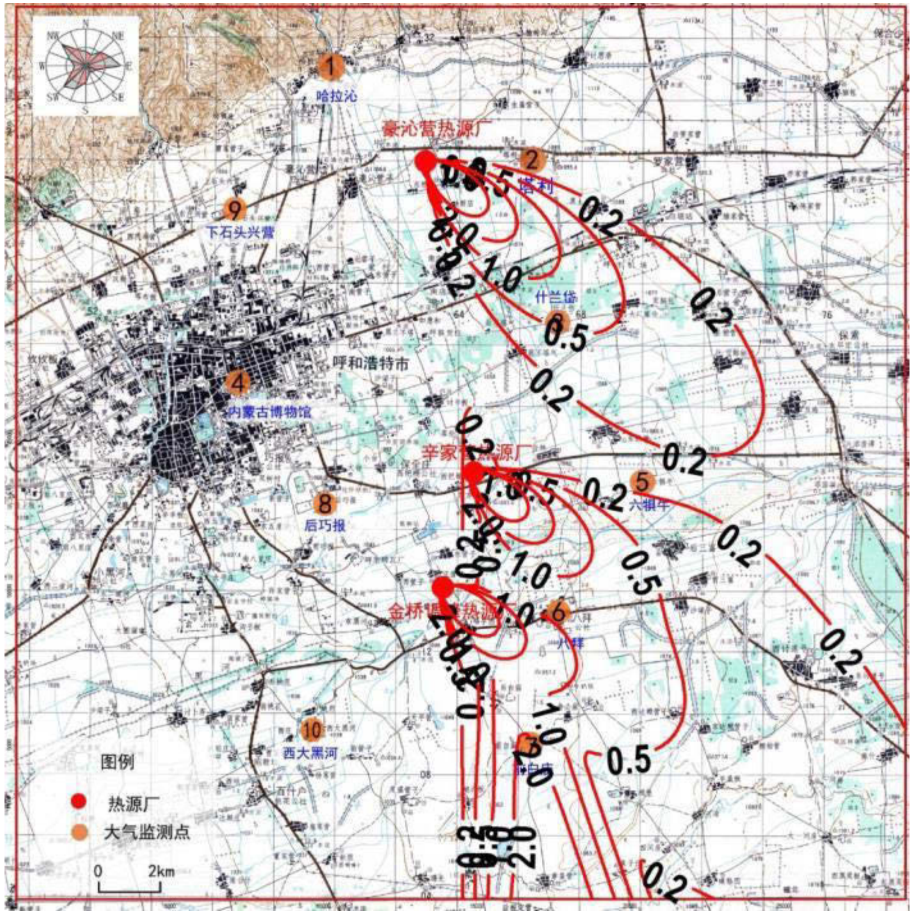
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 39: Case 1SO_2 contour map at time of worst case 1-hour average concentration of SO_2 and NO_2 contribution from the Project (8pm, 19 Apr 2012). Unit: µg/Nm^3



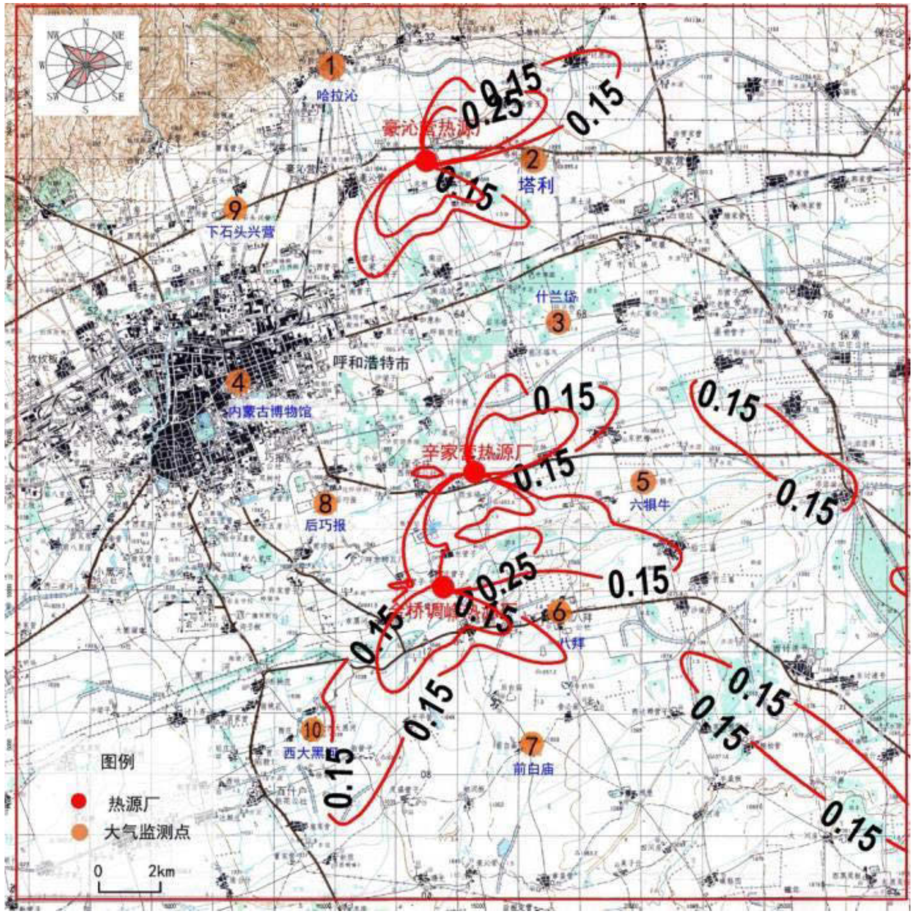
Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 40: Case 1 NO_2 contour map at time of worst case 1-hour average concentration of SO_2 and NO_2 contribution from the Project (8pm, 19 Apr 2012). Unit: µg/Nm^3



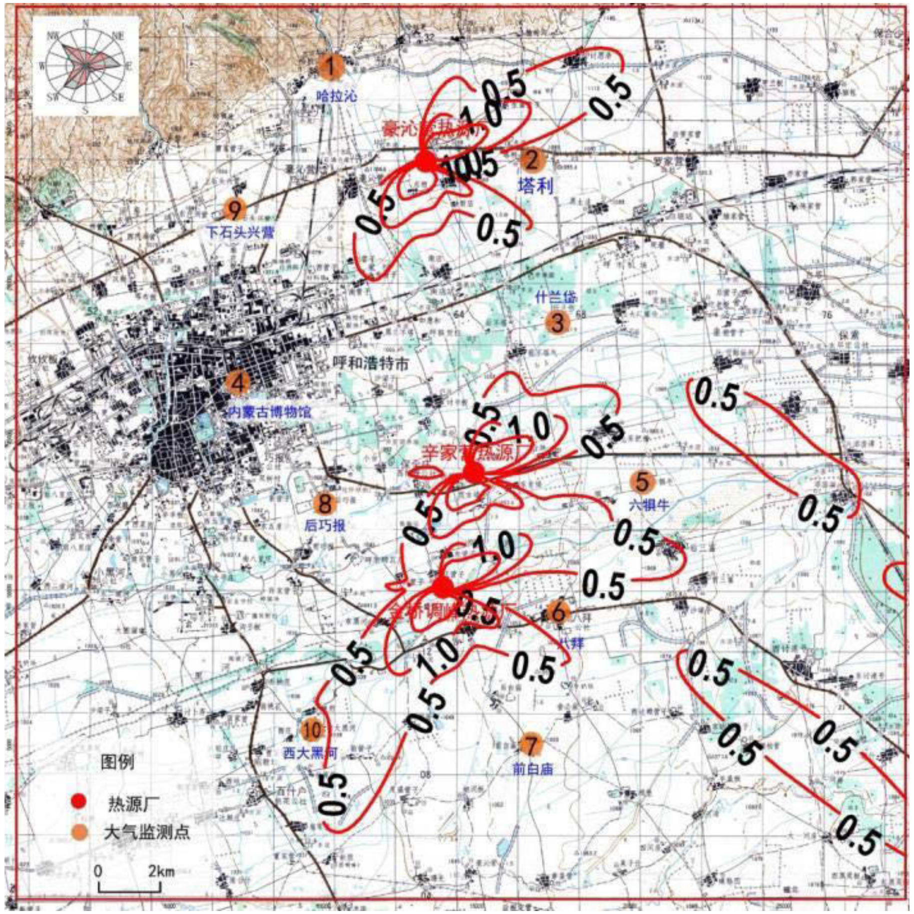
Source: Air Quality Modeling Assessment,Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

Figure 41: Case 1 SO_2 contour map at time of worst case 24-hour average concentration of SO_2 and NO_2 contribution from the Project (8pm, 23 Apr 2012). Unit: µg/Nm³



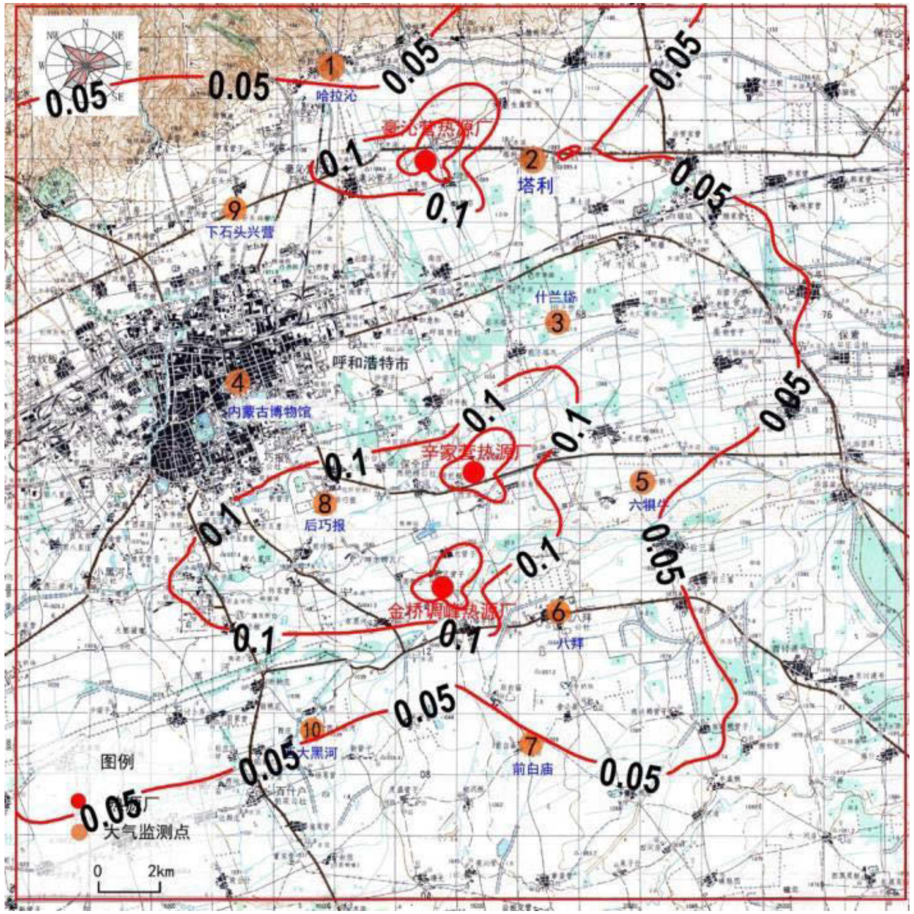
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 42: Case 1 NO_2 contour map at time of worst case 24-hour average concentration of SO_2 and NO_2 contribution from the Project (8pm, 23 Apr 2012). Unit: µg/Nm³



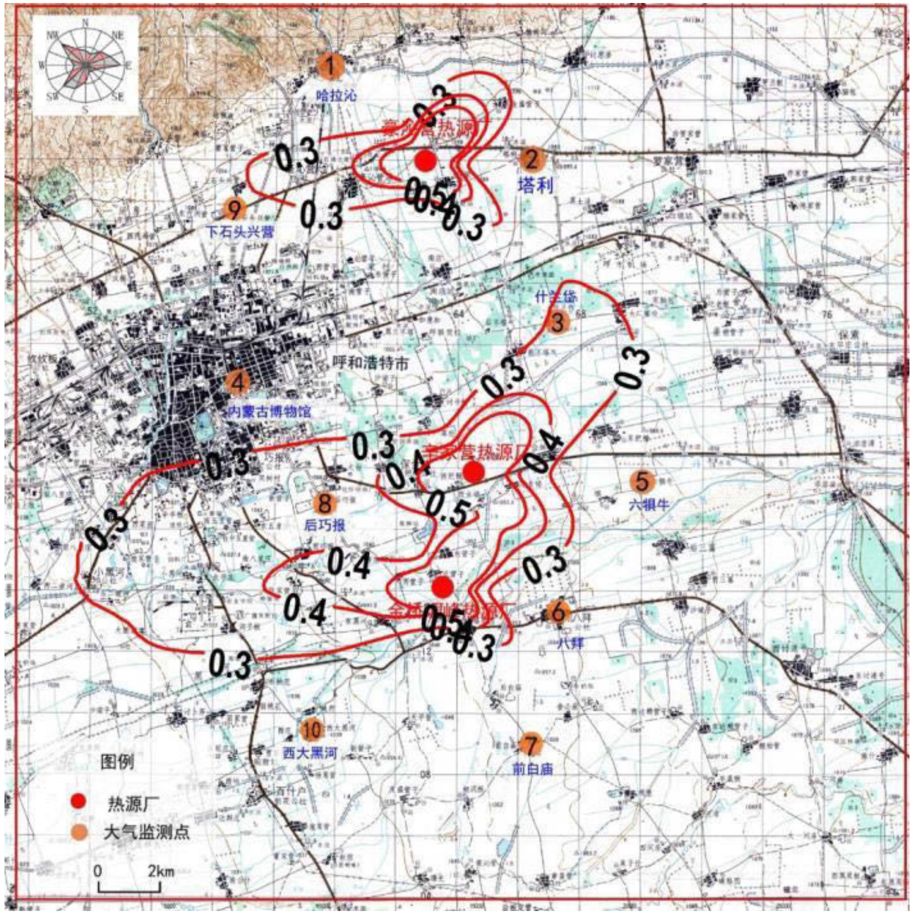
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

Figure 43: Case 1 SO_2 contour map at time of annual average concentration of SO_2 and NO_2 contribution from the Project Unit: µg/Nm^3



Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 44: Case 1 NO_2 contour map at time of annual average concentration of SO_2 and NO_2 contribution from the Project.Unit: µg/Nm^3



Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

Case 2 (Three HSPs + Haoqingying Phase II; and Three HSPs + Haoqingying Phase II + Background)

Worst case 1-hour average SO_2 and NO_2 GLCs

220. The ten worst case 1-hour average SO_2 and NO_2 GLCs and corresponding date and position resulting from the Project +Haoqingying Phase II HSP are presented in **Table 59**. **Figure 45** and **Figure 46** show SO_2 and NO_2 concentration contour lines diagrams at the time when the maximum 1-hour average concentration of SO_2 and NO_2occurred. The modelling shows that, under the meteorological conditions of 2012, the worst case 1-hour average GLC of SO_2 and NO_2 from the Project and the Haoqingying Phase II HSP are 26.30 µg/m³ and 89.40 µg/m³, equivalent to 5.26% and 44.70% respectively of the standard. The location is 310m from the Haoqingying HSP.

221. The worst case 1-hour average SO_2 GLCs at the monitoring sites range from 3.13 to 6.47 µg/m³, while the worst case 1-hour average NO_2 GLCs at the monitoring sites range from 17.70 to 49.50 µg/m³. The worst case GLCs occur at Tali Village. **Table 60** presents the cumulative Case 2 modelling results (e.g. worst background concentration value from monitoring + worst case concentration predicted GLCfrom the Project + Haoqingying Phase II HSP). The results show that the worst case 1-hour GLCs for SO_2 range from 43.59-59.81 µg/m³ and for NO_2 range from 81.10-112.50 µg/m³, which account for 8.72-11.96% and 40.55-56.25% of the corresponding standard, respectively.

Worst case 24-hour average SO_2 and NO_2 GLCs

222. The ten worst case 24-hour average SO_2 and NO_2 GLCs and corresponding date and position are presented in **Table 56**. **Figure 47** and **Figure 48** show SO_2 and NO_2 concentration contour lines diagrams at the time when the maximum 1-hour average concentration of SO_2 and NO_2occurred. The modelling shows that, under the meteorological conditions of 2012, the worst case 1-hour average GLC of SO_2 and NO_2 from the from the Project and theHaoqingying Phase II HSP are 4.16 µg/m³ and 17.30 µg/m³, equivalent to 2.77% and 21.63% respectively of the standard. The locations are 346m from the Xinjiaying HSP and 733m from the Haoqingying HSP, respectively.

223. The worst case 24-hour average SO_2 GLCs at the monitoring sites range from 0.25 to 0.49 µg/m³, while the worst case 24-hour average NO_2 GLCs at the monitoring sites range from 1.41 to 3.26 µg/m³. The worst case GLCs occur at Shilandai Village and Tali Village, respectively. **Table 62** presents the cumulative Case 2 modelling results (e.g. worst background concentration value from monitoring + worst case concentration predicted GLCfrom the Project and the Haoqingying Phase II HSP). The results show that the worst case 24-hour GLCs for SO_2 range from 22.36-24.41 µg/m³ and for NO_2 range from 28.50-36.59 µg/m³, which account for 14.92-16.28% and 35.63-45.74% of the corresponding standard, respectively.

Worst case annual average SO_2 and NO_2 GLCs

224. The ten worst case annual SO_2 and NO_2 GLCs and corresponding date and position are presented in **Table 63**. **Figure 49** and **Figure 50** show SO_2 and NO_2 annual average concentration contour line diagrams. The modelling shows that, under the meteorological conditions of 2012, the worst case annual average GLCs of SO_2 and NO_2 from the Project and the Haoqingying Phase II HSP are 0.814 µg/m³ and 4.65 µg/m³, equivalent to 1.36% and 11.63% respectively of the standard. The locations are 500m and (SO_2) and 777m (NO_2) from the Haoqingying HSP.

Table 59: Case 2 ten worst case 1-hour SO_2 and NO_2 GLCs and corresponding date and positions.

Pollutant	Time	**Meteorological conditions** (wind direction in degrees, wind speed and temperature)	**Worst case GLCs** Predicted GLC concentration from Project + Haoqingying Phase 2 (μg/m^3)	**Worst case GLCs** Ratio of GLC concentration to Standard (%)	Grid Position
SO_2	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	26.30	5.26	13600, 23800
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	24.70	4.94	15200, 13600
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	24.40	4.88	13600, 23800
	10pm, 15 Apr	308, 7.3m/s, T=14.2℃	24.20	4.84	15200, 13600
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	24.10	4.82	15200, 13600
	9pm, 23 Jun	305, 6.7m/s, T=20.2℃	22.60	4.52	15200, 13600
	8pm, 30 Apr	315, 7.7m/s, T=18.1℃	22.50	4.50	14200, 9800
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	21.90	4.38	14000, 10000
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	21.00	4.20	14200, 10000
	5pm, 21, Jan	307, 7m/s, T=-6.1℃	20.40	4.08	15200, 13600
NO_2	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	89.40	44.70	13600, 23800
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	84.20	42.10	15200, 13600
	7pm, 19 Apr	311, 8.4m/s, T=17.1℃	83.10	41.55	13600, 23800
	10pm, 15 Apr	308, 7.3m/s, T=14.2℃	82.50	41.25	15200, 13600
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	82.10	41.05	15200, 13600
	9pm, 23 Jun	305, 6.7m/s, T=20.2℃	77.10	38.55	15200, 13600
	8pm, 30 Apr	315, 7.7m/s, T=18.1℃	76.60	38.30	14200, 9800
	8pm, 19 Apr	310, 8.8m/s, T=15.4℃	74.50	37.25	14000, 10000
	7am, 12, Aug	86, 0.8m/s, T=18.9℃	73.10	36.55	11800, 24000
	7am, 12, Aug	86, 0.8m/s, T=18.9℃	73.00	36.50	12000, 24000

Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 60: Case 2 worst case 1-hour SO_2 and NO_2 cumulative (worst case predicted + worst case background) GLCs at monitoring sites.

Pollutant	Monitoring Site	Worst case background concentration* (μg/m^3)	Worst case predicted concentration from Project + Haoqingying Phase 2 (μg/m^3)	Worst case cumulative concentration (μg/m^3)	Ratio of cumulative concentration to standard (%)
SO_2	Halaqin village	38	5.59	43.59	8.72
	Tali village	43	6.47	49.47	9.89
	Shilandai village	44	4.89	48.89	9.78
	Inner Mongolia museum	52	3.23	55.23	11.05
	Liujuniu village	54	3.13	57.13	11.43
	Babai village	54	4.96	58.96	11.79
	Qianbaimiao village	54	5.81	59.81	11.96
	Houqiaobao village	52	3.43	55.43	11.09
	Xiashitouxinying village	52	4.57	56.57	11.31
	West Dahei River village	54	4.08	58.08	11.62
NO_2	Halaqin village	56	35.20	91.20	45.60
	Tali village	63	49.50	112.50	56.25
	Shilandai village	63	36.60	99.60	49.80
	Inner Mongolia museum	62	22.80	84.80	42.40
	Liujuniu village	65	22.40	87.40	43.70
	Babai village	65	24.50	89.50	44.75
	Qianbaimiao village	65	25.60	90.60	45.30
	Houqiaobao village	62	19.10	81.10	40.55
	Xiashitouxinying village	62	32.40	94.40	47.20
	West Dahei River village	65	17.70	82.70	41.35

Note: background concentration is the maximum concentration recorded at the site during the ambient air quality monitoring.

Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 61: Case 2 ten worst case 24-hour SO_2 and NO_2 GLCs and corresponding date and positions.

Pollutant	Time	Meteorological conditions (wind direction in degrees, wind speed and temperature)	Worst case GLCs: Predicted GLC concentration from Project + Haoqingying Phase 2 (μg/m^3)	Worst case GLCs: Ratio of GLC concentration to Standard (%)	Grid Position
SO_2	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	4.16	2.77	15200, 14000
	12pm, 23 Apr	82, 1.8m/s, T=11.5℃	3.41	2.27	14200, 10400
	12pm, 18 Oct	318, 0.5m/s, T=4.8℃	3.40	2.27	15200, 13600
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	3.35	2.23	14200, 9800
	12pm, 21 Jun	142, 1.0m/s, T=23℃	3.29	2.19	13600, 23600
	12pm, 16 Oct	202, 1.7m/s, T=8.2℃	3.24	2.16	15200, 13600
	12pm, 21 Jan	14, 1m/s, T=-5.9℃	3.19	2.13	15200, 13600
	12pm, 29 Jun	312, 1.5m/s, T=20.8℃	3.17	2.11	15200, 13600
	12pm, 17 May	279, 3.1m/s, T=9.6℃	3.15	2.10	14200, 10400
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	3.13	2.09	13600, 23600
NO_2	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	17.30	21.63	13800, 23400
	12pm, 24 Jul	16, 2.2m/s, T=22.3℃	17.00	21.25	13000, 23400
	12pm, 6 Jun	324, 4.5m/s, T=17.6℃	16.90	21.13	13800, 24400
	12pm, 21 Jun	142, 1.0m/s, T=23℃	16.90	21.13	13800, 23400
	12pm, 7 Sep	69, 1.3m/s, T=10.8℃	16.60	20.75	12600, 23800
	12pm, 21 Jun	142, 1.0m/s, T=23℃	16.30	20.38	13600, 23400
	12pm, 21 Jun	142, 1.0m/s, T=23℃	15.90	19.88	13600, 23600
	12pm, 6 May	97, 0.6m/s, T=17.9℃	15.90	19.88	13800, 24400
	12pm, 12 Mar	220, 1.5m/s, T=0.4℃	15.80	19.75	14000, 23200
	12pm, 24 Jul	16, 2.2m/s, T=22.3℃	15.70	19.63	12800, 23400

Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 62: Case 2 worst case 24-hour SO_2 and NO_2 cumulative (worst case predicted + background) GLCs at monitoring sites.

Pollutant	Monitoring Site	Worst case background concentration* (μg/m^3)	Worst case predicted GLC concentration from Project + Haoqingying Phase 2 (μg/m^3)	Worst case cumulative concentration (μg/m^3)	Ratio of cumulative concentration to standard (%)
SO_2	Halaqin village	22	0.37	22.37	14.92
	Tali village	23	0.45	23.45	15.63
	Shilandai village	23	0.49	23.49	15.66
	Inner Mongolia museum	24	0.31	24.31	16.20
	Liujuniu village	23	0.25	23.25	15.50
	Babai village	23	0.33	23.33	15.55
	Qianbaimiao village	23	0.39	23.39	15.59
	Houqiaobao village	24	0.39	24.39	16.26
	Xiashitouxinying village	24	0.41	24.41	16.28
	West Dahei River village	22	0.36	22.36	14.91
NO_2	Halaqin village	26	2.50	28.50	35.63
	Tali village	30	3.26	33.26	41.58
	Shilandai village	34	2.59	36.59	45.74
	Inner Mongolia museum	30	1.99	31.99	39.99
	Liujuniu village	32	1.41	33.41	41.76
	Babai village	32	1.48	33.48	41.85
	Qianbaimiao village	33	1.74	34.74	43.43
	Houqiaobao village	33	1.90	34.90	43.63
	Xiashitouxinying village	30	2.51	32.51	40.64
	West Dahei River village	29	1.76	30.76	38.45

Note: background concentration is the maximum concentration recorded at the site during the ambient air quality monitoring.

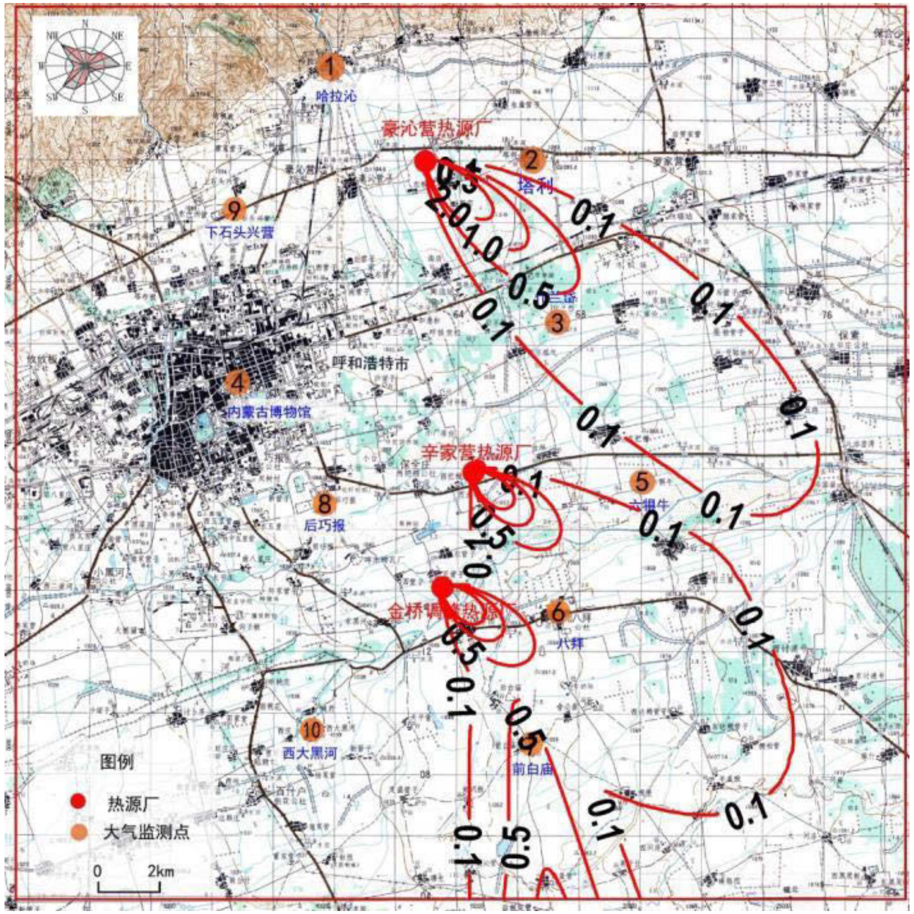
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 63: Case 2 ten worst annual average SO_2 and NO_2 GLCs and corresponding positions.

Pollutant	Position	Worst case GLCconcentration from Project + Haoqingying Phase 2 (μg/m^3)	Ratio of GLC concentration to Class II standard limit (%)
SO_2	13600, 24400	0.814	1.36
	13800, 24400	0.776	1.29
	13600, 24200	0.754	1.26
	15200, 14200	0.723	1.21
	14200, 10400	0.722	1.20
	13800, 24600	0.713	1.19
	13600, 24600	0.677	1.13
	15000, 14200	0.635	1.06
	14000, 24600	0.628	1.05
	14000, 10400	0.626	1.04
NO_2	13800, 24600	4.65	11.63
	13800, 24400	4.57	11.43
	13600, 24400	4.38	10.95
	13600, 24600	4.25	10.63
	14000, 24600	4.24	10.60
	13800, 24800	4.05	10.13
	14000, 24800	3.94	9.85
	14000, 24400	3.86	9.65
	13600, 24800	3.62	9.05
	14200, 24600	3.50	8.75

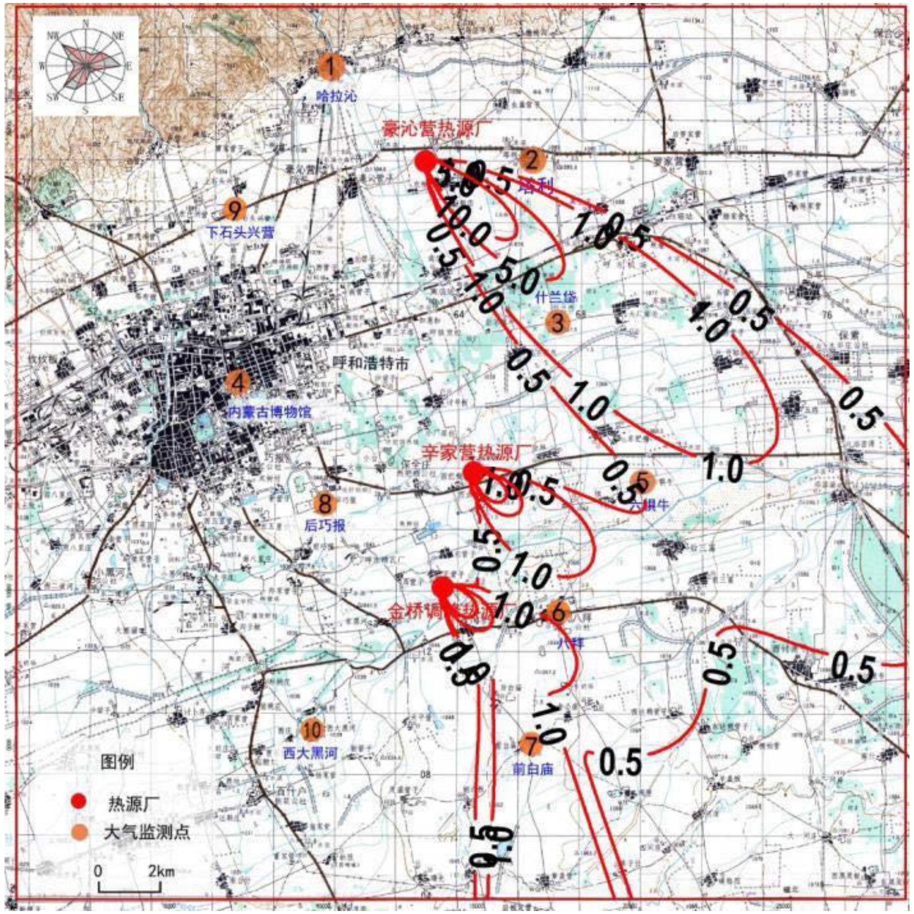
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd.

Figure 45: Case 2SO_2 contour map at time of worst case 1-hour average concentration of SO_2 and NO_2 contribution from Project and Haoqingying Phase II (8pm, 19 Apr 2012). Unit: µg/Nm^3



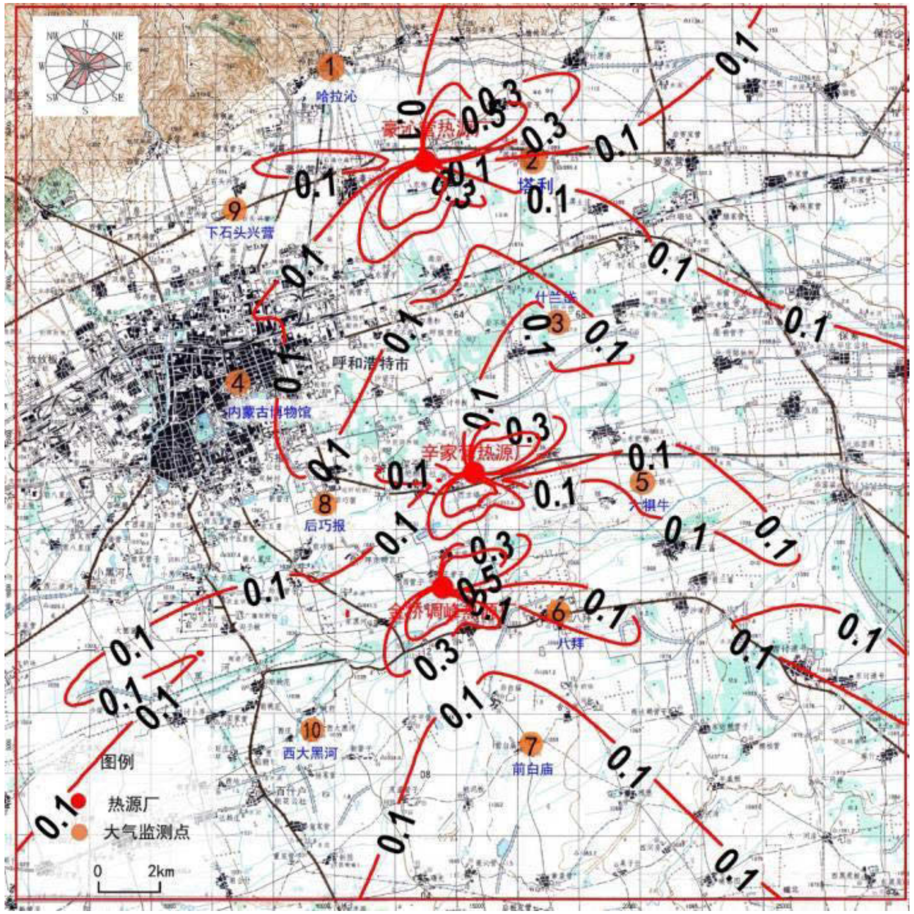
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 46: Case 2NO_2 contour map at time of worst case 1-hour average concentration of SO_2 and NO_2contribution from Project and Haoqingying Phase II (8pm, 19 Apr 2012). Unit: µg/Nm^3



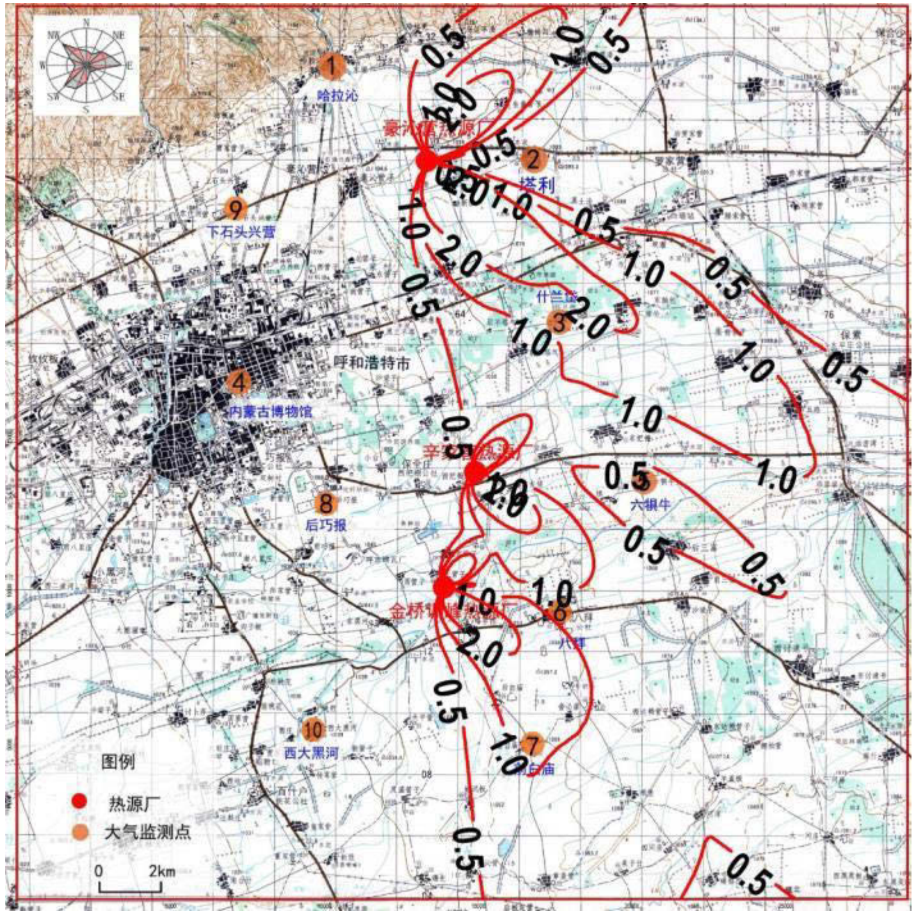
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

Figure 47: Case 2SO_2 contour map at time of worst case 24-hour average concentration of SO_2 and NO_2contribution from Project and Haoqingying Phase II(8pm, 23 Apr 2012). Unit: µg/Nm^3



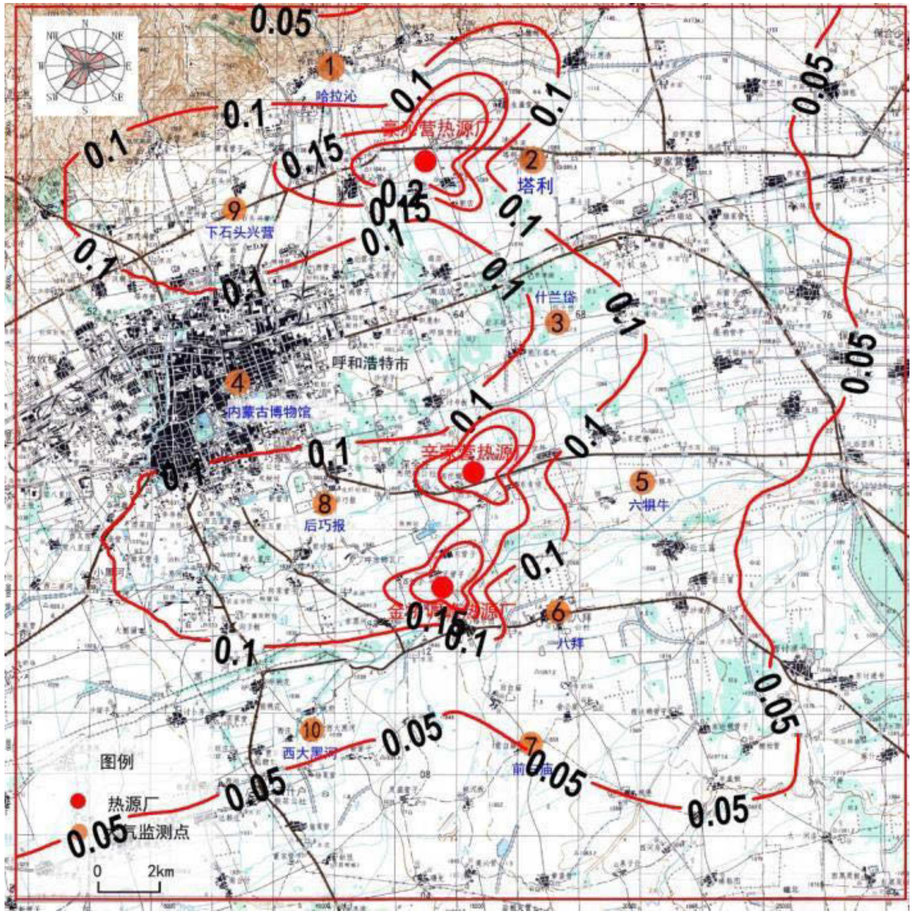
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 48: Case 2NO_2 contour map at time of worst case 24-hour average concentration of SO_2 and NO_2contribution from Project and Haoqingying Phase II(8pm, 23 Apr 2012). Unit: µg/Nm^3



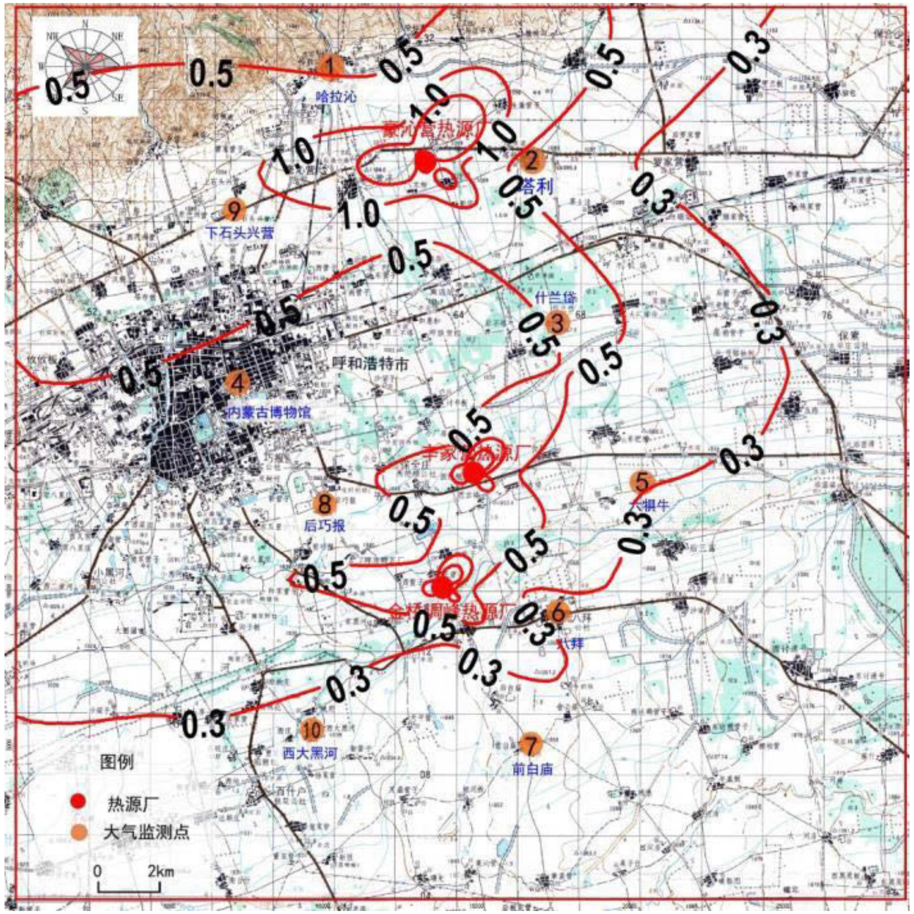
Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

Figure 49: Case 2SO_2 contour map at time of annual average concentration of SO_2 and NO_2contribution from Project and Haoqingying Phase II. Unit: μg/Nm^3



Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd..

Figure 50: Case 2NO_2 contour map at time of annual average concentration of SO_2 and NO_2contribution from Project and Haoqingying Phase II. Unit: μg/Nm^3



Source: Air Quality Modeling Assessment, Low-carbon Heating Project of Inner Mongolia, May 2014. Prepared by Zhong Ye Dong Fang Ltd

v. Conclusion

227. The results of Case 1 AERMOD dispersion modeling show that the Project's low NO_x natural gas-fired and electrode boilers will have minimal negative air quality impacts. Even the top ten worst case GLC Project contributions of SO_2 and NO_2, which occurred at 0.05% of the receptors and only one time each per year, are fully in compliance with PRC standards, and contributions over the rest of the modeling grid are a very small fraction of the applicable standards. Cumulative worst case modelling (worst case GLC Project contributions + worst case background concentrations) are also fully in compliance with PRC standards. Case 2 modeling with worst case contributions from the Project + the planned Phase II Haoqingying HSP were similarly fully in compliance with PRC standards, as was cumulative Case 2 modelling. In summary, the modeling results indicate that even the worst case cumulative GLCs, which occur only a few times per year at a few specific locations, are fully in compliance with PRC Standards.

2. Water Consumption

228. It was estimated that the Project with original scope would utilize an estimated 962,580 m^3 of municipal water during the 183 day heating season for domestic and production water and fire protection systems (Xinjiaying and Jinqiao water consumption will be 1620 m^3/d each, and Haoqingying water consumption will be 2020 m^3/d). However, due to the revised project component with less boiler numbers would result in much less water consumption of the project.

229. Hohhot's municipal water supply capacity is 460,000 m^3/d (260,000 m^3/d from groundwater and 200,000 m^3/d from the Yellow River), or 168.9 million m^3/year. The total Project (with the revised component) water consumption would be much less than 962,580 m^3/year(,which is equivalent to 0.57% of Hohhot's water supply capacity). Thus, it is expected to the impact on Hohhot's water supply would be very insignificant. Appendix V presents letters from the Hohhot Municipal Water Supply Company confirming the ability of the municipal water supply system to supply the required water.

3. Wastewater

230. The Project will generate both domestic and production wastewater. Production wastewater includes:

(i) Wastewater from the HSP water treatment plants:Make-up water for the boilers and associated equipment will be filtered, pre-treated, softened and the oxygen content will be reduced. Ion exchange will be utilized to remove Ca^{2+} and Mg^{2+}. Wastewaterwill begenerated during backwashing and regenerationprocesses.

(ii) Boiler blowdown: The water that is intentionally wasted from a boiler in order to avoid concentration of impurities during continuing evaporation of steam.

231. Domestic wastewater will be produced from worker sanitation facilities. Domesticwastewater will be treated in digestion tanks, and then in combination with the production wastewater, will be discharged to the Hohhot municipal sewerage system for treatment at the Jinqiao wastewater treatment plant (WWTP), located west of Hangkai Road.[25] Each HSP will be equipped with an emergency wastewater overflow tank (1200 m^3

[25] The WWTP provides treatment in compliance with *Discharge Standard of Pollutants for Municipal*

capacity for Haoqingying and Jinqiao). **Table 64** summarizes the annual wastewater discharges for the two HSPs, as the revised project scope will not have Xinjianying HSP. It is important to note that estimated amount of waste water was based on the original project scope. Thus, it is expected the amount of waste water would be much lower than the presented figures due to reduction of water consumption at HSPs. All emission concentration of SS, COD, BOD_5 and ammonia nitrogen will be in compliance with Class III standard requirements of *IntegratedWastewater Discharge Standard* (GB8978-1996), which sets the emission standards for wastewater discharged to a municipal sewerage system.

Table 64: Predicted wastewater concentrations and mass per year, pre and post treatment.

Heating zone	Wastewater Parameter	Pollutant concentration and quantity before treatment		Pollutant concentration and quantity after treatment		Discharge Standard (Class III, GB8978-1996)
		Concentration (mg/l)	Mass (t/a)	Concentration (mg/l)	Mass (t/a)	Concentration (mg/l)
Haoqingyin g	Quantity	-	91,315.2	-	91,315.2	
	SS	71.56	6.97	63.81	6.21	400
	COD	56.45	5.51	52.05	5.08	500
	BOD_5	23.02	2.19	22.10	2.10	300
	NH^3	2.88	0.26	2.88	0.26	-
Jinqiao	Quantity	-	40,859.4	-	40,859.4	
	SS	98.94	4.04	88.22	3.6	400
	COD	110.05	4.5	101.47	4.15	500
	BOD_5	53.6	2.19	51.45	2.1	300
	NH^3	6.43	0.26	6.43	0.26	-

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

4. Solid Waste

232. It was estimated that the Project with original scope would generate an estimated 390 kg of domestic waste per day or 71.2 t/a. However, the amount would be reduced due to the elimination of Xinjianying HSP udner the revised project scope. Solid waste, if not properly managed, can cause visual and environmental impacts.[26] However, To mitigate this risk, the following measures will be implemented:

(i) Waste bins will be provided at all facilities.

(ii) Wastes will be routinely collected by the local sanitation department for recycling, if possible, or final disposal at an approved waste disposal site.

(iii) No permanent on-site solid waste disposal will be permitted at HSPs or HESs.

(iv) No burning of wastes will be permitted at HSPs or HESs..

(v) All structures and/or components replaced during maintenance activities will be reused or recycled to the extent possible. Non-recyclable parts will be disposed at an approved waste disposal site.

Wastewater Treatment Plant (GB 18918-2002). Treated effluent from the WWTP is used by Hohhot municipality as reclaimed water for landscape watering along the Xiaohei River, irrigation water for afforestation in the Jinqiao development zone, and road spraying.

26 Based on 200 workers at Haoqingying and 180 at Xinjiaying and Jinqiao, and a waste production factor of 0.5 kg/worker/day.

233. Once the HSP is operational, 50 small coal-fired boilers in the Jinqiao heating zone will be decommissioned. The decommissioning is outside of the scope of the Project, and will be undertaken by the Hohhot municipal government's Public Utilities Bureau. The decommissioning will be in compliance with the Hohhot municipal government policy *Notice to Substituting Gas-fired Heating Boiler for Coal-fired Heating Boiler* (Notice No. 142, issued by the Hohhot municipal government in 2013). The policy requires that all relevant municipal departments (construction, gas supply, heating supply, environment, finance), etc., to support the transition to gas fired heating. The decommissioning will be done under the supervision of the Hohhot EPB, which will be responsible for ensuring appropriate treatment and disposal of waste.

