

# Initial Environmental Examination (Update)

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Project Number: 50096-002  
July 2020

People's Republic of China: Air Quality Improvement in the Greater Beijing-Tianjin-Hebei Region – China National Investment and Guaranty Corporation's Green Financing Platform Project (Guangrao 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject)

Prepared by China National Investment and Guaranty Corporation for the Asian Development Bank.

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## **CURRENCY EQUIVALENTS**

(Inter-bank average exchange rate as of 1 July 2020)

Currency Unit - Yuan (CNY)

CNY 1.00 = US\$ 0.1414

USD 1.00 = 7.0710 CNY (mid-rate)

## **ABBREVIATIONS**

ACM	Asbestos-Containing Material
ADB	Asian Development Bank
AP	Affected Person
ASL	Above Sea Level
CSC	Construction Supervision Company
DCS	Distributed Control System
DI	Design Institute
EA	Executing Agency
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Monitoring Plan
EMS	Environmental Monitoring Station
EMU	Environment Management Unit
EPB	Environmental Protection Bureau
ETDZ	Economic and Technological Development Zone
FGD	Flue Gas Desulfurization
FSR	Feasibility Study Report
GHG	Green House Gas
GRM	Grievance Redress Mechanism
HES	Heat Exchange Station
IA	Implementing Agency
IEE	Initial Environmental Examination
MEP	Ministry of Environmental Protection
NDRC	National Development and Reform Commission
PMO	Project Management Office
PPCU	Project Public Complain Unit
PPE	Personnel Protective Equipment
SCADA	Supervisory Control and Data Acquisition
SPS, ADB	Safeguard Policy Statement, ADB
TCE	Tons coal equivalent
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

## WEIGHTS AND MEASURES

BOD <sub>5</sub>	Biochemical Oxygen Demand, five days
cm	Centimeter
CO <sub>2</sub>	Carbon Dioxide
COD	Chemical Oxygen Demand
dB(A)	A-weighted sound pressure level in decibels
DO	Dissolved Oxygen
GJ	Gega Joule
ha	Hectare
kcal	Kilo calorie
kg	Kilogram
km	Kilometer
kWh	Kilowatt Hour
m	meter
m/s	Meters per Second
m <sup>3</sup>	Cubic Meters
mg/l	Milligrams per Liter
mg/m <sup>3</sup>	Milligrams per Cubic Meter
mg/Nm <sup>3</sup>	Milligrams per Normal Cubic Meter
MW	Megawatt
NH <sub>3</sub> -N	Ammonia Nitrogen
Nm <sup>3</sup>	Normal Cubic Meter
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
°C	Degrees Celsius
pH	A measure of the acidity or alkalinity of a solution
PM	Particulate Matter
PM <sub>10</sub>	Particulate Matter smaller than 10 micrometers
PM <sub>2.5</sub>	Particulate Matter smaller than 2.5 micrometers
SO <sub>2</sub>	Sulfur Dioxide
SS	Suspended Solids
TN	Total Nitrogen
TSP	Total Suspended Particulates

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## **1 EXECUTIVE SUMMARY**

### **1.1 Introduction**

This is the Initial Environmental Examination (IEE) report for the Guangrao 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject of proposed People's Republic of China: Air Quality Improvement in the Greater Beijing-Tianjin-Hebei Region – China National Investment and Guaranty Corporation's (hereafter referred to as I&G) Green Financing Platform Project. Elion Technology Co., Ltd, (hereafter referred to as Elion) Guangrao Subcompany is the subborrower and the total investment of entrust loan is 220 million RMB. The project is located at Guangrao Binhai New Area (hereafter referred to as GBNA), Guangrao County, Dongying City, Shandong Province which is at northeast of Guangrao County. The project started construction at September 2015 and is under trial operation now. Main content of the project is installation of two 35 t/h micro-fine coal atomization boilers for heat supply by steam and supporting pipe network.

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 B, requiring the preparation of an IEE (this report) including an environmental management plan (EMP). Because construction of the project is completed, environmental impact during operation phase is analyzed in this report.

### **1.2 Project introduction**

Domestic environment impact assessment (EIA) report was prepared by Henan Yuantong Environment Protection Engineer Co., Ltd. Then the EIA report was submitted to Dongying Environmental Protection Bureau (EPB) for approval. The domestic EIA was reviewed by the Dongying EPB and approved at June 24, 2015. This report has been prepared based on a domestic Feasibility Study Report (FSR), domestic EIA report, site visits undertaken by national EIA team hired by I&G and public consultations with key stakeholders and affected persons.

Construction of the project can meet the requirements in regional EIA report of

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GBNA. The project area is divided into boiler area, chemical water treatment area and extension area. The main content of project includes installation of two boilers, supporting facilities (ancillary workshops for boilers, office building, Pulverized coal (PC) process workshop, chemical water treatment workshop and ancillary workshop, material storage room), storage facilities (PC storage tower, coal transportation system, ash storage room, lime powder storage room, urea storage room and gypsum storage room), utilities (water supply system, power supply system, chemical water treatment system, cooling water system, ash and slag handling system and air compressor system) and environment protection facilities (desulfurization, denitration and dust removal system, septic tank, temporary storage room for solid waste and online monitoring system).

The parameters of the steam provided by project are: pressure is 1.6 MPa, degree is around 245 °C. If the users have different requirements on the steam, they can adjust the parameter by themselves. Steam users are the enterprises in GBNA and steam pipeline is overhead installed.

### **1.3 Project benefits**

The project will provide heat to enterprises in GBNA to instead of small coal-fired boilers owned by the enterprises. To mitigate environmental impacts, the project will use Micro-fine Coal Atomization technology to increase combustion efficiency of boilers, then coal consumption of will be reduces compared to traditional coal fired boilers. The project's implementation will: (i) significantly reduce heat cost; (ii) reduce coal consumption and pollutants emission; and (iii) improve air quality in GBNA. When compared to the equivalent production of heat through traditional coal-fired boilers, once operational the project will: (i) result in annual energy savings equivalent to 48,721 tons of standard coal, thereby providing a global public good by avoiding the annual emission of 121,461 tons of carbon dioxide (CO<sub>2</sub>), a greenhouse gas; (ii) improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO<sub>2</sub>) by 124.56 tons, nitrogen oxides (NO<sub>x</sub>) by 19.9 tons, and particulate matter (PM) by 47.53 tons; and (iii) eliminate the negative impacts of coal

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transportation through urban areas by truck.

#### **1.4 Environmental impacts and mitigation measures**

The project will establish a district steam heating system in GBNA and existing small coal fired boilers in GBNA will be demolished. The project's implementation will reduce coal consumption and pollutants emission and improve air quality in GBNA by combustion efficiency.

The project is located at GBNA. The project will not entail any permanent or temporary physical displacement or economic displacement because land acquisition of GBNA has been completed by authorities. Construction phase of the project is already completed now. During construction phase, mitigation measures were implemented according to the requirements in domestic EIA such as preparation of a reasonable construction schedule, control of construction area and plant afforestation after construction etc. Potential negative environmental impacts during construction phase were limited which were associated with soil, surface water, ground water, ambient air, flora and fauna, nearby residents and were disappeared after the construction was completed.

Potential negative environmental impacts during operation phase include flue gas (flue gas of boilers and dust-laden flue gas), waste water, noise (mainly from pumps and fans) and solid waste (fly ash and coal slag). The flue gas is treated before emission and can meet relevant standards. The report undertakes atmospheric dispersion modeling for SO<sub>2</sub>, PM<sub>10</sub>, TSP, ammonia and NO<sub>x</sub> using SCREEN3, a US EPA approved screening mode to estimate the effects to ambient air quality of the project. Based on the modeling result, the project will have very limited effects to the ambient air quality. The wastewater of the project will be treated by different methods according to wastewater quality. Most of the treated wastewater will be recycled or reused and only few will be discharged to municipal sewer. By noise reduction measures, noise levels at the site boundaries can meet relevant standards. Because there are no environmental sensitive receptors within 200m outside the boundaries, the project will not have negative noise impacts to the receptors. Production waste will

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be sold out for recycling. Domestic waste will be routinely collected by the local sanitation department for recycling, if possible, or final disposal at an approved waste disposal site.

### **1.5 Environment management plan (EMP)**

A comprehensive EMP for operation phase was developed 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 the 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 environment, health and safety (EHS). Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

### **1.6 Grievance Redress Mechanism**

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

### **1.7 Information Disclosure and Public Consultations**

The subborrower undertook first information disclosure from March 30, 2014 to April 11, 2015 and second information disclosure from April 16, 2015 to April 29, 2015. Project public information was disclosed on the subborrower and EPB's website. Project public information was also disclosed at the communities where beneficiaries and potentially affected persons (AP) located by leaflets and posts on bulletin boards of the communities. The information included project content, potential environmental

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impacts, and mitigation measures. Public had a better understanding of the project by public consultation. Questions, suggestions and feedback from the public were also collected to make the project reasonable.

EIA Institute conducted questionnaire survey on March 28, 2015. A total of 90 questionnaires were distributed to beneficiaries and AP and 90 completed questionnaires were received. The top three environment issues respondents identified were air pollution (67.8%), water pollution (20.0%) and noise pollution (6.7%).

Overall support for the project is very strong; 98.9% of the respondents indicated that the project will improve local economic development and 97.8% of respondents indicated that they supported the project.

The subborrower undertook one public consultation meeting in November 1, 2017. Meeting participants were asked to complete a questionnaire. A total of 36 questionnaires were distributed and 36 completed questionnaires were received.

69.4% of respondents indicated that the top environment issue was ambient air quality, 80.6% of respondents indicated that they concerned about the air pollution caused by the project and 100% of respondents indicated that they supported the project.

The subborrower will continue to conduct regular information disclosure and public consultation to communicate with beneficiaries and AP during the operations phase. Ongoing consultation will ensure that public concerns are understood and dealt with in a timely manner.

### **1.8EMP implementation agency**

Elion Guangrao subcompany is responsible for operation and management of the project. EHS department of Elion Guangrao subcompany is responsible for environment protection and safety production of the project.

### **1.9Conclusion**

Based on domestic EIA report and environment due diligence, the project has

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identified potential negative environment impacts and appropriately established mitigation measures. If the mitigation measures are well implemented and monitored, identified environmental impacts of the project will be reduced to an acceptable level. The project is environmentally feasible.

Overall, Micro-fine Coal Atomization technology is used in the project to achieve district steam to the GBNA. The project's implementation will improve air quality in GBNA and bring environmental and economic benefits for the development of GBNA.

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## 2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This IEE has been prepared in accordance with both the PRC's national and local environmental legal and institutional framework and environmental assessment requirements, and applicable ADB policies, requirements and procedures.

### 2.1 PRC Environmental Legal Framework

The environmental protection and management system in the PRC consists of a well-defined hierarchy of regulatory, administrative and technical institutions. At the top level the People's Congress 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. Provincial and local governments can also issue provincial and local environmental regulations and guidelines in accordance with the national ones. EIA procedures have been established in the PRC for over 20 years. Domestic EIA should follow national and local laws and regulations. Key applicable PRC laws and regulations are listed in Table 2-1.

**Table 2-1 Applicable PRC laws and regulations**

No.	Title of the Law	Year Issued/Updated
1	Environmental Protection Law	2014
2	Environmental Impact Assessment Law	2016
3	Water Law	2002
4	Water Pollution Prevention and Control Law	2008
5	Air Pollution Prevention and Control Law	2015修订
6	Noise Pollution Prevention and Control Law	1996
7	Solid Waste Pollution Prevention and Control Law	2004
8	Water and Soil Conservation Law	2010
9	Cultural Relics Protection Law	2015
10	Land Administration Law	2004
11	Cleaner Production Promotion Law	2002
12	Urban and Rural Planning Law	2008
13	Circular Economy Promotion Law	2009
14	Energy Conservation Law	2015

No.	Title of the Law	Year Issued/Updated
15	Environmental Protection Tax Law	2018
16	Construction project environment protection management regulations	2017
17	Management Guideline on EIA Categories of Construction Projects	2017
18	National Hazardous Wastes Catalogue	2016
19	Integrated Reform Plan for Promoting Ecological Progress	2015
20	Notice of the State Council on soil pollution prevention and control action plan	2016
21	Notice of the State Council on water pollution prevention and control action plan	2015
22	Notice of the State Council on air pollution prevention and control action plan	2013
23	Guiding Ideas on Promoting Public Participation in Environmental Protection	2015
24	Method of environmental information public disclosure for enterprises and institutions	2015
25	Provisional Regulations on Public Participation in Environmental Impact Assessment	2006
26	Comprehensive utilization management method of fly ash	2013

Applicable PRC environmental management and assessment guidelines are summarized in table2-2.