5. Chemicals and Hazardous Materials

234. Toxic, hazardous, and harmful materials present in the operation of HSPs include petroleum products, solvents, scale and corrosion inhibitors, and chemicals used for water analysis and purification. Chemicals used to assess water quality include:

- EDTA standard solution, $C_{(EDTA)}$ =0.02mmol/L；
- Silver nitrate standard solution, $C_{(AgNO3)}$ =0.0282mmol/L；
- Dilute sulphuric acidstandard solution, $C_{(1/2H2SO4)}$ =0.10mmol/L；
- Potassium chromate indicator (10%)
- Erio-chrome black T indicator (1%)
- Methyl orange indicator (1g/L)
- Ammonia - ammonium chloride buffer solution (pH=10)
- Sodium hydroxide solution (2mol/L)
- Phenolphthalein indicator (5g/L)

235. Between 3 to 5 liters of the above chemicals will be required annually, and will be stored off-site at an independent laboratory.

236. Scale and corrosion inhibitor will be used in the boilers and the primary pipe network at a concentration of 15-20g/t. Approximately 0.5 to1 ton will be required annually for each HSP. Caustic soda will be used for pH adjustment of water in the boilers and primary pipe networks. Up to 200 kg will be required per heating zone per annum.

237. Chemicals can have impacts on human health and the environment if not appropriately managed. Special care will be taken to mitigate these risks, including:

(i) A register of all activities that involve the handling of potentially hazardous substances will be developed, including protocols for the storage, handling and spill response. This will include all fuels, oils, grease, lubricants, and other chemicals.

(ii) All chemicals, toxic, hazardous, and harmful materials will be transported in spill proof tanks with filling hoses and nozzles in working order,

(iii) All chemicals, toxic, hazardous, and harmful materials will be stored in secureareas with impermeable surfaces and protective dikes such that spillage or leakage will be contained from affecting soil, surface water or groundwater systems. Their usage will be strictly monitored and recorded. Some chemicals will be stored off-site, such as water quality analysis chemicals which will be stored at an independent laboratory.

(iv) Material safety data sheets (MSDSs) will be posted for all hazardous materials.

(v) Oil absorbents will be readily accessible in marked containers.

(vi) Good housekeeping procedures will be established to avoid the risk of spills.

(vii) Spills will be dealt with immediately, and personnel will be trained and tasked with this responsibility.

(viii) Workers will be properly trained before handling hazardous wastes and have the requisite PPE.

(ix) Hazardous waste will be temporarily stored in closed containers away from direct sunlight, wind, water and rain in secure designated areas with impermeable surfaces and protective dikes such that spillage or leakage will be contained.

(x) Hazardous wastes will be collected and disposed by licensed contractors on an as needed basis.

238. Under the revised project scope, five 29 MW coal boilers will be dismantled, which is considered as hazardous waste. A project contractor for coal boiler demolition will be engaged to ensure the proper handling and disposal of coal boiler demolition waste in accordance with the PRC regulationis and standards.

6. Noise

239. Noise sources during operation will mainly be from HSP and HES operation, and will include blowers, transformers, pumps, and cooling equipment. The noise level of the equipment ranges from 85 to 100 dB(A).

240. To mitigate noise impacts the Project design will use low-noise equipment as far as possible, and will also utilizenoise elimination, shock absorption, insulatedenclosures and sound dampeningmaterials on exterior walls. These measurescan typically reduce noise intensity by approximately 20dB(A) (**Table 65**).All plant and equipment, including vehicles will be properly maintained in order to minimize noise. Also, appropriate personal noise protective equipment (PPE) will be provided to the workers who are likely to be exposed to high noise level environments.

Table 65: Main Project noise sources and mitigation measures.

No	Noise Source	Estimated Noise Emission dB(A)	Number per Heating zone	Mitigation Measures	Estimated Mitigated Noise Emission dB(A)
1	**Process equipment**				
1	Blower	100	5 – 7	Blower room, sound absorber, noise deadener	80
2	Circulating water pump	95	4 -5	Pump station, sound absorber, vibration attenuation	80
3	Water supplement pump	90	3	Pump station, sound absorber, vibration attenuation	75
2	**Heat-supply pipe network**				
1	Circulating water pump of heat-supply pipe network	90	88 - 174	Pump station, sound absorber, vibration attenuation	75
2	Water supplement	85	44 - 87	Pump station, sound	70

No	Noise Source	Estimated Noise Emission dB(A)	Number per Heating zone	Mitigation Measures	Estimated Mitigated Noise Emission dB(A)
	pump			absorber, vibration attenuation	

Sources: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

241. Estimated site boundary noise levels are presented in **Table 66**to **Table 68**. The results indicate that with appropriate mitigations, total noise levels at the boundaries will meet the relevant Class II standard in *Noise Standards for Industrial Enterprises at Site Boundary* (GB12348-2008) during the daytime (60dB(A) and the nighttime (50dB(A). In addition, estimated noise levels at adjacent sensitive points will meet the relevant Class II standard in*Environmental Quality Standards for Noise* (GB3096-2008) during the daytime (60dB(A) and the nighttime (50dB(A). Noise levels at HESs will also meet the Class II standard in *Noise Standards for Industrial Enterprises at Site Boundary* (GB12348-2008) during the daytime (60dB(A) and the nighttime (50dB(A).

242. With appropriatemitigations, Project operation is not expected to have any significant noise impacts on surrounding areas.

Table 66: Predicted noise levels at site boundaryand sensitive locations, HaoqingyingHeating zone.

Location	Site	Daytime Leq(dBA)			Nighttime Leq(dBA)		
		Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission	Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission
Site boundary	1	50.1	45.31	51.34	48.3	45.31	50.07
	2	51.2	43.16	51.83	47.7	43.16	49.01
	3	52.3	30.91	52.33	48.5	30.91	48.57
	4	52.7	29.87	52.72	49.2	29.87	49.25
	5	50.6	24.12	50.61	48.9	24.12	48.91
	6	51.3	21.94	51.31	49.8	21.94	49.81
	7	50.9	24.24	50.91	49.0	24.24	49.01
	8	51.8	29.60	51.83	48.5	29.60	48.56
	9	51.2	40.23	51.53	48.0	40.23	48.67
Sensitive Areas[a]	1 1st floor	49.8	21.61	49.81	49.1	21.61	49.11
	1 3rd floor	50.5	29.92	50.54	49.8	29.92	49.84
	1 6th floor	50.2	29.91	50.24	49.6	29.91	49.65
	2 1st floor	52.4	21.01	52.40	49.8	21.01	49.81
	2 2nd floor	51.8	25.26	51.81	49.7	25.26	49.72
	2 6th floor	50.9	25.25	50.91	49.5	25.25	49.52

[a.] Table 46 indicates the location of sensitive areas for noise monitoring.
Sources: EIA Table Reports Low-carbon Heating Project of Inner Mongolia, Haoqingying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 67: Predicted noise levels at site boundary and sensitive locations, Xinjiaying Heating zone.

Location	Site	Daytime Leq(dBA)			Nighttime Leq(dBA)		
		Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission	Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission
Site Boundary	1	54.1	30.13	54.12	48.7	30.13	48.76
	2	54.9	25.72	54.91	48.1	25.72	48.13
	3	53.2	23.02	53.20	47.3	23.02	47.32
	4	51.2	28.79	51.22	47.1	28.79	47.16
	5	52.1	36.27	52.21	47.0	36.27	47.35
	6	51.2	40.43	51.55	47.4	40.43	48.20
Sensitive Areas[a]	1 1st floor	53.7	22.64	53.70	49.2	22.64	49.21

[a.] Table 46 indicates the location of sensitive areas for noise monitoring.
Source: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Xinjiaying Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

Table 68: Predicted noise levels at site boundary and sensitive locations, Jinqiao Heating zone.

Location	Site	Daytime Leq(dBA)			Nighttime Leq(dBA)		
		Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission	Ambient Noise Level	Estimated Noise Emission of the Heating zone	Total Superimposed Noise Emission
Site boundary	1	45.6	30.25	-	44.4	30.25	-
	2	47.9	32.71	-	45.8	32.71	-
	3	48.4	29.91	-	44.3	29.91	-
	4	47.0	30.20	-	44.8	30.20	-
Sensitive points[a]	1 1st floor	49.2	22.91	49.21	45.8	22.91	45.82
	3 1st floor	46.9	20.02	46.91	45.1	20.02	45.11
	4 1st floor	51.0	35.80	51.13	44.7	35.80	45.23
	2 1st floor	47.4	28.83	47.46	46.0	28.83	46.08
	2 3rd floor	46.3	35.86	46.68	45.2	35.86	45.68
	2 6th floor	51.3	35.80	51.42	47.3	35.80	47.60

[a.] Table 46 indicates the location of sensitive areas for noise monitoring.
Source: EIA Table Reports: Low-carbon Heating Project of Inner Mongolia, Jinqiao Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

7. Occupational Health and Safety

243. Plant operation poses risks to workers. Accidental release of chemicals, and hazardous materials may present health and safety risks to workers. Natural gas also presents fire, burn and explosivehazards.

244. To minimize risks associated with leaks of natural gas:

(i) All natural gas works will be in compliance with relevant PRC building code requirements, including the *Code for Design of City Gas Engineering* (GB 50028-2006) and *Regulation on Electric Apparatus Design for Explosion and Fire Risk Environment* (GB50058-92).

(ii) Independent gas regulation stations will be constructed at least 14 meters away from other buildings and 30 m from the site boundary, to minimize the risk of explosion damaging other Project facilities or the public.[27]The China Gas Company of Hohhot will construct and operate the gas regulation stations.

(iii) The gas regulation stations will be specially designed to withstand and contain explosions.

(iv) Gas regulation stations and the connection to the boilers will be equipped with flammable gas detection, alarm and fire suppression systems. In case of a gas leak, automatic shutdown valves will shut down the gas supply,the system will generate audible and visual alarms, and the emergency ventilation system will exhaust gas from the stations so as to protect the building and operators. Normal air change for the stations will be six times per hour, but in emergencies the ventilation system will change the air 12 times per hour. Electrical devices within the explosion risk area will be safety equipped.

(v) The gas pipelines feeding into the pressure regulation stations will be embedded underground, and will be coated with three layers of PE corrosion protection sleeves. The gas lines exiting the gas pressure regulation stations will be suspended overhead, and will be treated 4 times with anti-corrosion paint. Pipelines will be grounded and equipped with anti-lightning devices where applicable.

(vi) All other at risk areas will have flammable gas detection and alarm systemsable generate audible and visual alarms, and automatic fire suppression systems.

(vii) All gas related devices will be brightly colored and equipped with warning signs.

245. To mitigate potential health and safety risks to workers, the following measures will be taken:

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[27] In the *Code for Design of City Gas* Engineering (GB 50028-2006) the recommended distance from a gas regulation station with no more than 1.6 MPa inlet pressure to other buildings is 9 m. In the Project, the minimum distance from gas regulation stations to the nearest building is 21 m in the Xinjiaying HSP, 15 m in the Jinqiao HSP, and 14 m in the Haoqingying HSP respectively, which fully conforms to the national code requirement.

Gas regulation stations are defined as Class II explosion risks. Space within 4.5 meter away from a regulation station is included in the explosion risk region, as regulated in *Regulation on Electric Apparatus Design for Explosion and Fire Risk Environment* (GB50058-92). The minimum distance from a gas regulation station to a site boundary fence is 30 meter in three HSPs, which confines the explosion risk within the plant sites; explosions will not impact areas outside the site boundaries.

(i) Pperation phase EHSplans for each heating zone including fire prevention and control will be developed and implemented, and workers will be trained regularly on their implementation.

(ii) The HSPgeneral arrangementswill be designed in strict compliance with relevant PRC fire, health and safety standards. Fire compartments will be established based on the fire risk, and fire-resistant buildings/structures will include fire-proof doors and windows.

(iii) Fire-alarm and suppression systems will be installed and tested regularly to ensure it functions properly.

(iv) The process control system will include an out-of-limit alarm to ensure all hazardous materials are safety under control at all time.

(v) PPE, including goggles, gloves, safety shoes, will be provided to workers.

(vi) Naked fire sources, hot surfaces, electric sparks, electrostatic sparks and ignition sources will be strictly controlled, especially near natural gas.

(vii) Control measures will be strictly undertaken to ensure the discharge, exhaust and safety relief of flammable fuels in enclosed systems.

(viii) No unauthorized personnel should be allowed into HSPs or HESs.

(ix) Authorized personnel must have appropriatePPE at all times.

8. Emergency Response Plan

246. An emergency risk and response plan for each heating zone will be established in accordance with the "*National Environmental Emergency Plan*" (24 January 2006) and other relevant PRC laws, regulations and standardsand will include measures in the World Bank EHS guidelines with respect to occupational and community health and safety. Major elements of the emergency response plan are presented in**Table A-3** of **Appendix I**.

D. Anticipated Positive Operation Phase Impacts

247. The 1,560 MW of clean-burning natural gas-fired heating capacity and 50 MW of wind powered electrode heating capacity generated by the proposed Project will replace heat that otherwise would typically have been generated by coal-fired power plants. Once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,500 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2; and (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons. (see Appendix VI for additional information).

248. The construction of the demonstration wind powered electrode boilers will play a role in utilizing renewable natural resources, saving non-renewable fossil energy, reducing pollution and protecting the environment, and supporting the sustainable development of energy, economy and society.

VI. ALTERNATIVE ANALYSIS

249. An analysis of Project alternatives was undertakenduring the feasibility stage to determine the most financially and technically feasible way of achieving the Project objectives while minimizing environmental and social impacts.

A. No Project Alternative

250. The district heating area in Hohhot increased from 14.74 million m^2 in 2004 to 86.81 million m^2in 2012, an annual growth rate of 24.81%. According to the Hohhot Urban Heating Plan, by 2015 the total urban heating area will increase to 151.3 million m^2, and by 2020 it will reach 243.1 million m^2. With rapid urban expansion heat demand increases dramatically, leading to an urgent need to construct new heating infrastructure.

251. If the Project is not implemented,heat from traditional coal-fired HSPs will be required to meet the increasing demand for district heating in Hohhot, and existing polluting small coal-fired boilers may continue to be used. The Project's implementation will improve air quality and significantly reduce coal consumption and GHG emissions.It will also provide valuable hands on experience and mitigate some of the technology risks associated with demonstration projects. Successful wind-powered electrodeboilerdemonstration will help lead to market acceptance and expand deployment in the PRC. For these reasons the "no project" alternative is considered unacceptable.

B. HeatSource

252. There are several heat sources options for district heating, including combined heat and power (CHP) plants, large coal, natural gas or biomass-fired heat source plants (HSPs), solar energy, industrial or residential waste heat, geothermal energy, and heat pumps.

253. CHPs and HSPs are considered the most proven, economically viable, energy efficient and environmentally friendly heat source options for northern China. In Jinqiao there is an existing CHP which will cover the heating base load, and the Project will install a natural gas-fired HSP to cover the peak load. In Haoqingying and Xinjiaying there are no CHPs planned under the Hohhot Urban Heating Plan, and the Project will install HSPs including 50 MW of demonstration wind powered electrode boilers in Haoqingying.

C. HSP Fuel

254. It was initially conceived that the three HSPs would be coal-fired. However, due to concerns raised by the PRC Government and the ADB respect to SO_2, NOx and PM emissions, the Project was subsequently redesigned to utilize natural gas-fired boilers and 50 MW of demonstration wind powered electrode boilers.

255. Natural gas is the recommended fuel source in the IFC *EHS Guidelines*. Natural gas generally produce negligible quantities of particulate matter and sulfur oxides, and levels of nitrogen oxides are about 60% of those from plants using coal (without emission reduction measures). Natural gas-fired plants also release lower quantities of carbon dioxide, a greenhouse gas.

256. The use of natural gas and electrode boilers in the Project will contribute to energy efficiency improvement and emissions reduction in Hohhot. In addition, gas-fired boilers do not require large coal storage sheds or ash storage silos, and do not need water and

electricity for coal, fly and bottom ash and slag treatment. Thus, the use of natural gas-fired instead of coal-fired HSPs will require less land and will consume less water and electricity. Furthermore, the transmission of natural gas by pipeline will eliminate the negative impacts of coal transportation through urban areas by truck or train.

257. Biomass-fired CHPs were not considered practical due to the limited available biomass fuel resources in the Hohhot region.

D. Low NOx Gas Boilers

258. The domestic EIAs indicates that boiler NOx emission will be 137.31mg/m^3, based on a 2007 survey of industrial natural gas boilers in PRC. It's important to note that this emission level is in compliance with both the PRC natural gas boiler emission standard of 400 mg/m^{3}and 200 mg/m^3 in sensitive areas (*PRC Emission Standards of Air Pollutants for Coal-burning, Oil-burning, Gas-fired Boilers* (GB 13217-2001)), and the 2007 IFC *EHS Guidelines*of 240 mg/m^3 for boilers.However, to in order to maximize environmental benefits, the Project has committed to using low NOx natural gas boilers producing less than 100 mg/m^3 NOx emissions.

E. Piloting Electrode Boilers

259. The Project will pilot the use of wind powered electric boilers. Electric boilershave several key advantages over fossil fuel fired boilers: they have extremely quick response times; they are flexible for cyclical or intermittent operations; they are clean firing, produce no combustion emissions and do not require stacks; they are greater than 99% efficient; and they are smaller in volume and footprint than fossil fired boilers.

260. There are two main types of electric boilers:

Electrode Boilers
- Works by passing current through the water between two electrodes. The resistance of the water produces heat.
- Supply voltage: 6 – 14 kV.
- Power output: 6 to 100 MW.

Electric Resistance Boilers
- Works by passing current through an electrically resistive element to transfer heat to the water.
- Supply voltage: 380 – 690 V.
- Power output: up to 6 MW.

261. Electrodeboilers have been selected for the Project due to their higher output which requires fewer units, and their higher supply voltage (electrode boilers use high voltage connectionwhich eliminates the need for step-down transformers; resistive boilers utilizelow voltage so more transformers are required). Based on the heating needs of the Haoqingying zone, the required HSP footprint, and the investment cost associated with different types of electric boilers, it was determinedthat the Project will pilot the use of two 25 MW wind powered high-efficiency zero-emission demonstration 10 kV electric powered boilers instead low voltage small scale electric boilers.If small scale electric boilers are used, it will occupy much larger space, which will lead to 2.7 times higher investment cost for HSP building construction comparing to the electrode boiler option.

F. Heat System Connection

262. District heating systems utilize direct or indirect connections between the heat

source and the customers.

263. A direct connection supplies hot water directly from the boiler to the consumer’s radiators. The advantages of a direct connection system are that it is simple and requires less capital investment than an indirect connection. The system has only one closed loop that connects the heat source and transmission pipelines to the consumer’s system. However, should a problem arise in any portion of the system, such as a pipeline leak or rupture, the entire system will be affected. Direct connection is only suitable for smaller heating systems with a hot water temperature less than 100°C.

264. An indirect connection system uses heat exchange stations (HESs) between the heat source and the customers. The system has two closed loops, a primary loop and a secondary loop. Both loops work independently of each other without direct interference allowing a higher temperature and pressure heat source. This higher supply temperature and greater temperature difference between the supply and the return can be handled in a smaller transmission pipe, lowering the capital costs for the heat transmission system. The disadvantage of the indirect system is that there are additional costs for the HESs, including capital, operational, maintenance and land acquisition.

265. Based on the advantages and disadvantages of the two systems, indirect connection systems were selected for theheating zones. The proposed indirect connection systemswill includes the heat sources, primary heating networksand HESs. The primary heating network working pressure will be 1.6 MPa, the supply water temperature will be 120°C and the return water temperature will be 60°C. The heating zones will not include the secondary networks between the HESs and end-users.

G. Pipeline

266. The Project will utilize direct-buried pre-insulated bonded pipeline, which is by far the most commonly used technology for both new district heating and cooling systems and for rehabilitation of existing systems. Steel pipes and insulation materials made of polyurethane foam (PUR) and high density polyethylene (HDPE) are bonded into one piece in a sandwich-like structure. Compared to onsite insulated pipe buried in a tunnel, direct-buried pre-insulation bonded pipe has many advantages including lower capital costs, reduced heat losses and improved energy efficiency, better anti-corrosive and insulation performance, longer service life, limited land acquisition requirement and shorter installation cycles. Although pre-insulated bonded pipe is designed for direct-bury installation, some sections of pipeline may need to run overhead and/or use trench laying modes, depending on local site conditions.

H. Piloting Building Level HESs

267. The Project will utilize a combination of traditional large sized HESs and smaller building-level HESs. In the PRC, most HESs used in district heating system are large sized and serve multiple buildings. Compared to building-level HESs, they require more secondary network and more complicated control apparatus to meet the demand of different buildings. As most of the secondary network is constructed by real estate enterprises or building owners, there will be cost reduction for a heating company. Yet, poor construction quality by housing developers may lead to energy and water loss in secondary pipe networks and may require additional maintenance cost for the heating company that are usually in charge of pipeline maintenance and operation.

268. In recent years some projects have piloted using building-level HESsin the PRC. In a building-level HES, all equipment and auxiliary parts are be installed in one small

prefabricated package.[28] They are installed very close to user, typically in the basement of the building to be served. Usually it does not require large size expensive pipes, neither the secondary pipe networks. More importantly, control methods tailored to each building can be developed. Using building-level HES will result in less transmission loss, improved hydraulic balance and improved efficiently in utilizing heat energy. It will also conserve energy, land and space, and reduce fuel costs compared to traditional sized HESs.

269. The Project will construct a total of 180 HESs. After carefully considering local conditions and the practicality of locate building-level HESs in building basements, it was decided to install 11 building-level HESs as a pilot in IMAR. Once the pilot HESs are proven successfully in the ADB project, more building-level HESs could be used in the future.

I. Overall Alternative Analysis

270. Base on the overall analysis of alternatives, the Project has selected the most appropriate heat source, fuel type, low NOx burner, electric boiler, heat system connection, pipeline type and installation method, and HES type.

[28] Building level HESs will be approximately 2 m long, 1.5 m wide and 2 m high. The final dimensions will be dependent on the manufacturer.

VII. INFORMATION DISCLOSURE AND PUBLIC CONSULTATION

A. PRC and ADB Requirements for Public Consultation

1. PRC Requirements

271. Relevant provisions in the PRC *Environmental Impact Assessment Law* (2003) and the *Regulations on the Administration of Construction Project Environmental Protection* (No. 253 Order of the State Council, 1998) require that an EIA study for a construction project shall solicit opinions from affected residents, as well as other organizations and concerned stakeholders. However, the requirements for public consultation are different for various sectors and projects. For an environmental Category A project (such as a coal-fired power plant), full EIA reports are required including two rounds of public consultations, while for a Category B project (such as the district heating projects), only a simplified tabular EIA is required without a requirement for any public consultation.

2. ADB Requirements

272. ADB's SPS has specific requirements for information disclosure and public consultation.Information disclosure involves delivering information about a proposed project to the general public and to affected communities and other stakeholders, beginning early in the project cycle and continuing throughout the life of the project. Information disclosure is intended to facilitate constructive engagement with affected communities and stakeholders over the life of the project.

273. In order to make key documents widely available to the general public, the SPS requires submission of a finalized EIA for Category A projects, and a final IEE for Category B projects, to ADB for posting on the ADB website.The SPS requires that borrowers take a proactive disclosure approach and provide relevant information from environmental assessment documentation directly to affected peoples and stakeholders.

274. The SPS also requires that the borrower carry out consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.

B. Public Consultation and Information Disclosure

275. The HCHC and the HCDIOundertook public consultationand information disclosure in accordance with the *Interim Guidelines on Public Consultation for EIA* (2006). The two phase process began when the Project design still incorporated coal-fired HSPs, and continuedwhen the design was revised to natural gas-fired HSPs.

1. Phase 1: Public Consultation and Information Disclosure, Coal-Fired HSPs

a) Information Disclosure

276. The HCHC and the HCDIO disclosed Project information in three steps:

i) The first public project information noticewas posted on theHCDIO website in August 2011, early in the EIA preparation process. The information in the first public notification is listed below:

a) Project name and summary of the three heating zones.

b) Name and contact information of the proponent.

c) Name and contact information of the institute responsible for preparing the domestic EIAs of the three heating zones.

d) Domestic EIA procedures and content.

e) Type of domestic EIA notification notice.

f) Request for questions, suggestions and feedback from the public.

ii) Asecond public information notice was posted on the HCDIO website from September 28, 2011 to October 14, 2011, prior to the submission of the EIAs to the Hohhot EPB. . The notice included Project name and summary of the three heating zones

a) Name and contact information of the proponent.

b) Name and contact information of the institute responsible for preparing the domestic EIAs of the three heating zones.

c) Potential project environmental impacts and mitigation measures.

d) Key conclusions of the domestic EIA reports

e) Contact information to get abridged versions of the domestic EIA reports.

iii) A public project information noticewas posted on page 5 of the Inner Mongolia Morning Post on February 18, 2012.

277. No public feedback was received in response to any of the project information notices.

b) BeneficiarySurvey

278. In early October 2011 the EIA Institute conducted surveys in each of the three heating zone areas. The questionnaires targeted beneficiaries and potentially affected persons in the immediate vicinity of the heating zone sites. In each location a total of 50 questionnaires were distributed. In Haoqingying 47 completed questionnaires were collected, but 1 was invalid; in Xinjiaying 49 completed questionnaires were collected; and in Jinqiao43 completed questionnaires were collected, but one was invalid. The questionnaire is presented in **Table 69.Figure 51** presents a sample completed questionnaire.

279. **Table 70** presents summary information on the questionnaire respondents. The survey covered a wide age range. 60% of respondents were male and the remainder female. 80% were Han and 17% were Mongolian. Over 55% of respondents had an education level of college and above, while 20% of participants had only completed high school. The occupations of the respondentswere quite diverse, representing the opinions of a wide range of Project stakeholders.

Table 69: Project public consultation questionnaire, coal-fired boilers (2011).

<table>
<tr><th>Name</th><th>Sex</th><th>Age</th><th>Nationality</th><th>Education level</th><th>Occupation</th><th>ID number</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Address</td><td colspan="6"></td></tr>
<tr><td colspan="7">Project information (a project summary was provided here)</td></tr>
<tr><td rowspan="3">Understanding of the Project</td><td colspan="2">Good understanding</td><td></td><td rowspan="3">Project’s anticipated effect on the local economy</td><td>Large effect</td><td></td></tr>
<tr><td colspan="2">Moderate understanding</td><td></td><td>Moderate effect</td><td></td></tr>
<tr><td colspan="2">Low understanding</td><td></td><td>No effect</td><td></td></tr>
<tr><td rowspan="3">Project’s anticipated effect on the local living standards</td><td colspan="2">Positive effect</td><td></td><td rowspan="3">Attitude to the project</td><td>Agree</td><td></td></tr>
<tr><td colspan="2">No effect</td><td></td><td>Disagree</td><td></td></tr>
<tr><td colspan="2">Negative effect</td><td></td><td>No opinion</td><td></td></tr>
<tr><td rowspan="5">Environmental issues in your home area</td><td colspan="2">Air pollution</td><td></td><td rowspan="5">Environmental issues of highest concern during construction and operation periods</td><td>Air pollution</td><td></td></tr>
<tr><td colspan="2">Water pollution</td><td></td><td>Water pollution</td><td></td></tr>
<tr><td colspan="2">Noise</td><td></td><td>Noise</td><td></td></tr>
<tr><td colspan="2">Solid waste pollution</td><td></td><td>Solid waste pollution</td><td></td></tr>
<tr><td colspan="2">Don't know</td><td></td><td>No opinion</td><td></td></tr>
<tr><td colspan="7">Suggestions or requirements for the project:</td></tr>
<tr><td colspan="7">Project’s effect on lifestyle, education and learning, work and entertainment</td></tr>
</table>

Effect	**Lifestyle**	**Education and Learning**	**Work**	**Entertain-ment**	**Other**
Positive effect					
Limited effect					
Negative effect					
No effect					

Sources: EIA Reports: District Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, October 2011. Prepared by Zhong Ye Dong Fang Ltd. Translated from original Chinese.

Figure 51: Sample completed questionnaire, coal-fired boilers (2011).

呼和浩特市城发辛家营(4×116MW)、金桥(4×116MW)、豪沁营(5×116MW)区域集中供热工程—金桥调峰热源厂供热区域

环境影响评价公众参与调查表

姓名	杨宇	性别	男	年龄	24	民族	汉
文化程度	中专	职业	技术员	联系电话	15847751404		
身份证号码	15010519880814301X						
您所属组织名称（如：人大代表、政协委员、群众团体、学术团体、工作单位等）或家庭住址	赛罕区鄂尔多斯大街						

工程概况：呼和浩特市城发辛家营(4×116MW)、金桥(4×116MW)、豪沁营(5×116MW)区域集中供热工程—金桥调峰热源厂供热区域拟在北至鄂尔多斯东街，东至二环东路，西至呼伦贝尔南路的供热范围内新建一座 4×116MW 层燃热水锅炉房、新建 17.06km 一级热水管网、新建 44 座水水热力站。本项目供热面积 953.1 万 m^2。

本工程污染主要来自热源厂锅炉烟气、灰渣、生活污水、厂区废水及鼓风机、引风机等产生的噪音。该项目将采用综合的治理措施，降低烟尘、二氧化硫和氮氧化物的排放量；使废气中的各项污染物达标排放，并满足地方总量控制要求。废水达标排放。燃煤灰渣外运综合利用。

您对该工程建设的了解程度	很了解	✓	所建工程对发展当地经济的作用	较大	✓
	有所了解			一般	
	不了解			没有促进	
所建工程对提高您所在地的生活水平	有所提高	✓	您对该项目建设的态度如何	赞成	✓
	没有提高			反对	
	有所下降			无所谓	
您所居住的地区存在哪些环境问题	空气污染		在该工程的建设期及运营期您最关心哪些环境问题	空气污染	✓
	水污染			水污染	
	噪声污染	✓		噪声污染	
	垃圾污染			垃圾污染	
	不了解			无所谓	

您对所建工程有什么建议或要求：尽量不影响周边居民的正常生活。

所建工程对您的生活、学习、工作和娱乐有何影响

影响方面 / 影响程度	生活	学习	工作	娱乐	其他
有较好影响	✓	✓	✓		
影响不大	✓	✓	✓	✓	
有不利影响	✓	✓			
没有影响				✓	✓

Sources: EIA Reports: District Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, October 2011. Prepared by Zhong Ye Dong Fang Ltd.

Table 70: Summary data on questionnaire respondents, coal-fired boilers (2011).

Parameter	Indicator	Jinqiao		Xinjiaying		Haoqingying	
		No.	%	No.	%	No.	%
Sex	Male	29	69.0	28	57.1	25	54.3
	Female	13	31.0	21	42.9	21	45.7
Age	Below 30	9	21.4	25	51.0	10	21.7
	31-40	19	45.2	16	32.7	14	30.4
	41-50	11	26.2	6	12.2	17	37.0
	Above 50	3	7.1	2	4.1	4	8.7
	No Response					1	2.2
Nationality	Han people	35	83.3	35	71.4	39	84.8
	Mongolian	5	11.9	14	28.6	5	10.9
	Other	2	4.8	0	0	2	4.3
Education level	Primary School or Below	0	0	0	0	0	0
	Junior school	11	26.2	17	34.7	0	00
	High school, including technical secondary school	9	21.4	18	36.7	5	10.8
	Bachelor degree or above, including junior college	22	52.4	14	28.6	41	89.1
Occupation	Farmer	9	21.4	13	26.5	0	0
	Worker	6	14.3	15	30.6	15	32.6
	Self-employed entrepreneurs	-	-	7	14.3	-	-
	Civil servant	0	0	0	0	0	0
	Other	27	64.3	14	28.6	31	67.4

Sources: EIA Reports: District Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, October 2011. Prepared by Zhong Ye Dong Fang Ltd.

280. **Table 71** and **Table 72** present the survey results. Over 90% of the respondents indicated that they had either good or moderate knowledge of the proposed Project, indicating that the Project information had been well disseminated. When the participants were asked to identify the main environmental impacts during construction and operation, air pollution and noise were most commonly identified, both which are effectively addressed in the mitigation measures. Over 85% of respondents believe the Project will have a positive effect on the local standard of living, 80% believe it will have a positive effect on the local economy, and 60% believe the project will have a positive effect on their work. Overall, 97% of respondents are supportive of the Project (3% didn’t respond to that question).

Table 71: Survey results (respondentsunderstanding of Project impacts, respondent's attitude towards project, key local environmental issues).

Question	Option	Jinqiao		Xinjiaying		Haoqingying	
		No.	%	No.	%	No.	%
Understanding of the Project	Good understanding	22	52.4	3	6.1	3	6.5
	Moderate understanding	18	42.9	45	89.8	35	76.1
	Low understanding	2	4.8	2	4.1	8	17.4
Project's anticipated effect on local living standards	Positive effect	40	95.2	47	93.9	33	71.7
	No effect	2	4.8	3	6.1	12	26.1
	Negative effect	0	0	0	0	1	2.2
Environmental issues in your home area (can select more than one)	Air pollution	8	19.0	44	60.6	14	30.4
	Water pollution	3	7.1	1	1.4	8	17.4
	Noise	23	54.8	25	35.2	14	30.4
	Solid waste pollution	6	14.3	1	1.4	3	6.5
	Don't know	8	19.0	1	1.4	13	28.3
Project's anticipated effect on local economy	Large effect	38	90.5	47	93.9	26	56.5
	Moderate effect	3	7.1	3	6.1	19	41.3
	No effect	1	2.4	0	0	1	2.2
Attitude to the project	Agree	42	100	46	91.8	46	100
	Disagree	0	0	0	0	0	0
	No opinion	0	0	4	8.2	0	0
Environmental issues of highconcern during construction and operation periods(can select more than one)	Air pollution	13	31.0	41	42.3	13	28.3
	Water pollution	2	4.8	3	3.1	15	32.6
	Noise	5	11.9	47	47.4	18	39.1
	Solid waste pollution	7	16.7	5	5.2	4	8.7
	No opinion	7	16.7	1	1.0	3	6.5
	No response	12	28.6	0	0	0	0

Sources: EIA Reports: District Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, October 2011. Prepared by Zhong Ye Dong Fang Ltd.

Table 72: Survey results (respondents views on Project impact on lifestyle, education and learning, work and entertainment).

Heating zone / Effect	Lifestyle		Education/Learning		Work		Entertainment		Other	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Haoqingying										
Positive effect	25	54.3	9	19.6	26	56.5	8	17.4	8	17.4
Limited effect	17	37.0	25	54.3	17	37.0	20	43.5	17	37.0
Negative effect	0	0	0	0	1	2.2	0		0	
No effect	4	8.7	12	26.1	2	4.3	18	39.1	2	4.3
No Response	0	0	0	0	0	0	0		19	41.3
Xinjiaying										
Positive effect	42	85.7	45	91.8	46	93.9	3	6.1	0	0
Limited effect	3	6.1	2	4.1	3	6.1	2	4.1	3	6.1
Negative effect	1	2.1	0	0	0	0	2	4.1	0	0
No effect	1	2.1	2	4.1	0	0	42	85.7	46	93.9
No Response	2	4.1	0	0	0	0	0	0	0	0
Jinqiao										
Positive effect	15	35.7	9	21.4	13	31.0	9	21.4	8	19.0
Limited effect	19	45.2	22	52.4	19	45.2	20	47.6	2	4.8
Negative effect	0	0	0	0	0	0	0	0	0	0
No effect	7	16.7	10	23.8	9	21.4	12	28.6	26	61.9
No Response	1	2.4	1	2.4	1	2.4	1	2.4	6	14.3

Sources: EIA Reports: District Heating Project of Inner Mongolia, Haoqingying, Xinjiaying and Jinqiao Heating Resource Plants of Hohhot City Development Company, October 2011. Prepared by Zhong Ye Dong Fang Ltd.

2. Phase 2: Public Consultation and Information Disclosure, Natural Gas-Fired HSPs

a) Beneficiary Social Analysis Surveys

281. As part of the social safeguards due diligence undertaken for the Project (natural gas-fired design), a social analysis was undertaken to (i) assess social patterns influenced by the Project including the identification of any adverse effects; (ii) assess the current status of poverty within the heating zone areas and analyzed the poverty reduction impact resulting from the Project; and (iii) analyze and proposes activities which would complement the Project by enhancing the livelihood of the vulnerable people within the heating zone areas, including the preparation of a reemployment plan for the workers of small boilers which are to be closed as a result of the Jinqiao heating zone.

282. The methodology for the social analysis included socioeconomic surveys (carried out from October – November 2013) and local consultations. The consultants visited all heating zones and held meetings with the IA and various district government agencies including the development and reform committees, land administration bureaus, civil affairs bureaus, ethnic minority affairs bureaus, urban construction bureaus and women's federations, etc.

283. The social analysis indicates that the by 2020 the Project will benefit an estimated 294,500 user HHs with a population of 883,500. The social analysis results are partially presented in Chapter VII, and are presented in full in the social analysis report.[29]

b) EIA Disclosure

284. The EIAs prepared for the revised design incorporating natural gas-fired boilers is, at the time of writing, being disclosed on the HCDIO website. The links are provided below:

http://www.hhhtscf.com/info.asp?id=438
http://www.hhhtscf.com/info.asp?id=439
http://www.hhhtscf.com/info.asp?id=440

c) Project Information Disclosure and Public Consultation Meeting

285. A public consultation meeting for the natural gas-fired project design was held April 10th, 2014. A public project information notice was posted in the Hohhot Daily newspaper for two weeks prior to the meeting. The notice provided updated basic project information, and invited residents in the project areas to attend the meeting (**Figure 52**). The meeting was held at the Xinjiaying heat supply branch office, which is centrally located amongst the three heating zones. The meeting was attended by 52 participants.

286. During the meeting information was presented about the project status, potential environmental impacts and proposed mitigation measures (**Figure 53**). Participants were asked to complete a brief questionnaire (**Table 73**). A total of 42 completed questionnaires were received (**Figure 54**).**Table 74** presents summary data on the questionnaire respondents.

[29] Inner Mongolia Autonomous Region District Heating Supply Project, Social Analysis Report. December, 2013.

Figure 52: Public notice in Hohhot Daily newspaper, natural gas-fired boilers, March/April 2014.

呼市城发公司召开内蒙古呼和浩特市低碳供热项目公众磋商会的公告

为解决呼和浩特市东部区域日益突出的供热需求，满足城市实施可持续发展的需要，加强节能减排，保护大气环境，呼和浩特市城发投资经营有限责任公司正在申请亚洲开发银行贷款，建设内蒙古呼和浩特市低碳供热项目——辛家营、金桥、毫沁营区域集中供热工程，建设内容包括 19 台燃气热水锅炉，总容量 1560MW，2 台电锅炉，总容量 50MW，增加供热能力 2971.13 万平方米。

本项目符合国家相关产业政策、节能减排要求，符合《呼和浩特市城市总体规划纲要（2005-2020 年）》和《呼和浩特市城市供热规划（2010-2020 年）》，并在筹建中得到了国家发展和改革委员会、国家财政部，内蒙古自治区、呼和浩特市两级政府、地方发改委、财政部门以及亚洲开发银行的大力支持，目前项目各项前期工作正在顺利进行中。

为增加本项目建设的透明度，扩大市民的知情权、参与权和监督权，我公司与亚洲开发银行将召开公众磋商会，诚意邀请本项目区域居民、政府有关部门和关心项目建设的社会各界热心人士参加，交流本项目的施工建设、环境保护、社会影响和效益等方面问题，提出宝贵意见建议。

会议时间：暂定 2014 年 4 月 10 日上午 9 时

会议地点：呼和浩特市赛罕区西把栅乡辛家营村南城发辛家营供热分公司

联系电话：0471-5103421

Unofficial Translation:

Public consultation meeting notice of low-carbon heat supply project in Hohhot, Inner Mongolia by Hohhot urban investment and management Limited Liability Company

Hohhot Urban Investment and Management Limited Liability Company- Chengfa - is applying for a loan from ADB for purpose of addressing the needs of heat supply in east Hohhot urban area, achieving sustainable development of Hohhot, enhancing energy saving, and reducing pollution and protecting the ambient environment. The loan will be used for low-carbon heat supply project in Hohhot, Inner Mongolia- Xinjiaying, Jinqiao and Haoqingying district heat supply projects. The project includes 19 gas fired hot water boilers with a total capacity of 1560 MW and 2 electrical boilers with a total capacity of 50 MW. The project will increase heat supply area by 29.7113 million m².

The project is consistent with relevant national industrial policy, energy saving and pollution reduction requirements, and also consistent with *Hohhot Master Plan Outline (2005-2020)* and *Hohhot Urban Heating Plan (2005-2020)*. During project preparation process, the project received strong support from National Development and Reform Commission, National Finance Ministry, Inner Mongolia Autonomous Region Government, Hohhot Government, Hohhot Municipal Development and Reform Commission, Hohhot Finance Department and ADB. Now preliminary work of the project is proceeding smoothly.

Chengfa and ADB will hold a public consultation meeting for the purpose of making the project more transparent and giving the public more rights to know, participate and supervise. Residents in the project site, relevant government departments and social persons who concern about the project are cordially invited to the meeting. Problems on project construction, environmental protection, social impact and benefits etc. will be communicated and discussed in the meeting. Suggestions and advice on the project are welcomed.

Meeting time: 9 am of Apr 10th, 2014 (tentative)
Meeting place: The meeting will be held in one branch company of Chengfa- Xinjiaying heat supply company which is located at south of Xinjiaying Village, Xibazha Township, Saihan District, Hohhot.
Contact No: 0471- 5103421

Source: HCDIO, 2014.

Figure 53: Public consultation photographs, natural gas-fired boilers (2014).

HCDIO senior staff and environmental consultants present information about the proposed Project.

Public consultation participants.

Public consultation discussion.

Questionnaires being completed by public consultation participants.

Source: HCDIO, 2014.

287. **Table 75** presents a summary of the questionnaire results. All (100%) of the respondents indicated that they agreed or conditionally agreed with the proposed Project. When the participants were asked to identify the main environmental impacts during construction and operation, water pollution, air pollution and noise were most commonly identified, all of which are effectively addressed in the mitigation measures.

C. Future Consultation Activities

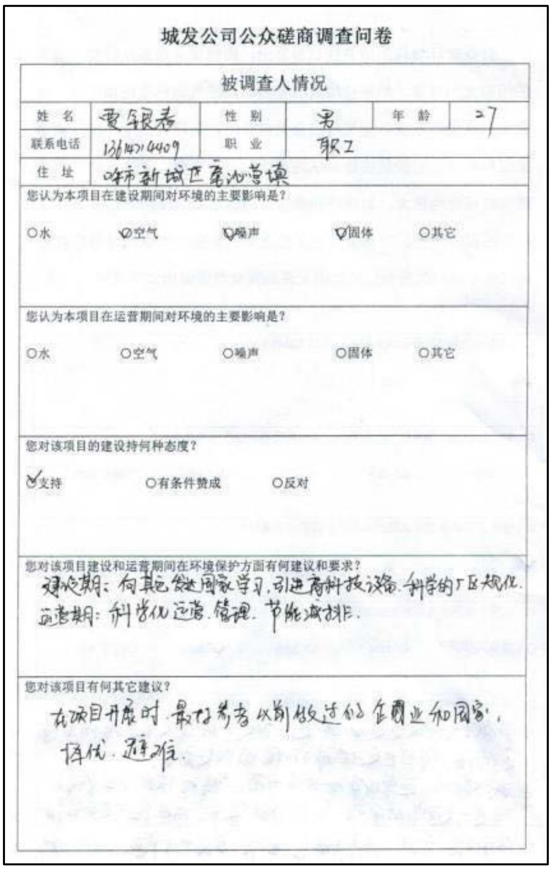
288. HCDIO will continue to conduct regular community liaison activities during the construction and operations phases, including the implementation of the grievance redress mechanism (GRM, see Chapter VIII).

Table 73: Project public consultation questionnaire, natural gas-fired boilers (2014).

Status of Participants					
Name		Sex		Age	
Contact number		Occupation			
Address					
What are the project’s main environment impacts during construction phase in your opinion? ○Water ○ Air ○ Noise ○ Solid waste ○ Other (dust etc.)					
What are the project’s main environment impacts during operation phase in your opinion? ○Water ○ Air ○ Noise ○ Solid waste ○ Other (dust etc.)					
Attitude to the project ○ Agree ○ Conditional agree ○ Disagree					
Suggestions or requirements for environment protection of the project:					
Other suggestions or requirements for environment protection of the project:					

Source: HCDIO, 2014.

Figure 54: Sample completed questionnaire, coal-fired boilers (2011).



城发公司公众磋商调查问卷

被调查人情况					
姓 名	雷银春	性 别	男	年 龄	27
联系电话	13614710409	职 业	职工		
住 址	呼市新城区毫沁营镇				

您认为本项目在建设期间对环境的主要影响是？

○水 ○空气 ○噪声 ○固体 ○其它

您认为本项目在运营期间对环境的主要影响是？

○水 ○空气 ○噪声 ○固体 ○其它

您对该项目的建设持何种态度？

○支持 ○有条件赞成 ○反对

您对该项目建设和运营期间在环境保护方面有何建议和要求？

建设期：向其他发达国家学习，引进高科技设备，科学的厂区规化。

运营期：科学化运营、管理、节能减排。

您对该项目有何其它建议？

在项目开展时，最好参考以前做过的企业和国家，择优、避难。

Source: HCDIO, 2014.

Table 74: Summary data on questionnaire respondents, natural gas-fired boilers (2014).

Parameter	Indicator	No.	%
Sex	Male	31	73.8
	Female	11	26.2
Age	Below 30	10	23.8
	31-40	19	45.2
	41-50	5	11.9
	Above 50	7	16.7
	No Response	1	2.4
Occupation	Farmer	5	11.9
	Worker	8	19.0
	Self-employed entrepreneurs	2	4.8
	No response	14	57.1
	Civil servant	3	7.1

Source: HCDIO, 2014.

Table 75: Public consultation questionnaire results, natural gas-fired boilers (2014).

	Options	No	%
What are the project's main environment impacts during construction phase in your opinion? (can select more than one)	Water	12	28.6
	Air	22	52.4
	Noise	22	52.4
	Solid waste	4	9.5
	Other (dust etc.)	0	0
What are the project's main environment impacts during operation phase in your opinion? (can select more than one)	Water	10	23.8
	Air	31	73.8
	Noise	15	35.7
	Solid waste	4	9.5
	Other (dust etc.)	10	0
Attitude to the project	Agree	38	90.5
	Conditional agree	4	9.5
	Disagree	0	0

Source: HCDIO, 2014.

VIII. GRIEVANCE REDRESS MECHANISM

A. Introduction

289. A Project grievance can be defined as an actual or perceived Project related problem that gives ground for complaint by an affected person (AP). As a general policy, HCDIO will work proactively toward preventing grievances through the implementation of impact mitigation measures and community liaison activities that anticipate and address potential issues before they become grievances. In addition, as the Project has strong public support and will not involve any involuntary land or property acquisition or resettlement, significant grievance are unlikely. Nonetheless, during construction and operation it is possible that unanticipated impacts may occur if the mitigation measures are not properly implemented, or unforeseen issues arise. In order to address complaints if or when they arise, a Project grievance redress mechanism (GRM) has been developed in accordance with ADB requirements and Government practices. A GRM is a systematic process for receiving, recording,evaluating and addressing AP's Project-related grievances transparently and in a reasonable period of time.

B. ADB's GRM Requirements

290. The ADB's SPS requires the IA to establish a GRM to receive and facilitate resolution of affected person's concerns and complaints about the project's environmental performance during construction as well as operation phase of the project. The GRM should be scaled to the risks and adverse impacts of the project; should address affected people's concerns and complaints promptly, using an understandable and transparent process; should be readily accessible to all sections of the community at no cost and without retribution; and, should not impede access to the PRC's judicial or administrative remedies.

C. Current Practice in the PRC

291. At the national level a framework to address grievance has been established. State Council Decree No. 431 "Regulations on Letters and Visits"(January 2005) codifies a complaint mechanism at all levels of government, and safeguards the complainants from any retaliation. The Ministry of Environmental Protection(MEP) "Decree No. 34 Environmental Letters and Visits System"provides specific guidelines to establish a system and address environmental complaints.

292. Currently, when APs are negatively affected by project activities, such as noise, dust or safety issues caused by construction activities, they may complain to the contractors and the project IA by themselves or through their community organizations, or complain directly to local EPBs. If the issue is not resolved they may take legal action, though that is typically considered as a last option.

293. In the case of issues occurring during the construction period, an AP can complain to the contractors first if the construction activities are the source of the problem. If the contractors do not respond to the complaintor their responses cannot resolve the issue, the AP may contact municipal EPBs or the district/county EPBs, who will record the complaints and then visit the sites to investigate and obtain the contractors' side of the story. Sometimes, the two sides might contradict, each defending its own argument. In such cases, the local EPBs will need to consult with the contractor or the supervising engineer to acquire relevant project information and collect data. This kind of fact-finding or site investigation is usually time-consuming, thus delaying the implementation of appropriate mediation

measures.

294. Weaknesses of the current practiceincludes: (i) lack of specialized units to address grievances at the project level; and (ii)lack of specific timeframes for actions and responses to be undertaken to resolve the complaints. These weaknesses have been addressed in the Project GRM.