**Table 2-2 Applicable PRC EIA guideline**

No.	Guideline	Code and/or Year Issued/Updated
1	Technical Guidelines for EIA – General Program	HJ2.1-2016
2	Technical Guideline for EIA – Atmospheric Environment	HJ 2.2-2008
3	Technical Guideline for EIA – Surface Water	HJ/T 2.3-1993
4	Technical Guideline for EIA – Acoustic Environment	HJ 2.4-2009
5	Technical Guideline for EIA – Groundwater Environment	HJ 610-2016
6	Technical Guideline for EIA – Ecological Impact	HJ 19-2011
7	Technical Guidelines for Environmental Risk Assessment for Construction Projects	HJ/T 169-2004
8	Technical guidelines on water pollution control	HJ2015-2012

	engineering	
9	Technical guidelines for air pollution control projects	HJ2000-2010
10	Wet flue gas desulfurization project technical specification of industrial boiler and furnace	HJ462-2009
11	Engineering technical specification of flue gas selective non-catalytic reduction Denitration for thermal power plant	HJ563-2010
12	Engineering technical specification of flue gas selective catalytic reduction Denitration for thermal power plant	HJ562-2010
13	Technical specifications for collection, storage, transportation of hazardous waste	HJ2025-2012
14	Technical code for fire protection water supply and hydrant systems	GB50974-2014
15	Self-monitoring Technology guidelines for Pollutions Sources - General rule	HJ 819-2017
16	Self-monitoring guidelines for pollution sources -Thermal power generation and boiler	HJ 820-2017
17	Technical guidelines for fugitive emission monitoring of air pollutants	HJ/T 55-2000
18	Code of practice for selection of personal protective equipment	GB/T 11651-2008
19	Safety signs and guideline for the use	GB2894-2008
20	Guidelines for enterprises to develop emergency response plan	AQ/T 9002-2006

## 2.2 Applicable ADB Policies, Regulations and Requirements

The major applicable ADB policies, regulations, requirements and procedures for EIA are the *Safeguard Policy Statement* (SPS, 2009) which provides the basis for ADB financed project. The SPS promotes good international practice as reflected in internationally recognized standards such as the World Bank Group's *EHS Guidelines*<sup>1</sup>. When host country regulations differ from these levels and measures, the borrower/client is to achieve whichever is more stringent.

Domestic EIA is prepared based on PRC EIA approval procedure which required the construction and operation of the project to meet environment quality standards such as ambient air, water, noise etc.

The SPS establishes an environmental review process to ensure that projects

<sup>1</sup> World Bank Group, *Environmental, Health, and Safety Guidelines*, April 30, 2007, Washington, USA.

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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

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.

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.

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.

## 2.3 Relevant International Agreements

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 2-3.

**Table 2-3 Applicable international agreements**

No.	Agreement	Year	Purpose
1	Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat	1975	Preventing the progressive encroachment on and loss of wetlands for now and the future
2	Convention on Biological Diversity	1993	Conservation and sustainable use of biodiversity.
3	UN Framework Convention on Climate Change	1994	Stabilizing greenhouse gas (GHG) concentrations in the atmosphere at a level that will prevent anthropogenic induced climate change.
4	Kyoto Protocol	2002	Controlling emissions of anthropogenic GHGs in ways that reflect underlying national differences in GHG emissions, wealth, and capacity to make the reductions.
5	Montreal Protocol on Substances That Deplete the Ozone Layer	1989	Protection of the ozone layer

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## 2.4 World Bank EHS Guideline

During the design, construction, and operation of a project the ADB SPS 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*).<sup>2</sup> 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. Relevant guidelines referenced in this report include the *General EHS Guidelines* and the *EHS Guidelines for Thermal Power Plants*.

## 2.5 Applicable PRC standards

The environmental quality standard system in the PRC is classified into two categories by function: ambient environmental standards and pollutant emission/discharge standards. Standards applicable to the project are presented in Table 2-4.

**Table 2-4 Applicable PRC environmental standards**

No.	Standard	Code/Date
1	Surface Water Quality Standards	GB 3838-2002
2	Ambient Air Quality Standards	GB 3095-2012
3	Environmental Quality Standards for Noise	GB 3096-2008
4	Groundwater Quality Standard	GB/T 14848-93
5	Integrated emission standard of air pollutants	GB 16297-1996
6	Integrated emission standard of regional air pollutants in Shandong Province	DB37/2376-2013

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<sup>2</sup> World Bank Group, *Environmental, Health, and Safety Guidelines*, April 30, 2007, Washington, USA.  
<http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines>

No.	Standard	Code/Date
7	Integrated Emission Standards of Particulate Matter from Stationary Source of Shandong Province	DB37/1996-2011
8	Emission Standards for odor pollutants	GB14554-93
9	Discharge standard of pollutants for municipal wastewater treatment plant	GB18918-2002
10	Noise Standards for Construction Site Boundary	GB 12523-2011
11	Noise Standards for Industrial Enterprises at Site Boundary	GB 12348-2008
12	Standard for pollution on the storage and disposal site for general industrial solid wastes	GB 18599-2001
13	Standard for pollution control on hazardous waste storage	GB 18597-2001

### 2.5.1 Ambient Air Quality

Ambient air quality limits are intended to indicate safe exposure levels for the majority of the population, 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. Ambient air quality assessment area of the project is a circle with a radius of 2.5 km and circle center is the project center. Class 2 standards apply to this assessment area.