D. Proposed Project GRM

295. The HCHC will establish a Project Public Complaints Unit (PPCU). The PPCU will be coordinated by at least two staff members. The contact persons for the different GRM entry points (residential community leaders, neighborhood organizations, local authorities, district EPB, contractors and operators) will be defined prior to construction and operation. Organizational charts of the GRM, including the contact persons of the entry points will be disclosed at each heating zoneconstruction site. The Project will provide training to the members of the PMO and the contact persons of the GRM entry points to ensure that responsibilities and procedures are clear. The concept of the proposed project GRM is shown in**Figure 55**.

1. Grievance Types, Documentation, and Eligibility Assessment

296. Public grievances will most likely relate to environmental issues encountered during the construction phase. Grievances may include vehicle operation and transportation of heavy equipment and materials; fugitive dust emissions and construction noise; soil erosion and haphazard disposal of waste materials in inappropriate places; and safety measures for the protection of the general public and construction workers. Construction-related grievances can be numerous, and managing them is the contractor's responsibility under its contract with the IA. Operation related grievances may occur due to complaints about HSP or EHSenvironmental performance.

297. All complaints will be recorded in a systematic fashion by the PPCU. Effective tracking and documentation will promote timely resolution; assist in keeping concerned parties (the complainant and appropriate Project personnel) informed about the status of the case and progress being made toward resolution; record responses and outcome(s) so as to promote fairness and consistency; provide a record of settlements; and assist when assessing the effectiveness of the process and action(s) to resolve complaints.

298. Once a complaint has been appropriately recorded, the PPCU will identify if the complaint is eligible. Eligible complaints include those where (i) the complaint pertains to the project, and (ii) the complaint falls within the scope of environmental issues that the GRM is authorized to address. Ineligible complaints include those where (i) the complaint is clearly not project-related; (ii) the nature of the issue is outside the mandate of the environment GRM (such as issues related to resettlement, allegations of fraud or corruption); and (iii) other company or community procedures are more appropriate to address the issue. If the complaint is rejected, the complainant will be informed of the decision and the reasons for the rejection.

2. GRM Steps and Timeframe

299. The GRM consistsof 5 escalating steps. A key goal of the GRM is to solve problems early at the lowest step.A conceptual diagram of the GRM is presented in**Figure 55**and each step is described below:

Step 1: If a concern arises, the AP should try to resolve the issue of concern directly with the contractor/operator and/or the IA project manager. If the concern is resolved successfully, no further follow-up is required. Nonetheless, the contractor/operator and/or the project manager shall record any complaint and actions taken to resolve the issues and report the results to the PPCU. If no solution is found within 15 working days or if the complainant is not satisfied with the suggested solution under Step 1, proceed to Step 2.

Step 2: The AP will submit the grievance to the PPCU, either directly or via other entry points such as District EPBs or community leaders. The PPCU must assess the eligibility of the complaint, identify a solution, and give a clear reply within 15 working days to the complainant and to HCDIO and the contractor (if relevant) with the suggested solution. The contractor, during construction, and HCDIO, during operation, shall implement the redress solution and convey the outcome to the PPCU within 7 working days.

Step 3: If no solution is identified by the PPCU or if the complainant is not satisfied with the suggested solution under Step 2, the PPCU will organize, within two weeks, a multi-stakeholder meeting where all relevant stakeholders, including the complainant, HCDIO, the contractor/operator, and local District EPB will be invited. The meeting will aim to find in a solution acceptable to all, and identify responsibilities and an action plan. The contractor during construction and HCDIOduring operation will implement the agreed-upon redress solution and convey the outcome to the PPCU within 7 working days.

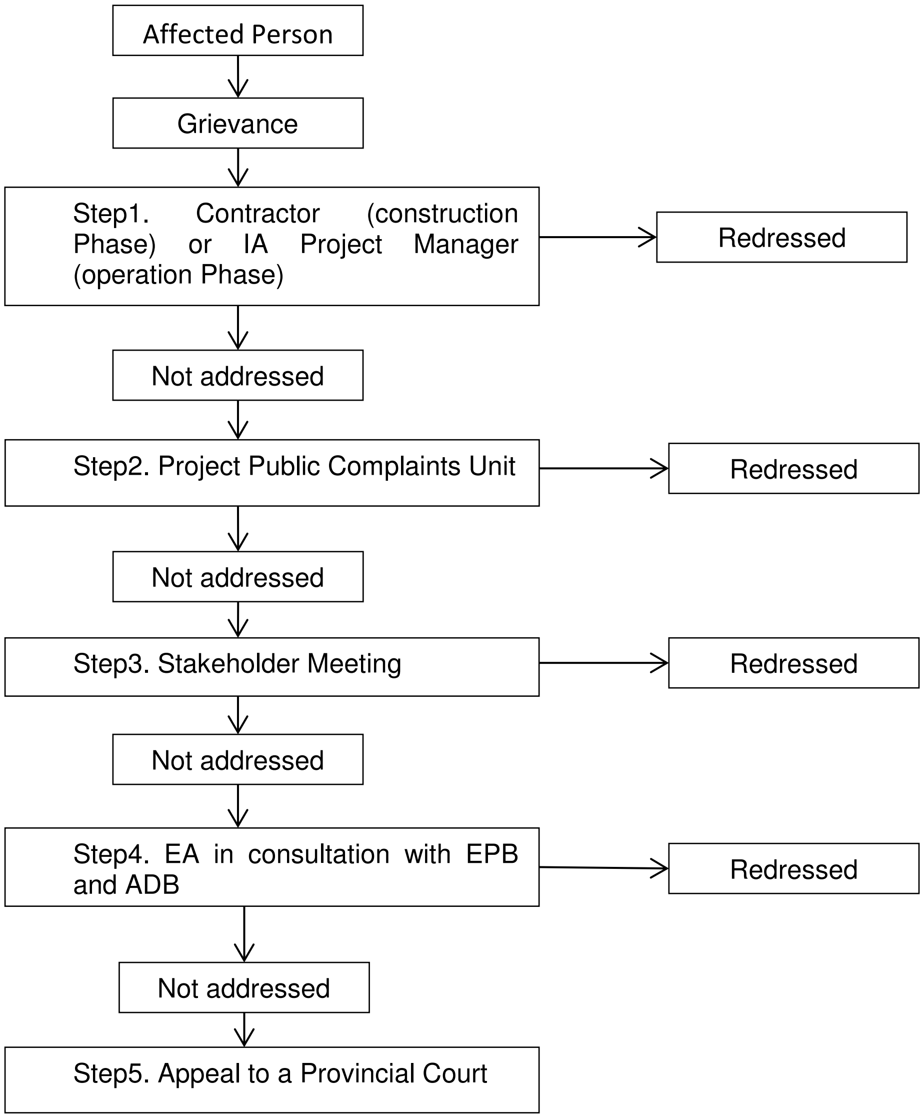
Step 4: If the multi-stakeholder hearing process under Step 3 is not successful, the PPCU, through HCDIO, will inform the EA, the Hohhot EPB and the ADB accordingly. The EA with the consultation from the Hohhot EPB and ADB will review the situation and attempt to develop an alternative approach to resolve the complaint within 15 working days.

Step 5: If the complainant is not satisfied with the suggested solution under Step 4 the AP may advance the grievance to the Provincial Court. If the AP is not satisfied with the Provincial Court judgment, there may be an opportunity for appealing to a higher level of court.

300. The PPCU as well as the District EPBs will accept the complaints and grievances lodged by the affected persons free of charge. Any costs incurred should be covered by contractor or HCDIOor from the contingency of the contract.

301. A summary of GRM activities will be reported by HCDIOin the annual project progress reports and sent to ADB. The GRM will be operational during the entire construction phase and during the operations until the project completion.

Figure 55: ProjectGRM



ADB = Asian Development Bank, AP = affected person, EPB = environmental protection bureau, IA = implementation agency, PPCU = Project Public Complaints Unit

IX. CONCLUSIONS

302. The proposed Low-carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region, (the Project), will upgrade and expand district heating in three heating zones in Hohhot city. The Project will provide 1,422 MW heat covering approximately 30 million m^2 of public and residential building space. A total of 878 MW heat out of 1,422 MW will come from natural gas (61%); 50 MW from wind (4%); 50 MW from MSW (4%); and 444MW (31%) from CCHP.

303. The Project will bring significant positive environmental benefits. Air quality dispersion modelling results indicate that even the worst case cumulative operation phase pollutant ground level concentrations (GLCs), which occur only a few times per year at a few specific locations, are fully in compliance with PRC Standards. When compared to the equivalent production of heat through traditional coal-fired sources, once operational the Project will: (i) result in the closure of 50 small urban low-efficiency and polluting coal-fired boilers; (ii) eliminate the use and transport through urban areas of 1.25 million tons of raw coal; (iii) result in energy savings equivalent to 675,500 ton of standard coal, thereby providing a global public good by avoiding the annual emission of 1,682,000 tons CO_2; and (iv) improve local air quality through the estimated annual reduction of emissions of SO_2 by 9,000 tons, NO_x by 9,500 tons, PM by 25,600 tons, and fly and bottom ash by 187,700 tons.By 2020 the Project will provide low-emission high efficiency district heating to an estimated 294,500 households with a population of 883,500.

304. Through the environmental assessment process the Project has (i) selected an appropriate technology to reduce the emission of pollutants; (ii) identified negative environment impacts and appropriately established mitigation measures; (iii) received public support from the majority of Project beneficiaries and affected people; (iv) established an effective Project GRM; (v) assessed the capacity of the implementing agency; (vi) prepared a comprehensive EMP including environmental management and supervision structure, environmental mitigation and monitoring plans, and capacity building and training.

305. Based on the analysis conducted it is concluded that overall the Project will result in significant positive socioeconomic and environmental benefits, and will not result in significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Overall, any minimal adverse environmental impacts associated with the Project can be prevented, reduced, or minimized through the appropriate application of mitigation measures. It is therefore recommended that:

i) the Project's categorization as ADB environment category A is confirmed;

ii) this EIA is considered sufficient to meet ADB's environmental safeguard requirements for the Project, and no additional studies are required; and

iii) the Project be supported by ADB, subject to the implementation of the commitments contained in the EMP and allocation of appropriate technical, financial and human resources by the EA and IA to ensure these commitments are effectively and expediently implemented.

APPENDIX I: ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

1. This is the EnvironmentalManagement Plan (EMP) for the proposed Low-carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region (IMAR). The Project will provide 1,560 megawatts (MW) of clean-burning natural gas-fired heating capacity and 50 MW of demonstration wind powered electrode heating capacity, which in combination will heat approximately 30 million m^2 of public and residential building space.

2. The objectives of the EMP are to ensure (i) implementation of identified mitigation and management measures to avoid, reduce, mitigate, and compensate for anticipated adverse environment impacts; (ii) implementation of monitoring and reporting; and (iii) the Project compliance with the PRC's relevant environmental laws, standards and regulations and ADB's Safeguard Policy Statement (SPS). Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

B. Implementation Arrangements

3. The Government of IMAR (GIMAR) is the executing agency (EA) and the HohhotChengfa Heating Company is the implanting agency (IA). Hohhot City Development Investment and Operation Company (HCDIO, commonly referred to as the "Chengfa Company") is engaged to provide supervision to project implementation and good governance. The HCHC and the HCDIO jointly established a Project Management Office (PMO) with a Project Manager. The PMO will include an appropriately staffed Environment, Health and Safety Unit (EHSU), and will be supported by a Loan ImplementationEnvironment Consultant (LIEC). The PMO EHSU will include the Project Public Complaints Unit (PPCU). The Haoqingying, Xinjiaying and Jinqiao Branches of the HCHC will be responsible for the direct management of the three heating zones, and each branch will also form an EHSU. Aconceptualized project management chart is presented in **Figure A-1**.

4. The PMOwill be responsible for day-to-day project implementation management including procurement and contract management, and payment to contractors.

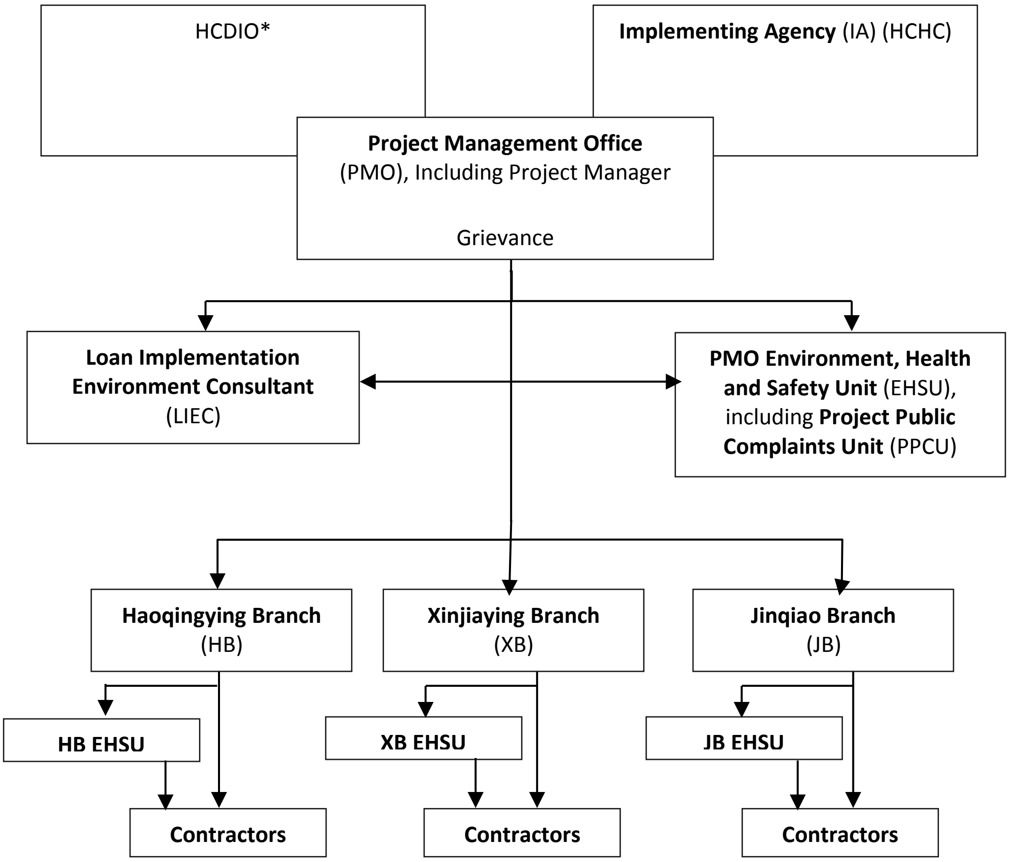
5. The EHSU within the PMOwill consist of an EHSU leader and an appropriate number of staff. To ensure the EMP requirements are incorporated into construction contracts, the PMO EHSU will prepare and provide the following specification clauses to incorporate in the bidding procedures: (i) a list of environmental management requirements to be budgeted by the bidders in their tendering documents; (ii) environmental clauses for contractual terms and conditions; and (iii) environmental monitoring requirements in domestic EIAs, the EIA and the EMP. The PMO EHSU will oversee EMP implementation, provide specific mitigation implementation guidance to the Branch EHSUs and contractors, and prepare EMP monitoring reports semi-annually during construction and annually during operation. The EHSU will prepare and submit the EMP monitoring reports to the PMO who will review the reports and submit them to ADB and to the Saihan District EPB.[1]

6. The PMOthrough the EHSU will be responsible for contractingthe Hohhot

[1] The Saihan District EPB has been delegated by Hohhot EPB to be responsible for environment protection supervision and inspection during the construction phase.

Environmental Protection Bureau (EPB) Environment Monitoring Station (EMS) to undertake construction and operation phase ambientmonitoring.

Figure A-1: Conceptualized Project Management Structure.



*Note: The HCDIO will provide management oversight to the IA and will (i) liaise with the GIMAR, and Hohhot municipal government; (ii) sign onlending agreements with the GIMAR, through Hohhot municipal government, and will onlend to the HCHC; (iii) be directly responsible for making equity contributions; (iv) provide support and supervision in the project procurement with the IA; and (v) provide timely managerial and technical support to the IA to ensure the timely project implementation as well as good governance of the project. The HCDIO and HCHC will jointly establish a project management office (PMO).

7. A LIECwill provide project management and technical support to the PMO. The LIC will be a part-time consultant who will support the PMO EHSU in mitigation implementation, environmental monitoring, reporting, and addressing any environment related issues that arise including grievances. The LIEC will develop construction and operation phase EHS plans.

8. The Branch EHSUs will have day-to-day responsibility for ensuring mitigation implementation in their respective heating zones. They will respond to complaints, and support the PMO EHSU in monitoring and reporting.

9. The Contractors will be responsible for implementing relevant mitigation measures during construction. Following the award of the construction contract,the Contractorswill prepare Construction Site Environmental Management Plans (CSEMPs)which detail the

means by which the Contractors will comply with the EMP. The Contractors will implement the CSEMPs, and will take all reasonable measures to minimize the impact of construction activities on the environment.

10. The PMO EHSU and the LIECwill be responsible for regular internal inspections of mitigation measures at the construction site, in accordance with the EnvironmentalMonitoring Plan (EMoP). The Hohhot Environmental Protection Bureau (EPB) Environment Monitoring Station (EMS) will undertake construction and operation phase ambient monitoring as per the EMoP. It is anticipated that the Saihan District EPBwill also undertake random environmental compliance inspections during construction and operation.The Saihan District EPB will also conduct an environmental acceptance inspection after a three months trial operation period.

11. ADB will be responsible for reviewing the overall environmental performance of the Project. ADB will review the semi-annual and annual environmental monitoring reports submitted by the PMO and will disclose the reports on its website. ADB will conduct due diligence of environment issues during the project review missions. If the PMO fails to meet safeguards requirements described in the EMP, ADB will seek corrective measures and advise the IA on items in need of follow-up actions.

12. Key Project institutions and their EMP implementation responsibilities are summarized in **Table A-1.**

C. Institutional Strengthening and Capacity Building

13. The institutional strengthening and capacity building focusses on the development of construction and operation phase EHS plans by the LIEC (one plan per heating zone) in accordance with relevant PRC laws and regulations, and the provision of training on the EHS plan implementation as well as implementation of the EMP and ADB and PRC safeguard requirements. In addition to typical good construction EHS practices, the EHS plans and capacity building will emphasize worker and community safety for natural gas boilers.

14. In the construction phase significant works should not be undertaken until the construction EHS plan has been developed and training provided on its implementation. Similarly, heating zone operation should not commence until the operation phase EHS plan has been developed, and training provided on its implementation.

15. Development of the EHS plans, training topics, contents, estimated budgets and number of participants are presented in **Table A-2**.

Table A-1: Summary of Institutions and Responsibilities for EMP Implementation

Institution	Responsibilities
HCHC - Implementing Agency (IA)	Together with the HCDIO, jointly establish appropriately staffed Project Management Unit (PMO) and hire LIEC and EMS; provide overall projectmanagement guidance to PMO;
HCDIO	Together with the HCHC, jointly establish appropriately staffed Project Management Unit (PMO) and hire LIEC and EMS; provide supervision and guidance to the HCHC in order to ensure smooth and effective project management and good governance; Provide overall project management guidance to PMO.
Project Management Office (PMO)	Establish appropriately staffed Environment, Health and Safety Unit (PMO EHSU); provide overall management and direction to EHSU.
PMO Environment, Health and Safety Unit (EHSU)	Ensure incorporation of EMP requirements into bidding documents and contracts; oversee EMP implementation; provide mitigation implementation guidance to the Branch EHSUs and contractors; undertake compliance inspections of mitigation measures at the construction sites, in accordance with the EMoP; establish a Project Public Complaints Unit (PPCU) and ensure implementation of grievance redress mechanism (GRM); recruit and supervisethe Hohhot Environmental Protection Bureau (EPB) Environment Monitoring Station (EMS) to undertake construction and operation phase ambient monitoring; prepare EMP monitoring reports semi-annually during construction and annually during operation; coordinate the role of the LIEC.
Loan Implementation Environment Consultant (LIEC)	Provide technical assistance to the PMO EHSU in all aspects of EMP implementation; develop construction and operation phase EHS plans and provide training to the staff of the IA and contractor on EMP and EHS, utilizing additional consultants as required; assist and coordinate environmental monitoring, including undertaking compliance inspections and assisting EMS with ambient monitoring; assist PMO EHSU in addressing any environmental issues that may arise, including grievances; and assist the PMO EHSU in preparing semi-annual and annual environmental EMP monitoring reports.
Branch EHSUs	Day-to-day responsibility for mitigation implementation; assisting PMO EHSU and LIEC for compliance and ambient monitoring; assisting in implementation of GRM.
Contractors	Develop and implement Construction Site Environmental Management Plans (CSEMPs) in accordance with the EMP and other contract conditions; implement all required mitigations during construction; report all spills and accidents, and take appropriate actions.
Hohhot EPB EMS	Conduct ambient monitoring according to the EMP monitoring plan (EMoP).
Saihan District EPB	Inspect the facilities during construction and operation to ensure compliance; enforce applicable the PRC's environmental laws and regulations; review EMP monitoring reports; and conducting an environmental acceptance inspection after a three months trial operation period.Ensure the boiler decommissioning activities led by Hohhot Utility Bureau will be performed in accordance with relevant PRC environmental laws and regulations and other all relevant domestic requirements. Ensure the gas company to follow a domestic EIA approval procedures and requirements and perform their gas pipe construction in accordance with all the relevant PRC environmental laws and regulations, and other domestic requirements, including their domestic EIA requirements. Ensure a planned Phase II HSP to meet all domestic approval requirements to minimize cumulative impact at project site.
ADB	Monitor and supervise the overall environmental performance of the project; review the environmentalmonitoring reports and disclose the project monitoring

Institution	Responsibilities
	reports on its website; conduct due diligence of environment issues during the project review missions.

Table A-2: Institutional Strengthening and Training Program

Training Topic	Trainers	Attendees	Contents	Times	Period (days)	# Persons	Budget (USD)	Source of Funds
Construction Phase EHS Plan Development and Training	LIEC	IA, PMO, EHSU, Branch PMOs, Saihan District EPB, Contractors	**ADB and PRC EHS laws, regulations and policies** – ADB's safeguard policy statement – Project applicable PRC EHS laws, policies, standards and regulations International environmental, health and safety management practice in civil constructions **GRM** – GRM structure, responsibilities, and timeframe Types of grievances and eligibility assessment **Implementation of EMoP** – Impacts and mitigation measures during construction and operation – Monitoring and auditing mechanism – Reporting requirements Corrective actions for EMP **Implementation of Heating zone Construction Phase EHS Plans** – Plan descriptions – Roles and responsibilities	6 (2 per sub-project)	3	15	**EHS Plan Development** (fees and per diem): 3 plans x 10 days/plan x 350/day = $10,500 **EHS Plan Training Course Development** (fees and per diem): 10 days x $350/day = $3500 **Course Delivery** (fees and per diem): 6 x 5days x 350/day = $10,500 (fixed costs): $1000 per course delivery x 6 = $6000 **TOTAL = $30,500**	ADB

Training Topic	Trainers	Attendees	Contents	Times	Period (days)	# Persons	Budget (USD)	Source of Funds
Operation Phase EHS Plan Training	LIEC	IA, PMO, EHSU, Branch PMOs, Saihan District EPB	**International good practices in natural gas-fired HSP operation** – Environmental, health and safety issues associated with natural gas-fired HSPs. **Implementation of Operation Phase EHS Plans** – Plan descriptions – Roles and responsibilities	6 (2 per sub-project)	3	15	**Course EHS Plan Development** (fees and per diem): 3 plans x 10 days/plan x 350/day = $10,500 **EHS Plan Training Course Development** (fees and per diem): 10 days x $350/day = $3500 **Course Delivery** (fees and per diem): 6 x 5 days x 350/day = $10,500 (fixed costs): $1000 per course delivery x 6 = $6000 **TOTAL = $30,500**	ADB
			Total	**12**	**36**	**180**	**$70,000**	

D. Potential Impacts and Mitigation Measures

16. The potential impacts of the project during construction and operation have been identified and appropriate mitigation measures developed (see Chapter V of the EIA). Detailed impacts and mitigation measures are presented in **Table A-3.**

E. Environment Monitoring Plan

17. An environment monitoring plan (EMoP) to monitor the environmental impacts of the Projectand assess the effectiveness of mitigation measures is presented in **Table A-4**. The EMoP includes both compliance inspection undertaken by the PMO EHSU supported by the LIC EHSS, and ambient and dischargeair, noise, wastewater and flue gas monitoring undertaken during both construction and operation phases. The monitoring methods and standard for ambient and discharge monitoring parameters are presented in **Table A-5.**

18. The data and results of environmental compliance 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.

Table A-3: Environment Impacts and Mitigation Measures

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
A. Pre-construction Phase					
Incorporate Mitigation Measures and Monitoring in Detailed Design and Bidding and Contracting	Include mitigation measures and monitoring program in detailed designs	– Environmental mitigation measures identified in this EIA, the EMP including health and safety requirements, landscaping, etc, and the domestic EIAs will be incorporated in the engineering design.	EHSU supported by LIEC	PMO, ADB	Detailed Design Budget
	Include mitigation measures and monitoring program in bidding documents	– Environmental mitigation measures identified in this EIA and the domestic EIAs will be incorporated in the bidding documents for the project, and will be included in contract documents for civil constructions and equipment installations. All contractors shall be required to strictly comply with the EMP.	EHSU supported by LIEC	PMO, ADB	Detailed Design Budget
	Environmental monitoring incorporated into design.	– The environmental monitoring program (EMoP, see Table A-4 in Appendix I) will be incorporated into the design to ensure that environmental impacts are closely monitored and activities of the Project construction and operating are closely supervised against the PRC environmental laws, regulations and standards, ADB SPS, and the Project EMP and approved domestic EIAs.	EHSU supported by LIEC	PMO, ADB	Detailed Design Budget
Grievance Redress Mechanism (GRM)	Impacts on Project Affected Persons	– In accordance with the GRM presented in Chapter VIII of the EIA, establish a Project Public Complaints Unit (PPCU) in IA's office; provide GRM training for PPCU members and GRM access points; disclose the PPCU's phone number, fax, address, and email to the public.	EHSU supported by LIEC	PMO, ADB	PMO Operating Budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
B. Construction Phase					
Erosion and Spoil	Soil erosion, spoil disposal	Good practice construction erosion controls and site maintenance: – HSP site storm water runoff will be assessed and estimated and appropriate storm water drainage systems to minimize soil erosion will be implemented, including perimeter bunds and establishment of temporary detention and settling ponds to control topsoil runoff. – Fish ponds along the northwestern boundary of the Jinqiao HSP will be protected by silt fences when nearby construction activities are underway. – Spoil will be reuse of on-site to the maximum extent feasible as fill to rehabilitate disturbed areas or for landscaping. – Temporary spoil storage sites will be identified, designed, and operated to minimize impacts. Sites will be restored at the conclusion of storage activities. – Excess spoil that cannot be used on-site will be transported to an approved spoil disposal site. – Spoil and aggregate piles will be covered with landscape material. – During earthworks the area of soil is exposed to potential erosion at any one time will be minimized. – Construction and material handling activities during periods of rains and high winds will be limited or halted. – Pipelines will be installed and backfilled in a sequenced section-by-section approach, with sections not exceeding 300 m in length. Open excavation areas during trenching activities will be minimized, and appropriate construction compaction techniques utilized. – Any planned paving or vegetating of areas will be done as soon as practical after the materials are removed to protect and stabilize the soil. – Once construction is complete disturbed surfaces will be	Contractors directed by Branch EHSUs	EHSU supported by LIEC	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		properly sloped and revegetated with native trees and grass (see greening plan, below).			
Wastewater	Surface and groundwater contamination from construction wastewater, and domestic water	Good wastewater management practices: – Adequate temporary sanitary facilities and ablutions will be provided for construction workers. Toilets will be equipped with septic tanks in accordance with PRC standards. – Septic tanks will be pumped out on an as needed basis, and the effluent will be discharged for final treatment at the Jinqiao wastewater treatment plant. – Wastewater from the canteen should be treated in an oil-water separator, and then discharged into the municipal sewer for final treatment at the Jinqiao wastewater treatment plant. – Construction wastewater will be directed to temporary detention and settling ponds prior to discharge to urban storm sewers. – Areas where construction equipment is being washed will be equipped with water collection basins and sediment traps.	Contractors directed by Branch EHSUs	EHSU supported by LIEC	Contractor construction budget
Air Pollution	Dust, vehicle emissions	– HSP sites, HES sites and pipeline sections under construction will be fully enclosed by a 3 m fence prior to the commencement of construction. Fence height will be increased near sensitive locations (residential areas, schools, clinics and hospitals). – Water will be sprayed on active construction sites where fugitive dust is being generated on a daily basis, and more frequently during windy days. – Construction activities will be halted during high wind events. – All construction piles with the potential to generate dust will be covered and/or regularly watered. – Transport vehicles will be limited to low speeds in construction sites. – Loads will be covered during truck transportation to avoid spillage or fugitive dust generation. Fine materials will be	Contractors directed by Branch EHSUs	EHSU supported by LIC EHSS	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		transported in fully contained trucks. – Construction site roads will be well maintained, and watered and swept on an as-needed basis. Construction site road entry points will be equipped with truck drive through wash ponds. – Transport routes will avoid residential neighborhoods and other sensitive areas to the maximum extent practical. – Vehicles and construction machineries will be maintained to a high standard (to be done off-site) to ensure efficient operating and fuel-burning and compliance with the PRC emission standards GB 11340-2005, GB 17691-2005, GB 18285 -2005 and GB 18352-2005. – The use of coal for cooking on site, heating and hot water is prohibited. – Non-ozone depleting blowing agents will be utilized for the polyurethane foam (PUR) during the construction of pre-insulated bonded heating pipes.			
Noise	Impacts from construction noise on sensitive resources	To ensure construction activities meet PRC noise standards (*Noise Standards for Construction Site Boundary*, GB 12523-2011) and protect workers: – Construction activities will be restricted to 6:00-12:00 h and 14:00-22:00 h. Construction activities will be prohibited during the nighttime (22:00 h to 07:00 h). Exceptions will only be allowed in special cases, and only after getting approval of the surrounding residents, EPB and other relevant departments. – When undertaking construction planning, simultaneous high-noise activities will be avoided, and high noise activities will be scheduled during that day rather than evening hours. Similarly, construction sites will be planned to avoid multiple high noise activities or equipment from operating at the same location. – Low-noise equipment will be selected as much as possible. – Noise levels from equipment and machinery must conform to	Contractors directed by Branch EHSUs	EHSU supported by LIC EHSS	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		the PRC standard GB 12523-2011, will be equipped with mufflers, and will be properly maintained to minimize noise. – Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum. – Noise personnel protective equipment (PPE) will be provided to workers. – Transportation routes and delivery schedules will be planned during detailed design to avoid densely populated and sensitive areas and high traffic times. – Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and hospitals. – Given their location within residential areas, special attention will be paid to protect sensitive sites near HESs and along the pipeline routes: – High noise construction activities will be positioned as far away from sensitive sites as possible. – Low noise equipment will be utilized to the extent possible. – Temporary or permanent noise barriers will be installed to protect sensitive sites.			
Solid Waste	Inappropriate Waste Disposal	– Wastes will be reused or recycled to the extent possible. – Littering by workers will be prohibited. – Domestic waste containers will be provided at all work sites. Domestic waste will be collected on a regular basis by the local sanitation departments and transported for recycling, reuse, or disposal at a licensed landfill, in accordance with relevant PRC regulations and requirements. – Construction waste dumpsters will be provided at all work sites. Construction waste, including boiler demolition waste, will be collected on a regular basis by a licensedwaste collection company and transported for recycling, reuse, or	Contractors, local sanitation departments (domestic waste), licensed waste collection companies (construction waste)	EHSU, LIC	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		disposal at a licensed landfill, in accordance with relevant PRC regulations and requirements. – Dismantled boilers will be properly disposed or recycled in accordance with relevalant PRC regulations and requirements. – Coal ash will be properly collected, stored, transported for recycling (coal ash can be sold to make construction materials) – Excavated soil will be backfilled onsite to the extent possible. Excess spoil that cannot be used on-site will be transported to an approved spoil disposal site. – There should be no final waste disposal on site. Waste incineration at or near the site is strictly prohibited. – Contractors will be held responsible for proper removal and disposal of any significant residual materials, wastes, and contaminated soils that remain on the site after construction.			
Hazardous and Polluting Materials	Inappropriate transportation, storage, use and spills	– A hazardous materials handling and disposal protocol that includes spill emergency response will be prepared and implemented by contractors. – Storage facilities for fuels, oil, chemicals and other hazardous materials will be within secured areas on impermeable surfaces provided with dikes, and at least 300 m from drainage structures and important water bodies. A standalone site within the storage facility will be designated for hazardous wastes. – Suppliers of chemicals and hazardous materials must hold proper licenses. They will follow all relevant protocols in “Operation Procedures for Transportation, Loading and Unloading of Dangerous or Harmful Goods” (JT 3145-91). – A licensed company will be hired to collect, transport, and dispose of hazardous materials, including hazardous waste from coal boiler demolition waste, in accordance with relevant PRC regulations and requirements. – Vehicles and equipment will be properly maintained and	Contractors, waste management companies	EHSU, LIEC	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		refueled in designated service areas on impermeable surfaces provided with oil traps, at least 300 m from drainage structures and important water bodies.			

Flora and Fauna	Removal of vegetation	– A greening plan will be implementedin each HSP site vegetation plans will be developed, using appropriate native species. According to the domestic EIAs, the approximate area to be vegetated for each HSP is:
		  – Haoqingying greening area: 34,486 m^2
		  – Xinjiaying greening area: 27,226 m^2.
		  – Jinqiao greening area: 34,375 m^2.
		– Any vegetated areas impacted by pipeline works or construction of HESs will be restored post-construction using appropriate native species.
			DI (plan design), Contractors (plan implementation)	EHSU, LIEC	Contractor construction budget

	Waterway pipeline crossing	The Jinqiao heating zone will require one river crossing. To minimize potential impacts: – Directional drilling will be used to embed the pipeline under the waterway. – The waterbody will be protected by siltation fences.			
Socioeconomic Resources	**Community Disturbance and Safety**	**Traffic and Public Safety** Traffic control plans, agreed to by the local traffic control authority, will be developed and implemented for each heating zone in order to minimize community disturbance: – Local government, using information provided by the PMO, will inform residents, institutions, bossiness and other affected parties as to planned construction activities including schedule and duration of construction works, and expected traffic and other disruptions. – Transportation routes and delivery schedules will be planned during detailed design to avoid densely populated and sensitive areas and high traffic times. – Warning signs and cones will be installed along roads to protect workers and people in the neighborhood. Safety flag people will be used if appropriate.	DI (plan design), Contractors (plan implementation)	EHSU, LIC	Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		– During evening construction warning lights will also be used. – Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and hospitals. – Roadside earthworks should be completed as quickly as possible, and all spoil either backfilled or removed. – Road crossing will use the pipe-jacking installation method where possible in order to minimize disruption. – Public access to construction sites and other areas of danger will be restricted and temporary barriers installed.			
		Access to Public Services, Private Properties and Businesses – Local authorities will be consulted to minimize disruption of public services such as telephone, water, gas and power supply. Contactors will use good construction practices to avoid disruption of other services. – The Contractor shall take measures to minimize disruption of access to private properties and businesses where possible. – Temporary access to affected private properties, businesses and public service buildings will be provided including temporary crossings over pipeline trenches, and subsequently good quality permanent access will be provided.	Contractors directed by Branch EHSUs	EHSU supported by LIEC	Contractor construction budget
	Worker Occupational Health and Safety	Contractors will implement adequate precautions to protect the health and safety of their workers: – Each contractor will implement the relevant heating zone construction phase EHS plan developed by the LIC EHS experts. – An EHS officer will be appointed by each contractor to implement and supervise the EHS management plan. – The EHS Plans will: – Identify and minimize the causes of potential	EHS Plan Developed by LIEC EHS Plan implemented by contractors directed by Branch EHSUs	EHSU EHSU supported by LIEC	LIEC Budget Contractor construction budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		hazards to workers. – Implement appropriate safety measures. – Ensure the provision of adequate type and number of fire extinguishers and first aid facilities onsite. – Provide training to workers on occupational health and safety and emergency response, especially with respect to using potentially dangerous equipment. – Ensure that all equipment is maintained in a safe operating condition. – Ensure that material stockpiles or stacks, such as, pipes are stable and well secured to avoid collapse and possible injury to workers. – Provide appropriate personal protective equipment (PPE) to workers to minimize risks, including ear protection, hard hats and safety boots, and post adequate signage in risk areas. – Provide procedures for limiting exposure to high noise or heat working environments in compliance with PRC noise standards for construction sites (GB 12523-2011). – Provide training to workers on the storage, handling and disposal of hazardous wastes. – Ensure regular safety meetings with staff.			

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
Physical Cultural Resources	PCRs may be damaged if proper precaution is not taken.	– The tomb south of the Jinqiao HSP will be demarcated by fence and signs as a no-entry area. – A construction phase chance find procedure will be established and activated if any chance finds of PCRs are encountered: – construction activities will be immediately suspended if any PCRs are encountered; – destroying, damaging, defacing, or concealing PCRs will be strictly prohibited in accordance with PRC regulations; – the local Cultural Heritage Bureau will be promptly informed and consulted; and, – construction activities will resume only after thorough investigation and with the permission of the local Cultural Heritage Bureau.	Contractors	EHSU supported by LIEC and District Cultural Heritage Bureau	In the event that a PCR is discovered, the direct cost for comp-ensation to contractor will be covered by a special fund to be devel-oped for cultural relic protection.

C. Operation Phase

Air Pollution	Combustion Emissions	– Low NOx natural-gas fired boilers will utilized producing less than 100 mg/m3 NOx emissions (1,560 MW heating capacity) and ensure at least the parameters indicated in Table 54 and 55 to be met. – Zero emission wind-powered demonstration electrode boilers utilized (50 MW heating capacity).	Contractors (construction) IA (operation)	EHSU Saihan District EPB	Contractor construction budget IA operation budget
Water	Municipal Water Consumption	– Confirmations obtained from Hohhot Municipal Water Supply Company on availability of sufficient supply.	Hohhot Municipal Water Supply Company	Hohhot Water Affairs Bureau	IA operation budget
Wastewater	Discharge of Production and Domestic Wastewater	– Domestic wastewater will be treated in digestion tanks, and then in combination with the production wastewater, will be discharged to the Hohhot municipal sewerage system for treatment at the Jinqiao wastewater treatment plant. – Each HSP will be equipped with an emergency overflow tank	IA	Saihan District EPB	IA operation budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		(1200 m^3 capacity for Haoqingying and Jinqiao, and 1500 m^3 capacity for Xinjiaying). – All emission concentration of SS, COD, BOD_5 and ammonia nitrogen will be in compliance with Class III standard requirements of integrated wastewater discharge standard (GB8978-1996), which sets the emission standards for wastewater discharged to a municipal sewerage system.			
Solid Waste	Collection and Disposal	– Waste bins will be provided at all facilities. – Wastes will be routinely collected by the local sanitation department for recycling, if possible, or final disposal at an approved waste disposal site. – No permanent on-site solid waste disposal will be permitted at HSPs or HESs. – No burning of wastes will be permitted at HSPs or HESs.. – All structures and/or components replaced during maintenance activities will be reused or recycled to the extent possible. Non-recyclable parts will be disposed at an approved waste disposal site.	District Sanitation Departments	Saihan District EPB	IA operation budget
Chemical and Hazardous Materials	Inappropriate Management	– A register of all activities that involve the handling of potentially hazardous substances will be developed, including protocols for the storage, handling and spill response. This will include all fuels, oils, grease, lubricants, and other chemicals. – All chemicals, toxic, hazardous, and harmful materials will be transported in spill proof tanks with filling hoses and nozzles in working order, – All chemicals, toxic, hazardous, and harmful materials will be stored in secure areas with impermeable surfaces and protective dikes such that spillage or leakage will be contained from affecting soil, surface water or groundwater systems. Their usage will be strictly monitored and recorded. Some chemicals will be stored off-site, such as water quality analysis chemicals which will be stored at an independent	IA, Licensed Contactors	Saihan District EPB	IA operation budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		laboratory. – Material safety data sheets (MSDSs) will be posted for all hazardous materials. – Oil absorbents will be readily accessible in marked containers. – Good housekeeping procedures will be established to avoid the risk of spills. – Spills will be dealt with immediately, and personnel will be trained and tasked with this responsibility. – Workers will be properly trained before handling hazardous wastes and have the requisite PPE. – Hazardous waste will be temporarily stored in closed containers away from direct sunlight, wind, water and rain in secure designated areas with impermeable surfaces and protective dikes such that spillage or leakage will be contained. - Hazardous wastes will be collected and disposed by licensed contractors on an as needed basis.			
Noise	Impact on Sensitive Receptors	– The Project design will use low-noise equipment as far as possible, and will also utilize noise elimination, shock absorption, insulated enclosures and sound dampening materials on exterior walls to ensure the noise level indicated in Tables 68-70 to be met. – All plant and equipment, including vehicles will be properly maintained in order to minimize noise. – Appropriate personal noise protective equipment (PPE) will be provided to the workers who are likely to be exposed to high noise level environments.	Contractors (construction) IA (operation)	EHSU Saihan District EPB	Contractor construction budget IA operation budget
Occupational Health and Safety	Risks to Workers	To minimize risks associated with leaks of natural gas: – All natural gas works will be in compliance with relevant PRC building code requirements, including the *Code for Design of City Gas Engineering* (GB 50028-2006) and *Regulation on Electric Apparatus Design for Explosion and Fire Risk*	Contractors (construction) IA (operation)	EHSU Saihan District	Contractor construction budget IA operation

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		Environment (GB50058-92). – Independent gas regulation stations will be constructed at least 14 meters away from other buildings and 30 m from the site boundary, to minimize the risk of explosion damaging other Project facilities or the public.[31] – The China Gas Company of Hohhot will construct and operate the gas regulation stations. – The gas regulation stations will be specially designed to withstand and contain explosions. – Gas regulation stations and the connection to the boilers will be equipped with flammable gas detection, alarm and fire suppression systems. In case of a gas leak, automatic shutdown valves will shut down the gas supply, the system will generate audible and visual alarms, and the emergency ventilation system will exhaust gas from the stations so as to protect the building and operators. Normal air change for the stations will be six times per hour, but in emergencies the ventilation system will change the air 12 times per hour. Electrical devices within the explosion risk area will be safety equipped. – The gas pipelines feeding into the pressure regulation stations will be embedded underground, and will be coated with three layers of PE corrosion protection sleeves. The gas lines exiting the gas pressure regulation stations will be suspended overhead, and will be treated 4 times with anti-corrosion paint. Pipelines will be grounded and equipped with anti-lightning devices where applicable.	Plans developed by LIEC Plans implemented by IA	EPB PMO, Saihan District EPB Saihan District EPB	budget LIEC Budget IA Budget

[31] In the *Code for Design of City Gas* Engineering (GB 50028-2006) the recommended distance from a gas regulation station with no more than 1.6 MPa inlet pressure to other buildings is 9 m. In the Project, the minimum distance from gas regulation stations to the nearest building is 21 m in the Xinjiaying HSP, 15 m in the Jinqiao HSP, and 14 m in the Haoqingying HSP respectively, which fully conforms to the national code requirement.

Gas regulation stations are defined as Class II explosion risks. Space within 4.5 meter away from a regulation station is included in the explosion risk region, as regulated in *Regulation on Electric Apparatus Design for Explosion and Fire Risk Environment* (GB50058-92). The minimum distance from a gas regulation station to a site boundary fence is 30 meter in three HSPs, which confines the explosion risk within the plant sites; explosions will not impact areas outside the site boundaries.

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		– All other at risk areas will have flammable gas detection and alarm systems able generate audible and visual alarms, and automatic fire suppression systems. – All gas related devices will be brightly colored and equipped with warning signs. To mitigate potential health and safety risks to workers, the following measures will be taken: – In operation phase EHS plans for each heating zone including fire prevention and control will be developed and implemented, and workers will be trained regularly on their implementation. – The HSP general arrangements will be designed in strict compliance with relevant PRC fire, health and safety standards. Fire compartments will be established based on the fire risk, and fire-resistant buildings/structures will include fire-proof doors and windows. – Fire-alarm and suppression systems will be installed and tested regularly to ensure it functions properly. – The process control system will include an out-of-limit alarm to ensure all hazardous materials are safety under control at all time. – PPE, including goggles, gloves, safety shoes, will be provided to workers. – Naked fire sources, hot surfaces, electric sparks, electrostatic sparks and ignition sources will be strictly controlled, especially near natural gas. – Control measures will be strictly undertaken to ensure the discharge, exhaust and safety relief of flammable fuels in enclosed systems. – No unauthorized personnel should be allowed into HSPs or HESs. – Authorized personnel must have appropriate PPE at all times.			
	Emergency	An emergency risk and response plan for each heating zone will	Plans developed	Saihan District	LIEC budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	

	Response	be established in accordance with the "National Environmental Emergency Plan" (24 January 2006) and other relevant PRC laws, regulations and standards, and will include measures in the World Bank EHS guidelines with respect to occupational and community health and safety. The plan must be established and in place before the plant is operational.
		
		Indicative plan requirements are as follows:
		– Procedures for responding to different types of emergency situations will be identified in the response plan.
		– Emergency exercises will be conducted and they should include different emergency scenarios.
		
		Training Requirements
		– Appropriate operating and maintenance employees will be trained to ensure that they are knowledgeable of the requirements of emergency response plan. Training will be provided as follows:
		    – Initial training to all employees before the HSP plant is put in operation;
		    – When new equipment, materials, or processes are introduced.
		    – When emergency response procedures have been updated or revised.
		
		Annual Emergency Simulation
		– Simulated emergency exercises will be conducted at least annually.
		
		Receiving Notification of a Possible Emergency
		– When a supervisor receives a report of a possible emergency situation, he/she should obtain at minimum the following information from the reporting person:
		    – Name of person reporting emergency;
			by EHSU with support from LIEC
			
			Plans implemented by IA
				EPB, local emergency authorities
				
				Saihan District EPB, local emergency authorities
					
					IA budget

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		– Nature of emergency - leak, fire, interruption of service if leak, odor present, etc. – Details of emergency: location, amount, how long has the odor been noticed, what actions have been taken, etc. – Leaks or other emergencies require prompt investigation. **Immediate On-site Action** – The first responder will assess the nature of the report. This assessment should include the status of the emergency, an estimation of how the incident might progress, and an evaluation of the manpower, equipment, and materials needed to adequately cope with the situation. – If there is a strong odor or any measurable reading of gas detected inside a structure: – Clear the building of all occupants. – Eliminate potential ignition sources. – Localize or isolate the problem and shut off gas as needed. – Determine the extent of the hazardous area and establish a restricted area. – The responding supervisor shall determine the extent of the emergency and inform the dispatcher of the condition at the site. – If emergency procedures are put into effect, the responding supervisor should select a location and establish an emergency command post. – The responding supervisor will assign one person to remain at the command post to maintain communications until the emergency is over. – When necessary, the command post will be coordinated with the local emergency responders. When local emergency responders are involved, they will be in charge of the			

Category	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Responsibility		Source of Funds
			Implemented by	Supervised by	
		incident. – The responding supervisor will make himself known to fire and/or police department officials, or other authority having jurisdiction, and will remain with them during the emergency. – All employees reporting to the scene of the emergency will report to the command post for identification and instructions. – Key personnel will be alerted, and it will be their responsibility to keep the emergency personnel under their supervision informed and available for emergency call out. – When a system failure cannot be made safely by normal procedures, emergency shutdown procedures should be implemented. – Reduce system pressure or segment a section before repair procedures are implemented. – Well trained and qualified personnel will be dispatched to monitor system pressure and repair work. **Communication with Public Officials** – When an emergency resulting in a hazard to the public safety occurs, the local fire department, police, the city medical emergency center and other relevant public officials should be notified. An emergency call list will be prepared and make it available at the plant control room.			

DI = design institute, EHSS = environment, health and safety specialist, EHSU = environment, health and safety unit, EIA = environment impact assessment, EMP = environment monitoring plan, EMS = environment monitoring station, EPB = environment protection bureau, GRM = grievance redress mechanism, IA = implementing agency, LIC = loan implementation environmental consultant. Source: Domestic Project EIA Reports (2014) and TA consultants.

Table A-4: EnvironmentalMonitoring Plan (EMoP)

Subject	Parameter	Location	Frequency	Implemented by	Supervised by	Source of Funds
A. Construction Phase						
Erosion and Spoil	Compliance inspection of erosion protection measures and spoil management	Construction sites, spoil disposal sites	Monthly; and once after completion of spoil disposal	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIC: ADB LIEC Budget
Wastewater generated from construction	Compliance inspection of wastewater mitigation measures (detention ponds, septic systems)	HSP construction sites	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIC: ADB LIEC Budget
Air Pollution	Ambient dust monitoring (TSP, PM_{10})	HSP construction sites; representative number (15%) of HESs and pipeline constriction segments	Monthly	Hohhot EPB EMS	PMO	EPB EMS lump sum monitoring contract
	Compliance inspection of dust mitigation measures (water spraying, cover transport vehicles, etc.); and maintenance and condition of vehicles and construction equipment.	All construction sites	Weekly when there are construction activities	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIC: ADB LIEC Budget
Noise	Leq dB(A)	HSP construction sites; representative number (15%) of HESs and pipeline constriction segments	Monthly: a day each time and two samples; once during daytime, once during nighttime.	Hohhot EPB EMS	PMO	EPB EMS lump sum monitoring contract

Subject	Parameter	Location	Frequency	Implemented	Supervised	Source of Funds
Solid Waste	Compliance inspection of domestic and construction waste collection and disposal	Waste collection and disposal sites.	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget
Hazardous and Polluting Materials	Complianceinspections of hazardous management, protocols, and licenses of suppliers and waste removers	Storage facilities for fuels, oil, chemicals and other hazardous materials. Vehicle and equipmentmaintenance areas.	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget
Greening Plan	Compliance inspection of implementation of greening plans (HSPs), HESs and pipelines	HSP sites, HES sites, pipeline routes.	After construction is complete.	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget
Health and Safety	Record and report both minor and lost-time incidents	HSPs, HESs, pipelines	Continuous	IA EHS Specialists	HCHC and HCDIO	Included in IAs' operation budgets
Socioeconomic Impacts	Compliance inspection to determine if traffic and public safety measures are in place	Pipeline and HSP construction sites at or near roads. Transportation routes.	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget
	Compliance inspection to determine if temporary access being provided to public and private properties	Pipeline routes	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget

Subject	Parameter	Location	Frequency	Implemented	Supervised	Source of Funds
	Compliance inspection to determine if EHS Plans developed and implemented, and workers have appropriate PPE	All construction sites	Monthly	EHSU supported by LIEC	PMO	EHSU: PRC PMO Budget LIEC: ADB LIEC Budget
B. Operation Phase						
HSP Emissions	SO_2, NO_2, TSP, PM_{10} (Compliance with Table 54 and 55)	Internal monitoring: sampling at stack of HSPs	Online continuous emission monitoring systems (CEMs)	IAs	Saihan District EPB	Included in IAs' operation budgets
	SO_2, NO_2, TSP, PM_{10} (Compliance with Table 54 and 55)	Calibration monitoring: at stack outlet of the HSPs	Twice per heating season.	Local EMSs	Saihan District EPB	EPB EMS lump sum monitoring contract
	CO_2	Calculated from natural gas consumption	Annually	IA	HCDIO	Included in IAs' operation budgets
Ambient Air Quality	SO_2, NO_2, TSP, $PM_{10,}$ $PM_{2.5,}$	Within 500 meter down-wind locations from each HSP; No.3 and No.6 indicated in Figures 41-52	Twice per heating season.	Hohhot EPB Monitoring Stations	Hohhot EPB	Hohhot EPB (Non project funds)
Domestic and Production Wastewater Discharged to Municipal Sewer	SS, COD, BOD_5	HSP Discharge Locations	Quarterly (4 times per year)	Local EMSs	Saihan District EPB	EPB EMS lump sum monitoring contract
Noise from HSP	Leq dB(A)	Compliance monitoring: at 1m outside of the HSPs' boundary	Twice per heating season.	Local EMSs	Saihan District EPB	EPB EMS lump sum monitoring contract

Subject	Parameter	Location	Frequency	Implemented	Supervised	Source of Funds
Noise from HES	Leq dB(A)	Compliance monitoring: at 1m outside of the HESs	Twiceper heating season, random selectionof HESs	Local EMSs	Saihan District EPB	EPB EMS lump sum monitoring contract
Health and Safety	Compliance inspection to determine if EHS Plans developed and implemented, and workers have appropriate PPE	HSPs, HESs, pipelines	Ongoing, random	IA EHS Specialists	HCHC and HCDIO	Included in IAs' operation budgets
	Record and report both minor and lost-time incidents during construction and operation	HSPs, HESs, pipelines	Continuous	IA EHS Specialists	HCHC and HCDIO	Included in IAs' operation budgets

dB = decibel, CEMS = continuous emissions monitoring system, EHSU =environment, health and safety unit, EMS = environment monitoring station, EPB = environment protection bureau, IA = implementing agency, Leq = equivalent continuous noise level, LIC = loan implementation environmental consultant, NO_2 = nitrogen dioxide, pH = potential hydrogen, TSP = total suspended particulate matter, PMO = project management office, SO_2 = sulfur dioxide.
Source: Domestic EIA Reports (2014) and TA consultants estimate.

19. Ambient and discharge monitoring will be conducted in compliance with relevant PRC regulations, methods and technical specifications:

(i) *Regulations of Quality Management for Environmental Monitoring,* July 2006.

(ii) *Technical Guideline on Environmental Monitoring Quality Management (HJ 630-2011)* published by Ministry of Environmental Protection in September, 2011.

(iii) *Technical Specifications for Installation and Acceptance of Ambient air Quality Continuous Automated Monitoring System for* SO_2*,* NO_2*,* O_3 *and CO(HJ 163-2013)* published by Ministry of Environmental Protection in June, 2013.

(iv) *Manual Methods for Ambient Air Quality Monitoring (HJ/T 194-2005)* published by Ministry of Environmental Protection in November, 2005.

(v) *Technical Specifications of Quality Assurance and Quality Control for monitoring of stationary pollution source (on trial) (HJ/T 373-2007)* published by Ministry of Environmental Protection in November, 2007.

(vi) *Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T 91-2002)* published by Ministry of Environmental Protection in December, 2002.

(vii) *Technical Specifications for Environmental Noise Monitoring Routine Monitoring for Urban Environmental Noise (HJ 640-2012)* published by Ministry of Environmental Protection in December, 2012

20. The standard monitoring methods, detection limits, and the standard code for each of the monitoring parameters are shown in **Table A-5.** The data and results of environmental inspection andmonitoring activities will be used to assess: (i) the extent and severity of actual environmental impacts against the predicted impacts and baseline 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.

Table A-5: Standard Monitoring Methods of Air, Noise and Wastewater

Media	Parameter	Method (Standard No.)	Standard/Averaging Period
Air	TSP (mg/m^3)	Gravimetric (GB/T15432-1995)	0.30 (24-hr)
	PM_{10} (mg/m^3)	Gravimetric with specific sampler (HJ/T 618-2011, Determination of atmospheric articles PM10 and PM 2.5 in ambient air by gravimetric method)	0.07 mg/m^3 (Annual) 0.15 mg/m^3 (24-hr)
	SO_2 (mg/m^3)	Formaldehyde absorbing-para rosaniline spectrophotometry (HJ 482-2009) Tetrachloromercurate(TCM)-pararosaniline method (HJ 483-2009)	.060 (annual) .150 (24-hr) .500 (1-hr)
	NO_2 (mg/m^3)	Ethylene diamine dihydrochloride spectrophotometric method (HJ 479-2009)	0.04 (annual) 0.08 (24-hr) 0.2 (1-hr)
	$PM_{2.5}$ (mg/m^3)	Gravimetric method with specific sampler (HJ/T 618-2011, Determination of atmospheric articles PM10 and PM 2.5 in ambient air by gravimetric method)	0.035 (annual) 0.07 (24-hr)
Noise	Equivalent Continuous A Sound (Leq)	Acoustimeter Method Emission standard of environment noise for boundary of construction site (GB12523-2011) Emission standard for industrial enterprises noise at boundary (GB12348-2008).	70(day) 55 (night) 60 day 50 night
Wastewater	pH value	Glass electrode method (GB6920-86)	6-9
	COD(mg/L)	Permanganate index (GB11914-89)	500
	Petroleum (mg/L)	Infrared spectra photograph (HJ 637-2012)	30
	SS (mg/L)	Gravimetric method (GB11901-89)	400
	BOD (mg/L)	dilution and seeding method (HJ 505-2009)	300

Source: PRC standards.
Standard Limits:

- Air pollution standard is Class II, *Ambient Air Quality Standards* (*GB3095—2012).*
- Noise at HSP boundary during construction is Class II, *Noise Standard for Construction Site Boundary* (GB12523-2011).
- Noise at boundary during operation period is Class II, *Noise Standard for Construction Site Boundary (GB12348-2008).*
- Ambient noise is Class II, *Environmental Quality Standards for Noise* (GB3096-2008).
- Wastewater is Class III, *Integrated wastewater discharge standard* (GB8978-1996).

F. Reporting Requirements

21. Based on the compliance inspection and ambient monitoring results, the EHSU, with support from the LIEC, will submit monthly monitoring reports to the PMO. The EHS with support from the LIEC, will also prepare EMP monitoring reports semi-annually during

construction and annually during operation. The repots will be submitted to the PMO, who will review them and then submit them to the ADB and the Saihan District EPB

22. No later than two months after completion of the construction work the PMO will submit a construction completion report to the Saihan District EPB. Within three months after project completion, an environmental acceptance inspection will be undertaken by the Saihan District EPB. ADB can request the PMO for a copy of the construction completion and environmental acceptance reports.

23. The environmental reporting requirements during the implementation of the project are summarized in the **Table A-6**.

Table A-6: Reporting Requirements

Report	Prepared by	Submitted to	Frequency
A. Construction Phase			
Environmental monitoring records	EHSU supported by LIEC	PMO	Monthly
Environmental monitoring report	EHSU supported by LIEC, prepares and submits to PMO	PMO reviews and submits to ADB	Semi-annually
B. Operation Phase			
Environmental monitoring report, including annual CO_2 emissions[32]	EHSU prepares and submits to PMO	PMO reviews and submits to ADB	Annually

G. Performance Indicators

24. Performance indicators (**Table A-7**) have been developed to assess the implementation of the EMP. These indicators will be used to evaluate the effectiveness of environmental management.

H. Estimated Budget for Mitigation and Monitoring

25. The estimated budgets for environmental mitigation and monitoring are summarized in **Table A-8**. Construction phase costs are estimated at 1.172 million USD; operation phase mitigation and monitoring costs are estimated at 1.236 million USD. The budget does not include major capital costs for mitigations (e.g. low NOx burners, flue gas stacks, etc).

[32] The ADB SPS requires quantification and monitoring of GHG emissions for Projects which emit more than 100,000 tCO2e per annum.

Table A-7: Performance Indicators

No.	Description	Indicators
1	Staffing	(i) PMO EHSU established with appropriately qualified staff. (ii) Appropriately qualified LIC EHSS recruited. (iii) Branch EHSUs established with appropriately qualified staff.
2	Budgeting	(i) Environment mitigation cost during construction and operation is sufficiently and timely allocated. (ii) Environment monitoring cost is sufficiently and timely allocated. (iii) Budget for capacity building is sufficiently and timely allocated.
3	Monitoring	(i) Compliance monitoring is conducted by EHSU and LIEC as per EMoP. (ii) Ambient and effluent monitoring is conducted by the local EMS as per EMoP. (iii) CEMS installed and functioning during operation phase.
4	Supervision	(i) ADB mission to review EMP implementation at least once a year during the construction phase. (ii) Saihan District EPB to supervise monitoring and reporting. (iii) Saihan District EPB to conduct an environmental acceptance inspection after a three months trial operation period.
5	Reporting	(i) Monthly environment monitoring reports prepared by the EHSUsupported by theLIEC are submitted to PMO. (ii) (Semi-annual (during construction period) and annual (during operation) EMP monitoring reports, prepared by the EHSU supported by the LIEC, are submitted to submitted to ADBand Saihan District EPB through the PMO. (iii) Construction completion report prepared by the PMO is submitted to EA and Saihan EPB. (iv) Environment acceptance report prepared by the Saihan EPB is submitted to the PMO and the ADBafter a three months trial operation period.
6	Capacity Building	(i) Construction phase HSE plan developed and in place before substantive construction activities begin. (ii) Training on HSE plan implementation, ADB safeguard policy, EMP implementation, and GRM is provided to at the beginning of project implementation. (iii) Operation phase HSE plan developed and in place before substantive Project operation activities begin. (iv) Training on HSE plan implementation and best international practices in natural-gas fired HSP operation is provided prior to Project operation.
7	Grievance Redress Mechanism	(i) Project public complaints unit (PPCU) is established in thePMO. (ii) Contact persons of PPCU are assigned and disclosed to the public before construction. (iii) Complains are recorded and processed within the set time framework in the GRM of this EIA.
8	Compliance with the PRC standards	(i) Project complies with the PRC's environmental laws and regulations and meets all required standards.

Table A-8:EMP Budget

Construction Phase									
1. Monitoring	**Unit**	**Unit Cost**	**# Months**	**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	**Budget**
Ambient Air - TSP, PM_{10}	Monthly Sampling	Included in lump sum EMS budget	60	Included in lump sum Hohhot EPB EMS budget			**98,361**	**600,000**	ADB
Noise	Monthly Sampling		60						
Wastewater	Monthly Sampling		60						
2. Capacity Building	**Unit**	**Course Cost**	**# Times**	**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	ADB
HSE Plan Development	HSE Plan - Construction	$ 3,500	1	3,500	3,500	3,500	10,500		
Construction HSE Training	HSE Course Development	3,500	1				3,500		
	HSE Course Delivery	2,750	2	5,500	5,500	5,500	16,500		
Subtotal							**30,500**	**186,050**	
3. Loan Implementation Consultant (LIC)	**Unit**	**Monthly Cost**	**# Months**				**Cost USD**	**Cost RMB**	ADB
LIC HSE Specialist	Person Months	$ 2,500	30				**75,000**	**457,500**	
4. Dust Control	**Unit**	**Unit Cost**		**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	PRC
	Pipeline dust control measures	Cost per subproject		1,639	1,967	1,967	**5,573**	**33,995**	
5. Mobile Noise Protection	**Unit**	**Unit Cost**		**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	PRC
	Pipeline mobile noise control measure	Cost per subproject		820	820	1,311	**2,951**	**18,001**	
6. Landscaping and Greening	**Unit**	**Unit Cost**		**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	PRC
	Landscaping Plan	Cost Per Subproject		$ 343,333	$ 271,667	$ 345,000	**960,000**	**5,856,000**	
TOTAL Construction Phase							***Cost USD***	***Cost RMB***	
							1,172,385	***7,151,546***	
Operation Phase									
	Unit	**Cost Per Boiler**	**# Boilers**	**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	PRC
1. Stack Emissions Monitoring	CEMS	$ 20,000.00	Jinqiao - 7	$ 140,000	$ 140,000	100,000			
Subtotal			Xinjiaying - 7				**380,000**	**2,318,000**	
			Haoqinying - 5						
2. Monitoring	**Unit**	**Sample Cost**	**# Months**	**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	ADB
Noise	Monthly Sampling	Included in lump sum EMS budget	24	Included in lump sum EMS budget			**32,787**	**200,000**	
Wastewater	Quarterly Sampling		24						
3. Noise Control	**Unit**	**Unit Cost**		**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	PRC
HSP Noise Insulation	Insulation	Cost Per Subproject		$ 163,934	$ 196,721	$ 163,934	524,589		
HSP Noise and Vibration Reduction Measures	Noise Reduction	Cost Per Subproject		$ 85,246	$ 90,164	$ 85,246	260,656		
HES Noise Control and Greening	Noise Control, Greening	Cost Per Subproject		$ 2,787	$ 2,459	$ 2,459	7,705		
							792,950	**4,836,995**	
4. Capacity Building	**Unit**	**Course Cost**	**# Times**	**Jinqiao**	**Xinjiaying**	**Haoqinying**	**Cost USD**	**Cost RMB**	ADB
HSE Plan Development	HSE Plan - Operation	$ 3,500	1	3,500	3,500	3,500	10,500		
Operation HSE Training	HSE Course Development	3,500	1				3,500		
	HSE Course Delivery	2,750	2	5,500	5,500	5,500	16,500		
Subtotal							**30,500**	**186,050**	
TOTAL Operation Phase							***Cost USD***	***Cost RMB***	
							1,236,237	***7,541,045***	
GRAND TOTAL Construction + Operation							***Cost USD***	***Cost RMB***	
							2,408,622	***14,692,591***	
							Cost USD	***Cost RMB***	
Contribution from ADB LIC and Environmental Support Budget:							***267,148***	***1,629,600***	ADB
Contribution from PRC Budget:							***2,141,474***	***13,062,991***	PRC

EMP Budget Notes:

Construction Phase

- Construction phase monitoring based on lump sum EMS proposal, with monthly monitoring at the three HSP sites and 15% of HES and pipeline sections.
- Construction phase EHS course development based on 10 consultant days at $350/day (fees and per diem). Course Delivery based on 5 consultant days per delivery at 350/day (fees and per diem) and fixed costs of $1000 per delivery.
- LIEC is a part time consultant.
- Dust and noise control based on domestic EIAs.
- Landscaping and greening costs from domestic EIAs, based on 26% of HSP area, and a cost of 60 Yuan per m^2.

Operation Phase

- CEMS costs from domestic EIAs. Cost to be incurred during construction.
- Operation phase monitoring based on lump sum EMS proposal, with monitoring at HSP sites and random selection of HESs, and HSP wastewater discharged to municipal sewer.
- HSP and HES noise control costs from domestic EIAs. Cost to be incurred during construction.
- Operation phase EHS course development based on 10 consultant days at $350/day (fees and per diem). Course Delivery based on 5 consultant days per delivery at 350/day (fees and per diem) and fixed costs of $1000 per delivery.
- Budget does not include major capital costs for mitigations (e.g. low NOx burners, stacks, etc).

I. Mechanisms for Feedback and Adjustment

26. The effectiveness of mitigation measures and monitoring plans will be evaluated through a feedback reporting system. If, during compliance inspections and monitoring, substantial deviation from the EMP is observed then the PMOwill consult with the Saihan EPB and ADB and propose appropriate changes to the EMP monitoring and mitigation plan.

27. Any major EMP adjustments will be subject to ADB review and approval and ADB may pursue additional environmental assessment and, if necessary, further public consultation. The revised EMP with ADB confirmation is subject to reposting on the ADB's website as the ADB public communications policy requires. The revised EMP will be passed to the PMO, the heating zone Branch PMOs, and the contractor(s) for implementation.

J. EPB Environmental Acceptance

28. After a three months trial period the Saihan DistrictEPB will conduct an environmental acceptance inspection for the Project. If the project is in compliance with all conditions for approval of the domestic EIA (see Appendix II), the Project can be put into formal operation.

APPENDIX II: EPB APPROVALS OF DOMESTIC EIAS

HaoqingyingHeating zone

呼和浩特市环境保护局文件

呼环政批字[2014]58号

呼和浩特市环境保护局
关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——毫沁营热源厂（二期）环境影响报告表的批复

呼和浩特市城发投资经营有限责任公司：

你公司关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——毫沁营热源厂（二期）环评审批的《申请》及由中冶东方控股有限公司编制完成该项目的《建设项目环境影响报告表》等相关材料收悉后，我局组成现场勘查组进行了现场踏勘，并通过了我局“建设项目环境影响评价技术审查委员会”的技术评审。项目符合《呼和浩特市城市供热规划（2010-2020）》，并取得了市发改委《关于呼和浩特市城发辛家营、金桥、毫沁营区域集中供热工程开展前期工作的批复》（呼发改投字[2011]438号）和风电调峰供热项目《合作协议书》。项目在公示期间未接到反对意见。项目经我局“建设项目审批委员会”审议，同意该项目建设，现批复如下：

一、项目基本情况

本工程热源位于呼和浩特市沙梁村以西，东侧为一期，一期工程东侧隔东站东街83m为沙梁村，南侧、西侧为空地，北侧为110国道。本项目中心坐标为40° 53'6.74"N，111° 44'46.86"E。原工程于2012年6月由我局以呼环政批字[2012]135号批复。项目占地面积10257m²。本工程建在原有基础上，建设5×116MW燃气热水锅炉房和2×25MW风电锅炉，30.68km一级热水管网和87座水水热力站，实现供热能力1135.5万m²。项目燃气由市政天然气管网供给，风电供热系统为热源厂在夜间21:00—次日9:00调峰热源。项目总投资75134.73元，其中环保投资581万元，占总投资比为0.77%。

项目为新建工程，我局同意你公司按照环评文件所列地点、性质、规模、环境保护对策措施进行建设。

二、项目应重点做好以下工作：

1、项目在建设期须严格按照市政府办公厅关于《市区建筑噪声和扬尘污染综合治理方案》（呼政办发[2011]135号）和市政府“关于开展建筑垃圾扬尘污染专项治理的通告”（呼政发[2013]34号）文件中相关内容执行：切实做好施工期的污染防治工作，合理安排施工作业时间，规范操作，加强管理。施工产生的扬尘应符合《防治城市扬尘污染技术规范》(HJ/T 393-2007)；施工噪声应符合《建筑施工场界环境噪声排放标准》(GB12523-2011)要求，夜间不得施工，因特殊工艺需连续昼夜施工的须经新城区环保局审批同意后方可施工。施工期间的食堂、采暖和热水等严禁使用原煤。

2、项目燃料为清洁能源天然气，燃烧废气通过30m高排气筒高空排放，须达到《锅炉大气污染物排放标准》（GB13271-2001）二类区II时段相关标准。

3、项目施工期生活污水经化粪池处理后由当地环卫部门负责拉运至最近的污水处理厂处理；软水制备系统排污水、锅炉排污水、锅炉净环水系统排污水与经化粪池处理后的生活污水和食堂含油废水经隔油池处理后，一并排入城市污水管网最终进入金桥污水处理厂处理。

4、项目产生的建筑垃圾须及时清理，定点运出；生活垃圾由环卫部门统一无害化处理。

5、项目选用符合国家标准的低噪声设备，安装时要安装减震设施，设备间要用隔声材料，设置隔声窗。通过厂房屏蔽、距离衰减以及厂区四周种植高大乔木的绿化隔离等方法，特别是换热站须选择在居民区较为空旷的地方，离居民楼不得小于10m，必要时须增设减震沟，使项目产生的噪声排放满足《工业企业厂界环境噪声排放标准》（GB12348-2008）中3类标准的要求。

6、项目范围内，不准在城区地下饮用水源井半径50m范围内铺设管网和设置施工营地等与供水无关的任何工程。

7、项目在施工前须委托有资质的环境监理部门，主要对项目区内保护城区地下水饮用水水源中所采取的措施、噪声、震动和所有涉水坑、池的防渗、防漏等工程进行环境监理，验收时须提交监理报告。

8、总量已批复。

9、项目须严格执行环评报告中提出的其他环境影响防治对策，确保污染物达标排放，加强对环保设施的监督管理及定期维护。

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。项目按环评和批复要求竣工后，建设单位须按照规定程序向我局提出申请，以便进行环境保护竣工验收，验收合格后，项目方可正式投入运行。

四、自批复之日起5年内该项目未开工建设，或规模、地点、工艺及环境保护措施发生变化，须重新进行审核。呼环政批字[2012]135号文件同时作废。

五、我局委托新城区环保局负责该项目施工期的环境保护监督检查工作，项目开工前15日须进行申报。

2014年3月28日

信息公开选项：公开

抄报：自治区环境保护厅。

抄送：市环境监察支队，新城区环保局，中冶东方控股有限公司。

呼和浩特市环境保护局　　2014年3月28日印发

Xinjiaying Heating zone

呼和浩特市环境保护局文件

呼环政批字[2014]60 号

呼和浩特市环境保护局
关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——辛家营热源厂（7×70MW 天然气热水锅炉）环境影响报告表的批复

呼和浩特市城发投资经营有限责任公司:

你公司关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——辛家营热源厂（7×70MW 天然气热水锅炉）环评审批的《申请》及由中冶东方控股有限公司编制完成的《建设项目环境影响报告表》等相关材料收悉后，我局组成现场勘查组进行了现场踏勘，并通过了我局“建设项目环境影响评价技术审查委员会”的技术评审。项目符合《呼和浩特市城市供热规划（2010-2020）》，并取得了市发改委《关于呼和浩特市城发辛家营、金桥、毫沁营区域集中供热工程开展前期工作的批复》（呼发改投字[2011]438 号）。项目在公示期间未接到反对意见。经我局“建设项目审批委员会”审议，同意该项目建设，现批复如下：

一、项目基本情况

本工程位于呼和浩特市如意河南部区域的西把栅乡，原大添路（规划七街）以北，规划三路以东。项目中心坐标为 40° 47'28.01"N，111° 46'10.77"E。此项目在现厂址西侧扩建，新征地面积 105087.86 m^2。本工程在 2012 年 6 月经我局已批复（呼环政批字[2012]136 号）。项目在原址上建设，建设规模为：扩建 7×70MW 燃气热水锅炉房、新建 26.02km 一级热水管网、新建 48 座水水热力站和辅助工程，供热能力 882.53 万 m^2。项目总投资 76429.23 元，其中环保投资 470.7 万元，占总投资比为 0.62%。

项目为新建工程，我局同意你公司按照环评文件所列地点、性质、规模、环境保护对策措施进行建设。

二、项目应重点做好以下工作：

1、项目在建设期须严格按照市政府办公厅关于《市区建筑噪声和扬尘污染综合治理方案》（呼政办发[2011]135 号）和市政府“关于开展建筑垃圾扬尘污染专项治理的通告”（呼政发[2013]34 号）文件中相关内容执行；切实做好施工期的污染防治工作，合理安排施工作业时间，规范操作，加强管理。施工产生的扬尘应符合《防治城市扬尘污染技术规范》(HJ/T 393-2007)；施工噪声应符合《建筑施工场界环境噪声排放标准》(GB12523-2011)要求，夜间不得施工，因特殊工艺需连续昼夜施工的经赛罕区环保局审批同意后方可施工。施工期间的食堂、采暖和热水等严禁使用原煤。

2、项目燃料为清洁能源天然气，燃烧废气通过 30m 高排气筒高空排放，须达到《锅炉大气污染物排放标准》（GB13271-2001）二类区 II 时段相关标准。

3、项目施工期生活污水经化粪池处理后由当地环卫部门负责拉运至最近的污水处理厂处理；软水制备系统排污水、锅炉排污水、锅炉净环水系统排污水与经化粪池处理后的生活污水和食堂含油废水经隔油池处理后，一并排入城市污水管网最终进入金桥污水处理厂处理。项目产生的污水未能进入污水处理厂之前，不得投入运行。

4、项目产生的建筑垃圾须及时清理、定点运出；生活垃圾由环卫部门统一无害化处理。

5、项目选用符合国家标准的低噪声设备，安装时要安装减震设施，设备间要用隔声材料，设置隔声窗，通过厂房屏蔽、距离衰减以及厂区四周种植高大乔木的绿化隔离等方法，特别是换热站须选择在居民区较为空旷的地方，离居民楼不得小于 10m，必要时须增设减震沟，使项目产生噪声的排放满足《工业企业厂界环境噪声排放标准》（GB12348-2008）中 3 类标准的要求。

6、项目范围内，不准在城区地下饮用水源井半径 50m 范围内铺设管网和设置施工营地等与供水无关的任何工程。

7、项目在施工前须委托有资质的环境监理部门，主要对项目区内保护城区地下水饮用水水源中所采取的措施、噪声、震动和所有涉水坑、池的防渗、防漏等工程进行环境监理，验收时须提交监理报告。

8、总量已批复。

9、项目须严格执行环评报告中提出的其他环境影响防治对策，确保污染物达标排放，加强对环保设施的监督管理及定期维护。

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。项目按环评和批复要求竣工后，建设单位须按照规定程序向我局提出申请，以便进行环境保护竣工验收。验收合格后，项目方可正式投入运行。

四、自批复之日起 5 年内该项目未开工建设，或规模、地点、工艺及环境保护措施发生变化，须重新进行审核。呼环政批字[2012]136 号文件同时作废。

五、我局委托赛罕区环保局负责该项目施工期的环境保护监督检查工作，项目开工前 15 日须进行申报。

2014 年 3 月 28 日

信息公开选项：公开

抄报：自治区环境保护厅。

抄送：市环境监察支队，赛罕区环保局，中冶东方控股有限公司。

呼和浩特市环境保护局　　2014 年 3 月 28 日印发

Jinqiao Heating zone

呼和浩特市环境保护局文件

呼环政批字[2014]59 号

呼和浩特市环境保护局
关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——金桥调峰热源厂环境影响报告表的批复

呼和浩特市城发投资经营有限责任公司:

你公司关于内蒙古呼和浩特市低碳供热项目——呼和浩特市城发公司辛家营、金桥、毫沁营区域集中供热工程——金桥调峰热源厂环评审批的《申请》及由中冶东方控股有限公司编制完成的《建设项目环境影响报告表》等相关材料收悉后，我局组成现场勘查组进行了现场踏勘，并通过了我局“建设项目环境影响评价技术审查委员会”的技术评审，项目符合《呼和浩特市城市供热规划（2010-2020）》，并取得了市发改委《关

1

于呼和浩特市城发辛家营、金桥、毫沁营区域集中供热工程开展前期工作的批复》（呼发改投字[2011]438 号）。项目在公示期间未接到反对意见。经我局“建设项目审批委员会”审议，同意该项目建设，现批复如下:

一、项目基本情况

项目总体工程位于金桥新市区东南部丰州路以东，喇嘛营路以西，三环南路以北，世纪大街以南区域，西距正喇嘛营约 21m。本项目中心坐标为 40° 45'28.65"N，111° 44'58.48"E。新征地面积 131701.7m²（包括一期和二期用地），本工程为一期，原工程于 2012 年 6 月经我局已呼环政批字[2012]137 号文件批复。项目占地面积 23404.64m²，本工程的建设规模为：7×70MW 燃气热水锅炉房、17.06km 一级热水管网、44 座水水热力站和其它辅助工程，供热能力为 953.10 万 m²。项目总投资 82636.12 元，其中环保投资 513 万元，占总投资比为 0.62%。

项目为新建工程，我公司同意你局按照环评文件所列地点、性质、规模、环境保护对策措施进行建设。

二、项目应重点做好以下工作:

1、项目在建设期须严格按照市政府办公厅关于《市区建筑噪声和扬尘污染综合治理方案》（呼政办发[2011]135 号）和市政府“关于开展建筑垃圾扬尘污染专项治理的通告”（呼政发[2013]34 号）文件中相关内容执行；切实做好施工期的污染防治工作，合理安排施工作业时间，规范操作，加强管理。施工产生的扬尘应符合《防治城市扬尘污染技术规范》(HJ/T 393-2007)；施工噪声应符合《建筑施工场界环境噪声排放标

2

准》(GB12523-2011)要求，夜间不得施工，因特殊工艺需连续昼夜施工的经赛罕区环保局审批同意后方可施工。施工期间的食堂、采暖和热水等严禁使用原煤。

2、项目燃料为清洁能源天然气，燃烧废气通过 30m 高排气筒高空排放，须达到《锅炉大气污染物排放标准》（GB13271-2001）二类区 II 时段相关标准。

3、项目施工期生活污水经化粪池处理后由当地环卫部门负责拉运至最近的污水处理厂处理；软水制备系统排污水、锅炉排污水、锅炉净环水系统排污水与经化粪池处理后的生活污水和食堂含油废水经隔油池处理后，一并排入城市污水管网最终进入金桥污水处理厂处理。项目产生的污水未能进入污水处理厂之前，不得投入运行。

4、项目产生的建筑垃圾须及时清理、定点运出；生活垃圾由环卫部门统一无害化处理。

5、项目选用符合国家标准的低噪声设备，安装时要安装减震设施，设备间要用隔声材料，设置隔声窗，通过厂房屏蔽、距离衰减以及厂区四周种植高大乔木的绿化隔离等方法，特别是换热站须选择在居民区较为空旷的地方，离居民楼不得小于 10m，必要时须增设减震沟，使项目产生噪声的排放满足《工业企业厂界环境噪声排放标准》（GB12348-2008）中 3 类标准的要求。

6、项目范围内，不准在城区地下饮用水源井半径 50m 范围内铺设管网和设置施工营地等与供水无关的任何工程。

7、项目在施工前须委托有资质的环境监理部门，主要对项目区内保护城区地下水饮用水水源中所采取的措施、噪声、

3

震动和所有涉水坑、池的防渗、防漏等工程进行环境监理，验收时须提交监理报告。

8、总量已批复。

9、项目须严格执行环评报告中提出的其他环境影响防治对策，确保污染物达标排放，加强对环保设施的监督管理及定期维护。

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。项目按环评和批复要求竣工后，建设单位须按照规定程序向我局提出申请，以便进行环境保护竣工验收。验收合格后，项目方可正式投入运行。

四、自批复之日起 5 年内该项目未开工建设，或规模、地点、工艺及环境保护措施发生变化，须重新进行审核。呼环政批字[2012]137 号文件同时作废。

五、我局委托赛罕区环保局负责该项目施工期的环境保护监督检查工作，项目开工前 15 日须进行申报。

2014 年 3 月 28 日

信息公开选项：公开

抄报：自治区环境保护厅。

抄送：市环境监察支队，赛罕区环保局，中冶东方控股有限公司。

呼和浩特市环境保护局　　　　2014 年 3 月 28 日印发

4

Summary Translation of EPB Approval of Domestic EIAs

The EPB's Construction Project EIA Technical Review Committee reviewed the report. Based on the evaluation's recommendation, the Hohhot EPB approved the domestic EIAs on 28 March 2014. The approval documents specify requirements for the IA to comply with during construction and operation:

i) Dust generated by construction and construction noise should comply with relevant PRC standards. Construction at night is forbidden unless the continuous day and night construction is required for some special process and approval has been obtained from the EPB in Saihan district. Coal used for canteen, heating and hot water during the construction phase is forbidden.

ii) Project fuel is clean energy-natural gas and flue gas is to be emitted through 30m high exhaust funnels. The flue gas emissions should comply with the relevant PRC standards.

iii) Domestic wastewater generated in construction phase and operation phase should be treated by digestion tank before discharge. Operation phase wastewater from water treatment plant and blowdown should be mixed with domestic waste water treated by digestion tank and canteen oily wastewater treated by oil separation tank, then discharged into the municipal sewer for final treatment at the Jinqiao wastewater treatment plant.

iv) Construction waste generated by the project should be collected in a timely manner and sent for disposal at an appropriate facility. Non-hazardous domestic waste should be collected by the local sanitation departments.

v) Noise reduction measures should be adopted such that the project noise complies with relevant PRC standards.

vi) Activities which are not related to water supply such as pipelines laying, construction camps, etc., are forbidden within a 50 meters radius of water supply wells in urban areas.

vii) Environmental supervision should be implemented by qualified environmental supervision department. Environmental supervision mainly focuses on underground water resource protection measures, noise, vibration and leakage, seepage control of water pools and tanks. Environmental supervision report should be submitted when acceptance check of project starts.

viii) Total quantity control of pollution has already been approved.

ix) Environment impact control and treatment measures in the EIAs report must be executed strictly to ensure discharge of pollution in compliance with relevantstandards. Supervision, management and periodic maintenance of environmental protection should be undertaken.

x) Environmental protection measures and the main project should be designed, constructed and put into operation simultaneously. After the project is completed according to the requirement of EIA and this approval document, the construction company should apply for environment protection acceptance of completed project according to established procedures. After the acceptance is approved, the project can start to operate formally.

xi) If the project construction has not started within 5 years of the approval date, or project scale, location, process and environmental protection measures change, the projects should be reassessed and approval documents will be obsolete.

xii) The Saihan district EPB is delegated by Hohhot EPB to be responsible for the environment protection supervision and inspection during construction phase. Application of environment protection supervision and inspection must be submitted at least 15 days before project construction begins.

APPENDIX III: EXISTING BOILERS TO BE DECOMMISSIONED, JINQIAO HEATING ZONE

No	Name	Type of boiler	Set number	Coal consumption (t/a)	Coal type	Sulphur content (%)	Precipitator type	Dust removal efficiency (%)	Chimney height(m)/ number	Flue gas emission (m^3/h)	Pollutant emission (t/a)			Heating supply area (m^2)
											Smoke	SO_2	NO_X	
1	Longde Huayuan	QXW7-0.7/95-70	1	2541	bituminous coal	0.6	wet	85	20/1	8976	7.97	20.73	7.47	100000
		DZL2.8-0.7/95-70	1	590.90	bituminous coal	0.6	wet	86	26/1	2087	1.73	4.82	1.74	
2	Ziyun plot	DHW7-1.0/115-70	1	2223	bituminous coal	0.7	wet	84	32/1	7852	7.44	21.16	6.54	100000
		DHW4.2-0.7/95-70	1	908.90	bituminous coal	0.7	wet	85	31/1	3211	2.85	8.65	2.67	
3	Xuefu Huayuan	DHW7-1.0/115-70	3	5637.41	bituminous coal	0.5	wet	87	28/1	19913	15.33	38.33	16.57	180000
4	Artificial limb factory	QXW2.8-0.7/95-70	1	438.47	bituminous coal	0.6	wet	86	20/1	1549	1.28	3.58	1.29	14000
5	Qingcheng University	DZL1.4-0.7/95-70	1	313.19	bituminous coal	0.6	wet	85	26/1	1106	0.98	2.56	0.92	10000
6	Semiconductor factory dormitory	DZL1.4-0.7/95-70	2	275.61	bituminous coal	0.5	wet	87	27/1	974	0.75	1.87	0.81	8800
7	Veterinary station	DZL2.8-0.7/95-70	1	686.00	bituminous coal	0.5	wet	85	20/1	2423	2.15	4.66	2.02	48200
		DZL4.2-0.7/95-70	1	823.57	bituminous coal	0.6	wet	86	28/1	2909	2.41	6.72	2.42	
8	Insurance company	SZL7-1.0/115-70	2	3445.09	bituminous coal	0.5	wet	84	31/1	12169	11.53	23.43	10.13	110000
9	Inner Mongolia petrochemical academy of sciences	QXW2.8-0.7/95-70	1	512.2	bituminous coal	0.6	wet	82	35/1	1809	1.93	4.18	1.51	18000
		DZL0.7-0.7/95-70	1	51.54	bituminous coal	0.6	wet	85	20/1	182	0.16	0.42	0.15	
10	Hydrology team	KZL240-1.0/110/70-A	1	939.57	bituminous coal	0.6	wet	84	35/1	3319	3.15	7.67	2.76	30000
11	Commodity Inspection and Testing Bureau	DHW4.2-0.7/95-70	1	800.31	bituminous coal	0.7	wet	85	27/1	2827	2.51	7.62	2.35	60000
		DHW7-1.0/115-70	1	1078.83	bituminous coal	0.7	wet	85	20/1	3811	3.39	10.27	3.17	

No	Name	Type of boiler	Set number	Coal consumption (t/a)	Coal type	Sulphur content (%)	Precipitator type	Dust removal efficiency (%)	Chimney height(m)/ number	Flue gas emission (m^3/h)	Pollutant emission (t/a)			Heating supply area (m^2)
											Smoke	SO_2	NO_X	
12	Stockbreeding machine Signature station	SZL7-1.0/115-70	2	256.25	bituminous coal	0.7	wet	84	20/1	905	0.86	2.44	0.75	9000
		DZL1.4-0.7/95-70	1	25.62	bituminous coal	0.5	wet	83	35/1	91	0.09	0.17	0.08	
13	Baota Zhuangyuan	DZL4.2-0.7/95-70	1	879.3	bituminous coal	0.6	wet	84	31/1	3106	2.94	7.18	2.59	41200
		DZL2.8-0.7/95-70	1	411.04	bituminous coal	0.5	wet	84	20/1	1452	1.38	2.80	1.21	
14	International Business and Economics School	QXW7-1.0/95-70	2	313.2	bituminous coal	0.6	wet	86	25/1	1106	0.92	2.56	0.92	10000
15	Xinya Cashmere Wool ltd.	DZL2.8-0.7/95-70	2	250.6	bituminous coal	0.6	wet	87	38/1	885	0.68	2.04	0.74	8000
16	Ruitong auto repair company	SZL7-1.0/115-70	1	187.9	bituminous coal	0.7	wet	84	28/2	664	0.63	1.79	0.55	6000
17	Xinshiji Lvse Zhuangyuan	DZL1.4-0.7/95-70	2	469.8	bituminous coal	0.6	wet	85	30/1	1659	1.47	3.83	1.38	15000
18	Inner Mongolia grassland workstation	SHL1.4	1	178	Fine coal	0.4	wet	80	25/1	629	0.74	0.97	0.52	15000
		KZL2.8	1	291.78		0.4	wet	82		1031	1.10	1.59	0.86	
19	Stockbreeding machine station	DHW7-1.0/115-70	2	240	bituminous coal	0.6	wet	85	35/1	848	0.75	1.96	0.71	11800
		DZL10.5-1.25/95-70	1	129.56	bituminous coal	0.6	wet	86		458	0.38	1.06	0.38	
20	Drilling crew property company of Saihan district	DHW4.2-0.7/95-70	1	626.4	bituminous coal	0.7	wet	84	34/1	2213	2.10	5.96	1.84	20000
21	Kaiao cashmere sweater factory	DZL2.8-0.7/95-70	1	156.6	bituminous coal	0.6	wet	86	20/1	553	0.46	1.28	0.46	5000
22	Power company district	QXW2.8-0.7/95-70	1	1039.8	bituminous coal	0.7	wet	85	30/1	3673	3.26	9.90	3.06	33200
23	Bluesky Residence	DHW2.8-0.7/95-70	1	213.0	bituminous coal	0.7	wet	87	34/1	752	0.58	2.03	0.63	6800
24	Chemical plant residential district	DZL2.8-0.7/95-70	2	281.9	bituminous coal	0.7	wet	83	28/1	996	1.00	2.68	0.83	9000
25	Fenghuayuan plot	SZL14-1.25/115-70	1	1660	bituminous coal	0.6	wet	86	40/1	5864	4.86	13.55	4.88	70000
		SZL7-1.0/115-70	1	532.33	bituminous	0.7	wet	85		1880	1.67	5.07	1.57	

No	Name	Type of boiler	Set number	Coal consumption (t/a)	Coal type	Sulphur content (%)	Precipitator type	Dust removal efficiency (%)	Chimney height(m)/ number	Flue gas emission (m^3/h)	Pollutant emission (t/a)			Heating supply area (m^2)
											Smoke	SO_2	NO_X	
					coal									
26	Medical institute	DHW7-1.0/115-70	1	992.8	bituminous coal	0.7	wet	86	29/1	3507	2.91	9.45	2.92	31700
27	TV cabinet factory	SZL7-1.0/115-70	1	689.0	bituminous coal	0.6	wet	84	26/1	2434	2.31	5.62	2.03	22000
28	Hohhot Cigarettes Factory (new)	SZL10.5-1.25/115-70	2	9395.7	bituminous coal	0.5	wet	83	26/1	33189	33.42	63.89	27.62	300000
29	Mengniu milk industry	DZL2.8-0.7/95-70	1	62.6	bituminous coal	0.7	wet	85	30/1	221	0.20	0.60	0.18	2000
	Total		50	40548.66							130.30	315.08	119.21	1294700

Source: EIA Table Report: Low-carbon Heating Project of Inner Mongolia Jinqiao Heating Resource Plant of Hohhot City Development Company, March 6 2014. Prepared by Zhong Ye Dong Fang Ltd.

APPENDIX IV: NATURAL GAS SUPPLY LETTER OF COMMITMENT

呼和浩特中燃城市燃气发展有限公司文件

呼市中燃　工程　字[2013]10号　　　　签发人：乔庆基

关于给呼和浩特城发公司热源厂供天然气的承诺函

呼和浩特市城发投资经营有限责任公司：

根据呼和浩特城发集中供热工程辛家营热源厂、金桥热源厂、毫沁营热源厂建设位置、建设规模及天然气用气量需求，根据《呼和浩特市燃气规划（天然气部分）2010—2020》及我司近期天然气工程建设计划，我公司能够保障上述热源厂的供气需求。

特此承诺。

附：

《关于呼和浩特城发热源厂供天然气说明》

《呼和浩特中燃高压（次高压）天然气管道图》

二〇一三年四月二十二日

主题词：供气　承诺函

拟文单位：工程技术部　　　　2013年4月22日印发

审核人：丁志　　　　共印4份

APPENDIX V: HOHHOT CHUNHUASHUIWU WATER SUPPLY COMPANY COMMITMENT LETTERS TO SUPPLY DOMESTIC WATER

HaoqingyingHeating zone

关于内蒙古呼和浩特市城发毫沁营扩建 5*116MW

锅炉项目供水的承诺

根据呼和浩特地区集中供热现状，结合城市发展及其需求，关于内蒙古呼和浩特市城发毫沁营扩建 5*116MW 的用水，该热源厂现使用的自备井日最大出水量为 2400 m³，届时可以满足供水要求。

呼和浩特市春华水务应急供水公司

二〇一一年八月十一日

Xinjiaying Heating zone

关于内蒙古呼和浩特市城发辛家营扩建 4*116MW

锅炉项目供水的承诺

根据呼和浩特地区集中供热现状，结合城市发展及其需求，关于内蒙古呼和浩特市城发辛家营扩建 4*116MW 的用水，该热源厂现使用的自备井日最大出水量为 2400 ㎡，届时可以满足供水要求

呼和浩特市春华水务应急供水公司

二〇[illegible]一年八月十一日

呼和浩特市供排水管网发展有限责任公司
文 件

呼水管发行发[2011] 33 号　　　　签发人：乔力群

关于解决金桥调峰热源厂供排水问题的复函

呼市城发投资经营有限责任公司：

贵公司《关于解决金桥调峰热源厂供排水问题的函》于 2011 年 6 月 22 日已收悉。我公司委派技术部有关人员赴现场踏勘，经专题会议研究决定：位于丰州路以东、喇嘛营路以西、三环南路以北、世纪大街以南区域内，该区域在供水、排水规划范围内，需办理供排水接入手续，距该项目最近供水水源是炼油厂西门。

特此复函

呼市供排水管网发展有限责任公司

二0一一年六月二十七日

APPENDIX VI: COAL AND ENERGY EMISSION REDUCTION CALCULATIONS

Pollutant	Emission of the Project	Emission of baseline	Emission Reduction
	Ton/a	Ton/a	Ton/a
Total Project			
CO_2	397,897	2,079,784	1,681,887
NO x	166	9,640	9,475
PM	-	25,600	25,600
SO_2	-	8,988	8,988
Fly Ash and Bottom Ash ton/a	9,387	187,732	187,732
Standard coal	159,798	835,255	675,457
Raw Coal ton/a	-	1,248,287	1,248,287
Jinqiao Area			
CO_2	15,019	664,413	649,394
NO x	6	3,080	3,073
PM	-	8,178	8,178
SO_2	-	2,871	2,871
Fly Ash and Bottom Ash ton/a	-	59,973	59,973
Standard coal	6,032	266,832	260,801
Raw Coal ton/a	-	398,780	398,780
Xinjiaying Area			
CO_2	75,006	615,206	540,201
NO x	31	2,852	2,820
PM	-	7,573	7,573
SO_2	-	2,659	2,659
Fly Ash and Bottom Ash ton/a	-	55,532	55,532
Standard coal	30,123	247,071	216,948
Raw Coal ton/a	-	369,247	369,247
Haoqinying Area			
CO_2	307,873	800,165	492,293
NO x	128	3,709	3,581
PM	-	9,849	9,849
SO_2	-	3,458	3,458
Fly Ash and Bottom Ash ton/a	-	72,227	72,227
Standard coal	123,644	321,352	197,708
Raw Coal ton/a	-	480,259	480,259

APPENDIX VII: ENVIRONMENTAL DUE DILIGENCE OF ASSOCIATED FACILITIES

I.ENVIRONMENTAL DUE DILIGENCE - SANHECUN HEAT SOURCE PLANT

Prepared by Dai Lei, Environment Safeguards Consultant (February 2016).

A. Introduction

1. In accordance with the ADB Safeguard Policy Statement (SPS) (2009). Environmental due diligence assessment of the Sanhecun Heat Source Plant (HSP), has been conducted as part of the proposed scope change during the implementation of Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region(IMAR).

2. According the proposed scope change, Haoqinying heating zone will get heat from the existing Sanhecun HSP, which is owned and operated by the Hohhot Chengfa Heating Company-the project implementation agency. At the Sanhecun HSP, five 29 MW coal-fired circulating fluidized bed (CFB) boilers will be shut down and two 70 MW low nitrogen oxides (NO_X) natural gas boilers will be installed under the proposed project scope change. To improve boiler efficiency, pre-heaters and economizers will be installed for new gas boilers. In addition, the current surplus heat from existing three 70 MW natural gas boilers at the Sanhecun HSP will be provided to Haoqinying heating zone. In sum, a total of 350 MW heat will be supplied to the Haoqinying heating zone.

B. Environmental Due Diligence Review Approach

3. This report is based on a site visit, consultations with the Sanhecun HSP managers and technical staff, and a review of plant environmental and technical documentations, including environmental monitoring reports. The site visit was undertaken January26th2016, with the following participants:

Environmental Due Diligence Reviewers:
Dai Lei, National Environmental Safeguards Consultant

Hohhot Chengfa Heating Company:
Mr. Zhang Feifei, Deputy Manager of Xingjiaying HSP
Mr. Wang Junping,Deputy Manager of Sanhecun HSP
Mr.Bai Hongxing, Environment Engineer of Production Department of Sanhecun HSP

4. Documentation reviewed during and after the facility visit include:
- EIA Approval of Sanhecun HSP Phase I project by IMAR EPB (May 17,1995);
- EIA Approval of Sanhecun HSP Phase II project by IMAR EPB (January 6,2006);
- EIA Approval of Sanhecun HSP Phase III project by IMAR EPB (July 13, 2011);
- Stack Emission Monitoring Report (from October23, 2015 to January 15, 2016);
- Site Boundary Noise Monitoring Report (November20, 2015).

C. Project Description

1. Location

5. The Sanhecun HSP is located in northeast urban area in Hohhot City, which is currently providing heat to Sanhecun heating network (west of Haoqingying heating zone), with the coverage of 7.8 million m^2 (**Figure 1**). The Sanhecun HSP site covers 75,546 m^2 and at north of Aimin Street and east of the site is one railway. West of site boundary is about 1km from North Xingan Road. North and west of the site are residential area. And further north is a community park.

Figure 1: Sanhecun HSP, Sanhecun heating zone, and Haoqingying heatng zone

Source: HCHC.