The World Health Organization (WHO) Air Quality Guidelines are recognized as international standards and are adopted by the World Bank Group's Environment, Health and Safety Guidelines (*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 standards are presented in Table 2-5.

- For TSP, there are PRC standards but no corresponding WHO guidelines.
- For PM<sub>10</sub>, PRC Class 2 annual average and 24-hour average standards meet WHO IT-1 guidelines (there are no 1-hour average standards or guidelines for either PRC or WHO).
- For PM<sub>2.5</sub> PRC Class 2 annual and 24-hour standards meet WHO IT-1

guidelines (there are no 1-hour standards or guidelines for either PRC or WHO).

- For SO<sub>2</sub> WHO only has a 24-hour average guideline (0.125 mg/m<sup>3</sup>), which is slightly lower than the PRC standard (0.150 mg/m<sup>3</sup>). However, SO<sub>2</sub> levels are low in the project area, and the project will only contribute extremely low levels of SO<sub>2</sub>, so the very minor difference is inconsequential.
- For NO<sub>2</sub> 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.

Overall the PRC standards show a high degree of equivalency to the WHO guidelines or IT-1 values, and they are adopted for use in this IEE report

**Table 2-5 PRC Ambient Air Quality Standards (GB3095-2012) and WHO ambient air quality guidelines, mg/m<sup>3</sup>**

Standard	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO
WHO Ambient Air Quality Guidelines							
Annual mean	-	0.020	0.010	-	0.040	-	-
Annual mean IT-1	-	0.070	0.035	-	-	-	-
24-hr mean	-	0.050	0.025	0.020	-	-	-
24-hr mean IT-1	-	0.150	0.075	0.125	-	-	-
8-hr mean	-	-	-	-	-	0.100	-
8-hr mean IT-1	-	-	-	-	-	0.160	-
1-hr mean	-	-	-	-	0.200	-	0.030
1-hr mean IT-1	-	-	-	-	-	-	-
PRC Ambient Air Quality Standard (Class 2)							
Annual mean	0.200	0.070	0.035	0.060	0.040	-	-
24-hr mean	0.300	0.150	0.075	0.150	0.080	-	0.004
8-hr mean	-	-	-	-	-	0.160	-
1-hr mean	-	-	-	0.500	0.200	0.200	0.010

Source: WHO Air Quality Guidelines (2006) in IFC EHS Guidelines (2007), and PRC GB 3095-2012.

## 2.5.2 Water

Because the project will not have impacts on surface water, ground water or sea water, no standard is applicable.

## 2.5.3 Noise

Table 2-6 presents the relevant PRC *Urban Noise Standards* compared with relevant international guidelines from the WHO (as presented in the *EHS Guidelines*). Category I and II standards are applicable to the project area. The classes within the

standards are not directly comparable, but the limits of PRC Category III standards are stringent than WHO Class II standards. Category III is utilized in this IEE report.

**Table 2-6 PRC *Environmental Quality Standards for Noise* (GB3096-2008) and relevant international guidelines.**

Category	PRC Standards Leq dB(A)		International Standards One Hour Leq dB(A)		Comparison
	Day 06-22h	Night 22-06h	Day 07-22h	Night 22-07h	
0: Areas needing extreme quiet, such as special health zones	50	40	WHO Class I: residential, institutional, educational: 55	WHO Class I: Residential, institutional, educational: 45	Classes are not directly comparable, but PRC Class III standards exceed WHO Class II standards. PRC standards are utilized in this report.
I: Mainly residential; and cultural and educational institutions	55	45			
II: Mixed residential, commercial and industrial areas	60	50	WHO Class II: industrial, commercial: 70	WHO Class II: Industrial, Commercial: 70	
III: Industrial areas	65	55			
IV: Area on both sides of urban trunk roads 4a	70	55			
4b	:70	60			

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

#### 2.5.4 Boiler emission

Applicable PRC national boiler emission standards and regulations are *Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers* (GB 13271-2014), *Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB 37/2374-2013) and *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province* (No. 98 order, 2015, Shandong EPB). Emission standard for boilers are also included in international standard *EHS Guidelines for Thermal Power Plants* of WB. Table 2-7 presents the relevant PRC standards compared with relevant international standards (EHS Guidelines).

The most stringent standard is *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province*. Because the EIA of the project was approved at June 24, 2015 and *Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province* came into effect at August 13, 2015, thus, *Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB37/2374-2013) is applicable to the project.

**Table 2-7 Relevant PRC Boiler Emission Standards and Relevant International Guidelines, mg/m<sup>3</sup>**

Standard	PM	SO <sub>2</sub>	NO <sub>x</sub>
<i>EHS Guidelines for Thermal Power Plants</i>	30	400	200
<i>Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers</i> (GB 13271-2014)	50	300	300
<i>Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers in Shandong Province</i> (DB37/2374-2013)	30	200	300
<i>Guidance on promotion of ultra-low emission of coal-fired units and boilers in Shandong Province</i> (No. 98 order, 2015, Shandong EPB)	10	50	200

### 2.5.5 Wastewater Emission

Table 2-8 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.

Wastewater of the project during operation phase includes sewage water of boilers, sewage water from chemical water treatment system, wastewater from desulfurization process, sewage water from circulating cooling water system and

domestic wastewater. Sewage water of boilers is discharged to municipal rain water pipe network after neutralization and sedimentation treatment. Sewage water from chemical water treatment system is clean then part of it is reused in desulfurization system and the left is discharged to municipal rain water pipe network after neutralization and sedimentation treatment. Wastewater from desulfurization process is used for humidification in ash storage room. Sewage water from circulating cooling water system is used as spray water in the plant to control ash and dust. Domestic wastewater is reused as landscape water after treated by septic tank. All wastewater is required to meet Class 1A of *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants* (GB 18918-2002).