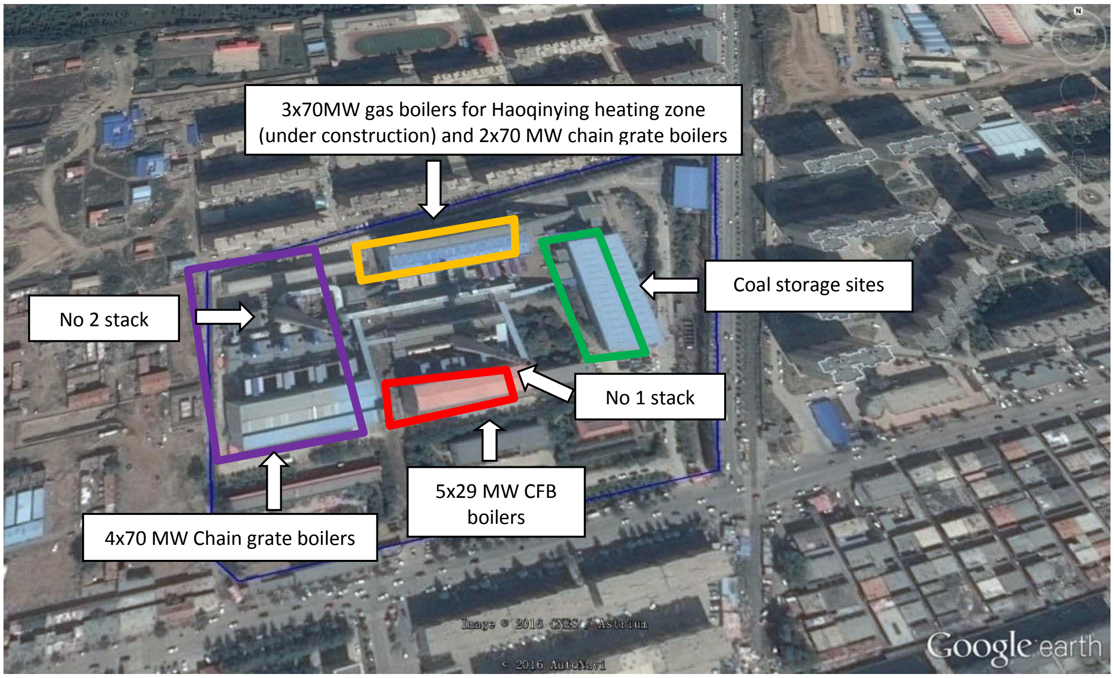
Figure 2: Sanhecun HSP and surrounding area

Source: Google Earth, 2016 and Consultant.

Figure 3: Sanhecun HSP looking from the south

Source: Consultant.

Figure 4: Sanhecun HSP layout



Source: Google Earth 2016 and Sanhecun HSP

2. Purpose and Capacity

6. At the Sanhecun HSP, five 29 MW circulating fluidized bed (CFB) boilers were installed in 2001 (phase I). Four 70 MW chain grate boilers were installed in 2009 (phase II) and two additional 70MW chain grate boilers were installed in 2015 (phase III). Three 70 MW natural gas boilers (phase III) are recently installed through KfW[1] fund, which are expected to be in operation for 2016-2017 heating season.

[1] The KfW is a German government-owned development bank.

Figure 5: Newly installed 70 MW natural gas boiler at Sanhecun HSP(January 2016)

Source: Consultant.

7. Heating supply capacity of Sanhecun HSP is 775 MW and can provide heat to 14.63 million m^2. Actual heat supply area[2] of Sanhecun HSP is 7.8 million m^2, which means Sanhecun has 346.25 MW surplus heat capacity. By connecting heating networks between Sanhecun HSP and Haoqingying HSP, the surplus heat from Sanhecun HSP will be supplied to Haoqingying heating network, consequently the number of boilers at Haoqingying HSP can be reduced.

3. Fuel

8. At the Sanhecun HSP, coal with low sulfur content (<0.7%) is used, which is primarily coming from Jungar Banner, Erdos city, Inner Mongolia. Coal is transported by truck with a proper seal. Coal is unloaded and stored onsite. During 2014-2015 heating season, about 200,000 tons coal is used. Coal analysis data are well kept. **Table 1** presents data sample from December 14, 2015 to December 20, 2015.

Table 1: Coal analysis data

Date	Total moisture (%)	Moisture (air dried basis) (%)	Ash (air dried basis) (%)	Volatile (air dried basis) (%)	Total sulfur(air dried basis) (%)	Fixed carbon (air dried basis) (%)	Lower net calorific value (as received basis) (MJ/kg)

[2] Housing development in Sanhecun heating zone has been slow down and heating area demand did not increase as expected.

2015.12.14	15.87	3.88	12.025	30.79	0.26	53.305	22.69
2015.12.15	15.50	4.24	12.70	29.40	0.30	47.35	22.23
2015.12.16	16.30	4.72	12.41	29.71	0.30	46.70	22.03
2015.12.17	16.30	4.25	15.00	29.70	0.37	44.63	21.26
2015.12.18	14.80	3.78	18.53	29.42	0.45	42.74	20.35
2015.12.19	14.40	3.90	13.96	29.24	0.40	47.12	22.26
2015.12.20	16.20	4.09	12.68	30.22	0.35	46.32	21.95

Source: Sanhecun HSP.

4. Water Supply and Wastewater

9. Domestic water and production water are supplied from municipal water system. The plant has around 304 staff and daily domestic water consumption is 45.6 m^3/d[3]. Production water for boilers is treated using iron exchange resin filtering.

10. Wastewater from the Sanhecun HSP canteen is first filtered by oil-separation system and then, is discharged to septic tank, where domestic wastewater is also collected. Then all domestic wastewater is discharged to the municipal sewer system and treated at the adjacent municipal wastewater treatment plant.

11. All production wastewater is recycled and reused. Detailed information is listed below:

- Industrial salt is used for regeneration of iron exchange resin. The eluate from soft water preparation for boilers are reused in coal wash system;
- Wash and back wash water from soft water preparation system; discharged wastewater from boilers and equipment cooling water are reused as make-up water for flue gas desulfurization (FGD) system;
- Wastewater is circulated in coal wash system by sediment and clarification;
- Wastewater from FGD system is treated in the wastewater pre-treatment facility at the plant, and after neutralization flocculation and sediment, the wastewater is recycled.

12. To protect groundwater and meet the anti-seepage standard, different anti-seepage measures are undertaken according to locations and relevant anti-seepage requirements.

5. Solid Wastes

13. The Sanhecun HSP produces approximately 32,400 t/a of fly ash, 9,600 t/a of coal slag, and 2800 t/a of FGD gypsum slag. All coal combustion waste products are sold to an offsite construction company for recycling in the production of bricks and other construction materials.. The construction company is a sub company of Hohhot Chengfa Heating Company.

14. Domestic waste is collected, transported and treated by the sanitation department of Xincheng District. Treatment of hazardous waste treatment is properly managed by the contracted companies with proper licenses.

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[3] Daily domestic water consumption for one person is 0.15 m^3/d

6. Noise

15. Noise sources during operation will mainly be from boiler rooms, fans, and desulfurization equipment, including transformers, pumps, and cooling equipment. While using low-noise equipment as far as possible, the plant layout and facilities are designed to mitigate noise impacts during operation using shock absorption, insulated enclosures and sound dampening materials. These measures can typically reduce noise intensity. All plant and equipment, including vehicles are properly maintained in order to minimize noise. Also, the workers who are likely to be exposed to high noise level environment are strictly use appropriate personal noise protective equipment (PPE) provided.

7. Air pollutants

16. All CFB boilers are equipped with selective non catalytic reduction (SNCR) denitrification, semi-dry flue gas desulfurization (FGD), and bag-type dust collector to control dust, sulfur dioxide (SO_2) and nitrogen oxides (NO_X). Exhaust gases from all CFB boilers are collected and discharged though a single 120m high stack. All chain grate boilers are equipped with wet FGD and bag-type dust collector for dust and SO_2 control. Exhaust gases from all chain grate boilers are collected and discharged though a single 120m high stack. The FGD systems of all boilers are upgraded in 2015 in order to meet more stringent national emission standards introduced in 2014.

Figure 6: Sanhecun HSP No 1 stack

Source: Consultant.

17. For three 70 MW low NO_X gas boilers, a new stack is currently under construction for the exhaust gas from all three gas boilers.

18. There are two coal storage sites: One is a closed storage facility where the coal loading is occurring in an indoor condition. Currently, Sanhecun are constructing to close open-air coal loading site to transform it into a closed facility. It is expected to be completed before the 2016 heating season.

Figure 7: Closed coal unloading site, Sanhecun HSP

Source: Consultant.

Figure 8: Open coal unloading site, Sanhecun HSP

Source: Consultant.

D. Environmental Management System and Performance

1. Environmental Management System

19. The Sanhecun HSP has a total of 304 staff. Responsibility for environmental management and safety management rests with Production Safety Technical Department, which has 12 staff. One full time staff is working on environmental management and safeguards issues and two full time staff are working on safety management and safeguards issues. Responsibility for occupational health rests with Labor Department, which has 7 staff. One full time staff is working on occupational health and safeguards issues. The plant is currently working on getting ISO 9001 (Quality Management Systems), ISO 14001 (Environmental Management Systems) and ISO 18001 (Occupational Health and Safety) certification.

20. Because The Sanhecun HSP is a sub-company of Hohhot Chengfa Heating Company, the Sanhecun HSP follows Quality management system (QMS), Safety management system (SMS), Occupational health management system (OHMS) and Environment management system (EMS) of Hohhot Chengfa Heating Company. All the systems are prepared based on relevant national, provincial and local laws and regulations. All the systems are annually reviewed and if necessary, updated.

21. During the site visit, environment engineer of the Sanhecun HSP provided some environmental documents. The documents include: environment, occupational health and safety management system (2015 version); operation and management system for environment protection facilities (2015 version); management regulation on wastewater, exhaust gas, noise and solid waste; environmental protection liability statement; energy metering equipment management and environment protection team structure and responsibilities.

22. In addition, Hohhot Chengfa Heating Company also provided a copy of the following documents: (i) safety production supervision and management system of Hohhot Chengfa Heating Company, (ii) Environment protection management system of Hohhot Chengfa Heating Company, and (iii) Occupational health management system of Hohhot Chengfa Heating Company. The twenty five safety management regulations of safety production supervision and management system are listed below:

Table 2: Summary of safety management regulations

No	Name
1	Management assessment standard
2	Safety production responsibility system
3	Safety production management system
4	Work permit management system
5	Operation permit management system
6	Equipment periodical test and rotation system
7	Operation shift change system
8	Operation patrol inspection system
9	Management system for potential safety hazard check and rectification
10	Fire safety management system
11	Flame operation management system and implementation rules
12	Management system for safety technology measures, labor protection measures and anti-accident measures
13	Management system for accident, barrier and anomaly division
14	Management system for special operators safety training assessment

15	Hazardous chemical safety management system
16	Hoisting machinery and equipment safety management system
17	Scaffold installation, demolition and utilization safety management system
18	Safety production education and training management system
19	Safety production meeting system
20	Maintenance safety management system
21	Project outsourcing management system
22	Electrical safety equipment management system
23	Hydrochloric acid management system
24	Safety management system for heat supply network maintenance and operation
25	Personal protection equipment management system

Source: Hohhot Chengfa Heating Company.

23. The Sanhecun HSP also follows emergency management system of Hohhot Chengfa Heating Company and has an emergency response procedure. Regular emergency response training and drills are undertaken. A copy of emergency response procedure was provided during the site visit.

24. Overall, the Sanhecun HSP has an adequate environmental, occupational health and safety management system which involves a lot of regulations and policies. The system and regulations are updated regularly. The Sanhecun HSP also has an emergency response procedure and working properly. The staff confirmed that in the last three years, no accident on environment, occupational health and safety was occurred.

2. Approvals and Licenses

25. The Sanhecun HSP obtained all the necessary approvals and fully complied with all relevant PRC requirements, including EIA approvals (see in Annex 1, 2 and 3) and occupational health and safety approvals.

26. The Sanhecun HSP also obtained all necessary environmental acceptance approvals. Because three 70 MW gas boilers project are not finished, environmental acceptance approval for this project is not obtained yet. During the EIA preparation process for the KfW funded three gas boilers, information disclosure and public consultation were implemented to the project beneficiaries and affected people. No public negative feedback was received during public consultation. In addition, no public concern was raised responding to the information notices.

27. Responding to the '*Interim measure for review and management of total emission quantity indicators for major pollutants of construction project',* the new regulation to control total amount of emissions, was issued by Ministry of Environmental Protection in December 31, 2014 and the latest EIA of Sanhecun HSP was approved on July 13, 2011 with the indication of acceptance of their total emission quantity as a part of the EIA approval.

3. Environmental Performance

a. Applicable environmental standards

28. **Table 3** presents a summary of relevant air pollutants emission standards for the Sanhecun HSP. It is noted that different boilers have different emission standards: CFB boilers must be full compliance with Table 1 in *Emission Standards of Air Pollutants from Thermal Power Plant* (GB 13223-2011). Chain grate boilers must be full compliance with Table 1 in

Emission Standards of Air Pollutants for boiler (GB 13271-2014). Natural gas boilers must be full compliance with Table 2 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).

Table 4 presents the relevant ambient air quality standards for the Sanhecun HSP surrounding area, while **Table 5** presents ambient noise standards. **Table 6** presents groundwater standards.

29. **Table 7** presents the relevant wastewater emission standard.

30. Because production wastewater in the Sanhecun HSP is collected and recycled and domestic wastewater is discharged to municipal sewer, the Sanhecun HSP does not discharge any wastewater to surface water body. No surface water standard is applicable.

Table 3: Summary of Environmental Pollution Standards Applicable to the Sanhecun HSP.

Pollutant	Limit	Standards Source
Stack Emissions for CFB boilers		
SO_2	200 mg/m^3	Table 1 in *Emission Standards of Air Pollutants from Thermal Power Plant* (GB 13223-2011).
NOx	200 mg/m^3	
PM	30 mg/m^3	
Stack Emissions for chain grate boilers		
SO_2	400 mg/m^3	Table 1 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).
NOx	400 mg/m^3	
PM	80 mg/m^3	
Stack Emissions for gas boilers		
SO_2	50 mg/m^3	Table 2 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).
NOx	200 mg/m^3	
PM	20 mg/m^3	
Other		
Fugitive PM	1.0 mg/m^3 at site boundary	Table 2 of *Integrated Emission Standard of Air Pollutants* (GB 16297-1996)
Daytime Noise (06:00-22:00 h)	60 dB(A) at site boundary	Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008)
Nighttime noise (22:00-06:00 h)	50 dB(A) (at site boundary)	

Table 4: Applicable ambient air quality standards – Class II, Ambient Air Quality Standards (GB 3095—2012) (unit: mg/m^3)

Pollutants	Annual mean(class 2)	24-hr mean(class 2)	1-hr mean(class 2)
TSP	0.200	0.300	--
PM_{10}	0.070	0.150	--
$PM_{2.5}$	0.035	0.075	--
SO_2	0.060	0.150	0.500
NO_2	0.040	0.080	0.200

Table 5: Applicable ambient environment noise standard – Class II, Environmental Quality Standards for Noise (GB3096-2008)

Item	Class II	Class III
Daytime Noise (06:00-22:00 h)	60 dB(A)	65 dB(A)
Nighttime noise (22:00-06:00 h)	50 dB(A)	55 dB(A)

Table 6: Applicable groundwater standard (Class III, *GB/T14848-93 Quality Standard for Ground Water*)

No	Item	Unit	Limit
1	pH	-	6.5-8.5
2	Total hardness ($CaCO_3$)	mg/L	≤450
3	Fluoride	mg/L	≤1.0
4	Chloride	mg/L	≤250
5	Ammonia nitrogen	mg/L	≤0.2
6	Nitrate	mg/L	≤20
7	Nitrite	mg/L	≤0.02
8	Volatile phenols	mg/L	≤0.002
9	Total dissolved solids	mg/L	≤1000
10	Permanganate index	mg/L	≤3.0
11	Total coliforms	/L	≤3.0

Table 7: PRC *Wastewater quality standards for discharge to municipal sewers* (Class A, CJ 343-2010)

No	Pollutant	Maximum acceptable concentration (MAC) mg/L (except pH and chromaticity)
		Class A
1	pH	6.5-9.5
2	SS	400
3	COD	500
4	Ammonia nitrogen	45
5	Petroleum	20
6	Chromaticity	50
7	BOD	350
8	Total phosphorus	8
9	Total nitrogen	70
10	Total iron	5

b. Stack Emissions Monitoring and Results

31. It is confirmed that the Sanhecun HSP has fully complied with relevant standards on stack emissions. The followings are the approved exhaust gas monitoring results between October23, 2015 and January 15, 2016, which shows their full compliance.

Table 8: Stack emission monitoring result (from October23, 2015 to January 15, 2016) unit: mg/m^3

Date	Pollutants	Concentration	Limit
October 20, 2015	SO_2	38.7	400
	NOx	291.1	400
October 27, 2015	SO_2	24.3	400
	NOx	257.0	400
	PM	35.7	80
November 7, 2015	SO_2	100.7	400
	NOx	305.2	400
November 27, 2015	SO_2	120.7	400
	NOx	248.9	400
	PM	52.3	80
December 4, 2015	SO_2	73.0	400
	NOx	270.9	400
December 8, 2015	SO_2	203.3	400
	NOx	377.7	400
December 15, 2015	SO_2	55.7	400
	NOx	266.1	400
December 30, 2015	SO_2	219	400
	NOx	328	400
January 7, 2016	SO_2	203.7	400
	NOx	301.1	400
	PM	48.9	80

Source: Sanhecun HSP.

32. Responding to new environmental requirements in the PRC, the Sanhecun HSP is now equipped with a continuous emission monitoring system (CEMS) that monitors in real time SO_2, NOx, PM, and air flow. Data are sent electronically to the Hohhot Environmental Protection Bureau (EPB) Center. As this CEMS is only installed in July 2015, officially accepted environmental data were not available at the time of due diligence. One 3rd party company is hired on a weekly basis for CEMS calibration. After the environmental acceptance is finished, the 3rd company will come to Sanhecun HSP on a quarterly basis for CEMS calibration. Besides, manual stack emissions monitoring are also undertaken on a quarterly basis by Hohhot EPB for calibration.

33. In this new CEMS, non-compliance can be immediately detected and close supervision from the local EPB is established between the plant and local authorities, which can ensure mitigation measures to be seriously and timely applied to lower the environmental impact to the largest extent.

Figure 9:CEMS control room(in red box), Sanhecun HSP

Source: Consultant.

c. Noise Monitoring and Results

34. Noise monitoring is undertaken at the site boundary on a quarterly basis. Based on quarterly noise monitoring, it is confirmed that the Sanhecun HSP is in compliance with the relevant standard, Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008). The following presents noise monitoring report on November 20, 2015, which shows their full compliance.

Table 9: site boundary monitoring result unit: dB(A)

Date	Site boundary	Daytime	Limit	Nighttime	Limit
2015.11.20	East	57.1	60	46.2	50
	South	56.4		46.9	
	West	58.8		47.1	
	North	57.5		46.3	

Source: Sanhecun HSP.

E. Conclusion

35. Based on this environmental due diligence assessment, the Sanhecun HSP has an adequate environmental, health and safety management system and obtained all the necessary approvals for the plant operation. Proper environmental mitigation measures and control devices are up to date to keep pace with more stringent emission standards and the plant meets all the

necessary environmental standards. Till now, no public complaint has been received. It is concluded that the Sanhecun HSP is well managed and performs good environmental, health and safety performance.

Annexes

Annex 1: EIA Approval of Sanhecun HSP Phase I project by IMAR EPB (May 17, 1995).

Annex 2: EIA Approval of Sanhecun HSP Phase II project by IMAR EPB (January 6, 2006).

Annex 3: EIA Approval of Sanhecun HSP Phase III project by IMAR EPB (July 13, 2011).

Annex 4: Stack Emission Monitoring Report (from October 23, 2015 to January 15, 2016).

Annex 5: Site Boundary Noise Monitoring Report (November 20, 2015).

Annex 1: EIA Approval of Sanhecun HSP Phase I project by IMAR EPB (May 17, 1995).

备考

内蒙古自治区环境保护局文件

内环字[1995]86号　　签发：吴国忠

关于《呼和浩特供热二期工程环境影响报告书》的批复

呼和浩特市热力公司：

你公司上报的《呼和浩特供热二期工程环境影响报告书》（简称《报告书》）收悉，经组织有关单位和技术人员审查，现批复如下：

一、《报告书》编制规范，符合国内建设项目环境影响评价和国际金融组织对建设项目环境影响评价的要求；《报告书》内容全面、重点突出、所采用的评价技术方案正确，评价结论可信，提出的污染防治对策建议可行，完成了"环评大纲"的工作内容和工作深度，可以做为本工程建设环境保护工作的依据。

二、呼和浩特市区大气煤烟型污染比较严重，本项目的建设，将淘汰大量的小型、落后分散的锅炉，从而大大减少了污染源和大气污染物排放量，使得呼市的大气环境质量和噪声、固废物排放情况及污染程度得到较大改善，大气质量、城市市容都有不同程度的提高，也使资源得到了有效的利用，具有明显的社会效益、环境效益和经济效益，同意本工程的建设。

三、锅炉要采用除尘效率不低于96%的高效文丘

用水膜除尘器。大气污染物排放不得超过《锅炉大气污染物排放标准》（GB13271－91）二类区标准。

四、冲灰水和锅炉排污水要全部循环利用，不得外排。

五、各噪声源要采取有效的消噪声措施，防止噪声污染。

六、粉煤灰和炉渣要积极进行综合利用或妥善储AL，防止造成二次污染。

七、要加强施工期的环境保护管理，以防止对周围环境造成影响。

八、污染防治设施必须要与主体工程同时设计、同时施工、同时投入运行；污染防治设施经我局验收后，该项工程方可投入运行。

一九九二年五月七日

主题词：工程　环境影响　报告书　批复

抄送：自治区计委、自治区日元贷款领导小组、呼市计委、呼市日元贷款领导小组、呼市环保局、呼市城建局、自治区环科所。

校对：杜俊峰　　印四份

Annex 2: EIA Approval of Sanhecun HSP Phase II project by IMAR EPB (January 6, 2006).

2

内蒙古自治区环境保护局

内环字〔2006〕1号

内蒙古自治区环境保护局 关于内蒙古呼和浩特市大气环境保护工程（一期）—呼和浩特市东区集中供热工程环境影响报告书的批复

呼和浩特市城发公司：

你公司报来的《内蒙古呼和浩特市大气环境保护工程（一期）—呼和浩特市东区集中供热工程环境影响报告书》（以下简称“报告书”）收悉，经研究，批复如下：

一、该项目的建设内容有热源、热水管网、热力站等。

热源包括在呼和浩特市东南热源厂扩建一座5×58MW锅炉房；在东北热源厂现有锅炉房内扩建一台29MW循环流化床热水锅炉和新建一座锅炉房，安装4×64MW链条炉；新建金桥热源厂2×20t/h蒸汽锅炉和4×64MW链条炉。

热网包括东南热源厂新建25.4km一级热水管网，东北热源厂新建17.9km一级热水管网，金桥热源厂新建1.85km蒸汽管网和17.37km一级热水管网。

新建热力站为：东南热源厂39座，东北热源厂37座，金桥热源厂31座。

工程总投资9.9994×10^8元，其中环保投资7451.4×10^4元，占

—1—

总投资的7.45%。

项目投产后，可实现热源替代。大幅度削减烟尘、二氧化硫排放量。经济效益、社会效益、环境效益明显。符合国家产业政策和环境保护的要求，同意项目建设。

二、项目建设应做好以下工作

1、制定煤质鉴别及管理制度，做好燃煤选配工作，保证供应渠道和有效监控，落实“报告书”对燃煤含硫量和灰份的要求。要通过规范工艺操作，保证污染物达标排放。项目建在二氧化硫控制区，二氧化硫排放量要严格控制在呼和浩特市环境保护局下达的控制指标之内。

2、结合机组和环境特点，合理安排厂区总平面布置。采用消音降噪措施，确保厂界噪声达标。

3、充分优化排水方案，加强节水措施，提高水的循环利用率。需排入城市下水管网的污水，所排水质必须达到《污水排入城市下水道水质标准》（GJ3082-1999），处理后的污泥必须保证按资源化的要求进行管理，防止二次污染。

4、贮煤场为全封闭贮场。共用煤场要制定切实可行的扬尘防治措施。

5、粉煤灰综合利用项目必须与热源厂同时建设。粉煤灰综合利用要有可靠的保证，厂区内设的临时贮灰场，要进行全封闭管理。

6、运煤、运灰要固定专用路线，车辆要采取覆盖措施，防止扬尘对道路及周边环境的污染。

7、排污口做到规范化管理，水、气需安装在线监测系统，为投产后的环境保护管理提供科学依据。

三、工程建设中要确保环保资金的投入和使用，保证环境保

护工程和设施的质量；该项目的污染防治设施和环境保护工程必须要与主体工程同时设计、同时施工、同时投入运行。

四、项目竣工后，建设单位按规定程序应向我局提出试生产申请并进行环境保护验收，验收合格后，项目方可正式运行。

五、请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。

二〇〇六年一月六日

主题词：环保　建设项目　报告书　批复

抄送：自治区发展和改革委员会，呼和浩特市环境保护局。

内蒙古自治区环境保护局办公室　　2006年1月6日印发

打字：刘广宇　　校对：周云强　　共印9份

Annex 3: EIA Approval of Sanhecun HSP Phase III project by IMAR EPB (July 13, 2011).

内蒙古自治区环境保护厅文件

内环审〔2011〕199号

内蒙古自治区环境保护厅关于呼和浩特市城发桥靠（6×70MW）、三合村（5×70MW）区域集中供热工程—桥靠热源厂供热区域环境影响报告书的批复

呼和浩特市城发投资经营有限责任公司：

你公司报送的由中冶东方工程技术有限公司编制的《呼和浩特市城发桥靠（6×70MW）、三合村（5×70MW）区域集中供热工程一桥靠热源厂供热区域环境影响报告书》（以下简称《报告书》）和呼和浩特市环保局对该项目的初审意见（呼环政函字〔2011〕112号）收悉。经研究，批复如下：

一、该项目位于呼和浩特市赛罕区新建东街，在桥靠热源厂（东南热源厂）区内现有的两座锅炉房东侧，扩建一座内设6台DXL70-1.6/130/70-AⅡ型热水锅炉的锅炉房，厂区总占地面积101402m²，其中本项目占地12659m²，新增供热能力789万m²，同时配套建设20.35km一级热水管网和33座热力站。项目总投资56639.34万元，其中环保投资约9098.8万元，占工程总投资的16.06%。

本项目建设符合国家产业政策和城市供热规划，呼和浩特

市发改委同意项目开展前期工作（呼发改投资〔2011〕204号），本扩建项目 SO_2 排放量259.22t/a，NO_x 排放量为805.56t/a，在供热区域内替代66台小锅炉，替代 SO_2 排放量1661.78吨。在全面落实《报告书》提出的各项生态保护和环境污染防治措施及投资预算前提下，环境不利影响能够得到一定的缓解和控制。因此，我厅同意你公司按照《报告书》中所列的建设项目性质、规模、地点、环境保护措施进行项目建设。

二、项目建设和运行管理中应重点做好以下工作：

（一）认真落实项目"以新代老"措施。将现有脱硫工艺改造为炉内喷钙工艺，控制钙硫比达到2.0，脱硫效率≥80%；将现有露天储煤场改建为封闭式干煤棚；将现锅炉软化水系统排污水、净环水排污水作为扩建及以新带老配套的脱硫系统的补充水；对热源厂内现有锅炉房、泵房、风机房等外墙上包裹隔声材料，将锅炉房东、西、北侧的窗户封闭，对确需进行采光和通风的部位，采用通风隔声窗。

（二）严格实施大气污染防治措施。锅炉烟气采用布袋除尘及石灰石—石膏湿法烟气脱硫，预留脱除 NO_x 装置的位置，烟气经120m高烟囱（安装CEMS）排放，除尘效率≥99%，脱硫效率≥90%，烟尘排放浓度小于18mg/m³，SO_2 排放浓度为97.71mg/m³，必须符合《锅炉大气污染物排放标准》（GB13271-2001）二类区Ⅱ时段标准的要求。煤场全部为封闭式干煤棚，受煤斗、地下通道、转运站、碎煤机室及煤仓间安置布袋除尘器，渣仓采用全封闭结构，石灰石筒仓顶部采用仓顶布袋除尘器，粉尘排放浓度和排放速率符合《大气污染物综合排放标准》（GB19297—1996）二级标准要求。

（三）加强水污染防治措施建设和管理。将软水制备系统再生废液及脱硫系统废水补充至冲渣水系统使用；软水制备系统废水中反洗、正洗废水及锅炉排污水、设备冷却水作为脱硫系统补水和冲渣废水，不外排；转运站、碎煤机室和输煤栈桥

冲洗水、重型框链除渣机水槽中的废水经沉淀后重复使用。脱硫系统设脱硫废水处理站，采用 pH 调节、反应、凝聚和澄清工艺，处理规模为 $10m^3/h$，废水处理后的水质必须符合《污水综合排放标准》（GB8978-1996）一级标准。生产废水全部闭路循环使用，不外排。

食堂废水经隔油后和生活污水全部进入化粪池处理达到《污水综合排放标准》（GB8978-1996）三级标准后，经过市政管网排放至辛辛板污水处理厂处理。

（四）锅炉渣经湿法冲渣后，由板链除渣机送入渣仓，再经自卸车外运；锅炉除尘器出灰口处设电动三通，出灰通过带伸缩装置的汽车散装机，与封闭罐车配套使用，外运综合利用；输煤、破碎系统除尘产生的煤尘及其冲洗系统的沉淀煤尘，送入锅炉作为燃料；脱硫系统筒仓和输送系统石灰石粉尘，直接送入石灰石制浆系统作为原料；脱硫石膏暂存在储仓内，采用封闭车辆外运。

（五）选用低噪声设备，合理选择各换热站厂址与布局，采取相应的减振、隔声和消声等措施，确保热源厂和换热站厂界噪声满足相应功能区标准要求。

（六）认真落实环境风险应急预案。特别是防止柴油罐发生柴油燃烧爆炸风险事故。配套建设烟气自动连续监测装置，并与地方环保部门联网。

（七）开展环境监理工作，在施工招标文件、施工合同和工程监理招标文件中明确环保条款和责任，定期向我厅提交环境监理报告，并将环境监理报告作为项目竣工环保验收的依据之一。

三、本期工程的污染防治措施必须与主体工程同时设计、同时施工、同时投入使用。本期工程竣工后，你公司必须按规定程序向我厅申请试运行和竣工环境保护验收，验收合格后方可正式投入生产。

四、我厅委托呼和浩特市环境保护局和赛罕区环境保护局对该项目施工期间的环境保护措施落实情况进行监督检查。

二〇一一年七月十三日

主题词： 环保　建设项目　环评　报告书　批复

抄送：自治区发展和改革委员会，呼和浩特市环境保护局，赛罕区环境保护局，自治区环境监察总队，自治区环境工程评估中心，中冶东方工程技术有限公司。

内蒙古自治区环境保护厅办公室　　2011年7月14日印发

共印13份

Annex 4: Stack Emission Monitoring Report (from October 23, 2015 to January 15, 2016).

表 1-2　　　有组织废气排放浓度监测结果表　　监测日期：2015.10.20

设施	点位	项目	单位	监测结果				执行标准限值	达标情况
				1	2	3	平均值		
	出口◎4	标干流量	m^3/h	758191	763408	765915	762505	-	
		SO_2排放浓度	mg/m^3	38.0	43.0	36.0	38.7	400	达标
		SO_2排放速率	kg/h	15.16	17.56	14.55	15.76	-	达标
		NO_x排放浓度	mg/m^3	298.5	292.6	283.8	291.1	400	-
		NO_x排放速率	kg/h	120.51	118.96	115.77	118.41	-	-
执行标准	《锅炉大气污染物排放标准》（GB13271-2014）								
备注	排气筒高 120m								

表 1-2　　　有组织废气排放浓度监测结果表　　监测日期：2015.10.20

设施	点位	项目	单位	监测结果				执行标准限值	达标情况
				1	2	3	平均值		
	出口◎4	标干流量	m^3/h	758191	763408	765915	762505		
		SO_2排放浓度	mg/m^3	38.0	43.0	36.0	38.7	400	达标
		SO_2排放速率	kg/h	15.16	17.56	14.55	15.76	-	达标
		NO_x排放浓度	mg/m^3	298.5	292.6	283.8	291.1	400	-
		NO_x排放速率	kg/h	120.51	118.96	115.77	118.41	-	-
执行标准	《锅炉大气污染物排放标准》（GB13271-2014）								
备注	排气筒高 120m								

表 1-2　　锅炉废气检测结果　　监测日期：2015. 10. 27

设施	点位	项目	单位	监测结果				执行标准限值	达标情况
				1	2	3	平均值		
锅炉	烟囱排放口（西）	标干流量	m^3/h	684818	762451	760395	735888	-	-
		颗粒物排放浓度	mg/m^3	21.6	33.8	51.8	35.7	80	达标
		颗粒物排放速率	kg/h	7.60	13.72	20.99	14.10	-	-
		SO_2 排放浓度	mg/m^3	21.0	24.0	28.0	24.3	400	达标
		SO_2 排放速率	kg/h	7.53	9.91	11.41	9.62	-	-
		NO_x 排放浓度	mg/m^3	270.4	245.8	245.8	257.0	400	达标
		NO_x 排放速率	kg/h	94.97	99.80	99.53	98.10	-	-
执行标准	《锅炉大气污染物排放标准》（GB13271-2014）								
备注	排气筒高 120m								

表 1-3　　锅炉废气检测结果　　监测日期：2015. 10. 27

设施	检测点位	检测日期	检测项目	单位	检测结果				
					1	2	3	平均值	标准值
锅炉	烟囱排放口（西）	2015-10-27	标干流量	Nm^3/h	758191	763408	765915	762505	—
			汞及其化合物排放浓度	mg/m^3	0.2×10^{-5}	7.8×10^{-5}	7.1×10^{-5}	5.0×10^{-5}	0.05
			汞及其化合物排放速率	kg/h	1.52×10^{-6}	5.95×10^{-5}	5.44×10^{-5}	3.81×10^{-5}	—
			林格曼黑度	级	<1				1
备注	1、《锅炉大气污染物排放标准》（GB13271-2014）； 2、锅炉运行工况达到 80%。								

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m^3）	结果评价
			1	2	3	平均值		
烟囱竖直烟道断面 30m 处（排放口西）	2015.11.07	标干烟气量（Ndm^3/h）	590257	602342	626558	606386	—	—
		SO_2 排放浓度（mg/m^3）	110.0	111.0	111.0	110.7	400	达标
		SO_2 排放速率（kg/h）	34.83	37.35	37.59	36.59	—	—
		NO_X 排放浓度（mg/m^3）	295.2	302.2	318.3	305.2	400	达标
		NO_X 排放排放速率（mg/m^3）	93.82	101.95	107.39	101.05	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　型号不明 除尘器为：布袋除尘器　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（颗粒物、二氧化硫、氮氧化物）	监测结果				标准限值（mg/m³）	结果评价
			1	2	3	平均值		
竖直烟囱断面 30m 处（排放口西）	2015.11.27	标干烟气量（Ndm³/h）	423770	421604	409633	418335.6	—	—
		颗粒物排放浓度（mg/m³）	43.7	53.9	59.7	52.3	80	达标
		颗粒物排放速率（kg/h）	13.90	16.40	17.60	16.00	—	—
		SO_2 排放浓度（mg/m³）	123.0	122.0	117.0	120.7	400	达标
		SO_2 排放速率（kg/h）	39.20	37.10	34.40	36.90	—	—
		NO_X 排放浓度（mg/m³）	259.0	258	229	248.9	400	达标
		NO_X 排放排放速率（mg/m³）	82.40	78.20	67.70	76.10	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　　　型号不明 除尘器为：布袋除尘器　　　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m³）	结果评价
			1	2	3	平均值		
烟囱竖直烟道断面 30m 处（排放口西）	2015.12.04	标干烟气量（Ndm³/h）	548672	543840	527846	552182	—	—
		SO_2 排放浓度（mg/m³）	76.0	70.0	73.0	73.0	400	达标
		SO_2 排放速率（kg/h）	29.08	26.65	26.92	27.55	—	—
		NO_X 排放浓度（mg/m³）	278.3	262.7	271.6	270.9	400	达标
		NO_X 排放排放速率（mg/m³）	106.87	100.00	100.35	102.41	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　　　型号不明 除尘器为：布袋除尘器　　　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m^3）	结果评价
			1	2	3	平均值		
烟囱竖直烟道断面 30m 处（排放口西）	2015.12.08	标干烟气量（Ndm^3/h）	512289	510016	549476	523927	—	—
		SO_2 排放浓度（mg/m^3）	208.0	188.0	214.0	203.3	400	达标
		SO_2 排放速率（kg/h）	87.09	78.43	96.16	87.23	—	—
		NO_X 排放浓度（mg/m^3）	375.2	379.0	379.0	377.7	400	达标
		NO_X 排放排放速率（mg/m^3）	157.26	158.15	170.39	161.93	—	—
备注	锅炉大气污染物排放标准　《GB13271-2014》 脱硫塔名称为：湿法脱硫　　　　　　型号不明 除尘器为：布袋除尘器　　　　　LQM/KE4100 烟囱高度 120 米　　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m^3）	结果评价
			1	2	3	平均值		
烟囱竖直烟道断面 30m 处（排放口西）	2015.12.15	标干烟气量（Ndm^3/h）	547797	527095	550912	541935	—	—
		SO_2 排放浓度（mg/m^3）	57.0	56.0	54.0	55.7	400	达标
		SO_2 排放速率（kg/h）	29.34	26.35	28.10	27.93	—	—
		NO_X 排放浓度（mg/m^3）	268.4	270.1	259.9	266.1	400	达标
		NO_X 排放排放速率（mg/m^3）	139.30	128.13	135.64	134.36	—	—
备注	锅炉大气污染物排放标准　《GB13271-2014》 脱硫塔名称为：湿法脱硫　　　　　　型号不明 除尘器为：布袋除尘器　　　　　LQM/KE4100 烟囱高度 120 米　　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m³）	结果评价
			1	2	3	平均值		
竖直烟囱断面 30m 处（排放口西）	2015.12.30	标干烟气量（Ndm^3/h）	582039	592590	594531	589720	—	—
		SO_2 排放浓度（mg/m^3）	184	197	276	219	400	达标
		SO_2 排放速率（kg/h）	93	103.1	150.3	115.5	—	—
		NO_X 排放浓度（mg/m^3）	332	327	325	328	400	达标
		NO_X 排放排放速率（mg/m^3）	168.1	170.7	177.0	171.9	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　型号不明 除尘器为：布袋除尘器　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

5

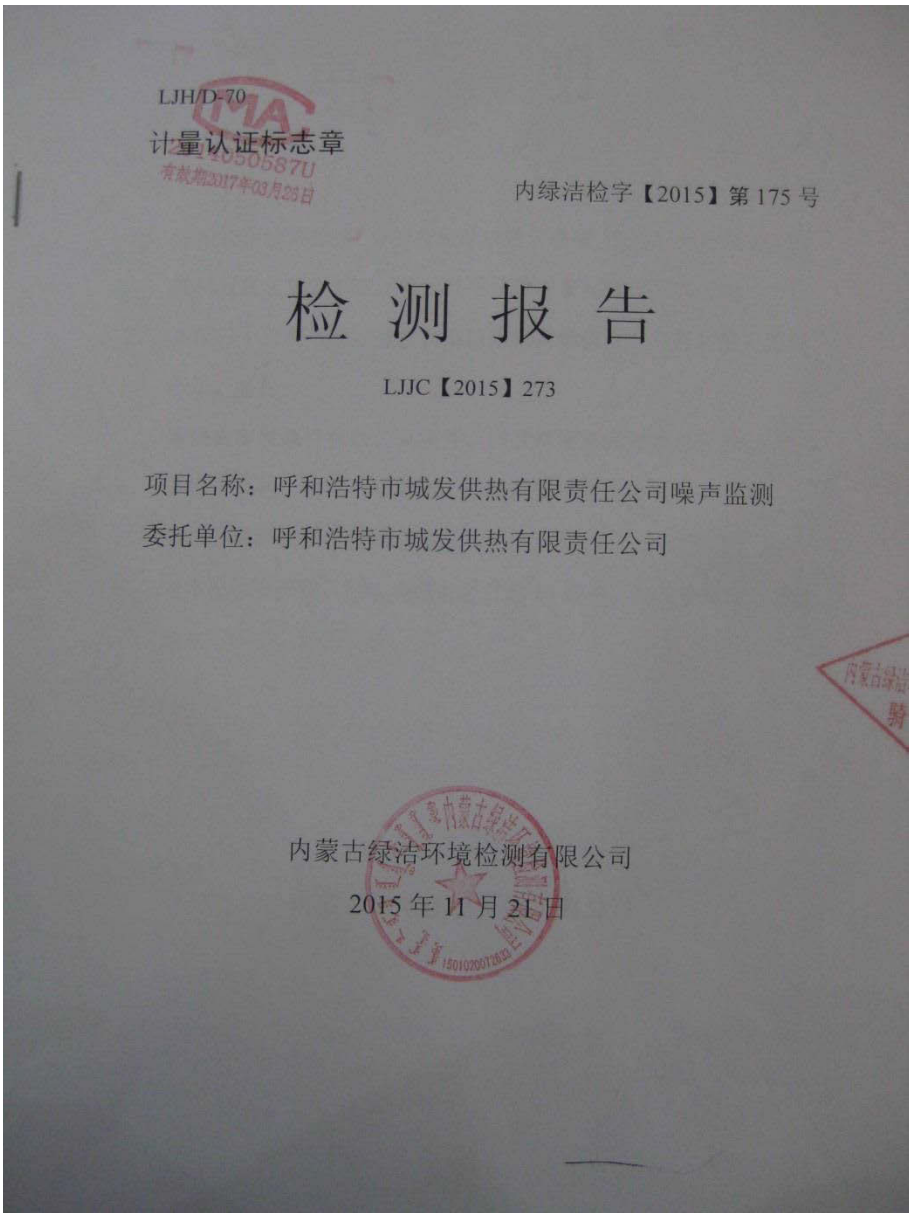
表 2　监测结果统计

监测点位	监测日期	监测项目（颗粒物、二氧化硫、氮氧化物）	监测结果				标准限值（mg/m³）	结果评价
			1	2	3	平均值		
竖直烟囱断面 30m 处（排放口西）	2016.01.06	标干烟气量（Ndm^3/h）	866929	850307	849173	855470	—	—
		颗粒物排放浓度（mg/m^3）	45.6	53.3	47.8	48.9	80	达标
		颗粒物排放速率（kg/h）	35.54	28.15	36.51	33.40	—	—
		SO_2 排放浓度（mg/m^3）	187.0	265.0	159.0	203.7	400	达标
		SO_2 排放速率（kg/h）	144.26	137.55	124.43	135.41	—	—
		NO_X 排放浓度（mg/m^3）	305.7	307.4	290.1	301.1	400	达标
		NO_X 排放排放速率（mg/m^3）	235.73	159.76	226.57	207.35	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　型号不明 除尘器为：布袋除尘器　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

表 2　监测结果统计

监测点位	监测日期	监测项目（二氧化硫、氮氧化物）	监测结果				标准限值（mg/m^3）	结果评价
			1	2	3	平均值		
竖直烟囱断面 30m 处（排放口西）	2016.01.14	标干烟气量（Ndm^3/h）	666199	697946	674770	679638	—	—
		SO_2 排放浓度（mg/m^3）	86.0	85.0	81.0	84.0	400	达标
		SO_2 排放速率（kg/h）	44.64	48.16	42.51	45.10	—	—
		NO_X 排放浓度（mg/m^3）	229.6	220.9	233.7	228.1	400	达标
		NO_X 排放排放速率（mg/m^3）	119.38	126.16	123.02	122.85	—	—
备注	锅炉大气污染物排放标准 《GB13271-2014》 脱硫塔名称为：湿法脱硫　　型号不明 除尘器为：布袋除尘器　　LQM/KE4100 烟囱高度 120 米　锅炉额定蒸发量为：100 吨							

Annex 5: Site Boundary Noise Monitoring Report (November20, 2015).



LJH/D-70

计量认证标志章

内绿洁检字【2015】第 175 号

检 测 报 告

LJJC【2015】273

项目名称：呼和浩特市城发供热有限责任公司噪声监测

委托单位：呼和浩特市城发供热有限责任公司

内蒙古绿洁环境检测有限公司

2015 年 11 月 21 日

1.采样仪器及分析方法

采样仪器及分析方法严格按照《声环境质量标准》(GB 3096—2008)。见表 1

表 1 项目采样仪器及分析方法一览表

监测项目	采样仪器	分析方法标准号或来源	方法检出限
厂界噪声	AWA6228 多功能声级计	GB 3096—2008	—

2.监测结果

监测结果详见表 2

表 2 **监测结果统计** 单位：dB

点位编号	监测点位	监测时间	昼间	夜间
ZS-001	厂界东	2015.11.20	57.1	46.2
ZS-002	厂界南		56.4	46.9
ZS-003	厂界西		58.8	47.1
ZS-004	厂界北		57.5	46.3
备注：《工业企业厂界环境噪声排放标准》(GB12348-2008) 2 类区标准，标准值为昼间 60、夜间 50。				

II. ENVIRONMENTAL DUE DILIGENCE - QIAOKAO HEAT SOURCE PLANT

A. Introduction

1. In accordance with the ADB Safeguard Policy Statement (SPS) (2009), environmental due diligence assessment of the Qiaokao Heat Source Plant (HSP) has been conducted as part of the proposed scope change during the implementation of Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region(IMAR).

2. According the proposed scope change, Xinjiaying heating zone will get heat from the existing Qiaokao HSP, which is owned and operated by the Hohhot Chengfa Heating Company-the project implementation agency. At the Qiaokao HSP, a total of 210 MW surplus heat exists, which will be supplied to the Xinjiaying heating zone by connecting two hIeating pipe networks.

B. Environmental Due Diligence Review Approach

3. This report is based on a site visit, consultations with the Qiaokao HSP managers and technical staff, and a review of plant environmental and technical documentations, including Continuous Emissions Monitoring Systems (CEMS) monitoring report. The site visit was undertaken January26th2016, with the following participants:

Environmental Due Diligence Reviewers:
Dai Lei, National Environmental Safeguards Consultant

Hohhot Chengfa Heating Company:
Mr. Zhang Feifei, Deputy Manager of Xingjiaying HSP
Mr. Chen Long Deputy Manager of Qiaokao HSP
Mr. Ji Ping, Environment Engineer of Production Department of Qiaokao HSP

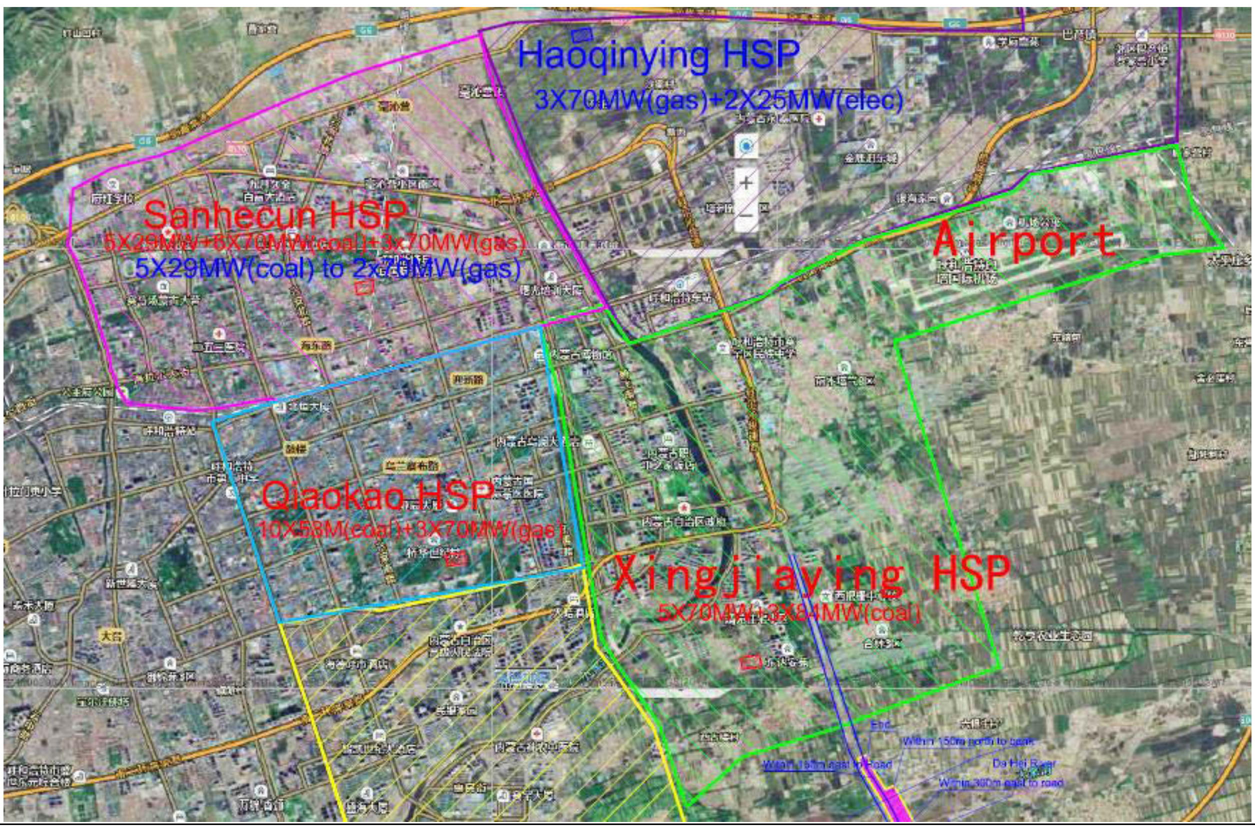
4. Documentation reviewed during and after the facility visit included:
- EIA Approval of Qiaokao HSP Phase I project by IMAR Environmental Protection Bureau (EPB) (May 17, 1995);
- EIA Approval of Qiaokao HSP Phase II project by IMAR EPB (January 6, 2006);
- EIA Approval of Qiaokao HSP Phase III project by IMAR EPB (July 13, 2011);
- No 1 Stack continuous emission monitoring system (CEMS) Monitoring Report (from January 3, 2016 to January 5, 2016);
- No 2 Stack CEMS Monitoring Report (from January 3, 2016 to January 5, 2016).