**Table 2-8 PRC Wastewater Quality Standards for Discharge to Municipal Sewers (CJ 343-2010)**

No.	Pollutants	Maximum acceptable concentration (MAC) mg/L (except pH and chromacity)
		Class 1A standard
1	pH	6~9
2	SS	10
3	COD	50
4	NH <sub>3</sub> -N	5

#### 2.5.6 Industrial noise emission

运营期厂界噪声执行《工业企业厂界环境噪声排放标准》(GB12348-2008)。表 2-7 列出了中国和美国的运营时工业企业厂界环境噪声排放标准。标准并不能直接对比，中国的 3 级标准严于世界卫生组织的 2 级标准。本报告使用中国的工业企业厂界环境噪声排放标准。During operation phase, noise at site boundaries should comply with Class II of the PRC *Industrial Enterprise Boundary Noise Emission Standard* (GB12348-2008). Table 2-9 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 III standards are stringent than WHO Class II standards. The PRC noise standards are utilized in this report.

**Table 2-9 PRC Noise Emission Standard for Construction Site Boundary**

**(GB12348-2008) and relevant international guidelines**

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

## 2.6 PRC Environmental Impact Assessment Framework

Article 16 of the PRC *Law on Environmental Impact Assessment* (revised in 2016) stipulates that an EIA document is required for any capital construction project producing significant environmental impacts. Projects are classified into three categories for environment impact:

- (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.

A full EIA report for category A project and a simplified tabular EIA report for category B project are similar to ADB's EIA and IEE reports, respectively. The registration form of an EIA is similar to an ADB Category C project.

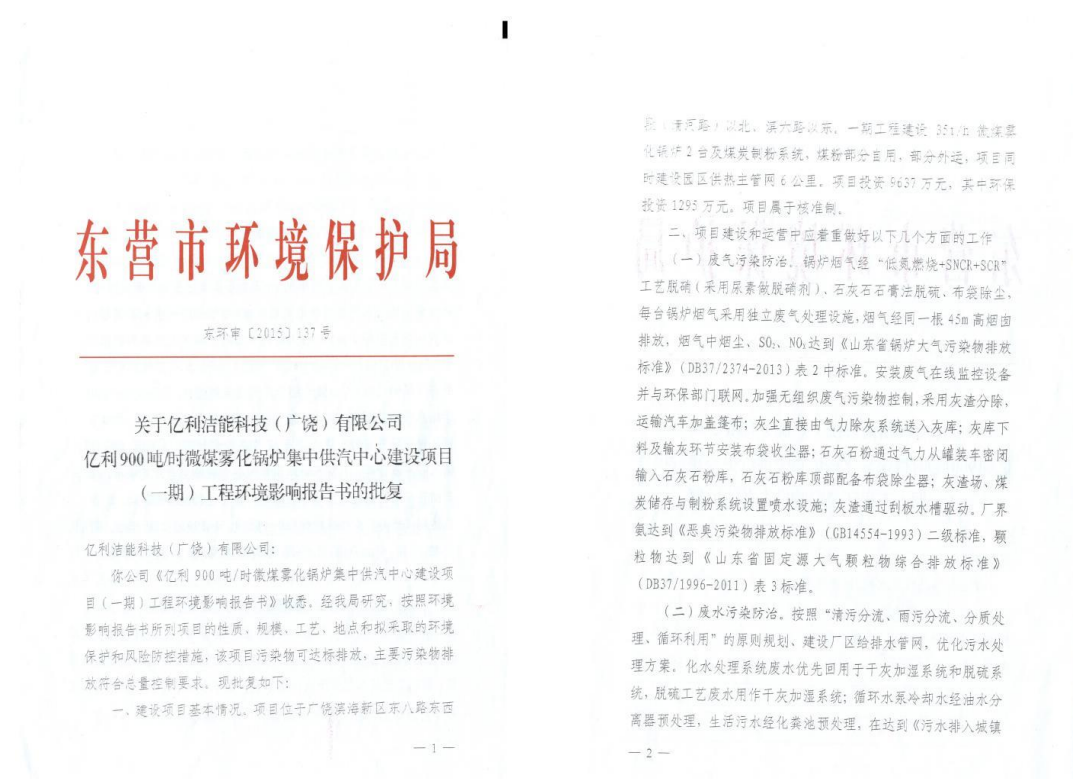
In 2008 the MEP issued "Management Guideline on EIA Categories of

Construction Projects” (revised in 2017). The MEP guidelines provide detailed EIA requirements for 50 sectors and 192 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).

The MEP’s “Construction project catalogue of for EIA approved by MEP” (2015) and “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.

## 2.7 Domestic EIA report

The proposed subproject was categorized as A under the PRC National EIA Law. A full EIA Report was prepared by Henan Yuantong Environment Protection Engineer Co., Ltd and submitted to Guangrao EPB for approval. Guangrao EPB approved the EIA report on 21 December 2015 and a copy of the approval is presented in Figure 2-1.



地下水质量标准》(GB343-2010)B类标准中达到广饶滨海新区污水处理厂进水水质要求后,接入广饶滨海新区污水处理厂进一步处理。对各生产车间等生产区地面、污水收集及处理系统、装置区、灰渣场等必须进行严格防渗、防腐处理,防止污染地下水和土壤。

(三)固废污染防治。严格执行《山东省选择性催化还原(SCR)脱硝催化剂技术要求》(DB37/T 2603-2014),使用高效无毒脱硝催化剂。油水分离器污油进锅炉焚烧,废脱硝催化剂由厂家回收再生,灰渣、脱硝石膏外售综合利用。暂存场所应按照《一般工业固体废物贮存、处置场污染控制标准》(GB18599-2001)及其修改单要求进行设置。

(四)噪声污染防治。选择低噪声设备,优化厂区平面布置,采取减振、隔声、消声等综合控制措施,确保厂界噪声符合《工业企业厂界环境噪声排放标准》(GB12348-2008)3类标准要求。

(五)环境风险防控。制定应急预案,配备必要的应急设备,并定期演练,切实加强事故应急处理及防范能力。化学危险品等按规定妥善管理,建设450立方米的事故池,确保事故状态时废水不直接外排,防止污染环境。