C. Project Description

1. Location

5. The Qiaokao heating zone is located south of Sanhecun heating zone and west of Xingjiaying heating zone. The Qiaokao HSP is located in northeast urban area in Hohhot City, which is currently providing heat to Qiaokao heating network with the coverage of 11.0 million m^2 (**Figure 1**). The Qiaokao HSP site is 101412 m^2 and is at south of East Xinjian Street, west of West Zhanlan Road and east of South Dongying Street.

Figure 1: Qiaokao HSP, Qiaokao heating zone, Xingjiaying heating zone



Source: HCHC.

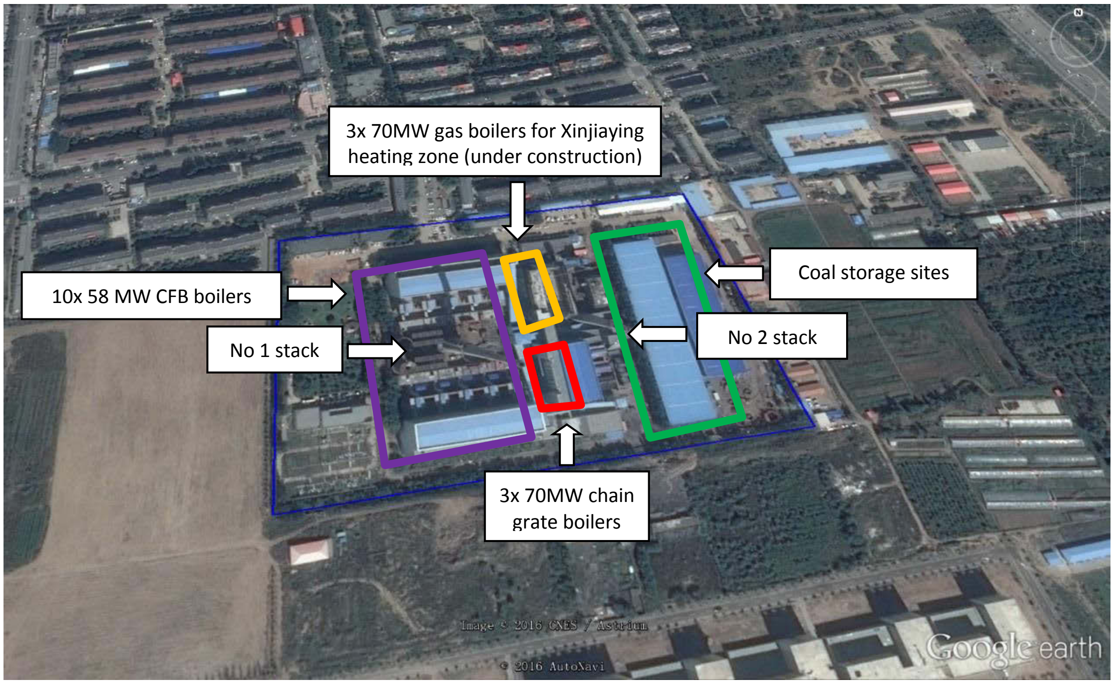
Figure 2: Qiaokao HSP and surrounding area

Source: Google Earth, 2016 and Consultant.

Figure 3: Qiaokao HSP Looking from the north

Source: Consultant.

Figure 4: Qiaokao HSP layout



Source: Google Earth 2016 and Qiaokao HSP

2. Purpose and Capacity

6. Phase I project at Qiaokao HSP was to install five 58 MW circulating fluidized bed (CFB) boilers in 2002 (three 58 MW CFB boilers were in 2001 and two 58 MW CFB boilers were in 2002). As Phase II project, five 58 MW (CFB) boilers were installed in 2008 (three 58 MW CFB boilers were in 2006 and two 58 MW CFB boilers were in 2008). Under KfW[1] finance, Phase III project was to install three 70 MW chain grate boilers and three 70 MW gas boilers. Two 70MW chain grate boilers were installed in 2012. One 70MW chain grate boilers was installed in 2015. At the time of due diligence, three 70 MW gas boilers were still under construction.

[1] The KfW is a German government-owned development bank.

Figure 5: Construction site of 3x70 MW gas boilers (January, 2016)

Source: Consultant.

7. A total heating supply capacity of Qiaokao HSP is 1,000 MW and can provide heat to 18.98 million m^2. Actual heat supply area of Qiaokao HSP is 11.4 million m^2, which means Qiaokao has 400 MW surplus heat capacity. By connecting heating networks between Qiaokao and Xinjiaying heating networks, the surplus heat from Qiaokao HSP will be supplied to Xinjiaying heating network, consequently the number of boilers at Xinjiaying HSP can be reduced.

3. Fuel

8. At the Qiaokao HSP, coal with low sulfur content (<0.7%) is used, which is primarily coming from Jungar Banner, Erdos city, Inner Mongolia. Coal is transported by truck with a proper seal. Coal is unloaded and stored onsite. During 2014-2015 heating season, about 330,000 tons coal is used. Coal analysis data are well kept. **Table 1** presents data sample from December 21, 2015 to December 27, 2015.

Table 1: Coal analysis data

Date	Total moisture (%)	Moisture (air dried basis) (%)	Ash (air dried basis) (%)	Volatile (air dried basis) (%)	Total sulfur(air dried basis) (%)	Fixed carbon (air dried basis) (%)	Lower net calorific value (as received basis) (MJ/kg)
2015.12.21	16.40	5.70	16.43	28.0	0.33	44.18	20.67
2015.12.22	15.4	4.52	14.84	28.48	0.31	46.22	25.554
2015.12.23	15.1	3.93	14.47	29.74	0.40	45.83	25.978
2015.12.24	15.4	4.40	12.58	28.90	0.28	47.89	26.468
2015.12.25	16.4	4.38	11.58	30.18	0.32	47.09	26.792
2015.12.26	15.0	3.60	14.18	29.67	0.42	46.34	26.24
2015.12.27	14.2	4.00	17.20	27.21	0.34	46.11	25.092

Source: Qiaokao HSP.

4. Water Supply and Wastewater

9. Domestic water and production water are supplied from municipal water system. The plant has around 394 staff and daily domestic water consumption is 59.1 m^3/d[2]. Production water for boilers is treated using iron exchange resin filtering.

10. Wastewater from the Qiaokao HSP canteen is first filtered by oil-separation system and then, is discharged to septic tank, where domestic wastewater is also collected. Then all domestic wastewater is discharged to the municipal sewer system and treated at the adjacent municipal wastewater treatment plant.

11. All production wastewater is recycled and reused. Detailed information is listed below:

- Industrial salt is used for regeneration of iron exchange resin. The eluate from soft water preparation for boilers are reused in coal wash system;
- Wash and back wash water from soft water preparation system; discharged wastewater from boilers and equipment cooling water are reused as make-up water for flue gas desulfurization (FGD) system;
- Wastewater is circulated in coal wash system by sediment and clarification;
- Wastewater from FGD system is treated in the wastewater pre-treatment facility at the plant, and after neutralization flocculation and sediment, the wastewater is recycled.

12. To protect groundwater and meet the anti-seepage standard, different anti-seepage measures are undertaken according to locations and relevant anti-seepage requirements.

[2] Daily domestic water consumption for one person is 0.15 m^3/d

5. Solid Wastes

13. The Qiaokao HSP produces approximately 54,400 t/year of fly ash, 15,600 t/year of coal slag, and 4500 t/year of FGD gypsum slag. All coal combustion waste products are sold to an offsite construction company for recycling in the production of bricks and other construction materials. The construction company is a sub company of Hohhot Chengfa Heating Company.

14. Domestic waste is collected, transported and treated by sanitation department of Saihan District. Treatment of hazardous waste treatment is properly managed by the contracted companies with proper licenses.

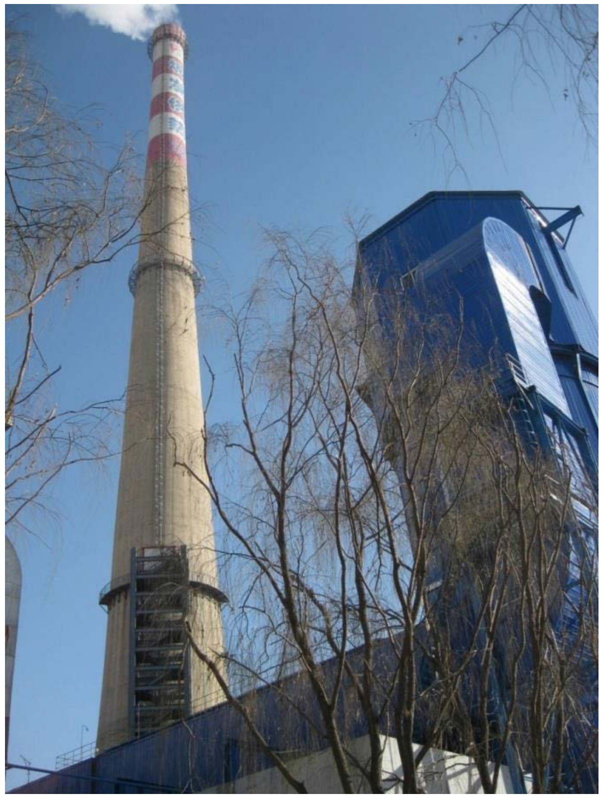
6. Noise

15. Noise sources during operation will mainly be from boiler rooms, fans, and desulfurization equipment, including transformers, pumps, and cooling equipment. While using low-noise equipment as far as possible, the plant layout and facilities are designed to mitigate noise impacts during operation using shock absorption, insulated enclosures and sound dampening materials. These measures can typically reduce noise intensity. All plant and equipment, including vehicles are properly maintained in order to minimize noise. Also, the workers who are likely to be exposed to high noise level environment are strictly use appropriate personal noise protective equipment (PPE) provided.

7. Air pollutants

16. All CFB boilers are equipped with SNCR denitrification, semi-dry FGD and bag-type dust collector to control dust, SO_2 and NO_X. Exhaust gases from all CFB boilers are collected and discharged though a single 150m high stack (No 1). All chain grate boilers are equipped with wet FGD and bag-type dust collector for dust and SO_2 control. Exhaust gases from all chain grate boilers are collected and discharged though a single 120m high stack (No 2). The FGD systems of all boilers are upgraded in 2015 in order to meet more stringent national emission standards introduced in 2014.

Figure 6: Qiaokao HSP No 1 stack



Source: Consultant.

17. For three 70 MW low NO_X gas boilers, a new stack is under construction for the exhaust gas from all three gas boilers.

18. There are two coal storage sites at Qiaokao HSP. One is a closed storage facility where the coal loading is occurring in an indoor condition. Currently, Qiaokao are constructing to close open-air coal loading site to transform it into a closed facility. It is expected to be completed before the 2016 heating season.

Figure 7: Closed coal unloading site, Qiaokao HSP

Source: Consultant.

19. Gypsum from FGD system is collected and send to transportation trucks in open space and result in dust pollution. Gypsum collection will be transformed to be closed in the future, which will be completed before the 2016 heating season.

D. Environmental Management System and Performance

1. Environmental Management System

20. The Qiaokao HSP has a total of 394 staff. Responsibility for environmental management and safety management rests with Production Safety Technical Department, which has 20 staff. Two full time staff are working on environmental management and safeguards issues and four full time staff are working on safety management and safeguards issues. Responsibility for occupational health rests with Labor Department, which has 11 staff. Two full time staff are working on occupational health and safeguards issues . The plant is currently working on getting ISO 9001 (Quality Management Systems), ISO 14001 (Environmental Management Systems) and ISO 18001 (Occupational Health and Safety) certification.

21. Because The Qiaokao HSP is a sub-company of Hohhot Chengfa Heating Company, the Qiaokao HSP follows Quality management system (QMS), Safety management system (SMS), Occupational health management system (OHMS) and Environment management system (EMS) of Hohhot Chengfa Heating Company. The Qiaokao HSP also follows emergency management system of Hohhot Chengfa Heating Company and has an emergency response procedure. Regular emergency response training and drills are undertaken. A copy of emergency response procedure was provided to the audit team during the site visit.

22. Overall, the Qiaokao HSP has an adequate environmental, occupational health and

safety management system which involves a lot of regulations and policies. The system and regulations are updated regularly. The Qiaokao HSP also has an emergency response procedure and working properly. The staff confirmed that in the last three years, no accident on environment, occupational health and safety was occurred.

2. Approvals and Licenses

23. The Qiaokao HSP obtained all the necessary approvals and fully complied with all relevant PRC requirements, including EIA approvals (see in Annex 1, 2 and 3) and occupational health and safety approvals.

24. The Qiaokao HSP also obtained all necessary environmental acceptance approvals. Because three 70 MW gas boilers project are not finished, environmental acceptance approval for this project is not obtained yet. During the EIA preparation process for these gas boilers, information disclosure and public consultation were implemented to the project beneficiaries and affected people. No negative feedback was received from the public consultation. No other public concern was raised responding to information notices.

25. Regarding the '*Interim measure for review and management of total emission quantity indicators for major pollutants of construction project',* which was issued by Ministry of Environmental Protection in December 31, 2014 for total emission control, the latest EIA of Qiaokao HSP that was approved on July 13, 2011 indicated total emission quantity approval as a part of EIA approvals.

3. Environmental Performance

a. Applicable environmental standards

26. **Table 2** presents a summary of relevant air pollutants emission standards for the Qiaokao HSP. It is noted that different boilers have different emission standards: CFB boilers must be full compliance with Table 1 in *Emission Standards of Air Pollutants from Thermal Power Plant* (GB 13223-2011). Chain grate boilers must be full compliance with Table 1 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014). Natural gas boilers must be full compliance with Table 2 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).

27.

28.

Table 3 presents the relevant ambient air quality standards for the Qiaokao HSP surrounding area, while

Table 4 presents ambient noise standards.

Table 5 presents groundwater standards.

29. **Table 6** presents the relevant wastewater emission standard.

30. Because production wastewater in the Qiaokao HSP is collected and recycled and domestic wastewater is discharged to municipal sewer, the Qiaokao HSP does not discharge any wastewater to surface water body. No surface water standard is applicable.

Table 2: Summary of Environmental Pollution Standards Applicable to the Qiaokao HSP.

Pollutant	Limit	Standards Source
Stack Emissions for CFB boilers		
SO_2	200 mg/m^3	Table 1 in *Emission Standards of Air Pollutants from Thermal Power Plant* (GB 13223-2011).
NOx	200 mg/m^3	
PM	30 mg/m^3	
Stack Emissions for gas boilers		
SO_2	50 mg/m^3	Table 2 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).
NOx	200 mg/m^3	
PM	20 mg/m^3	
Stack Emissions for chain grate boilers		
SO_2	400 mg/m^3	Table 1 in *Emission Standards of Air Pollutants for boiler* (GB 13271-2014).
NOx	400 mg/m^3	
PM	80 mg/m^3	
Other		
Fugitive PM	1.0 mg/m^3 at site boundary	Table 2 of *Integrated Emission Standard of Air Pollutants* (GB 16297-1996)
Daytime Noise (06:00-22:00 h)	60 dB(A) at site boundary	Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008)
Nighttime noise (22:00-06:00 h)	50 dB(A) (at site boundary)	

Table 3: Applicable ambient air quality standards – Class II, Ambient Air Quality Standards (GB 3095—2012) (unit: mg/m^3)

Pollutants	Annual mean (class 2)	24-hr mean (class 2)	1-hr mean (class 2)
TSP	0.200	0.300	--
PM_{10}	0.070	0.150	--

$PM_{2.5}$	0.035	0.075	--
SO_2	0.060	0.150	0.500
NO_2	0.040	0.080	0.200

Table 4: Applicable ambient environment noise standard – Class II, Environmental Quality Standards for Noise (GB3096-2008)

Item	Class II	Class III
Daytime Noise (06:00-22:00 h)	60 dB(A)	65 dB(A)
Nighttime noise (22:00-06:00 h)	50 dB(A)	55 dB(A)

Table 5: Applicable groundwater standard (Class III, *GB/T14848-93 Quality Standard for Ground Water*)

No	Item	Unit	Limit
1	pH	-	6.5-8.5
2	Total hardness ($CaCO_3$)	mg/L	≤450
3	Fluoride	mg/L	≤1.0
4	Chloride	mg/L	≤250
5	Ammonia nitrogen	mg/L	≤0.2
6	Nitrate	mg/L	≤20
7	Nitrite	mg/L	≤0.02
8	Volatile phenols	mg/L	≤0.002
9	Total dissolved solids	mg/L	≤1000
10	Permanganate index	mg/L	≤3.0
11	Total coliforms	/L	≤3.0

Table 6: PRC *Wastewater quality standards for discharge to municipal sewers* (Class A, CJ 343-2010)

No	Pollutant	Maximum acceptable concentration (MAC) mg/L (except pH and chromaticity)
		Class A
1	pH	6.5-9.5
2	SS	400
3	COD	500
4	Ammonia nitrogen	45
5	Petroleum	20
6	Chromaticity	50
7	BOD	350
8	Total phosphorus	8

9	Total nitrogen	70
10	Total iron	5

b. Stack Emissions Monitoring and Results

31. It is confirmed that the Qiaokao HSP has fully complied with relevant standards on stack emissions. The followings are the CEMS monitoring results between January 3, 2016 and January 15, 2016, which shows their full compliance.

Table 7: No 1 Stack CEMS Monitoring Report (from January 3, 2016 to January 5, 2016), shading notes an exceedance.

Time	SO_2 (mg/m^3)	NOx (mg/m^3)	PM (mg/m^3)	O_2 (wet)(%)
2016/1/3 0:00	192.22	186.68	15.21	10.41
2016/1/3 1:00	154.5	186.97	15.09	10.21
2016/1/3 2:00	155.69	130.39	17.38	10.26
2016/1/3 3:00	169.1	139.6	15.86	10.47
2016/1/3 4:00	164.26	132.76	16.19	10.47
2016/1/3 5:00	146.52	139.36	16.11	10.51
2016/1/3 6:00	155.12	131.14	16.7	10.48
2016/1/3 7:00	137.59	154.06	15.12	10.28
2016/1/3 8:00	152.96	155.14	13.99	10.42
2016/1/3 9:00	168.35	145.35	18.77	10.43
2016/1/3 10:00	180.3	146.83	19.63	10.23
2016/1/3 11:00	178.38	131.54	19.96	10.25
2016/1/3 12:00	188.38	140.12	20	10
2016/1/3 13:00	189.71	129.96	18.75	9.92
2016/1/3 14:00	158.64	177.33	18.34	10.07
2016/1/3 15:00	113.49	154.73	17.48	9.91
2016/1/3 16:00	175.4	186.52	13.78	9.96
2016/1/3 17:00	184.63	179.44	13.13	9.74
2016/1/3 18:00	65.33	163.11	19.76	10.31
2016/1/3 19:00	65.55	142.1	19.55	10.24
2016/1/3 20:00	72.66	147.66	18.44	10.01
2016/1/3 21:00	78.36	178.84	19.91	10.16
2016/1/3 22:00	156.62	176.2	20.81	10.31
2016/1/3 23:00	192.68	171.69	21.33	10.32
2016/1/4 0:00	136.72	183.57	20.77	10.36
2016/1/4 1:00	183.03	180.06	21.65	10.4
2016/1/4 2:00	185.74	156.84	22.52	10.41

2016/1/4 3:00	186.88	169.08	22.49	10.55
2016/1/4 4:00	154.4	184.01	22.31	10.62
2016/1/4 5:00	161.2	168.17	22.54	10.69
2016/1/4 6:00	160.08	152.16	23.25	10.91
2016/1/4 7:00	110.18	137.36	23.9	10.84
2016/1/4 8:00	151.83	159.08	23.7	10.69
2016/1/4 9:00	128.58	165.93	23	10.23
2016/1/4 10:00	111.84	191.69	24.42	10.29
2016/1/4 11:00	78.13	199.06	20.93	10.22
2016/1/4 12:00	166.99	197.42	20.1	10.33
2016/1/4 13:00	155.72	199.02	21.78	10.38
2016/1/4 14:00	130.06	199.1	22.16	10.41
2016/1/4 15:00	165.79	190.1	21.21	10.41
2016/1/4 16:00	142.3	190.11	24.73	10.49
2016/1/4 17:00	180.92	169.14	17.4	11.44
2016/1/4 18:00	191.14	172.6	7.24	10.4
2016/1/4 19:00	183.55	194.58	7.28	10.45
2016/1/4 20:00	166.68	193.32	7.14	10.5
2016/1/4 21:00	173.07	189.46	8.18	11.14
2016/1/4 22:00	179.67	185.42	7.24	10.61
2016/1/4 23:00	175.03	183.1	7.51	10.59
2016/1/5 0:00	154.8	180.85	7.4	10.62
2016/1/5 1:00	164.32	191.22	7.5	10.67
2016/1/5 2:00	184.26	176.31	10	11.53
2016/1/5 3:00	179.01	153.1	10.25	11.59
2016/1/5 4:00	165.16	166.16	11.57	11.37
2016/1/5 5:00	183.55	181.24	9.07	10.41
2016/1/5 6:00	162.84	188.13	6.87	9.87
2016/1/5 7:00	189.12	192.54	6.83	10
2016/1/5 8:00	128.66	186.28	6.76	9.75
2016/1/5 9:00	120.54	199.85	6.92	9.93
2016/1/5 10:00	90.76	197.46	6.91	9.78
2016/1/5 11:00	89.42	183.81	6.84	9.88
2016/1/5 12:00	79.17	196.77	6.8	9.83
2016/1/5 13:00	62.88	182.27	7.05	10.14
2016/1/5 14:00	162.75	180.59	6.9	10.04
2016/1/5 15:00	134.24	174.25	6.94	10.13
2016/1/5 16:00	93.48	163.29	13.71	10.04
2016/1/5 17:00	28.11	148.87	13.94	10.89

2016/1/5 18:00	38.9	145.93	14.11	9.69
2016/1/5 19:00	162.18	180.9	6.98	9.66
2016/1/5 20:00	150.66	167.59	7.04	9.86
2016/1/5 21:00	142.55	180.23	7.35	10.28
2016/1/5 22:00	95.98	190.58	7.21	10.21
2016/1/5 23:00	138.9	181.29	7.02	10.09
Limit	⩽200	⩽200	⩽30	

Source: Qiaokao HSP.

Table 8: No 2 Stack CEMS Monitoring Report (from January 3, 2016 to January 5, 2016), shading notes an exceedance.

Time	SO_2 (mg/m^3)	NOx (mg/m^3)	PM (mg/m^3)	O_2 (wet)(%)
2016/1/3 0:00	327.67	364.75	74.92	10.37
2016/1/3 1:00	340.57	376.24	73.94	10.24
2016/1/3 2:00	326.99	375.39	74.26	10.26
2016/1/3 3:00	341.96	370.83	72.1	9.94
2016/1/3 4:00	350.98	368.77	72.39	9.99
2016/1/3 5:00	326.28	373.93	72.24	9.94
2016/1/3 6:00	334.97	373.4	71.85	9.86
2016/1/3 7:00	330.74	374.04	71.41	9.78
2016/1/3 8:00	325.76	378	70.4	9.65
2016/1/3 9:00	309.59	363.44	68.85	9.38
2016/1/3 10:00	298.63	353.38	70.4	9.61
2016/1/3 11:00	271.32	344.83	74.34	10.17
2016/1/3 12:00	267.29	346.7	75.93	10.34
2016/1/3 13:00	264.25	336.37	75.32	10.27
2016/1/3 14:00	275.12	332.23	75.25	10.24
2016/1/3 15:00	272.79	326.13	74.33	10.16
2016/1/3 16:00	270.5	323.67	74.57	10.16
2016/1/3 17:00	253.69	319.36	55.97	9.7
2016/1/3 18:00	260.43	335.8	67.67	9.06
2016/1/3 19:00	256.82	338.43	67.8	9.03
2016/1/3 20:00	258.32	343.28	68.5	9.12
2016/1/3 21:00	249.8	347.4	68.16	9.06
2016/1/3 22:00	242.31	365.08	69.47	9.26
2016/1/3 23:00	266.82	368.36	69.95	9.31
2016/1/4 0:00	237.04	362.7	66.94	8.84
2016/1/4 1:00	233.68	357.98	66.51	8.76
2016/1/4 2:00	221.45	359.18	66.97	8.96
2016/1/4 3:00	232.49	355.78	68.64	9.16
2016/1/4 4:00	239.75	358.83	67.58	8.96

Time	SO_2 (mg/m^3)	NOx (mg/m^3)	PM (mg/m^3)	O_2 (wet)(%)
2016/1/4 5:00	231.02	364.93	67.3	8.91
2016/1/4 6:00	216.87	361.67	67.24	8.83
2016/1/4 7:00	217.44	364.29	67.91	8.91
2016/1/4 8:00	224.05	371.57	68.39	8.9
2016/1/4 9:00	229.49	368.16	67.52	8.8
2016/1/4 10:00	236.32	353.59	67.36	8.69
2016/1/4 11:00	231.84	351.99	68.03	8.67
2016/1/4 12:00	234.42	356.44	69.53	8.7
2016/1/4 13:00	234.11	360.29	71.09	8.62
2016/1/4 14:00	232.1	360.07	74.13	8.61
2016/1/4 15:00	234.71	362.8	77.51	8.93
2016/1/4 16:00	238.96	376.02	70.71	9.18
2016/1/4 17:00	248.3	381.38	49.21	9.58
2016/1/4 18:00	228.13	383.01	45.53	9.3
2016/1/4 19:00	231.01	385.7	45.7	9.41
2016/1/4 20:00	228.45	380.13	44.79	9.32
2016/1/4 21:00	236.62	364.82	43.84	9.22
2016/1/4 22:00	258.51	363.62	43.91	9.08
2016/1/4 23:00	207.33	376.71	49.17	10.34
2016/1/5 0:00	278.95	301.01	77.69	10.14
2016/1/5 1:00	219.36	295.23	70.93	10.84
2016/1/5 2:00	320.39	365.85	73.56	10.9
2016/1/5 3:00	366.43	359.1	72.13	10.45
2016/1/5 4:00	308.42	340.29	65.68	10.83
2016/1/5 5:00	206.91	356.74	67.82	10.3
2016/1/5 6:00	306.45	364.75	69.49	10.01
2016/1/5 7:00	320.61	337.37	68.17	10.14
2016/1/5 8:00	377.79	303.31	63.38	10.67
2016/1/5 9:00	294.52	328.96	69.98	10.79
2016/1/5 10:00	268.52	389.4	72.05	10.25
2016/1/5 11:00	336.04	385.82	76.43	10.51
2016/1/5 12:00	320.59	301.4	70.07	10.66
2016/1/5 13:00	279.68	328.86	59.68	10.32
2016/1/5 14:00	367.87	379.86	45.12	9.2
2016/1/5 15:00	358.97	301.75	45.45	9.3
2016/1/5 16:00	381.84	397.88	45.66	8.95
2016/1/5 17:00	383.32	389.88	46	8.97
2016/1/5 18:00	370.72	386.89	47.95	9.05
2016/1/5 19:00	356.28	383.82	47.31	8.92
2016/1/5 20:00	342.97	379.29	47.5	8.93
2016/1/5 21:00	353.67	379.71	48.67	9.18
2016/1/5 22:00	343.27	378.02	50.24	9.59

Time	SO_2 (mg/m^3)	NOx (mg/m^3)	PM (mg/m^3)	O_2 (wet)(%)
2016/1/5 23:00	345.69	381.25	49.33	9.55
Limit	≤400	≤400	≤80	

Source: Qiaokao HSP.

32. Responding to new environmental requirements in the PRC, the Qiaokao HSP is now equipped with a CEMS that monitors in real time SO_2, NOx, PM, and air flow. Data are sent electronically to the Hohhot (EPB) Center. As this CEMS is only installed in July 2015, officially accepted environmental data were not available at the time of due diligence. One 3rd party company is hired on a weekly basis for CEMS calibration. After the environmental acceptance is finished, the 3rd company will come to Qiaokao HSP on a quarterly basis for CEMS calibration. Besides, manual stack emissions monitoring are also undertaken on a quarterly basis by Hohhot EPB for calibration.

33. In this new CEMS, non-compliance can be immediately detected and close supervision from the local EPB is established between the plant and local authorities, which can ensure mitigation measures to be seriously and timely applied to lower the environmental impact to the largest extent.

Figure 8: CEMS control room, Qiaokao HSP

Source: Consultant.

c. Noise Monitoring and Results

34. Noise monitoring is undertaken at the site boundary on a quarterly basis. Based on quarterly noise monitoring, staff of Qiaokao HSP confirmed that the Qiaokao HSP is in compliance with the relevant standard, Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008).

E. Conclusion

35. Based on this environmental due diligence assessment, the Qiaokao HSP has an adequate environmental, health and safety management system and obtained all the necessary approvals for the plant operation. Proper environmental mitigation measures and control devices are up to date to keep pace with more stringent emission standards and the plant meets all the necessary environmental standards. Till now, no public complaint has been received. It is concluded that the Qiaokao HSP is well managed and performs good environmental, health and safety performance.

Annexes

Annex 1: EIA Approval of Qiaokao HSP Phase I project by IMAR EPB (May 17, 1995).

Annex 2: EIA Approval of Qiaokao HSP Phase II project by IMAR EPB (January 6, 2006).

Annex 3: EIA Approval of Qiaokao HSP Phase III project by IMAR EPB (July 13, 2011).

Annex 1: EIA Approval of Qiaokao HSP Phase I project by IMAR EPB (May 17, 1995).

内蒙古自治区环境保护局文件

内环字[1995]86号　　签发：吴国忠

关于《呼和浩特供热二期工程环境影响报告书》的批复

呼和浩特市热力公司：

你公司上报的《呼和浩特供热二期工程环境影响报告书》（简称《报告书》）收悉，经组织有关单位和技术人员审查，现批复如下：

一、《报告书》编制规范，符合国内建设项目环境影响评价和国际金融组织对建设项目环境影响评价的要求；《报告书》内容全面、重点突出、所采用的评价技术方案正确，评价结论可信，提出的污染防治对策建议可行，完成了"环评大纲"的工作内容和工作深度，可以做为本工程建设环境保护工作的依据。

二、呼和浩特市区大气煤烟型污染比较严重，本项目的建设，将淘汰大量的小型、落后分散的锅炉，从而大大减少了污染源和大气污染物排放量，使得呼市的大气环境质量和噪声、固废物排放情况及污染程度得到较大改善，大气质量、城市市容都有不同程度的提高，也使资源得到了有效的利用，具有明显的社会效益、环境效益和经济效益，同意本工程的建设。

三、锅炉要采用除尘效率不低于96%的高效文丘

置水膜除尘器。大气污染物排放不得超过《锅炉大气污染物排放标准》（GB13271－91）二类区标准。

四、冲灰水和锅炉排污水要全部循环利用，不得外排。

五、各噪声源要采取有效的消噪声措施，防止噪声污染。

六、粉煤灰和炉渣要积极进行综合利用或妥善储存，防止造成二次污染。

七、要加强施工期的环境保护管理，以防止对周围环境造成影响。

八、污染防治设施必须要与主体工程同时设计、同时施工、同时投入运行；污染防治设施经我局验收后，该项工程方可投入运行。

一九九五年五月十七日

内蒙古自治区环境保护局

主题词：工程　环境影响　报告书　批复

抄送：自治区计委、自治区日元贷款领导小组、呼市计委、呼市日元贷款领导小组、呼市环保局、呼市城建局、自治区环科所。

校对：杜俊华　印四份

Annex 2: EIA Approval of Qiaokao HSP Phase II project by IMAR EPB (January 6, 2006).

2

内蒙古自治区环境保护局

内环字〔2006〕1号

内蒙古自治区环境保护局关于内蒙古呼和浩特市大气环境保护工程（一期）—呼和浩特市东区集中供热工程环境影响报告书的批复

呼和浩特市城发公司：

你公司报来的《内蒙古呼和浩特市大气环境保护工程（一期）—呼和浩特市东区集中供热工程环境影响报告书》（以下简称“报告书”）收悉，经研究，批复如下：

一、该项目的建设内容有热源、热水管网、热力站等。

热源包括在呼和浩特市东南热源厂扩建一座5×58MW锅炉房；在东北热源厂现有锅炉房内扩建一台29MW循环流化床热水锅炉和新建一座锅炉房，安装4×64MW链条炉；新建金桥热源厂2×20t/h蒸汽锅炉和4×64MW链条炉。

热网包括东南热源厂新建25.4km一级热水管网，东北热源厂新建17.9km一级热水管网，金桥热源厂新建1.85km蒸汽管网和17.37km一级热水管网。

新建热力站为：东南热源厂39座，东北热源厂37座，金桥热源厂31座。

工程总投资9.9994×10^{8}元，其中环保投资7451.4×10^{4}元，占

—1—

总投资的7.45%。

项目投产后，可实现热源替代。大幅度削减烟尘、二氧化硫排放量。经济效益、社会效益、环境效益明显。符合国家产业政策和环境保护的要求，同意项目建设。

二、项目建设应做好以下工作

1、制定煤质鉴别及管理制度，做好燃煤选配工作，保证供应渠道和有效监控，落实“报告书”对燃煤含硫量和灰份的要求。要通过规范工艺操作，保证污染物达标排放。项目建在二氧化硫控制区，二氧化硫排放量要严格控制在呼和浩特市环境保护局下达的控制指标之内。

2、结合机组和环境特点，合理安排厂区总平面布置。采用消音降噪措施，确保厂界噪声达标。

3、充分优化排水方案，加强节水措施，提高水的循环利用率。需排入城市下水管网的污水，所排水质必须达到《污水排入城市下水道水质标准》（GJ3082-1999），处理后的污泥必须保证按资源化的要求进行管理，防止二次污染。

4、贮煤场为全封闭贮场。共用煤场要制定切实可行的扬尘防治措施。

5、粉煤灰综合利用项目必须与热源厂同时建设。粉煤灰综合利用要有可靠的保证，厂区内设的临时贮灰场，要进行全封闭管理。

6、运煤、运灰要固定专用路线，车辆要采取覆盖措施，防止扬尘对道路及周边环境的污染。

7、排污口做到规范化管理，水、气需安装在线监测系统，为投产后的环境保护管理提供科学依据。

三、工程建设中要确保环保资金的投入和使用，保证环境保

护工程和设施的质量；该项目的污染防治设施和环境保护工程必须要与主体工程同时设计、同时施工、同时投入运行。

四、项目竣工后，建设单位按规定程序应向我局提出试生产申请并进行环境保护验收，验收合格后，项目方可正式运行。

五、请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。

二〇〇六年一月六日

主题词：环保　建设项目　报告书　批复

抄送：自治区发展和改革委员会，呼和浩特市环境保护局。

内蒙古自治区环境保护局办公室　　2006年1月6日印发

打字：刘广宇　　校对：周云强　　共印9份

Annex 3: EIA Approval of Qiaokao HSP Phase III project by IMAR EPB (July 13, 2011).

内蒙古自治区环境保护厅文件

内环审〔2011〕199 号

内蒙古自治区环境保护厅
关于呼和浩特市城发桥靠（6×70MW）、三合村（5×70MW）区域集中供热工程—桥靠热源厂供热区域环境影响报告书的批复

呼和浩特市城发投资经营有限责任公司:

你公司报送的由中冶东方工程技术有限公司编制的《呼和浩特市城发桥靠（6×70MW）、三合村（5×70MW）区域集中供热工程—桥靠热源厂供热区域环境影响报告书》(以下简称《报告书》) 和呼和浩特市环保局对该项目的初审意见（呼环政函字〔2011〕112 号）收悉。经研究，批复如下:

一、该项目位于呼和浩特市赛罕区新建东街，在桥靠热源厂（东南热源厂）区内现有的两座锅炉房东侧，扩建一座内设 6 台 DXL70-1.6/130/70-AII 型热水锅炉的锅炉房，厂区总占地面积 101402m², 其中本项目占地 12659m², 新增供热能力 789 万 m², 同时配套建设 20.35km 一级热水管网和 33 座热力站。项目总投资 56639.34 万元，其中环保投资约 9098.8 万元，占工程总投资的 16.06%。

本项目建设符合国家产业政策和城市供热规划，呼和浩特

1

市发改委同意项目开展前期工作(呼发改投资〔2011〕204号),本扩建项目SO_2排放量259.22t/a,NO_x排放量为805.56t/a,在供热区域内替代66台小锅炉,替代SO_2排放量1661.78吨。在全面落实《报告书》提出的各项生态保护和环境污染防治措施及投资预算前提下,环境不利影响能够得到一定的缓解和控制。因此,我厅同意你公司按照《报告书》中所列的建设项目性质、规模、地点、环境保护措施进行项目建设。

二、项目建设和运行管理中应重点做好以下工作:

(一)认真落实项目"以新代老"措施。将现有脱硫工艺改造为炉内喷钙工艺,控制钙硫比达到2.0,脱硫效率≥80%;将现有露天储煤场改建为封闭式干煤棚;将现锅炉软化水系统排污水、净环水排污水作为扩建及以新带老配套的脱硫系统的补充水;对热源厂内现有锅炉房、泵房、风机房等外墙上包裹隔声材料,将锅炉房东、西、北侧的窗户封闭,对确需进行采光和通风的部位,采用通风隔声窗。

(二)严格实施大气污染防治措施。锅炉烟气采用布袋除尘及石灰石—石膏湿法烟气脱硫,预留脱除NO_x装置的位置,烟气经120m高烟囱(安装CEMS)排放,除尘效率≥99%,脱硫效率≥90%,烟尘排放浓度小于18mg/m³,SO_2排放浓度为97.71mg/m³,必须符合《锅炉大气污染物排放标准》(GB13271-2001)二类区Ⅱ时段标准的要求。煤场全部为封闭式干煤棚,受煤斗、地下通道、转运站、碎煤机室及煤仓间安置布袋除尘器,渣仓采用全封闭结构,石灰石筒仓顶部采用仓顶布袋除尘器,粉尘排放浓度和排放速率符合《大气污染物综合排放标准》(GB19297—1996)二级标准要求。

(三)加强水污染防治措施建设和管理。将软水制备系统再生废液及脱硫系统废水补充至冲渣水系统使用;软水制备系统废水中反洗、正洗废水及锅炉排污水、设备冷却水作为脱硫系统补水和冲渣废水,不外排;转运站、碎煤机室和输煤栈桥

冲洗水、重型框链除渣机水槽中的废水经沉淀后重复使用。脱硫系统设脱硫废水处理站，采用 pH 调节、反应、凝聚和澄清工艺，处理规模为 $10m^3/h$，废水处理后的水质必须符合《污水综合排放标准》（GB8978-1996）一级标准。生产废水全部闭路循环使用，不外排。

食堂废水经隔油后和生活污水全部进入化粪池处理达到《污水综合排放标准》（GB8978-1996）三级标准后，经过市政管网排放至辛辛板污水处理厂处理。

（四）锅炉渣经湿法冲渣后，由板链除渣机送入渣仓，再经自卸车外运；锅炉除尘器出灰口处设电动三通，出灰通过带伸缩装置的汽车散装机，与封闭罐车配套使用，外运综合利用；输煤、破碎系统除尘产生的煤尘及其冲洗系统的沉淀煤尘，送入锅炉作为燃料；脱硫系统筒仓和输送系统石灰石粉尘，直接送入石灰石制浆系统作为原料；脱硫石膏暂存在储仓内，采用封闭车辆外运。

（五）选用低噪声设备，合理选择各换热站厂址与布局，采取相应的减振、隔声和消声等措施，确保热源厂和换热站厂界噪声满足相应功能区标准要求。

（六）认真落实环境风险应急预案。特别是防止柴油罐发生柴油燃烧爆炸风险事故。配套建设烟气自动连续监测装置，并与地方环保部门联网。

（七）开展环境监理工作，在施工招标文件、施工合同和工程监理招标文件中明确环保条款和责任，定期向我厅提交环境监理报告，并将环境监理报告作为项目竣工环保验收的依据之一。

三、本期工程的污染防治措施必须与主体工程同时设计、同时施工、同时投入使用。本期工程竣工后，你公司必须按规定程序向我厅申请试运行和竣工环境保护验收，验收合格后方可正式投入生产。

四、我厅委托呼和浩特市环境保护局和赛罕区环境保护局对该项目施工期间的环境保护措施落实情况进行监督检查。

二〇一一年七月十三日

主题词： 环保　建设项目　环评　报告书　批复

抄送：自治区发展和改革委员会，呼和浩特市环境保护局，赛罕区环境保护局，自治区环境监察总队，自治区环境工程评估中心，中冶东方工程技术有限公司。

内蒙古自治区环境保护厅办公室　　2011年7月14日印发

共印13份

III. ENVIRONMENTAL DUE DILIGENCE - INNER MONGOLIA JINGCHENG SOLID WASTE TREATMENT CO., LTD

A. Introduction

1. In accordance with the ADB Safeguard Policy Statement (SPS) (2009), environmental due diligence was conducted for the Hohhot Inner Mongolia Jingcheng Solid Waste Treatment Co., Ltd (hereafter referred to as the Jingcheng SWT plant) as part of scope change proposed during the implementation of Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region(IMAR).

2. According the proposed scope change, Jinqiao heating zone will utilize heat from Jingcheng MSW CHP. The heat from Jingcheng SWT plant will be transported though a heating pipeline and a heat exchange station that will be constructed under the revised project scope. A total of 50 MW heat will be supplied to Jinqiao heating zone.

B. Environmental Due Diligence Review Approach

3. This report is based on a site visit, consultations with the Jingcheng SWT managers and technical staff, and a review of plant environmental and technical documentation. The site visit was undertaken January 27th 2016, with the following participants:

Environmental Due Diligence Reviewers:
Mr. Lei Dai, National Environmental Safeguards Consultant

Hohhot Chengfa Heating Company:
Mr. JianZhong Wang, Director of Chief Engineer Office
Mr. Feifei Zhang, Deputy Manager of Xingjiaying HSP

Jingcheng SWT plant:
Mr. Xiyang Wang, Deputy Manager

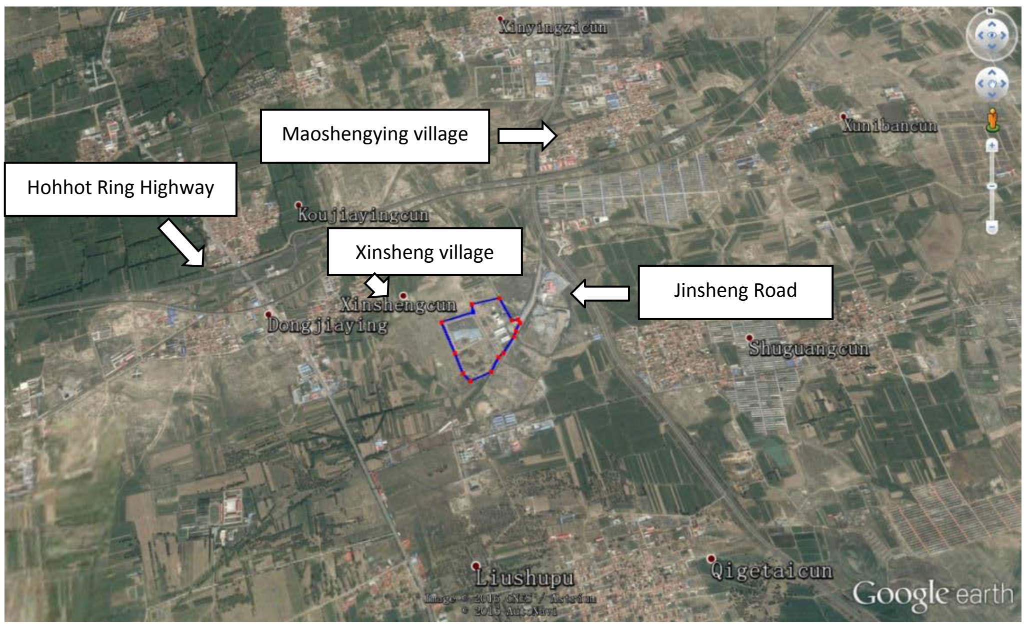
4. Documentation reviewed during and after the facility visit included:
- PRC Project Environmental Impact Assessment (EIA) report (2013);
- PRC Project Feasibility Study Report (FSR) (2012);
- EIA Approval by IMAR EPB (September 14, 2009);
- Annual Dioxin Emission Monitoring Report by National Research Center for Environmental Analysis and Measurements (October 19, 2015);
- Daily Exhaust Gas Monitoring Report (from January 21, 2016 to January 27, 2016).

C. Project Description

1. Location

5. The Jingcheng SWT plant is located south of Saihan District, Hohhot City. The Jingcheng SWT plant, covering 36.09 ha, is located approximately 5 km south of Jinqiao heating zone. The Jingcheng SWT plant is outside of urban area of Hohhot. There are villages around the Jingcheng SWT plant. There are Xinsheng and Dongjiaying villages in the west; Koujiaying village in the northwest; Maoshengying village in the northeast; Shuguang village in the east; Qihetai village in the southeast; and Liushupu village in the south. The nearest village is Xinsheng village which is about 260m away from the plant (**Figure 1**). Jinsheng Road is at east of the Jingcheng SWT plat and the nearest distance is about 600m.

Figure 1: Jingcheng SWT and surrounding area



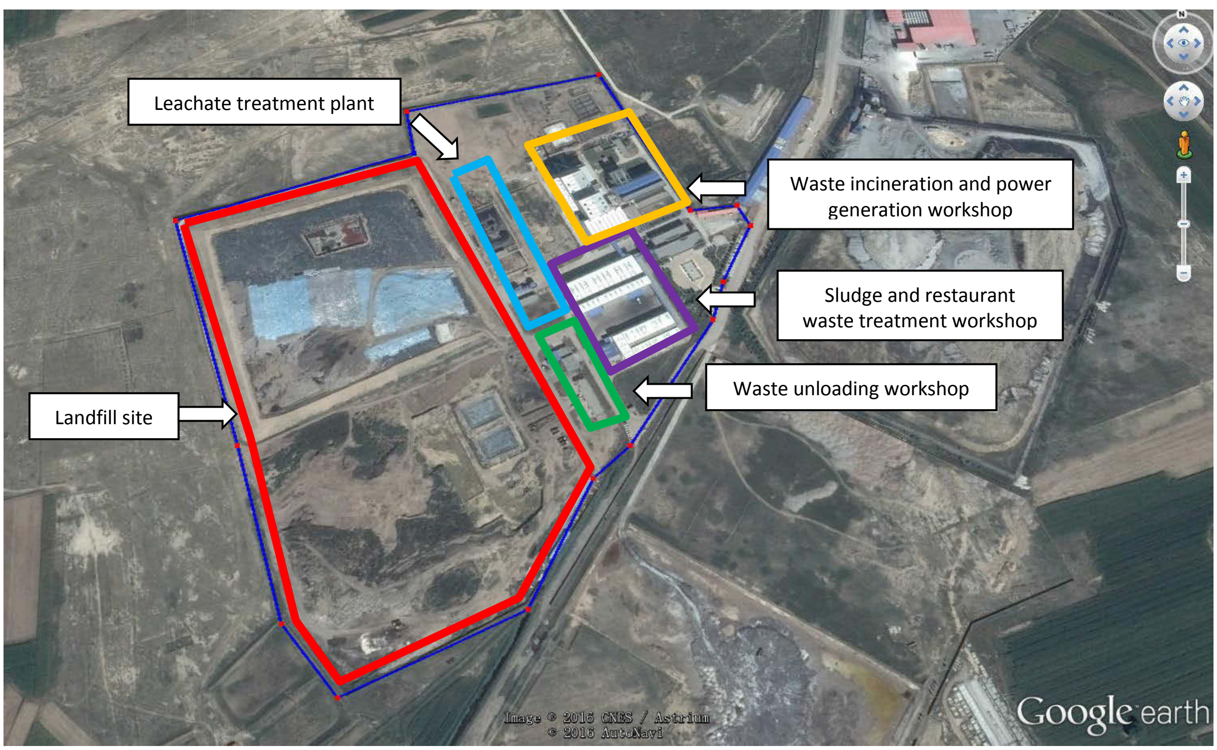
Source: Google Earth, 2016 and Consultant.

Figure 2: Jingcheng SWT incinerator

Source: Consultant.

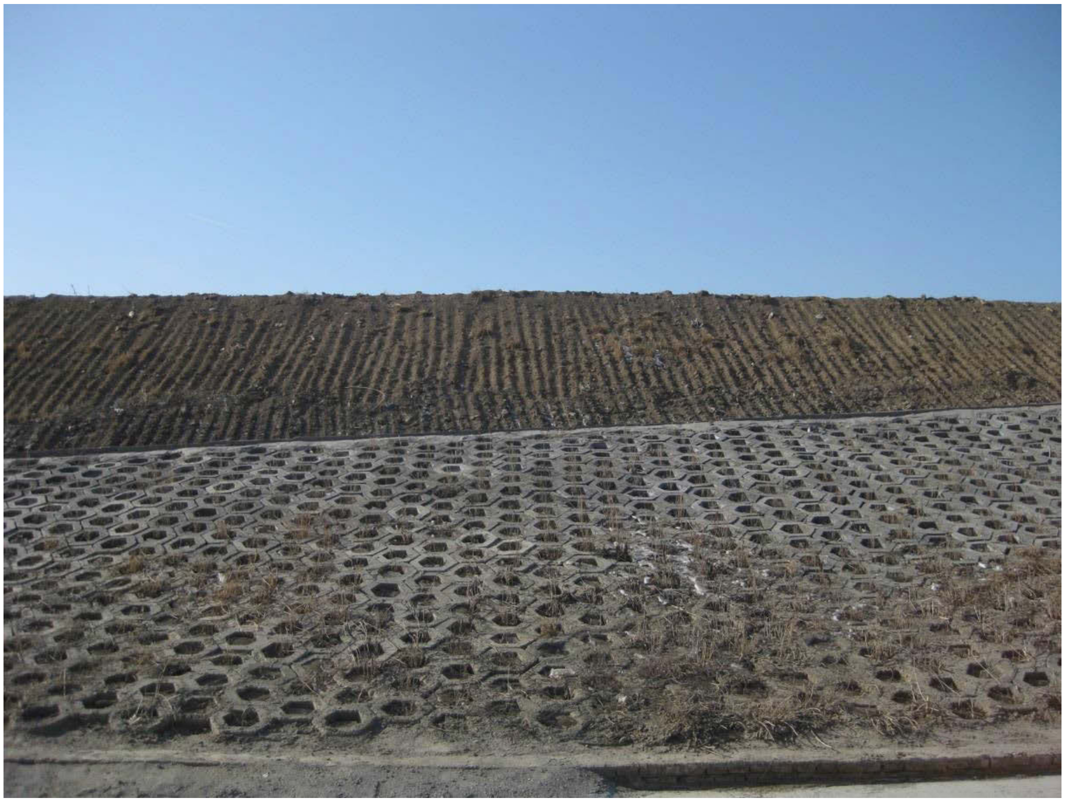
6. **Figure 3** shows an aerial view of the Jingcheng SWT plant including the waste unloading workshop, waste incineration and power generation workshop, sludge and restaurant waste treatment workshop, landfill site and leachate treatment plant.

Figure 3: Jingcheng SWT layout



Source: Google Earth 2016 and Jingcheng SWT

Figure 4: Landfill site of Jingcheng SWT



Source: Consultant.

2. Purpose and Capacity

7. The Jingcheng SWT plant was original built in 2012 for waste treatment by landfill, incineration and compost with a domestic waste treatment capacity of 1000 tons/day and sludge treatment capacity of 100 tons/day (incineration: 300 tons/day, landfill: 600 tons/day and compost: 230 tons/day). One 350 t/d leachate treatment plant was built to treat leachate from landfill and two 65 t/h sorting lines were built for waste sorting. In 2011, Jingcheng SWT plant built a restaurant food waste treatment workshop with a capacity of 150 tons/day. At the same time, Jingcheng SWT start to build two 500t/h incinerators with two 9 MW turbines to expand its capacity and power generation from waste. One incinerator with one turbine is installed in 2014 and the other incinerator and turbine is not installed because of financial issues.

8. Daily average domestic waste received in 2015 was 946 tons, which is equal to 345,290 tons per annum. Daily average incinerators treatment capacity was 400 tons in 2015 and operation time is 300 days. The annual waste incinerated was 120,000 tons. Other remaining solid municipal waste of 225,290 tons was landfilled. The total treated sludge in 2015 was 24,000 tons and the treated restaurant waste was 12,000 tons.

9. The incinerator generated 23 million kWh of power in 2015, out of which 8 million kWh was used for Jingcheng SWT plant operation and the rest 15 million kWh was sold to the Grid.

3. Fuel

10. Municipal solid waste of Hohhot is sent to the Jingcheng SWT plant. Then, large waste

like wood, stone will be first removed and then, stored in waste storage tank. After a period of semi-fermentation, waste is send to incinerator to produce power. The Jingcheng SWT plant is planning for upgrading so to produce both power and heat. The generated heat would be sold to Jinqiao heating network. The waste analysis data is listed in **Table 1**.

Table 1: Hohhot domestic waste analysis data

Item	Sample 1	Sample 2	Sample 3	Sample 4	Average
Water content (%)	58.76	52.28	57.20	57.86	56.52
Ash content of waste (wet basis, %)	10.47	16.91	21.37	23.34	15.16
hydrogen content of waste (wet basis, %)	3.22	3.22	2.88	2.33	3.04
Higher caloric value (wet basis) (kJ/kg)	7290	6624	6154	5670	6484
Lower caloric value (wet basis) (kJ/kg)	5149 4	4641	4126	3946	4466

Source: Jingcheng SWT.

Figure 5: Waste unloading site, Jingcheng SWT

Source: Consultant.

Figure 6: Waste storage tank, Jingcheng SWT plant

Source: Consultant.

4. Water Supply and Wastewater

11. Domestic water is supplied from a self-drilled well, which is approved by the local water bureau. The plant has 160 staff and daily domestic water consumption is 24 m^3/d[1]. The self-drilled well is 120m depth with a capacity of 15 m^3/h. The domestic water consumption is only 6.7% of available water source at the well.

12. Production water is supplied either from reclaimed water from Jinqiao waste water treatment plant (WWTP), which is located 1 km away from the Jingcheng SWT or from its own leachate treatment facility. Leachate wastewater that is generated from landfill, sorting lines, waste storage tank and composting system, sludge drying wastewater and waste treatment plant cleaning water(250 m^3/d) is treated at the leachate treatment system. The reclaimed water from the leachate treatment facility at Jingcheng SWT can be reused as production water.

13. The total reclaimed water produced at Jinqiao WWTP is 30,000 m^3/d; and one from from leachate treatment facility is 60 m^3/d. And daily average consumption for production water at Jingcheng SWT is 516.64 m^3/d. Thus, production water counts only 1.7% of the available reclaimed water.

14. Both domestic and production water need to be treated in the water treatment system before put into use. The water treatment methods are flocculation, sediment, filtration and backwash. The water treatment system at the Jingcheng SWT plant has 200 m^3/d capacity for ground water and 800 m^3/d capacity for reclaimed water.

[1] Daily domestic water consumption for one person is 0.15 m^3/d

15. Domestic wastewater (19.2 m^3/d) is discharged to municipal sewer system, and then, treated at Jinqiao WWTP. Production wastewater (72.6 m^3/d) is discharged to municipal sewer system and treated at Jinqiao WWTP. To protect groundwater and meet the anti-seepage standard, different anti-seepage measures are undertaken according to locations and relevant anti-seepage requirements. Besides, sludge treatment workshop, restaurant treatment workshop and incineration workshops are also implemented anti-seepage measures.

5. Solid Wastes

16. Treatment of hazardous waste of the Jingcheng SWT are listed below:

- Fly ash generated during incineration is mixed with chelating agent, water and cement for stabilization. In 2015, about 1200 tons stabilized fly ash mixture was disposed in landfill.
- Sludge generated during leachate treatment is treated in sludge treatment system of Jingcheng STWC.

17. Treatment of other waste are listed below:

- Composting residue is disposed at the landfill.
- Domestic waste that is not used for incineration is disposed at the landfill.
- Slag generated during incineration is sold to a third party company for recycling.
- Metal, stone and cement generated during sorting are sold to a third party company for recycling.

6. Noise

18. Noise sources during operation will mainly be from turbines, sorting equipment, landfill equipment, and filter press including transformers, pumps, compressor, and fans. While using low-noise equipment as far as possible, the plant layout and facilities are designed to mitigate noise impacts during operation using shock absorption, insulated enclosures and sound dampening materials. These measures can typically reduce noise intensity. All plant and equipment, including vehicles are properly maintained in order to minimize noise. Also, the workers who are likely to be exposed to high noise level environment are strictly use appropriate personal noise protective equipment (PPE) provided.

7. Air quality

19. Sludge treatment workshop is closed and working under negative pressure, then exhaust gas generated during sludge treatment is collected and send to incinerators for burning.

20. Restaurant waste treatment system, incinerators and sorting workshop are installed with odor treatment system.

21. Incinerator is equipped with selective non catalytic reduction (SNCR) denitrification, semi-dry desulfuration tower, activated carbon adsorption and bag-type dust collector. Flue gases of the incinerators are exhausted through one 60 m high stack.

D. Environmental Management System and Performance

1. Environmental Management System

22. The Jingcheng SWT has a total of 145 staff. **Table 2** presents staff number of different departments. Responsibility for environmental management rests with the Office Department which has 30 staff. One full time staff is working on environmental management and safeguards issues. Safety and Occupational health also belong to Office Department. One full time staff is working on occupational health management and safeguards issues and two full time staff are working on safety management and safeguards issues. The Jingcheng SWT is currently working on getting ISO 9001 (Quality Management Systems), ISO 14001 (Environmental Management Systems) and ISO 18001 (Occupational Health and Safety) certification.

Table 2: Staff number of different departments

Department	Staff No
Sludge treatment section	19
Restaurant waste section	10
Sorting section	16
Incinerator section (maintenance section which has 24 staff and is responsible for maintenance of all equipment in the plant is included)	60
Landfill section	10
Office	30
Total	145

Source: Jingcheng SWT.

23. The Jingcheng SWT has Quality management system (QMS), Safety management system (SMS), Occupational health management system (OHMS) and Environment management system (EMS). All four systems were prepared based on relevant national, provincial and local laws and regulations. All the systems are annually reviewed and updated if necessary.

24. During site visit, Environment management system manual is provided to audit team for review. Quality and Environment management manual was prepared according to *Quality management systems - Requirements (GB/T 19001-2008)* and *Environmental management systems — Requirements with guidance for use (ISO 14001-2004)*. QMS and EMS are determined in this manual. Policies and targets of quality and environment management are explained in this manual. This manual includes Environment target of Jingcheng SWT, structure and responsibilities of Jingcheng SWT and Directory of environmental and quality procedure documents.

25. The Jingcheng SWT has an emergency response procedure, and regular emergency response training and drills are undertaken.

26. Overall, the Jingcheng SWT has an adequate environmental, health and safety management system which involves a lot of regulations and policies. The system and regulations are updated regularly. The Jingcheng SWT also has an emergency response procedure and working properly.

2. Approvals and Licenses

27. The Jingcheng SWT obtained all the necessary approvals and fully complied with all relevant PRC requirements, including EIA approvals (see in Annex 1 and 2) and occupational health and safety approvals.

3. Environmental Acceptance Environmental Performance

a. Applicable environmental standards

28. **Table 3** presents a summary of relevant air pollutants emission standards for the Jingcheng SWT**. Table 4** and

29. **Table 5** presents the relevant wastewater emission standard (Effluence from leachate treatment system and water treatment system for reuse meet the standard in

30. **Table 5**. Other production wastewater and domestic wastewater meet the standard in **Table 4**).

31. **Table 6** presents the relevant ambient air quality standards for the Jingcheng SWT surrounding area, while

Table **7** presents ambient noise standards.

32. **Table 8** presents groundwater standards.

Table 3: Summary of Environmental Pollution Standards Applicable to the Jingcheng SWT.

Pollutant	Limit	Standards Source
Stack Emissions	24 hr mean	Table 4 in *Standard for pollution control on the municipal solid waste incineration* (GB 18485-2014).
SO_2	80 mg/m^3	
NOx	250 mg/m^3	
PM	20 mg/m^3	
CO	80 mg/m^3	
HCl	50 mg/m^3	
	Mean	
Hg	0.05 mg/m^3	
Dioxin	0.1 ng TEQ/m^3	
Sb+As+Pb+Cr+Co+Cu+Mn+Ni	1.0 mg/m^3	
Other		
Fugitive PM	1.0 mg/m^3 at site boundary	Table 2 of *Integrated Emission Standard of Air Pollutants* (GB 16297-1996).
H_2S	0.06 mg/m^3 at site boundary	*Emission standards for odor pollutants* (GB14554-93).
Ammonia	1.5 mg/m^3 at site boundary	
Odor	20 at site boundary	
Odor	20 at site boundary	
Odor	20 at site boundary	
Daytime Noise (06:00-22:00 h)	60 dB(A) at site boundary	Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008).
Nighttime noise (22:00-06:00 h)	50 dB(A) (at site boundary)	

Table 4: PRC *Wastewater quality standards for discharge to municipal sewers* (Class A, CJ 343-2010)

No	Pollutant	Maximum acceptable concentration (MAC) mg/L (except pH and chromaticity)
		Class A
1	pH	6.5-9.5
2	SS	400
3	COD	500
4	Ammonia nitrogen	45
5	Petroleum	20
6	Chromaticity	50
7	BOD	350
8	Total phosphorus	8
9	Total nitrogen	70
10	Total iron	5

Table 5: *Code for design of industrial recirculating cooling water treatment*（GB50050-2007)

No	Pollutant	Maximum acceptable concentration (MAC) mg/L (except pH and turbidity)
1	pH	6-9
2	SS	10
3	COD	30
4	Ammonia nitrogen	5
5	Oil content	5
6	Turbidity	5
7	BOD	10
8	Chloride	250
9	Total dissolved solids (TDS)	1000
10	Total iron	0.5

Table 6: Applicable ambient air quality standards (unit: mg/m^3)

Pollutants	Annual mean	24-hr mean	1-hr mean	Source
TSP	0.200	0.300	--	*Class II, Ambient Air Quality Standards* (GB 3095—2012)
PM_{10}	0.070	0.150	--	
$PM_{2.5}$	0.035	0.075	--	
SO_2	0.060	0.150	0.500	
NO_2	0.040	0.080	0.200	
CO	--	4.00	10.00	
Cd	0.00005	--	--	
Pb	0.0005	--	--	

Hg	0.00005	--	--	
		24-hr mean	**One time**	**Source**
HCL	--	0.015	0.05	*Hygienic standards for the design of industrial enterprises* (GBZ 1-2010)
Hg	--	0.0003	--	
Pb	--	0.0007	--	
H_2S	--	--	0.01	
NH_3	--	--	0.2	
	Annual mean			**Source**
Dioxin	0.6 pg TEQ/m^3	--	--	Japanese Standard

Table 7: Applicable ambient environment noise standard – *Class II, Environmental Quality Standards for Noise* (GB3096-2008)

Item	Class II	Class III
Daytime Noise (06:00-22:00 h)	60 dB(A)	65 dB(A)
Nighttime noise (22:00-06:00 h)	50 dB(A)	55 dB(A)

Table 8: Applicable groundwater standard (Class III, *GB/T14848-93 Quality Standard for Ground Water*)

No	Item	Unit	Limit
1	pH	-	6.5-8.5
2	Total hardness ($CaCO_3$)	mg/L	≤450
3	Fluoride	mg/L	≤1.0
4	Chloride	mg/L	≤250
5	Ammonia nitrogen	mg/L	≤0.2
6	Nitrate	mg/L	≤20
7	Nitrite	mg/L	≤0.02
8	Volatile Phenols	mg/L	≤0.002
9	Total dissolved solids	mg/L	≤1000
10	Permanganate index	mg/L	≤3.0
11	Total coliforms	/L	≤3.0

b. Stack Emissions Monitoring and Results

33. The Jingcheng SWT is equipped with a continuous emissions monitoring systems (CEMS) that monitors in real time CO,SO_2, NOx, PM, HCl, temperature, pressure and air flow. Data is sent electronically to the Inner Mongolia Autonomous Region (IMAR) Environment Protection Bureau (EPB) Data Center. It is confirmed that the Jingcheng SWT has fully complied with relevant standards on stack emissions. The followings are daily exhaust gas monitoring reports (from January 21, 2016 to January 27, 2016) (see in Annex 5) , which shows their full compliance *Standard for pollution control on the municipal solid waste incineration* (GB 18485-2014).

Table 9: Daily exhaust gas monitoring reports (from January 21, 2016 to January 27, 2016)

Date	Time	NOx (mg/m^3)	SO_2 (mg/m^3)	HCL (mg/m^3)	PM (mg/m^3)

Date	Time	NOx (mg/m^3)	SO_2 (mg/m^3)	HCL (mg/m^3)	PM (mg/m^3)
January 21, 2016	9:00	181	39	13	1
	10:00	185	38	12	1
	11:00	184	35	12	1
	12:00	179	36	12	1
	13:00	181	37	13	1
	14:00	183	36	13	1
	15:00	175	35	13	1
	16:00	170	35	14	1
	17:00	173	37	13	1
	18:00	179	36	12	1
	19:00	182	38	12	1
	20:00	178	39	11	1
	21:00	189	50	13	1
	22:00	188	46	14	1
	23:00	189	37	13	1
	0:00	191	36	13	1
	1:00	186	37	13	1
	2:00	186	3	13	1
	3:00	189	38	14	1
	4:00	193	40	14	1
	5:00	188	37	14	1
	6:00	183	36	15	1
	7:00	183	34	14	1
	8:00	182	30	14	1
January 22, 2016	9:00	178	38	12	1
	10:00	174	39	12	1
	11:00	176	41	13	1
	12:00	178	43	13	1
	13:00	173	43	14	1
	14:00	175	40	13	1
	15:00	174	41	12	1
	16:00	174	38	14	1
	17:00	173	39	14	1
	18:00	175	41	13	1
	19:00	178	41	12	1
	20:00	173	39	12	1
	21:00	175	38	14	1
	22:00	174	39	13	1
	23:00	170	34	14	1
	0:00	169	36	15	1
	1:00	175	39	17	1
	2:00	174	41	14	1

Date	Time	NOx (mg/m^3)	SO_2 (mg/m^3)	HCL (mg/m^3)	PM (mg/m^3)
	3:00	176	43	13	1
	4:00	175	43	12	1
	5:00	178	41	14	1
	6:00	175	43	15	1
	7:00	173	45	17	1
	8:00	171	41	16	1
January 23, 2016	9:00	173	30	20	1
	10:00	144	35	18	1
	11:00	154	29	20	1
	12:00	155	30	18	1
	13:00	157	28	16	1
	14:00	155	29	19	1
	15:00	150	28	18	1
	16:00	164	27	20	1
	17:00	173	23	17	1
	18:00	184	30	20	1
	19:00	154	35	20	1
	20:00	153	37	17	1
	21:00	173	32	17	1
	22:00	174	38	20	1
	23:00	164	39	18	1
	0:00	169	29	19	1
	1:00	168	28	20	1
	2:00	167	25	17	1
	3:00	171	26	18	1
	4:00	163	31	19	1
	5:00	175	33	20	1
	6:00	165	35	21	1
	7:00	161	34	18	1
	8:00	164	31	19	1
January 24, 2016	9:00	164	30	20	1
	10:00	139	35	18	1
	11:00	144	29	18	1
	12:00	152	30	20	1
	13:00	154	29	23	1
	14:00	155	28	16	1
	15:00	157	27	18	1
	16:00	153	27	19	1
	17:00	151	29	20	1
	18:00	152	28	18	1
	19:00	153	28	17	1
	20:00	154	29	20	1

Date	Time	NOx (mg/m^3)	SO_2 (mg/m^3)	HCL (mg/m^3)	PM (mg/m^3)
	21:00	174	46	13	1
	22:00	185	39	14	1
	23:00	185	37	14	1
	0:00	185	38	13	1
	1:00	184	36	14	1
	2:00	168	36	13	1
	3:00	171	36	12	1
	4:00	176	38	14	1
	5:00	171	37	14	1
	6:00	177	36	13	1
	7:00	174	37	12	1
	8:00	178	41	13	1
January 25, 2016	9:00	185	37	13	1
	10:00	185	38	13	1
	11:00	187	38	12	1
	12:00	185	39	12	1
	13:00	183	37	12	1
	14:00	179	39	13	1
	15:00	176	38	13	1
	16:00	180	37	13	1
	17:00	182	39	14	1
	18:00	178	40	13	1
	19:00	184	38	12	1
	20:00	185	36	12	1
	21:00	176	26	9	1
	22:00	173	28	10	1
	23:00	182	30	11	1
	0:00	176	30	9	1
	1:00	179	30	11	1
	2:00	181	29	13	1
	3:00	173	29	15	1
	4:00	176	27	17	1
	5:00	173	31	16	1
	6:00	176	31	14	1
	7:00	181	28	16	1
	8:00	176	32	14	1
January 26, 2016	9:00	178	38	14	1
	10:00	174	39	13	1
	11:00	176	34	13	1
	12:00	170	36	14	1
	13:00	169	39	12	1
	14:00	175	41	14	1

Date	Time	NOx (mg/m^3)	SO_2 (mg/m^3)	HCL (mg/m^3)	PM (mg/m^3)
	15:00	174	43	13	1
	16:00	178	43	14	1
	17:00	173	41	13	1
	18:00	171	43	13	1
	19:00	175	45	12	1
	20:00	174	41	12	1
	21:00	171	41	14	1
	22:00	175	40	13	1
	23:00	176	38	17	1
	0:00	178	37	15	1
	1:00	175	39	16	1
	2:00	175	41	14	1
	3:00	169	43	15	1
	4:00	171	43	17	1
	5:00	175	42	16	1
	6:00	175	40	14	1
	7:00	173	37	13	1
	8:00	171	39	12	1
January 27, 2016	9:00	164	30	20	1
	10:00	139	35	18	1
	11:00	144	34	18	1
	12:00	154	35	17	1
	13:00	155	36	16	1
	14:00	157	38	18	1
	15:00	151	40	20	1
	16:00	153	38	17	1
	17:00	154	27	18	1
	18:00	153	29	20	1
	19:00	154	28	21	1
	20:00	153	27	16	1
	21:00	170	38	12	1
	22:00	169	39	12	1
	23:00	171	38	13	1
	0:00	173	38	13	1
	1:00	175	39	12	1
	2:00	169	41	14	1
	3:00	171	41	14	1
	4:00	170	40	14	1
	5:00	173	41	13	1
	6:00	172	39	13	1
	7:00	171	38	13	1
	8:00	173	38	12	1

Source: Jingcheng SWT.

Figure 7: Jingcheng SWT control room screen showing real-time CEMS data

Source: Consultant.

34. Because CEMS cannot monitor real time dioxin concentration, national level dioxin monitoring is implemented annually. The Jingcheng SWT started operation in October 2014, the environmental review team was provided a copy of the 2015 dioxin monitoring report (see in Annex 4), which shows their full compliance with *Standard for pollution control on the municipal solid waste incineration* (GB 18485-2014).

Table 10: Annual dioxin monitoring results in 2015

No	Item	No	Concentration	Limit
1	Dioxin of exhaust gas of incinerator	1	0.080 ng TEQ/m^3	0.1 ng TEQ/m^3
2		2	0.013 ng TEQ/m^3	
3		3	0.0062 ng TEQ/m^3	
4		Average	0.033 ng TEQ/m^3	

Source: Jingcheng SWT.

35. Manual stack emissions monitoring is also undertaken on a quarterly basis by IMAR EPB for CEMS calibration. A 3rd party company is also hired on a quarterly basis for CEMS calibration.

c. Noise and Groundwater Monitoring and Results

36. Noise monitoring is undertaken at the site boundary on a quarterly basis.

37. To monitor ground water quality, five groundwater monitoring wells are installed and monitoring are periodically implemented. The parameters are pH, total hardness, permanganate index, ammonia nitrogen, nitrate nitrogen, and nitrite nitrogen. **Table 11** shows locations of ground water monitoring wells.

Table 11: Locations of groundwater monitoring wells

No	Location
1	30-50 m at upstream of landfill site
2	30-50 at both sides of groundwater flow direction at landfill site
3	30-50 at both sides of vertical direction of groundwater flow direction at landfill site

38. It is confirmed that quarterly noise monitoring shows that the Jingcheng SWT is in compliance with the relevant standard, Class II, *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008) and Class III, *Quality Standard for Ground Water* (GB/T14848-93).

E. Conclusion

39. Based on this environmental due diligence assessment, the Jingcheng SWT has an adequate environmental, health and safety management system and obtained all the necessary approvals for the plant operation. Proper environmental mitigation measures and control devices are up to date to keep pace with more stringent emission standards and the plant meets all the necessary environmental standards. Till now, no public complaint has been received. It is concluded that the Jingcheng SWT is well managed and performs good environmental, health and safety performance.

Annexes

Annex 1: Approval of EIA Report for Jingcheng SWT by IMAR EPB (September 14, 2009).

Annex 2: Approval of EIA Report for Jingcheng SWT by IMAR EPB (November 22, 2013).

Annex 3: Project Approval of Jingcheng SWT by IMAR Development and Reform Commission (IMAR DRC) (November 13, 2013).

Annex 4: Annual Dioxin Emission Monitoring Report by National Research Center for Environmental Analysis and Measurements (October 19, 2015).

Annex 5: Daily Exhaust Gas Monitoring Report (from January 21, 2016 to January 27, 2016).

Annex 1: Approval of EIA Report for Jingcheng SWT by IMAR EPB (September 14, 2009).

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呼和浩特市京城固体废物处置有限公司:

你公司报来的《呼和浩特市美商生活垃圾生化处理厂搬迁、改造工程环境影响报告书》(以下简称《报告书》)收悉。经研究,批复如下:

一、呼和浩特市美商生活垃圾生化处理厂搬迁、改造工程位于呼和浩特市赛罕区境内东南侧 13km,距北侧绕城公路 1.5km,东北侧为金桥热电厂粉煤灰场。该项目采用分选后进行“卫生填埋+堆肥+焚烧”技术处理生活垃圾,分选设计日处理能力为 1000t,通过分选,混合垃圾分成四大类:以塑料(少量)、纸张为主的高热值垃圾进入生活垃圾焚烧系统,焚烧垃圾量 300t/d;以灰土为主的垃圾进入卫生填埋场,填埋垃圾量 630t/d,服务年限为 10 年;以有机垃圾为主的垃圾进入堆肥系统,堆肥量 230t/d;铁、塑料等物质可回收利用。项目总占地面积 39.5×10^4 m^2,填埋场总库容量 325.7×10^4 m^3。工程建设内容主要包括填埋场工程、垃圾转运站工程及配套辅助工程。2009 年建设内容包括填埋库区、渗滤液提升泵站、渗滤液调节池、渗滤液处理车间、机修车间;2010-2011 年建设内容包括分选线、污泥处理利用系统、生活垃圾焚烧系统、堆肥系统;2012 年建设内容为沼气发电系统。项目总投资 27006 万元,环保投资为 8466.8 万元,占工程总投资的 31.35%。

该项目是环境卫生公益项目,符合国家的产业政策和城市总

1

体规划。《报告书》所提出的各项污染防治和生态保护对策、措施基本可行，可以作为该项目建设环境保护设计和管理的依据。从环境保护角度，同意项目建设。

二、 在下一步设计和建设中应重点注意以下问题：

（一）垃圾填埋场建设中要遵循预防为主、防治结合的原则，合理优化施工方案，施工期尽量减少施工占地，对土石方开挖、平整场地、弃土、建材装卸、车辆行驶等作业要注意扬尘对环境的影响。

（二）本工程垃圾填埋场的最大下挖深度要严格控制在 0.5m 以内，严禁工程对浅层地下水造成污染和破坏。

（三）垃圾填埋场大气污染物排放的场界浓度限值要符合《生活垃圾填埋场污染控制标准》（GB16889－2008）控制要求。在场界周围 700 米的距离内不得新建住宅、学校和医院等环境敏感设施。

（四）要按照《报告书》的要求，采取可靠措施，严格防止垃圾渗滤液对地下水和地表水的污染。严格落实对填埋场场底和边坡的各项防渗工程措施。

采用“厌氧（UASBF）+膜生化反应器（MBR）+纳滤（NF）+反渗透（RO）”工艺组合处理法处理渗透液，出水水质要满足《污水再生利用工程设计规范》（GB 50335-2002）要求。反渗滤浓缩水用于垃圾堆体的回喷用水、提取腐殖酸系统及回用于厂内厂房冲洗、道路冲洗及绿化用水。

（五）落实垃圾分选系统臭气和粉尘治理措施。采用封闭车间风选，通过除臭、除尘设备、除臭液喷淋管线、负压抽风管道后经布袋除尘器后排空。对垃圾填埋气先用火炬焚烧系统焚烧，待沼气发电系统建成后送发电机组发电；对垃圾填埋产生臭气采用散布消、脱臭剂的方式，及时用土覆盖压实。采取洒水防尘措施，设置防飞散网。采用“半干法+活性炭吸附+袋式除尘器”相结合的烟气净化工艺处理焚烧系统产生的烟尘、SO_2和二噁英等污染物，处理后要满足《生活垃圾焚烧污染控制标准》（GB 18485-2001）要求。

（六）待本工程建成后，现有呼和浩特市美商生活垃圾生化处理厂要关闭、停止使用，并落实好闭厂的各项环境保护措施，否则不予进行本工程环保竣工验收。

（七）落实地下水的监测措施，沿地下水走向，由东北向西南布设监测井 5 眼。

（八）项目建成后要加强环境保护日常管理工作，保证按期对污染源进行监测。

认真落实环境风险防范措施，避免垃圾爆炸、垮坝和未经处理污水溢出、渗滤液收集系统失效、焚烧炉运行故障等事件的发生。

（九）细化环保投资，保证摊平、碾压、喷淋等设备的投资。

（十）绿化或植被恢复措施因地制宜选择方案，重点做好填埋场隔离带的绿化。

（十一）认真开展环境监理工作，特别是做好垃圾填埋场防渗工程的环境监理，环境监理报告作为工程环保验收的依据之一。根据《内蒙古自治区环境保护局环境监理管理办法（试行）》规定，建设单位要与环境监理机构签定监理合同，并报我厅备案。在施工招标文件、施工合同和工程监理招标文件中明确环保条款和责任，定期向我厅提交工程环境监理报告。

三、该项目要严格执行环境保护“三同时”制度，各项污染防治设施与主体工程做到同时设计、同时施工、同时投产使用。项目建成后，你公司必须按规定程序分别向我厅申请试生产和环境保护竣工验收。验收合格后，该项目方可正式投入运营。

四、我厅委托呼和浩特市环境保护局及和赛罕区环境保护局负责该项目施工期的监督管理工作。

内蒙古自治区环境保护厅

二〇〇九年九月十日

主题词：环保　建设项目　报告书　批复

抄送：自治区发展和改革委员会，呼和浩特市环境保护局，赛罕区环境保护局，内蒙古自治区环境工程评估中心，内蒙古自治区环境监察总队，内蒙古自治区环境科学研究院。

内蒙古自治区环境保护厅办公室　　2009 年 9 月 14 日印发

共印 20 份

Annex 2: Approval of EIA Report for Jingcheng SWT by IMAR EPB (November 22, 2013).

内蒙古自治区环境保护厅

手机版【扫一扫】

首 页 | 政务公开 | 环境管理 | 环境服务 | 在线服务 | 政民互动 | 数据中心 | 特色栏目

首页 > 环境管理 > 环评审批 > 批准项目公告

关于对苏尼特右旗别鲁乌图硫铅锌铜矿西矿年采50万吨铜硫等多金属矿石等64个项目环境影响报告书批复的公告

【发布时间：2014年01月11日】 【来源：】 【大 中 小】 【打印】

关于对苏尼特右旗别鲁乌图硫铅锌铜矿西矿年采50万吨铜硫等多金属矿石等64个项目环境影响报告书批复的公告

公告期限：本公告自发布之日起7天届满。

行政复议与行政诉讼权力告知：公民、法人或其他组织认为公告的环境影响评价批复决定侵犯其合法权益的，可以在公告期限届满之日起六十日内提起行政复议，也可以自公告期限届满之日起三个月内提起行政诉讼。

附件下载1：2013年10-12月.xlsx

24	省道201线拉布大林至海拉尔段一级公路	呼伦贝尔市	呼伦贝尔市额尔古纳市、陈巴尔虎旗、海拉尔区、鄂温克族自治旗	交通运输部科学研究院	内环审[2013]214号	2013/11/22
25	通辽至大虎山铁路电气化改造工程（大郑线K164+100-K247+000段）	通辽市	通辽市的科尔沁区和科尔沁左翼后旗	铁道第三勘察设计院集团有限公司	内环审[2013]216号	2013/11/22
26	苏里格气田第六天然气处理厂工程	鄂尔多斯市	鄂尔多斯市乌审旗	河北奇正环境科技有限公司	内环审[2013]217号	2013/11/22
27	呼和浩特市京城固体废物处置有限公司垃圾焚烧余热发电工程	呼和浩特市	呼和浩特市赛罕区	内蒙古环科园环境科技有限责任公司	内环审[2013]219号	2013/11/22
28	省道218线巴彦诺日公至苏海图段公路改扩建项目	阿拉善盟	阿拉善盟阿拉善左旗	内蒙古新创环境科技有限公司	内环审[2013]220号	2013/11/22

Annex 3: Project approval of Jingcheng SWT by IMAR DRC, June 30, 2015.

内蒙古自治区发展和改革委员会

Inner Mongolia Development And Reform Commission

2016年1月29日 星期五 农历乙未年 腊月廿

呼和浩特 -3℃/-16℃

现在所在位置：首页>>项目审批、核准、备案

自治区发展改革委批复呼和浩特市京城固体废弃物处置有限公司垃圾焚烧余热发电工程节能评估报告书

发布机构：自治区发展改革委	发布时间：2013-11-13	索引号：NMG-002-00-0312000-2013-077
关 键 字：	组配分类：项目审批、核准、备案	文号：

2013年11月，呼和浩特市京城固体废弃物处置有限公司垃圾焚烧余热发电工程节能评估报告书获自治区发展改革委批复。该项目由呼和浩特市京城固体废弃物处置有限公司负责建设，建设规模为日处理垃圾量1000吨；主要建设内容为焚烧生产线、汽轮发电机组及相应的辅助附属工程。

Annex 4: Annual Dioxin Emission Monitoring Report by National Research Center for Environmental Analysis and Measurements (October 19, 2015).

2014000796E

检测

CNAS L2605

检 测 报 告

TEST REPORT

(2015)字 第(408)号

Serial No. 2015-408

委托单位： Applicant	呼和浩特市京城固体废物处置有限公司
样品名称： Sample Description	废气
检测类别： Test Type	委托检测
报告日期： Report Date	2015 年 10 月 19 日

国家环境分析测试中心

National Research Center for Environmental Analysis and Measurements

国家环境分析测试中心

检测报告单

(2015)字 第(408)号 第(1)页 共(5)页

委托单位名称	呼和浩特市京城固体废物处置有限公司
委托单位地址	内蒙古呼和浩特市赛罕区金桥开发区金桥热电厂
样品名称	废气
采样日期	2015年8月8日
采样地点	内蒙古呼和浩特市赛罕区金桥开发区曙光村
样品状态	气态、颗粒态分别采集于固态树脂（XAD）和石英纤维滤筒
检测日期	2015年9月7日至2015年9月30日

检测结果：

检测项目 / 样品描述		二噁英类 毒性当量(TEQ)质量浓度 (ng/m^3)
生活垃圾焚烧炉废气	第一次	0.080
	第二次	0.013
	第三次	0.0062
	平均值	0.033
GB18485-2014《生活垃圾焚烧污染控制标准》表4 生活垃圾焚烧炉排放烟气中污染物限值		0.1

注：1.工艺流程：生活垃圾储坑→抓斗进料→焚烧炉→二次燃烧室→热交换器降温→喷入活性炭→布袋除尘器→引风排放；

2.采样点位于水平烟道上，距地面高度12米；

3.二噁英类同类物测定结果和换算参见附表1至附表3.

（以下空白）

审 核：山岳	批 准：吴忠
报告编制：闫岩	签发日期：2015年10月19日

国家环境分析测试中心 检测专用章

国家环境分析测试中心

检测报告单

(2015)字 第(408)号 第(3)页 共(5)页

附表 2：生活垃圾焚烧炉废气第二次　　二噁英类分析结果

二噁英类		检出限	实测质量浓度(ρ_s)	换算质量浓度(ρ)	毒性当量(TEQ)质量浓度	
		ng/m³	ng/m³	ng/m³	TEF	ng/m³
多氯代二苯并-对-二噁英	2,3,7,8-T_4CDD	0.0007	0.0036	0.0042	×1	0.0042
	T_4CDDs	—	0.17	0.20	—	—
	1,2,3,7,8-P_5CDD	0.004	N.D.	N.D.	×0.5	0.0010
	P_5CDDs	—	0.085	0.10	—	—
	1,2,3,4,7,8-H_6CDD	0.006	N.D.	N.D.	×0.1	0.00030
	1,2,3,6,7,8-H_6CDD	0.007	N.D.	N.D.	×0.1	0.00035
	1,2,3,7,8,9-H_6CDD	0.005	N.D.	N.D.	×0.1	0.00025
	H_6CDDs	—	0.089	0.10	—	—
	1,2,3,4,6,7,8-H_7CDD	0.006	0.018	0.021	×0.01	0.00021
	H_7CDDs	—	0.036	0.042	—	—
	O_8CDD	0.007	0.029	0.034	×0.001	0.000034
	PCDDs 总量	—	0.41	0.48	—	0.0063
多氯代二苯并呋喃	2,3,7,8-T_4CDF	0.0007	0.0093	0.011	×0.1	0.0011
	T_4CDFs	—	0.40	0.47	—	—
	1,2,3,7,8-P_5CDF	0.004	0.008	0.009	×0.05	0.00045
	2,3,4,7,8-P_5CDF	0.01	N.D.	N.D.	×0.5	0.0025
	P_5CDFs	—	0.24	0.28	—	—
	1,2,3,4,7,8-H_6CDF	0.01	N.D.	N.D.	×0.1	0.00050
	1,2,3,6,7,8-H_6CDF	0.004	0.009	0.011	×0.1	0.0011
	1,2,3,7,8,9-H_6CDF	0.004	N.D.	N.D.	×0.1	0.00020
	2,3,4,6,7,8-H_6CDF	0.004	0.005	0.006	×0.1	0.00060
	H_6CDFs	—	0.040	0.047	—	—
	1,2,3,4,6,7,8-H_7CDF	0.003	0.010	0.012	×0.01	0.00012
	1,2,3,4,7,8,9-H_7CDF	0.004	N.D.	N.D.	×0.01	0.000020
	H_7CDFs	—	0.011	0.013	—	—
	O_8CDF	0.03	N.D.	N.D.	×0.001	0.000015
	PCDFs 总量	—	0.71	0.83	—	0.0066
二噁英类总量 (PCDDs+PCDFs)		—	1.1	1.3	—	**0.013**

【注】 1. 实测质量浓度(ρ_s)：二噁英类质量浓度测定值(ng/m³)。

2. 换算质量浓度(ρ)：二噁英类质量浓度的 11% 含氧量换算值(ng/m³)。

$$\rho = \frac{21-11}{21-\varphi_s(O_2)} \times \rho_s \quad (\text{实际氧气体积分数 } \varphi_s(O_2) = 12.5\%)$$

3. 毒性当量(TEQ)质量浓度：2,3,7,8-T_4CDD 毒性当量(TEQ)质量浓度，ng/m³。

4. 检出限：当实测质量浓度低于检出限时用"N.D."表示，计算毒性当量（TEQ）质量浓度时以 1/2 检出限计算。

5. 表中二噁英类质量浓度均为标准状态下的数值，废气样品采样量为 2.78m³。

6. 毒性当量因子 TEF 采用国际毒性当量因子 I-TEF。

国家环境分析测试中心

检测报告单

(2015)字 第(408)号 第(4)页 共(5)页

附表 3：生活垃圾焚烧炉废气第三次 二噁英类分析结果

二噁英类		检出限	实测质量浓度(ρ_s)	换算质量浓度(ρ)	毒性当量(TEQ)质量浓度	
		ng/m³	ng/m³	ng/m³	TEF	ng/m³
多氯代二苯并-对-二噁英	2,3,7,8-T_4CDD	0.0007	N.D.	N.D.	×1	0.00035
	T_4CDDs	—	0.034	0.040	—	—
	1,2,3,7,8-P_5CDD	0.004	N.D.	N.D.	×0.5	0.0010
	P_5CDDs	—	0.025	0.029	—	—
	1,2,3,4,7,8-H_6CDD	0.006	N.D.	N.D.	×0.1	0.00030
	1,2,3,6,7,8-H_6CDD	0.007	N.D.	N.D.	×0.1	0.00035
	1,2,3,7,8,9-H_6CDD	0.005	N.D.	N.D.	×0.1	0.00025
	H_6CDDs	—	0.017	0.020	—	—
	1,2,3,4,6,7,8-H_7CDD	0.006	N.D.	N.D.	×0.01	0.000030
	H_7CDDs	—	0.0069	0.0081	—	—
	O_8CDD	0.007	N.D.	N.D.	×0.001	0.0000035
	PCDDs 总量	—	0.086	0.10	—	0.0023
多氯代二苯并呋喃	2,3,7,8-T_4CDF	0.0007	0.0017	0.0020	×0.1	0.00020
	T_4CDFs	—	0.081	0.095	—	—
	1,2,3,7,8-P_5CDF	0.004	N.D.	N.D.	×0.05	0.00010
	2,3,4,7,8-P_5CDF	0.01	N.D.	N.D.	×0.5	0.0025
	P_5CDFs	—	0.073	0.086	—	—
	1,2,3,4,7,8-H_6CDF	0.01	N.D.	N.D.	×0.1	0.00050
	1,2,3,6,7,8-H_6CDF	0.004	N.D.	N.D.	×0.1	0.00020
	1,2,3,7,8,9-H_6CDF	0.004	N.D.	N.D.	×0.1	0.00020
	2,3,4,6,7,8-H_6CDF	0.004	N.D.	N.D.	×0.1	0.00020
	H_6CDFs	—	0.018	0.021	—	—
	1,2,3,4,6,7,8-H_7CDF	0.003	N.D.	N.D.	×0.01	0.000015
	1,2,3,4,7,8,9-H_7CDF	0.004	N.D.	N.D.	×0.01	0.000020
	H_7CDFs	—	0.033	0.039	—	—
	O_8CDF	0.03	N.D.	N.D.	×0.001	0.000015
	PCDFs 总量	—	0.22	0.26	—	0.0040
二噁英类总量 (PCDDs+PCDFs)		—	0.31	0.36	—	**0.0062**

【注】 1. 实测质量浓度(ρ_s)：二噁英类质量浓度测定值(ng/m³)。

2. 换算质量浓度(ρ)：二噁英类质量浓度的 11% 含氧量换算值(ng/m³)。

$$\rho = \frac{21-11}{21-\varphi_s(O_2)} \times \rho_s$$ (实际氧气体积分数 $\varphi_s(O_2)$ = 12.5%)

3. 毒性当量(TEQ)质量浓度：2,3,7,8-T_4CDD 毒性当量(TEQ)质量浓度, ng/m³。

4. 检出限：当实测质量浓度低于检出限时用"N.D."表示，计算毒性当量（TEQ）质量浓度时以 1/2 检出限计算。

5. 表中二噁英类质量浓度均为标准状态下的数值，废气样品采样量为 2.77m³。

6. 毒性当量因子 TEF 采用国际毒性当量因子 I-TEF。

Annex 5: Daily exhaust gas monitoring report (from January 21, 2016 to January 27, 2016)

烟气日常运行日志

2016年1月27日乙值白班

	O2	NOx	SO2	HCL	烟尘	烟气温度
9:00	8	164	30	20	1	150
10:00	8	139	35	18	1	147
11:00	9	144	34	18	1	147
12:00	8	154	35	17	1	148
13:00	8	155	36	16	1	149
14:00	9	157	38	18	1	148
15:00	8	151	240	20	1	147
16:00	9	153	38	17	1	146
17:00	8	154	27	18	1	148
18:00	9	153	29	20	1	147
19:00	8	154	28	21	1	151
20:00	9	153	27	16	1	148

烟气日常运行日志

2016年1月27日甲值夜班

	O2	NOx	SO2	HCL	烟尘	烟气温度
21:00	8	170	38	12	1	143
22:00	8	168	38	12	1	136
23:00	8	171	38	13	1	137
0:00	8	173	38	13	1	136
1:00	8	175	39	12	1	137
2:00	8	168	41	14	1	138
3:00	8	171	41	14	1	143
4:00	8	170	40	14	1	141
5:00	10	173	41	13	1	141
6:00	8	172	38	13	1	140
7:00	8	171	38	13	1	140
8:00	8	173	38	12	1	139

烟气日常运行日志

2016年1月26日甲值白班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
9:00	8	175	38	14	1	143
10:00	8	174	39	13	1	147
11:00	8	176	34	13	1	139
12:00	9	170	36	14	1	140
13:00	9	169	39	12	1	138
14:00	8	175	41	14	1	141
15:00	9	174	43	13	1	139
16:00	10	178	43	14	1	138
17:00	9	173	41	13	1	141
18:00	9	171	43	13	1	137
19:00	8	175	45	12	1	140
20:00	8	174	41	12	1	139

烟气日常运行日志

2016年1月26日丁值夜班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
21:00	9	171	41	14	1	138
22:00	9	175	40	13	1	141
23:00	9	176	38	17	1	145
0:00	8	178	37	15	1	143
1:00	9	175	39	16	1	142
2:00	9	175	41	14	1	140
3:00	9	169	43	15	1	137
4:00	10	171	43	17	1	139
5:00	10	175	42	16	1	141
6:00	9	175	40	14	1	143
7:00	9	173	37	13	1	146
8:00	8	171	39	12	1	145

烟气日常运行日志

2016年 1 月25日丁 值白 班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
9:00	8	185	37	13	1	131
10:00	9	185	38	13	1	128
11:00	8	187	38	12	1	129
12:00	8	135	39	12	1	126
13:00	8	183	37	12	1	127
14:00	9	179	39	13	1	129
15:00	8	176	38	13	1	128
16:00	8	180	37	13	1	125
17:00	8	182	39	14	1	127
18:00	9	178	40	13	1	128
19:00	8	184	38	12	1	126
20:00	8	185	36	12	1	129

烟气日常运行日志

2016年 1 月25日丙值 夜班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
21:00	9	176	26	9	1	146
22:00	9	173	28	10	1	147
23:00	9	182	30	11	1	146
0:00	8	176	30	9	1	148
1:00	8	179	20	11	1	147
2:00	8	181	29	13	1	149
3:00	9	173	29	15	1	150
4:00	8	176	27	17	1	148
5:00	9	173	31	16	1	146
6:00	8	176	31	14	1	143
7:00	8	181	28	16	1	147
8:00	8	176	32	14	1	143

烟气日常运行日志

2016年 1 月24日 丙值 白班

	O2	NOx	SO2	HCL	烟尘	烟气温度
9:00	8	164	30	20	1	150
10:00	8	139	35	18	1	147
11:00	8	144	29	18	1	147
12:00	9	152	30	20	1	148
13:00	8	154	29	23	1	149
14:00	8	155	28	16	1	148
15:00	8	157	27	18	1	147
16:00	9	153	27	19	1	148
17:00	8	151	29	20	1	147
18:00	8	152	28	18	1	149
19:00	9	153	28	17	1	148
20:00	8	154	29	20	1	147

烟气日常运行日志

2016年 1 月24日 乙值 夜班

	O2	NOx	SO2	HCL	烟尘	烟气温度
21:00	9	174	46	13	1	140
22:00	9	185	39	14	1	142
23:00	9	185	37	14	1	140
0:00	8	185	36	13	1	143
1:00	8	164	36	14	1	146
2:00	8	168	36	13	1	145
3:00	9	171	36	12	1	143
4:00	9	178	36	14	1	142
5:00	8	171	37	14	1	141
6:00	8	177	36	13	1	140
7:00	9	174	37	12	1	143
8:00	9	178	41	13	1	142

烟气日常运行日志

2016.年1月23日乙值白班

	O2	NOx	SO2	HCL	烟尘	烟气温度
9:00	8	173	30	20	1	150
10:00	8	144	35	18	1	148
11:00	9	154	29	20	1	147
12:00	8	155	30	18	1	146
13:00	9	157	28	16	1	149
14:00	8	155	29	19	1	147
15:00	9	150	28	18	1	151
16:00	8	164	27	20	1	147
17:00	9	173	23	17	1	149
18:00	8	184	30	20	1	147
19:00	9	154	35	20	1	147
20:00	8	153	37	17	1	148

烟气日常运行日志

2016年1月23日甲值夜班

	O2	NOx	SO2	HCL	烟尘	烟气温度
21:00	8	173	32	17	1	150
22:00	9	174	35	20	1	163
23:00	9	164	39	18	1	151
0:00	9	169	29	19	1	154
1:00	10	168	28	20	1	155
2:00	8	167	25	17	1	158
3:00	8	171	26	18	1	160
4:00	9	163	31	19	1	161
5:00	10	175	33	20	1	164
6:00	8	165	35	21	1	159
7:00	9	161	34	18	1	158
8:00	9	164	31	19	1	169

烟气日常运行日志

2016年1月22日甲值白班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
9:00	8	175	38	12	1	143
10:00	8	174	39	12	1	136
11:00	9	176	41	13	1	137
12:00	9	178	43	13	1	135
13:00	8	173	43	14	1	138
14:00	8	175	40	13	1	139
15:00	10	174	41	12	1	140
16:00	9	174	38	14	1	141
17:00	8	173	39	14	1	140
18:00	8	175	41	13	1	139
19:00	9	178	41	12	1	138
20:00	9	173	39	12	1	137

烟气日常运行日志

2016年1月22日丁值夜班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
21:00	8	175	38	14	1	143
22:00	8	174	39	13	1	147
23:00	8	170	34	14	1	144
0:00	9	169	36	15	1	142
1:00	9	175	39	17	1	140
2:00	9	174	41	14	1	137
3:00	10	176	43	13	1	138
4:00	9	175	43	12	1	139
5:00	8	178	41	14	1	142
6:00	9	175	43	15	1	145
7:00	10	173	45	17	1	146
8:00	9	171	41	16	1	145

烟气日常运行日志

2016年 1 月 21 日 丁 值 白 班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
9:00	8	181	38	13	1	125
10:00	9	185	38	12	1	127
11:00	8	184	35	12	1	130
12:00	8	179	36	12	1	128
13:00	8	181	37	13	1	125
14:00	9	183	36	13	1	126
15:00	8	175	35	13	1	129
16:00	8	170	35	14	1	131
17:00	8	173	37	13	1	129
18:00	9	178	36	12	1	125
19:00	8	182	38	12	1	127
20:00	9	178	39	11	1	128

烟气日常运行日志

2016年 1 月 21 日 丙 值 夜 班

	O_2	NOx	SO_2	HCL	烟尘	烟气温度
21:00	9	189	50	13	1	147
22:00	9	189	46	14	1	146
23:00	9	189	37	13	1	143
0:00	8	191	36	13	1	140
1:00	8	186	37	13	1	142
2:00	9	186	39	13	1	144
3:00	9	189	38	14	1	139
4:00	8	193	40	14	1	140
5:00	8	188	37	14	1	140
6:00	9	183	36	15	1	140
7:00	9	183	34	14	1	141
8:00	8	182	30	14	1	143

IV. ENVIRONMENTAL DUE DILIGENCE - JINGNENG SHENGLE THERMAL POWER CO., LTD

A. Introduction

1. This is an environmental due diligence assessment of the Inner Mongolia Jingneng Shengle Thermal Power Co., Ltd with combined cooling, heating and power (hereafter referred to as the Jingneng CCHP), being conducted as part of scope change proposed during the implementation of Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region(IMAR).