(六)污染物总量控制。项目建成后,化学需氧量、氨氮排放量分别控制在0.11吨/年、0.011吨/年以内,纳入广饶滨海新区污水处理厂统一管理。二氧化硫、氮氧化物排放量分别控制在26.3吨/年、36.7吨/年以内。

(七)其它要求。报告书确定的卫生防护距离为尿素储罐

- 3 -

100米。设置直径100米的围挡,按照国家和地方有关规范设置规范的污染防治设施。设置监测口和采样监测平台、固体废物堆放站,并设标识牌,严格落实报告书提出的环境管理及监测计划。

三、加强施工期的环保管理,落实施工期污染防治措施。由广饶县环保局负责项目施工期间的环境保护监督管理工作,市环境监察支队不定期抽查。

四、若该建设项目的性质、规模、工艺、地点或者防治污染、防止生态破坏的措施发生重大变动,应当重新报批该项目环境影响报告书,自环境影响报告书自批准之日起超过五年,方决定该项目开工建设的,该环境影响报告书应当报我局重新审核。

五、你公司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、同时投入使用的“三同时”制度。项目建设竣工后,向广饶县环保局书面提交试生产申请,经批准后方可进行试生产。在项目试生产期间,按规定程序向我局申请竣工环境保护验收,经验收合格后,项目方可正式投入运行。



抄送:市环境监察支队,广饶县环保局。

东营市环境保护局办公室

2015年6月24日印发

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Figure 2-1 EIA approval

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### **3 Project Description**

#### **3.1 Introduction**

The project will primarily build 2 × 35 t/h industrial pulverized coal-fired boilers which employs Micro-fine Coal Atomization technology in operation. Upon completion, the project will enable centralized steam provision to all enterprises in the project covered area and the existing boilers in the area will be entirely dismantled. The project involves zero domestic heating and provides steam solely for industrial purposes.

The project is located at the GBNA of Guangrao County, Dongying City, Shandong Province. The GBNA lies in northeasy of Guangrao County and south of Dongying City. The project location is shown in Figure 3-1 and sensitive receptors in project's surrounding areas are shown in Figure 3-2.

#### **3.2 Project Background and Regional Steam Supply Status**

At present, major enterprises settled in GBNA include Shandong Wanshengbo Science and Technology Co. Ltd., Shandong Oumeiya Chemical Co. Ltd., Dongying Liangxin Petroleum Technology Co. Ltd., and Shandong Huachi New Energy Co. Ltd., etc. These businesses all have continuous and stable production and thus maintain stable heat load, with thermal energy primarily used for heating and drying. Based on the heat load survey among enterprises in GBNA, the project team has strictly verified each and every enterprise's necessary heat load for production, properly considered their short-term development plans, and then estimated the short-term heat load of all the enterprises. Based on these results, with coincidence factor and transmission losses calculated, the computed superheated steam load of the project is 60.0 tons per hour.

In recent years, insufficient and unstable self-supply of steam has already become the bottleneck that severely hampers the business development of settled enterprises. At the same time, in response to requirement set out in *China's Action Plan on Air Pollution Prevention and Control*, which reads that “by 2017 coal-fired

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boilers with the capacity of 10 t/h and below should be primarily phased out in cities at and above prefecture-level, unless otherwise deemed necessary to be kept”, then Elion has invested in construction of the project.