2. According the proposed scope change, Xiajingying and Jinqiao heating zones will utilize waste heat from existing two 350 MW CCHP units of the Jingneng CCHP. Waste heat from Jingneng CCHP will be supplied to two heating zones through a long transmission pipelines (to be constructed under the project scope change).

B. Environmental Due Diligence Review Approach

3. This report is based on a site visit, consultations with the Jingneng CCHP managers and technical staff, and a review of plant environmental and technical documentation. The site visit was undertaken January 26th 2016, with the following participants:

Environmental Due Diligence Reviewers:
Dai Lei, National Environmental Specialist, TA-8403[1]

Hohhot Chengfa Heating Company:
Mr. Wang JianZhong, Director of Chief Engineer Office
Mr. Zhang Feifei, Deputy Manager of Xingjiaying Heat Supply Plant (HSP)

Jingneng CCHP:
Mr. Guo Jun, Director of Sales & Maketing Department
Ms. Fan Xiaoying, Deputy Director of Equipment Department
Mr. Li Ping, Environment Engineer of Safety Supervision Department

4. Documentation reviewed during and after the facility visit included:
- PRC Project Environmental Impact Assessment (EIA) report (2015);
- EIA approval by Hohhot Environment Protection Bureau (EPB) (June 4, 2015);
- Project approval by IMAR Development and Reform Commission (June 4, 2015);
- Environmental acceptance approval of No 1 350 MW CHP unit by Hohhot EPB (December 30, 2015);
- Environmental acceptance approval of No 1 350 MW CHP unit by IMAR EPB (January 6, 2016);
- Environmental acceptance approval of continuous emission monitoring system (CEMS) of No 1 350 MW CHP unit by Hohhot EPB (December 28, 2015).

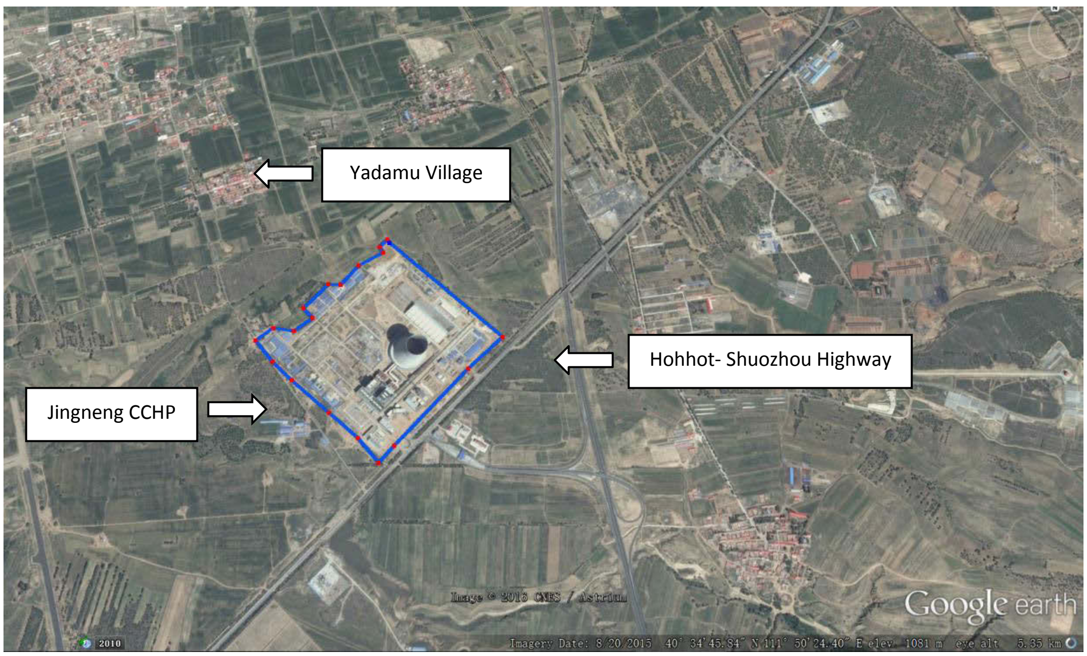
[1] TA-8403 PRC: Hohhot Smart Low-Carbon District Energy Project – Part II, Consultants (Project 47052-002).

C. Project Description

1. Location

5. The Jingneng CCHP is owned and operated by Inner Mongolia Jingneng Shengle Thermal Power Co., Ltd, which is a wholly owned subsidiary of Beijing Energy Investment Holding Co., Ltd. The Jingneng CCHP is located in Shengle Cloud Computing industrial Park in Shengle Town, Helingeer County in Hohhot City. It supplies (i) cooling and power to Shengle Cloud Computing industrial Park, and (ii) cooling and heating to Shengle Modern Service Industry Clusters, Helingeer Economic Development Zone in South Ruyi District, Helingeer County. The Jingneng CCHP occupies 26.12 ha, and surrounded by reserved construction land. The nearest village is Yadamu Village at northwest direction (**Figure 1**). Hohhot- Shuozhou Highway is at east of the CHP and the nearest distance is about 320m.

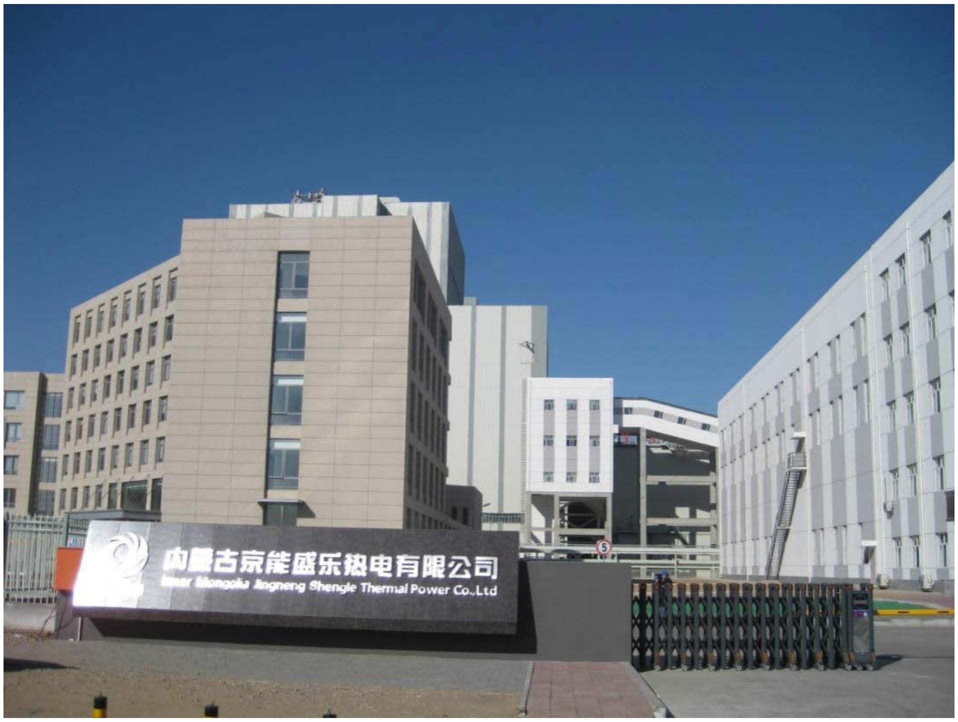
Figure 1: Jingneng CHP and surrounding area



Source: Google Earth, 2016 and Consultant.

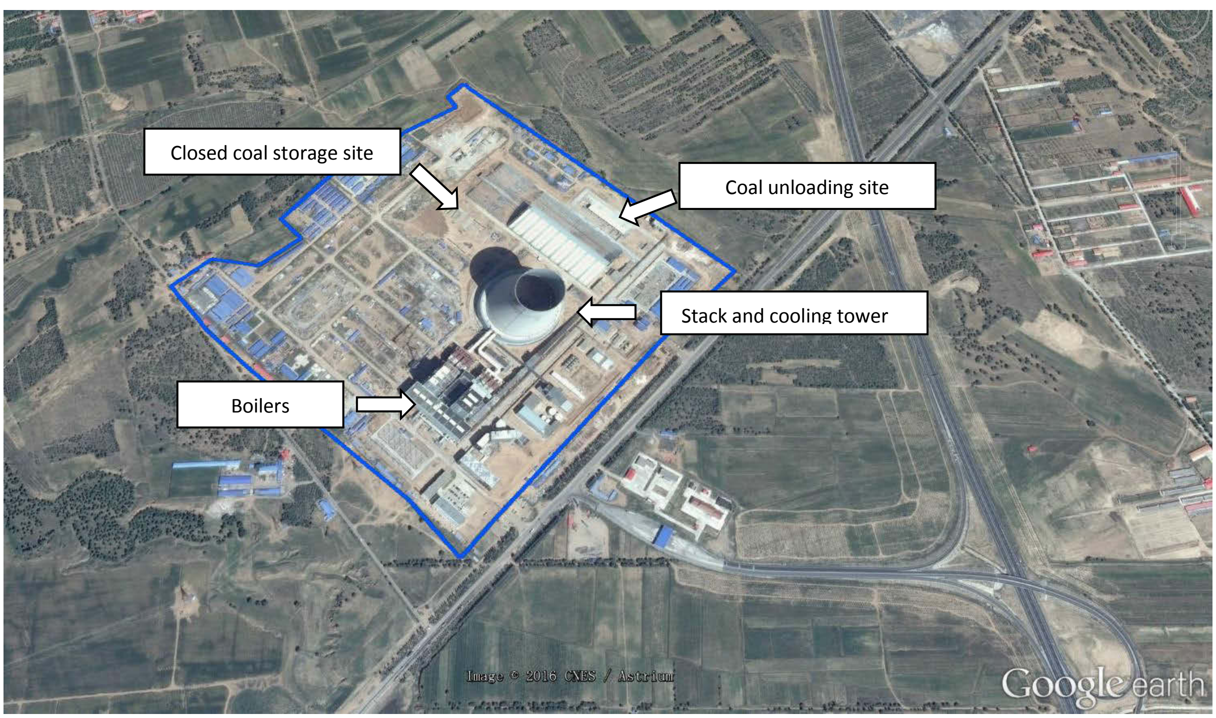
6. **Figure 3** shows an aerial view of the Jingneng CCHP including the boilers, office buildings, air cooling tower (this is an integrated cooling tower and a desulfurization tower is located inside the cooling tower, which also works as a stack) , closed coal storage site and coal unloading site.

Figure 2: Jingneng CHP looking from the southeast



Source: Consultant.

Figure 3: Jingneng CHP layout



Source: Google Earth 2016 and Jingneng Shengle Thermal Power Co., Ltd 2016

2. Purpose and Capacity

7. The plant was built in 2015 for cooling supply, heat supply and power generation. The

Jingneng CCHP started heating supply and power generation in November, 2015 and cooling supply will be started in summer of 2016.

8. The current configuration of the CCHP is two 350 MW supercritical pressure indirect air cooling CCHP units, two 1,181 t/h supercritical pressure once-through pulverized coal (PC) boilers and two 20 t/h coal fired start up boilers.

9. Total annual heat capacity is 5.02×10^6GJ and annual power generation is 38.5×10^8 kWh. In heating season, steam extraction capacity is two 487 t/h and rated heat supply capacity is 691MW and in non-heating season, steam extraction capacity is two 198 t/h which is provided to clients for cooling. By constructing heating pipelines between Jingneng CCHP and Xinjiaying and Jinqiao heating networks connection points, the surplus heat from Jingneng CCHP will be supplied to Xinjiaying and Jinqiao heating networks.

3. Fuel

10. At the Jingneng CCHP, coal with low sulfur content (<0.9%) is used that is primarily coming from Jungar Banner, Erdos city, Inner Mongolia. Slack coal from the coal mine is transported by truck with a proper seal. Coal is unloaded in an onsite closed coal storage site and stored. Annual coal consumption (annual operation time is 5,500 hours and daily operation time is 20 hours) for the CCHP is approximately 2.43 million tons. Coal analysis data are well kept which are listed in **Table 1**.

Table 1: Coal analysis data

Item	Symbol	Unit	Design data	Actual data
Total moisture	M_t	%	11.0	9.6
Moisture (air dried basis)	M_{ad}	%	5.55	4.97
Ash (as received basis)	A_{ar}	%	26.01	33.01
Volatile (dry ash-free basis)	V_{daf}	%	38.94	41.66
Carbon (as received basis)	C_{ar}	%	47.40	42.68
Hydrogen (as received basis)	H_{ar}	%	2.95	2.72
Nitrogen (as received basis)	N_{ar}	%	0.73	0.84
Oxygen (as received basis)	O_{ar}	%	11.22	10.35
Total sulfur (as received basis)	$S_{t,ar}$	%	0.69	0.80
Mercury content	Hg	μg/g	0.140	0.165
Net calorific value (as received basis)	$Q_{net,ar}$	MJ/kg	17.77	16.02

4. Water Supply and Wastewater

11. Domestic water is supplied from a municipal water system. Annual domestic water consumption of the CCHP is 17,500 m^3. Production water is supplied from reclaimed water of (i) wastewater treatment plant of Inner Mongolia Mengniu Biomass Energy Co., Ltd and (ii) wastewater treatment plant of Inner Mongolia Shengle Environmental Science and Technology Co., Ltd. It is confirmed that reclaimed water supply agreements were signed. Annual reclaimed water supply capacity of Inner Mongolia Mengniu Biomass Energy Co., Ltd in 2016 is 992,300 m^3 and Inner Mongolia Shengle Environmental Science and Technology Co., Ltd is 2,858,600

m^3. Annual production water consumption is 2,009,300 m^3, which means reclaimed water supply capacity is sufficient.

12. Reclaimed water from the two wastewater treatment plants is first, treated to reduce organics and hardness before being used as production water. General treatment process is aeration, membrane bio-reactor, and chlorination disinfection. Additional, boiler make-up water is treated with advancement by filter, ultra-filtration, reverse osmosis (RO) and ion exchange. And condensation water is treated by filter covered by resin powder and high speed mixed resin bed.

13. Domestic wastewater and storm water is collected and treated at the integrated wastewater treatment facility at the Jingneng CCHP, and then, recycled. All production wastewater is recycled and reused by different methods based on water quality. Detailed information is listed below.

- Free pressure wastewater and cooling water of ancillary facilities from turbine rooms and boilers are collected and used as make up water of ancillary facilities circulation water system after pressure raising;
- Concentrated water of RO equipment and circulating wastewater of ancillary facilities circulation water system are collected and recycled;
- Acid wastewater from boiler maintenance and boiler commissioning, wastewater from boiler equipment cleaning and wastewater from air pre-heater cleaning are collected, treated and recycled;
- Wastewater from floor cleaning of coal transportation system is collected, treated by in coal wastewater system (sediment and clarification treatment with a capacity of 10 t/h) and recycled;
- Oil wastewater from oil tank area is collected, oil-water separation treated and recycled;
- Wastewater from desulfurization is recycled after neutralization flocculation and sediment.

14. Based on the information above, the Jingneng CCHP does not discharge any wastewater and all wastewater will be recycled as landscaping water, road cleaning water, spray water in coal storage site, and make up water of desulfurization system.

15. To protect groundwater and meet the anti-seepage standard, different anti-seepage measures are undertaken according to locations and relevant anti-seepage requirements.

5. Solid Wastes

16. The Jingneng CCHP produces approximately 687,000 t/a of fly and bottom ash, 76,400 t/a of coal slag, and 94,600 t/a of FGD gypsum slag. All coal combustion waste products are sold to an offsite construction company for recycling in the production of bricks and other construction materials. The Jingneng CCHP singed a solid waste treatment agreement with Inner Mongolia Daihai Environment Protection company, Jingneng logistics service company and Inner Mongolia Mengyuan Cement company. All the production wastes are treated and recycled by these companies.

17. Domestic waste is collected, transported and treated by local sanitation department of Helingeer county.

18. Hazardous waste is handled and transported with certificated trucks by contracted companies with proper licenses for treatment and final disposal.

6. Noise

19. Noise sources during operation will mainly be from turbines, boiler rooms, coal mill, fans, desulfurization equipment, transformers, pumps, and cooling equipment. While using low-noise equipment as far as possible, the plant layout and facilities are designed to mitigate noise impacts during operation using shock absorption, insulated enclosures and sound dampening materials. These measures can typically reduce noise intensity. All plant and equipment, including vehicles are properly maintained in order to minimize noise. Also, the workers who are likely to be exposed to high noise level environment are strictly use appropriate personal noise protective equipment (PPE) provided.

7. Air pollutants

20. Both boilers are equipped with selective catalytic reduction (SCR) denitrification, desulfurization and dust collector integrated unit, and electric-bag integrated dust collector. Flue gases are exhausted through one 180 m high and 103.48m in inner diameter stack, which is located inside the integrated air cooling tower. In this design, the exhaust gas from the stack will be heated again within the cooling tower and rise higher.

21. Fugitive emission control measures are listed below:

- Coal storage site is fully closed and installed with spray equipment which spray water periodically. Head of coal conveyor equipment is installed spraying equipment. Feed channel of belt coal conveyor is fully closed;

- Coal transportation truck is covered to reduce dust;

- Fly ash and coal slag are mixed with water then transported by closed truck;

- The temporary storage of fly ash, gypsum and coal slag is equipped with spray equipment, where water is sprayed periodically. In strong wind weather, water spray frequency will be increased.

Figure 4: Jingneng CHP cooling tower and coal transporting trestle

Source: Consultant.

D. Environmental Management System and Performance

1. Environmental Management System

22. The Jingneng CCHP has a total of approximately 180 staff. Responsibility for environmental management rests with the Safety Supervision Department, which has 5 staff. One full time staff is working on environmental management and safeguards issues. Safety and Occupational health also belong to the Safety Supervision Department. One full time staff is working on occupational health management and safeguards issues and two full time staff are working on safety management and safeguards issues. As a newly built plant, the Jingneng CCHP is currently working on getting ISO 9001 (Quality Management Systems), ISO 14001 (Environmental Management Systems) and ISO 18001 (Occupational Health and Safety) certification.

23. The Jingneng CCHP has Quality management system (QMS), Safety management system (SMS), Occupational health management system (OHMS) and Environment management system (EMS). All four systems were prepared based on relevant national, provincial and local laws and regulations. All the systems are annually reviewed and updated if necessary.

24. During site visit, safety management regulation is provided to audit team for review. Organization structure of safety and fire protection committee are explained in this Safety management regulation with targets and responsibilities. Organization structure of safety and fire protection system and safety supervision system with detailed responsibilities are explained in this regulation too. Main contents of Safety management regulation are listed below:

- Safety management system;
- Safety and fire protection responsibility;
- Safety management content;
- Check and rectification of potential dangers;
- Safety education for staff;
- Special operation training management;
- Report and treatment procedures for safety accidents;
- Personal protection equipment management;
- Safety production expenses management.

25. Occupational hazards monitoring and management regulation is also provided to audit team for review. Occupational hazards monitoring and management regulation focuses on occupational health and safety and occupational disease prevention and control. Main contents are listed below. Other documents are also provided like personal protection equipment management record, occupational hazardous workplace record table, training and education record.

- Responsibilities of relevant departments
- management of occupational hazardous factors

- operation and management of occupational hazard factors protection facilities
- personal protection equipment management
- occupational hazardous factors monitoring
- management of occupational hazardous factors monitoring points
- environment assessment of work place
- notice of occupational hazardous factors
- occupational hazardous factors control and prevention
- emergency plan for occupational hazard accident
- propaganda and education
- noise standard and noise control
- High-temperature control

26. In addition, environment engineer of the Jingneng CCHP provided a copy of some environment documents to the audit team. The list includes Control procedures for identification and assessment of environment factors, Control procedures for acquisition and update of laws, regulations and other requirements, Control procedures for environment policies, targets, indicators and environment management programs, Control procedures for human resource, Control procedures for information communication, Documents control procedures, Operation control procedures, Wastewater emission management and control procedures, Energy and resources control procedures, Monitoring equipment control procedures, Environment operation control procedures, Control procedures for environment monitoring, Control procedures for compliance assessment, Control procedures for emergency preparation and response and Control procedures for prevention and corrective measures.

27. The Jingneng CCHP has an emergency response procedure, and regular emergency response training and drills are undertaken.

28. Overall, the Jingneng CCHP has an adequate environmental, health and safety management system which involves a lot of regulations and policies. The system and regulations are updated regularly. The Jingneng CCHP also has an emergency response procedure and working properly.

2. Approvals and Licenses

29. The Jingneng CCHP obtained all the necessary approvals and fully complied with all relevant PRC requirements, including EIA approvals (see in Annex 1) and occupational health and safety approvals.

30. Environmental acceptance of No 1 unit of the Jingneng CHP was approved on December 21, 2015 and No 2 unit was approved on January 23, 2016. It is confirmed that the Jingneng CCHP is compliance with all relevant PRC environmental acceptance requirements. During site visit, environmental acceptance approvals of No 1 unit by Hohhot EPB and IMAR EPB and CEMS of No 1 unit are provided to audit team (see in Annex 3, 4 and 5).

31. During the EIA preparation process, information disclosure and public consultation were implemented to the project beneficiaries and affected people. No public feedback was received

in response to any of the project information notices. One round of questionnaire based surveys was also undertaken in the villages nearby. Questionnaires from 117 villagers and 19 groups were received. 94.7% of the respondents indicated that they support the proposed project. Overall support for the project is very strong and the project received public support from the project beneficiaries and affected people. It is also confirmed that there was no public complaint received by the time of due diligence.

32. Based on *Interim measure for review and management of total emission quantity indicators for major pollutants of construction project* was issued by Ministry of Environmental Protection in December 31, 2014, total emission quantity indicators for major pollutants of the Jingneng CHP was approved by IMAR EPB before the EIA approved by Hohhot EPB (see article 8 of section 2 in Annex 1).

3. Environmental Performance

a. Applicable environmental standards

33. **Table 2** presents a summary of relevant emission standards for the Jingneng CCHP. **Table 3** presents the relevant ambient air quality standards for the Jingneng CCHP surrounding area. **Table 4** presents ambient noise standards. **Table 5** presents groundwater standards. Because wastewater in the CCHP is collected and recycled and two 3000 m^3 emergency tanks are installed for emergency, the CCHP will not discharge any wastewater to surface water body. No surface water standard is applicable.

Table 2: Summary of Environmental Pollution Standards Applicable to the Jingneng CHP

Pollutant	Limit	Standards Source
Stack Emissions		
SO_2	100 mg/m^3	Table 1 in *Emission Standards of Air Pollutants from Thermal Power Plant* (GB 13223-2011).
NOx	100 mg/m^3	
PM	30 mg/m^3	
Other		
Fugitive PM	1.0 mg/m^3 at site boundary	Table 2 of *Integrated Emission Standard of Air Pollutants* (GB 16297-1996)
Daytime Noise (06:00-22:00 h)	60 dB(A) at site boundary	Class II of *Emission Standard for Industrial Enterprises at Site Boundary* (GB 12348-2008)
Nighttime noise (22:00-06:00 h)	50 dB(A) (at site boundary)	

Table 3: Applicable ambient air quality standards – Class II, Ambient Air Quality Standards (GB 3095—2012) (unit: mg/m^3)

Pollutants	Annual mean (class 2)	24-hr mean (class 2)	1-hr mean (class 2)
TSP	0.200	0.300	--
PM_{10}	0.070	0.150	--
$PM_{2.5}$	0.035	0.075	--
SO_2	0.060	0.150	0.500
NO_2	0.040	0.080	0.200

Table 4: Applicable ambient environment noise standard – Class II, Environmental Quality Standards for Noise (GB3096-2008)

Item	Class II	Class III
Daytime Noise (06:00-22:00 h)	60 dB(A)	65 dB(A)
Nighttime noise (22:00-06:00 h)	50 dB(A)	55 dB(A)

Table 5: Applicable groundwater standard (Class III, *GB/T14848-93 Quality Standard for Ground Water*)

No	Item	Unit	Limit
1	pH	-	6.5-8.5
2	Total hardness ($CaCO_3$)	mg/L	≤450
3	Fluoride	mg/L	≤1.0
4	Chloride	mg/L	≤250
5	Ammonia nitrogen	mg/L	≤0.2
6	Nitrate	mg/L	≤20
7	Nitrite	mg/L	≤0.02
8	Volatile Phenols	mg/L	≤0.002
9	Total dissolved solids	mg/L	≤1000
10	Permanganate index	mg/L	≤3.0
11	Total coliforms	/L	≤3.0

b. Stack Emissions Monitoring and Results

34. It is confirmed that the Jingneng CCHP has fully complied with relevant standards on stack emissions. The environmental acceptance approvals (see in Annex 3 and 4) show that SO_2 concentration is 29 mg/m^3, NOx is 29.1 mg/m^3 and PM is 8.7 mg/m^3. All the concentration is far below the standard.

35. The Jingneng CCHP is equipped with a CEMS that monitors in real time SO_2, NOx, PM and air flow. Data is sent electronically to the IMAR EPB Data Center because the CHP is national control company. The data can be found on IMAR EPB's website. The link is http://www.nmgepb.gov.cn:9002/xxgk/base/data-selection!index.action.

Figure 5: Jingneng CHP control room and screen showing real-time CEMS data

Source: Consultant.

36. Manual stack emissions monitoring is also undertaken on a quarterly basis by IMAR EPB for CEMS calibration. A 3rd party company is also hired by the CCHP on a quarterly basis for CEMS calibration. Internal monitoring of stack emission operational parameters is also implemented which are used to manage operation.

c. Noise and Groundwater Monitoring and Results

37. Noise monitoring is undertaken at the site boundary on a quarterly basis.

38. To monitor ground water quality, nine groundwater monitoring wells are installed. Five wells are installed near the CCHP site and four are installed near fly ash storage site. Groundwater samples from the nine monitoring wells are taken for analysis every two months. The parameters are pH, COD, ammonia, fluoride etc,. **Table 6** shows locations of ground water monitoring wells.

Table 6: Locations of groundwater monitoring wells

No	Site	Location
1	Jingneng CHP	Upstream of Jingneng CHP
2		Downstream of industrial wastewater treatment plant
3		Downstream of domestic wastewater treatment plant
4		Downstream of closed coal storage site
5		Downstream of Jingneng CHP
6	Ash storage site	Upstream of ash storage site
7		Northwest of ash storage site

8		Southeast of ash storage site
9		Downstream of ash storage site

39. Environmental acceptance approvals (see in Annex 3 and 4) of the Jingneng CCHP present that noise monitoring results are compliance with the relevant standard, Class II of *Emission Standard for Industrial Enterprises at Site Boundary (GB 12348-2008)* and groundwater monitoring result are also compliance with the relevant standard, Class III of *Quality Standard for Ground Water* (*GB/T14848-93*).

E. Conclusion

40. Based on this environmental due diligence assessment, the Jingneng CCHP has an adequate environmental, health and safety management system and obtained all the necessary approvals for the plant operation. Proper environmental mitigation measures and control devices are up to date to keep pace with more stringent emission standards and the plant meets all the necessary environmental standards. Till now, no public complaint has been received. It is concluded that the Jingneng CCHP is well managed and performs good environmental, health and safety performance.

Annexes

Annex 1: Approval of EIA Report for Jingneng CHP (2 x 350 MW) by Hohhot EPB, June 4, 2015.

Annex 2: Project approval of Jingneng CHP (2 x 350 MW) by IMAR Development and Reform Commission, June 30, 2015.

Annex 3: Environmental acceptance of No 1 350 MW CHP unit by Hohhot EPB (December 30, 2015).

Annex 4: Environmental acceptance of No 1 350 MW CHP unit by IMAR EPB (January 6, 2016).

Annex 5: Environmental acceptance of continuous emission monitoring system (CEMS) of No 1 350 MW CHP unit by Hohhot EPB (December 28, 2015).

Annex 1: Approval of EIA Report for Jingneng CHP (2 x 350 MW) by Hohhot EPB, June 4, 2015.

呼和浩特市环境保护局文件

呼环政批字[2015]43 号

呼和浩特市环境保护局
关于内蒙古京能盛乐 2×350MW 冷热电联供项目
环境影响报告书的批复

内蒙古京能盛乐热电有限公司:

你公司《关于内蒙古京能盛乐 2×350MW 冷热电联供机组项目环境影响评价报告审查的请示》(京盛电字[2015]49 号)及由国电环境保护研究院编制完成的该项目《建设项目环境影响报告书》等相关材料收悉后，我局组织专家和相关部门对该项目进行了现场踏勘，并通过了专家技术审查委员会的审查。项目已取得国家能源局《关于同意内蒙古自治区 2014 年度国电建设规划实施方案的复函》(国能电力[2014]582 号)、自治区发改委《关于〈盛乐现代服务业集聚区、和林格尔经济开发区、如意南区及和林格尔县热电联产规划〉的批复》(内发改能源字[2014]375 号)、自治区住建厅《关于内蒙古京能盛乐 2×350MW "上大压小" 冷热电联供项目选址意见书的复函》(内件规函[2014]693 号)、呼和浩特市人民政府《关于〈盛乐

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现代服务业集聚区、和林格尔经济开发区、如意南区及和林格尔县城市供热规划（2011-2020）〉的批复》（呼政批字[2012]68号）、自治区国土厅《关于内蒙古京能盛乐2×350MW热电联产工程建设项目拟选址用地范围内未压覆已查明重要矿产资源的函》（内国土资函[2012]173号）、呼市国土局《关于内蒙古京能盛乐2×350MW热电联产项目的用地意见》（呼国土资通字[2012]45号）、自治区水利厅关于项目水资源论证报告书批复（内水资[2015]27号）和水土保持方案报告书的批复（内水保[2015]44号），以及市政府《关于承诺在内蒙古京能盛乐热电厂供热区域内关停供热小锅炉的函》。项目已开工建设，我局于2015年1月3日对该项目进行了行政处罚，根据《内蒙古自治区环境保护厅关于进一步做好环保违规建设项目清理整顿工作的通知》（内环办[2015]89号），经我局“建设项目审批委员会”审议，从环境保护角度同意该项目建设，现批复如下：

一、项目基本情况

项目位于呼和浩特市和林格尔县盛乐镇雅达牧村东南方约500m处，厂址四周为园区规划企业，用地性质为规划建设用地。厂区用地面积为26.12hm^2、贮灰场用地面积（初期）为9.76hm^2。本项目属于呼和浩特市和林格尔县热电联产规划中的热电冷联产项目，建设规模为2×350MW燃煤冷热电联供间接空冷机组，负责向盛乐现代服务业集聚区、和林格尔经济开发区、如意开发区(南区)及和林格尔县城区（城关镇）供汽和采暖供热，为附近的大型云计算中心提供制冷动力汽源以及主要向盛乐现代服务业集聚区供电。

项目新建2×350MW超临界间接空冷热电机组，配2×1181t/h超临界直流煤粉炉，以及2×20t/h燃煤启动锅炉、冷却水系统、供排水系统、除灰渣系统、封闭条形煤场等辅助设施；新建台格斗事故灰场，位于厂址西南侧直线距离约6.4km处，运灰道路长约10km；环保设施为烟气脱硝、脱硫和除尘装置，两台炉合用一座高180m、出口内径103.48m的间接空

冷排烟塔。厂外电力送出工程和厂外配套热网工程不在本次环评范围内。项目总投资311932万元，其中环保投资30217万元，占总投资比例9.69%。

项目为新建工程，该项目符合国家产业政策和和林格尔县城市总体规划及呼和浩特盛乐现代服务业集聚区总体规划，满足清洁生产要求。在落实报告书提出的各项环境保护措施和本批复要求后，污染物可达标排放，主要污染物排放总量符合环境保护部门核定的总量控制指标要求。因此，我局同意你公司按照环评文件所列地点、性质、规模、环境保护对策措施进行建设。

二、项目应重点做好以下工作

1、项目在建设期须严格按照市政府办公厅关于《市区建筑噪声和扬尘污染综合治理方案》（呼政办发[2011]135号）和市政府《关于开展建筑垃圾扬尘污染专项治理的通告》（呼政发[2013]34号）文件中相关内容执行；切实做好施工期的污染防治工作，合理安排施工作业时间，规范操作，加强管理。施工产生的扬尘应符合《防治城市扬尘污染技术规范》(HJ/T 393-2007)；施工噪声应符合《建筑施工场界环境噪声排放标准》(GB12523-2011)要求，夜间不得施工，因特殊工艺需连续昼夜施工的须经市环境监察支队审批同意后方可施工。施工期间的食堂、采暖和热水等严禁使用原煤。

2、强化大气污染防治措施。须采用低氮燃烧技术及SCR烟气脱硝装置（脱硝效率>84%）、电袋复合除尘器及SPC超净脱硫除尘一体化装置(综合除尘效率>99.98%)和SPC石灰石-石膏湿法脱硫（脱硫效率>98.6%），不准设烟气旁路和GGH。两台炉合用一座间接空冷排烟塔，烟气污染物排放须符合《火电厂大气污染物排放标准》(GB13223-2011)新建燃煤锅炉排放限值。

认真落实原辅料储运、破碎工序的扬尘控制措施，减少各类无组织排放。煤场、输煤系统各转运点等须封闭，并设洒水除尘装置、各落料口设布袋除尘装置；灰场配备蓄水池、喷洒

水设备，定期喷洒保持灰场湿度，并配备碾压设备，对灰面进行碾压。厂界大气污染物排放须符合《大气污染物综合排放标准》(GB16297-1996)排放限值。

3、落实节水与水污染防治措施。项目用水水源为内蒙古蒙牛生物质能有限公司污水处理厂及内蒙古盛乐环保科技有限公司污水处理厂再生水。项目厂区排水采用分流制，分为生活污水排水系统、工业废水排水系统及雨水排水系统。化学酸碱废水、凝结水处理废水、锅炉清洗废液、主厂房地面冲洗水等排入工业废水处理站处理后回用；脱硫废水经单独的处理系统处理后回用；生活污水进入生活污水处理装置（二级生化处理）处理后回用；煤场冲洗水等含煤废水经过煤水澄清池和过滤设备处理后供煤场喷洒和输煤栈桥的冲洗。所有废水均处理达标后全部回用，不外排。项目须设2座3000m^3事故蓄水池。

定期对厂区和灰场地下水进行监测。地下水防治分区防渗，重点污染防治区主要包括各类废水收集池、废水处理站、脱硝氨区等，一般污染防治区包括煤场等。重点污染防治区渗透系数＜1×10^{-10}cm/s、一般污染防治区渗透系数＜1×10^{-7}cm/s。严禁采用漫流、渗坑、渗井、裂隙等规避监管的方式排放。

4、做好固体废物分类处理、处置。粉煤灰、炉底渣、脱硫石膏须100%综合利用。综合利用不畅时可临时存至台格斗灰场贮存；脱硝废催化剂和废机油等危废须由有资质单位回收处置；生活垃圾由环卫部门统一清运。

5、强化噪声污染防治。选择低噪声设备，汽轮机、发电机、励磁机、磨煤机、空压机、各种水泵等均须安装在室内，窗户选用密闭和隔声性能良好的材料；锅炉排汽口和吹管末端安装降噪消声器；厂区实施绿化规划。厂界噪声应满足《工业企业厂界环境噪声排放标准》(GB12348 - 2008)2类标准。

6、强化环境风险防范和应急措施。液氨罐区须设置有效容积大于氨罐体积的围堰。加强对除尘、脱硫、脱硝等系统的设计和运行管理，定期开展环境风险应急培训和演练，有效防

范和应对环境风险。

7、强化污染源管理。按照国家和地方有关规定，建设规范的污染物排放口和固体废物堆放场，并设立标志牌。安装锅炉烟气污染物自动连续监测系统，并与市环保局联网。烟囱应按规范要求设置永久性监测口。

8、项目总量已由自治区环保厅批复。

9、严格执行环评报告中提出的其他环境影响防治对策，确保污染物达标排放，加强对环保设施的监督管理及定期维护，确保其正常稳定运行。

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。开展工程施工期环境监理，定期向环境保护行政主管部门提交监理报告。工程试生产前，应向我局提交书面试生产申请，经检查同意后方可进行试生产。在试生产期间，须按规定程序向我局申请竣工环境保护验收。经验收合格后，工程方可正式投入生产。工程建设内容或污染防治措施等发生重大变动，应重新履行相关审批手续。

四、我局委托市环境监察支队负责该项目施工期和运营期的环境监察工作，并足额征收排污费。

2015 年 6 月 4 日

信息公开选项：公开

抄报：自治区环境保护厅。

抄送：市环境监察支队，和林县环保局，国电环境保护研究院。

呼和浩特市环境保护局　　　　2015 年 6 月 4 日印发

Annex 2: Project approval of Jingneng CHP (2 x 350 MW) by IMAR Development and Reform Commission, June 30, 2015.

内蒙古自治区发展和改革委员会文件

内发改能源字[2015]827号

内蒙古自治区发展和改革委员会关于京能盛乐冷热电联供机组工程项目核准的批复

呼和浩特市发展改革委:

你委《关于内蒙古京能盛乐2×350MW冷热电联供机组工程项目核准的请示》(呼发改基础字[2015]290号)及有关材料均悉。经研究,现就该项目核准事项批复如下:

一、根据国家能源局《关于同意内蒙古自治区2014年度火电建设规划实施方案的复函》(国能电力[2014]582号)有关要求,为满足呼和浩特市盛乐云计算园区的可靠保障电源和制冷动能热源需求、并保障盛乐现代服务业集聚区、和林格尔经济开发

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区、如意南区及和林格尔县“三区一县”供热需求，实现能源梯级利用，提高能源利用效率，原则同意建设京能盛乐冷热电联供机组工程项目。

项目单位为北京能源投资（集团）有限公司。

二、项目建设地点为内蒙古自治区呼和浩特市盛乐现代服务业集聚区。

三、本工程新建2台35万千瓦超临界间接空冷燃煤发电机组，同步建设脱硫、脱硝和除尘装置。

该项目采用间接空冷技术，年取水量约202.68万立方米，生产用水采用蒙牛乳业集团污水处理厂、盛乐环保科技有限公司污水处理厂再生水，生活用水采用园区自来水。项目投产后，年耗煤213万吨，燃用准格尔矿区烟煤，公路运输进厂。电厂所排灰渣全部综合利用，灰场位于电厂厂址西南方向台格斗山沟内。

电厂以220千伏电压等级接入系统，出线2回线路接入和林1号220千伏变电站。

四、本工程动态总投资33.2亿元。其中项目资本金约占动态总投资的20%，由北京能源投资（集团）有限公司出资，资本金以外所需资金拟由银行贷款解决。

五、本工程安装高效除尘、脱硫、脱硝和在线烟气连续监测等装置。各项污染物排放指标要满足国家最新环保要求。

六、项目投产后供电煤耗等各项能耗指标要满足《内蒙古自

治区煤电节能减排升级与改造行动计划（2014-2020年）》有关要求，项目单位要优化工程设计，选用节能设备，加强节能管理。

七、在项目建设过程中，应严格执行《招标投标法》等有关法律法规和规章规定，认真组织项目的招标投标工作，详见附件。

八、核准本工程项目的相关文件分别是《自治区住建厅关于内蒙古京能盛乐 2×350MW“上大压小”冷热电联供项目选址的批复》（内建规[2012]547 号）、《内蒙古自治区国土资源厅关于内蒙古京能盛乐热电 2×350MW 冷热电联供机组工程项目用地的意见》（内国土资字[2015]278 号）、《呼和浩特市环境保护局关于内蒙古京能盛乐 2×350MW 冷热电联供项目环境影响报告书的批复》（呼环政批字[2015]43 号）、《内蒙古自治区水利厅关于京能盛乐 2×350MW 冷热电联供机组工程水资源论证报告书批复的函》（内水资[2015]27 号）、《内蒙古自治区发展和改革委员会关于内蒙古京能盛乐 2×350MW 冷热电联供机组工程节能评估报告书的批复》（内发改环资字[2015]451 号）等。

九、如需对本项目核准文件所规定的有关内容进行调整，请及时以书面形式向我委报告，并按照规定办理。

十、请项目单位根据本核准文件，办理相关城乡规划、土地使用、资源利用、安全生产、文物、军事等手续，并切实做好维护社会稳定等工作。

十一、本核准文件有效期限为 2 年，自发布之日起计算。在

核准文件有效期内未开工建设项目的，应在核准文件有效期届满30日前向我委申请延期。项目在核准文件有效期内未开工建设也未申请延期的，或虽提出延期申请但未获批准的，本核准文件自动失效。

附件：京能盛乐冷热电联供机组工程项目招标投标事项核准意见表

内蒙古自治区发展和改革委员会

2015年6月30日

抄送：自治区国土厅、住建厅、环保厅、水利厅，国家能源局华北监管局，北京能源投资（集团）有限公司

内蒙古自治区发展和改革委员会办公室　　2015年6月30日印发

Annex 3: Environmental acceptance of No 1 350 MW CHP unit by Hohhot EPB (December 30, 2015).

呼和浩特市环境保护局文件

呼环政验〔2015〕35号

呼和浩特市环境保护局
关于内蒙古京能盛乐热电有限公司
1号机组脱硫、脱硝、除尘系统完工验收的批复

内蒙古京能盛乐热电有限公司：

依据国家发展改革委、环境保护部《燃煤发电机组环保电价及环保设施运行监管办法》（发改价格〔2015〕536 号）要求，我局组织有关专家对你厂 1 号机组脱硫、脱硝、除尘工程进行了现场检查及验收。经研究，提出验收意见如下：

一、基本情况

1 号机组于 2015 年 12 月 21 日通过“168 小时”试运行，除

尘系统采用电袋复合除尘器，脱硫系统采用石灰石-石膏湿法（不设 GGH、引增合一）及 SPC 脱硫除尘一体化技术，脱硝系统采用低氮燃烧+选择性催化还原脱硝工艺（LNB+SCR），使用液氨做还原剂，并安装烟气在线监测装置（CEMS）。

二、监测结果

内蒙古自治区环境监测中心站监测结果（内环站字 YS［2015］第 60 号、第 61 号、第 62 号）表明：

1 号机组脱硫设施出口的二氧化硫最大排放浓度为 29mg/m³，脱硫效率为 99.1%-99.3%；脱硝反应器 A 侧、B 侧入口最大浓度分别为 273.2mg/m³、271.6mg/m³，出口最大浓度分别为 25.1mg/m³、16mg/m³，总出口最大浓度为 29.1mg/m³。A 侧脱硝效率为 90.19%-91.43%，B 侧脱硝效率为 93.94%-94.28%；烟尘最大排放浓度为 8.7mg/ m³，电袋除尘器除尘效率为 99.88%-99.93%，电袋除尘器+脱硫塔总除尘效率为 99.96%。

三、结论

经现场检查，并与验收监测内容进行核对，1 号机组二氧化硫、氮氧化物、烟尘排放浓度满足环评批复《火电厂大气污染物排放标准》（GB13223-2011）规定标准限值，并满足《燃煤发电机组环保电价及环保设施运行监管办法》（发改价格[2014]536 号）要求。1 号机组脱硫、脱硝、除尘设施于 2015 年 12 月 30 日通过环境保护验收。

四、其他要求

1．加强治理设施的运行管理，确保设施长期稳定运行和达标排放。

2．建立并完善污染物总量控制及治理设施运行台账。

3．定期对烟气连续在线监测系统进行校准，加强烟气连续在线监测系统的维护与管理。

2015 年 12 月 30 日

抄送：内蒙古自治区环境保护厅，呼和浩特市环境监察支队。

呼和浩特市环境保护局办公室　　2015 年 12 月 30 日印发

Annex 4: Environmental acceptance of No 1 350 MW CHP unit by IMAR EPB (January 6, 2016).

内蒙古自治区环境保护厅

内环函〔2016〕6号

内蒙古自治区环境保护厅关于内蒙古京能盛乐热电有限公司1#机组脱硫脱硝除尘设施通过验收的函

自治区发改委:

按照《燃煤发电机组环保电价及环保设施运行监管办法》(发改价格〔2014〕536号)第四条、第五条的要求，呼和浩特市环境保护局对内蒙古京能盛乐热电有限公司1#机组(350MW)脱硫、脱硝和除尘设施进行了现场验收，认定符合验收条件，以呼环政验〔2015〕35号文件同意该机组脱硫、脱硝及除尘设施于2015年12月30日通过环保验收。

专此致函。

内蒙古自治区环境保护厅

2016年1月6日

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Annex 5: Environmental acceptance of continuous emission monitoring system (CEMS) of No 1 350 MW CHP unit by Hohhot EPB (December 28, 2015).

呼和浩特市环境保护局文件

呼环验〔2015〕11 号

呼和浩特市环境保护局关于
内蒙古京能盛乐热电有限公司 1 号机组
脱硫及脱硝烟气在线监测设备通过验收的批复

内蒙古京能盛乐热电有限公司：

你公司《2×350MW 冷热电联供机组工程 1 号机组烟气在线连续监测系统验收的请示》收悉，我局组织有关专家对你公司 1 号机组脱硫出、入口及脱硝出、入口烟气在线监测设备进行了现场验收。经实地查看污染源自动监测设备的建设及运行状况，查阅并核实了有关技术资料，经过认真讨论，形成验收意见如下：

一、内蒙古京能盛乐热电有限公司 1 号机组脱硫出、入口安

装两套北京雪迪龙科技股份有限公司 SCS-900 型烟气排放连续监测系统，脱硝出、入口安装四套北京航天益来电子科技有限公司 CYA-863A 烟气排放连续监测系统，设备的选型基本符合要求。

二、烟气排放连续监测系统的安装基本符合《固定污染源烟气排放连续监测技术规范（试行）》（HJ/T75-2007）的相关要求。

三、脱硫及脱硝烟气在线监测设备与环保部门实现联网传输，设备运行基本正常。

四、烟气排放连续监测系统各项指标的比对监测均按照《固定污染源烟气排放连续监测系统技术要求及检测方法（试行）》（HJ/T76-2007）严格执行，监测结果合格。

五、验收结论为：内蒙古京能盛乐热电有限公司 1 号机组脱硫出、入口及脱硝出、入口共六套烟气在线监测设备通过验收。

六、整改要求：

（一）脱硫烟气在线监测站房不能完全达到污染源自动监控现场端建设规范要求，必须重新建设站房。

（二）现有监测点位的选取还存在问题，尤其是脱硫总排口流速的测量方式影响监测数据的准确性，建议选用多点测量方式。

（三）尽快提供脱硝烟气在线监测设备的最新资质，如逾期不能提供，则必须全部更换。

（四）加强烟气在线监测设备的运行维护工作，安排专人负责并持证上岗，或交于有实力的第三方运维公司进行专业化运

维，确保在线设备的正常运行及在线数据的及时、有效、稳定上传。

（五）严格按照《固定污染源烟气排放连续监测技术规范（试行）》（HJ/T75-2007）相关要求配备标准气体和校准、校验设备，确保在线设备的校准、校验工作正常实施。

（六）完善和落实在线监测设备各项管理及运行制度，并认真做好各类台账的记录工作。

（七）以上整改要求务于2016年3月20日前整改完毕。

七、请呼和浩特市环境监察支队做好整改期间的日常监督检查工作，确保整改按期落实到位。

特此批复。

附件：内蒙古京能盛乐热电有限公司1号机组脱硫及脱硝烟气在线监测设备验收合格标志信息表

2015年12月28日

呼和浩特市环境保护局办公室　　2015年12月28日印发

附件

内蒙古京能盛乐热电有限公司1号机组脱硫及脱硝烟气在线自动监测设备验收合格标志信息表

序号	监测点位	设备类型	验收合格标志编号
1	1号机组脱硫入口	烟气	150100221500023
2	1号机组脱硫出口	烟气	150100221500024
3	1号机组脱硝A侧入口	烟气	150100221500025
4	1号机组脱硝A侧出口	烟气	150100221500026
5	1号机组脱硝B侧入口	烟气	150100221500027
6	1号机组脱硝B侧出口	烟气	150100221500028