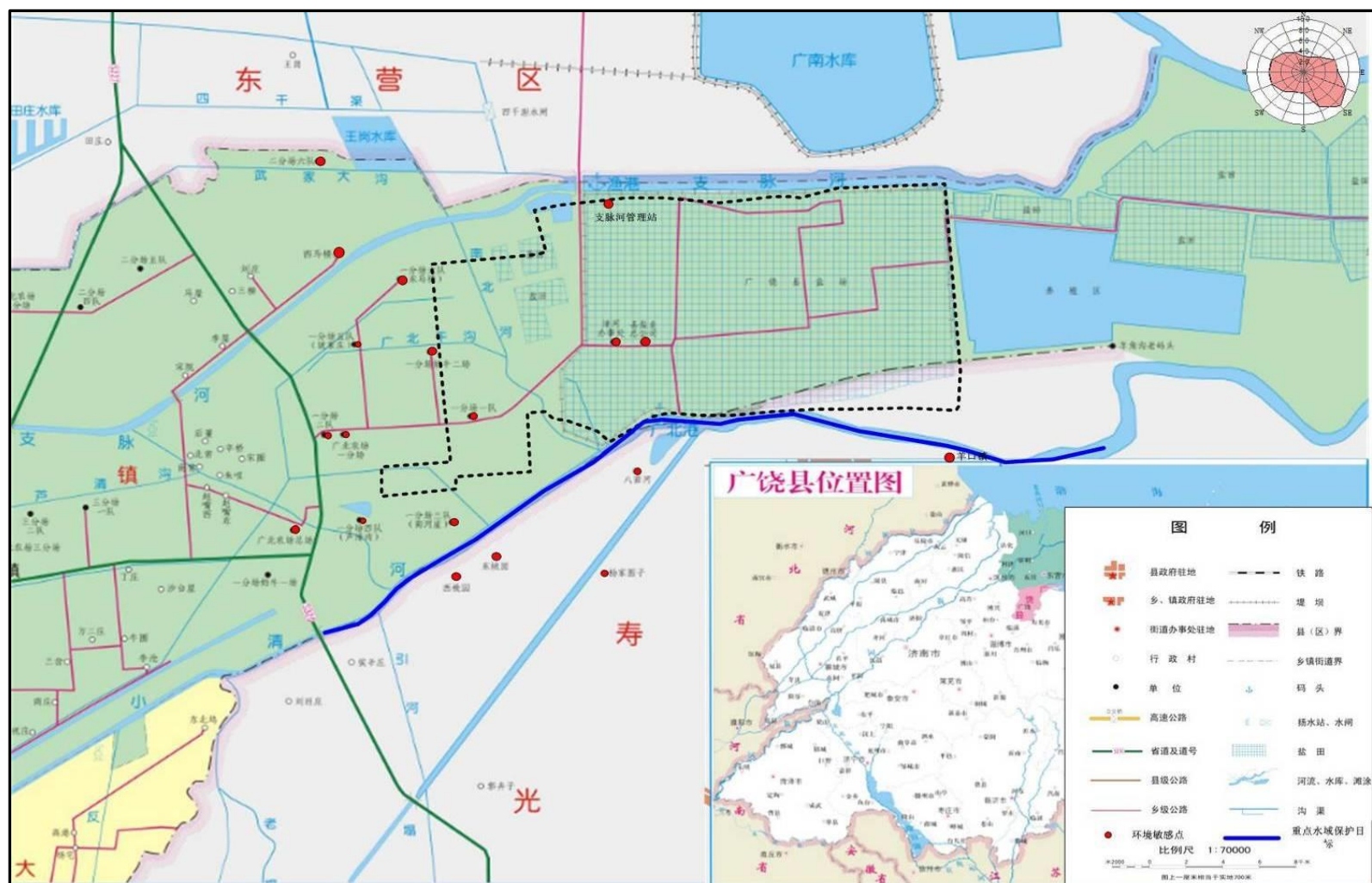


Figure 3-1 Location of the Project

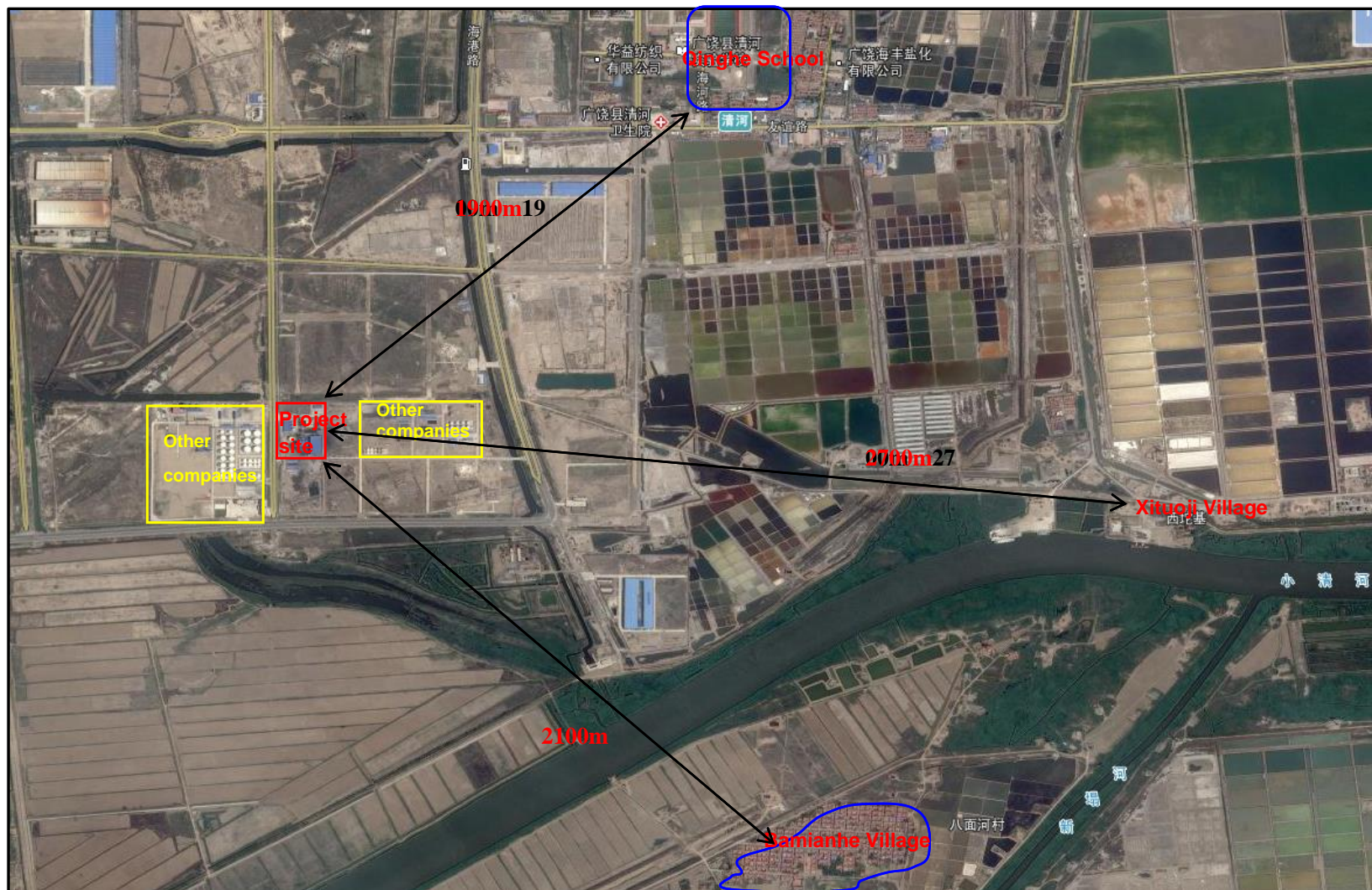


Figure 3-2 Location of the Sensitive Receptors in Project Surrounding Area

### 3.3 Regional Heat Demand

Large quantities of enterprises operating in GBNA have stable demand for steam. Elion Guangrao Subcompany conducted on-site survey and developed a list of heat demand and consumption for existing enterprises in GBNA, as shown in Table 3-1.

**Table 3-1 Heat Load Status of Enterprises in GBNA**

No.	Company	Steam Pressure (MPa)	Steam Temperature (°C)	Maximum steam load (t/h)	Note
1	Shandong Wanshengbo Science and Technology Co. Ltd	0.8	170	10	Saturated steam
2	Dongying Liangxin Petroleum Technology Co. Ltd	1.0	180	10	Saturated steam
3	Shandong Huachi New Energy Co. Ltd	0.8	220	25	Saturated steam
4	Shandong Oumeiya Chemical Co. Ltd	0.5	150	15	Saturated steam
Total		NA	NA	60	NA

The project has taken into account the thermal load demand of both existing businesses and newly settled enterprises in GBNA, and such factors as GBNA's short-term heat consumption and future development needs, to determine the heat load parameters for the centralized heat provision, as shown in Table 3-2.

**Table 3-2 List of Project Heat Load Parameters**

No.	Item		Unit	Number
1	Heat load	maximum continuous rating	t/h	70
		steam supply quantity	t/h	66.5
2	Annual operation hours		h	7200
3	Annual steam supply quantity		t/a	5.04×105
4	Annual TCE consumption		t/a	59162
5	Heat efficiency		%	90

The project will realize district steam supply to all enterprises in GBNA after the project is completed and all existing boilers in GBNA will be demolished.

### 3.4 Main project content

#### 3.4.1 Project components

Table 3-3 presents components under the project.

**Table 3-3 Project component**

Category	Item	
Principal Facilities	Boiler	2 × 35 t/h industrial pulverized coal-fired boilers which employs the Micro-fine Coal Atomization technology in operation
Auxiliary Facilities	Boiler room	One 3-storeyed building, taking up an area of 649.96 m <sup>2</sup> and a building area of 2036.52 m <sup>2</sup>
	Chemical water treatment workshop	One building, taking up an area of 1430.80 m <sup>2</sup> and a building area of 1062.43 m <sup>2</sup>
	PC process workshop	One 2-storeyed building, taking up an area of 1933.75 m <sup>2</sup> and a building area of 2210.00 m <sup>2</sup>
	Office building	One building, taking up an area of 660 m <sup>2</sup>
Storage and Transportation Facilities	Coal storage room	One semi-open coal storage shed of 72mx40m will be installed. 200m <sup>3</sup> PC storage room with a volume of 200 m <sup>3</sup> will be installed with two 150m <sup>3</sup> supporting coal storage towers
	Ash storage chamber	One storage chamber, with a volume of 200 m <sup>3</sup>
	Limestone storehouse	One storehouse, with a volume of 50 m <sup>3</sup> , capable of storing lime powder for 15-day use. One gypsum storehouse, with a volume of 150 m <sup>3</sup> , capable of storing gypsum for 15days
	Ash and slag storehouse	One storehouse, with an area of 600 m <sup>2</sup> , capable of storing ash and slag for 30 days
	Gypsum storehouse	One storehouse, with an area of 45 m <sup>2</sup> , located in desulfurization complex
Utility Facilities	Water supply system	Both industrial water and domestic water comes from the water supply network of GBNA, and the freshwater consumption is 2,052.1 t/d.
	Power supply system	Power for industrial use and domestic use comes from the power supply network of GBNA.
	Chemical water preparation and treatment system	One set of chemical water preparation and treatment system installed in the chemical water treatment shop, using “filtration + ultra-filtration + reverse osmosis” treatment system, with a treatment capacity of 85 m <sup>3</sup> /h
	Circulation cooling system	Industrial water is used for cooling to supporting facilities such as induced draft fan and cooling equipment
	Ash and slag handling system	A positive pressure dense phase pneumatic conveying system is installed to handle ash and slag.
	Boiler make up water system	Two deaerators will be installed with a capacity of 1680 t/d.
	Air compressor system	This project has installed one compressed air station, three 12 Nm <sup>3</sup> /min screw air compressors and one set of complex dryers. Oil-water separator and filters are also installed for air treatment.

Category	Item	
Environmental Protection Facilities	Exhaust Gas	Exhaust gas from boilers: Each boiler is equipped with one set of low NOx burning and SNCR denitration system, with denitration efficiency $\geq 50.0\%$ . Each boiler is connected to one bag filter, with dust removal efficiency $\geq 99.85\%$ . The two boilers share one limestone-gypsum wet flue gas desulfurization system, with design desulfurization efficiency $\geq 95\%$ . Exhaust gas is emitted through a chimney of 2.0 m diameter and 45-m height (one chimney shared by 2 boilers). One online monitoring system will be installed in the chimney to monitor SO <sub>2</sub> , NOx and PM and send the data to local EPB.
	Wastewater	The domestic sewage is treated by the septic tank and then used for site greening. Wastewater from the desulfurization system is used for humidifying ash storage chamber. Concentrated water produced by the chemical water system is unpolluted wastewater, part of which will be used in desulfurization system and the rest will be discharged into municipal drainage network after neutralization and sedimentation. The boiler effluent is unpolluted wastewater and will be discharged into municipal stormwater sewer after neutralization and sedimentation. Effluent from water recycling system is unpolluted wastewater and will be used for spraying to control dust-fall in project site.
	Solid Waste	One ash storage chamber (100 m <sup>3</sup> ), one gypsum storehouse (45 m <sup>2</sup> ) and one domestic solid waste collection tank
	Noise	Measures include installing vibration reduction base, muffler, sound insulation room, etc.
	Dust	Bag filters and dust collector will be installed in the top of limestone storage room, ash load and upload room and ash transportation room to collect dust. Sealed PC will be installed in the future.
	Ash and slag	Ash and slag will be temporally stored at storage room, then sold to construction material plants.
	Desulfurization gypsum	Desulfurization gypsum will be sold to construction material plants.
	Waste oil	Combusted in boilers
	Domestic waste	Will be collected by local sanitation department

Steam users are the enterprises in GBNA and steam pipeline is already overhead installed.

### 3.4.2 Environmental Protection Investment

Environmental protection facilities for the project include dust removal facility, desulfurization system, denitration system, chimney, flue, noise reduction set-ups, environmental monitoring equipment, as well as greening arrangements. The total environment related investment amounts to RMB 10.95 million yuan (10.95 million CNY). Table 3-4 shows the details.

**Table 3-4 Environmental protection investment**

No.	Category	Environmental Facilities	Investment (RMB 10,000 Yuan)
1	60Exhaust Gas Treatment	2 Bag filters	60
2		Limestone-gypsum wet flue gas desulfurization system	120
3		Two sets of low NOx burning and SNCR denitration system	540
4		One chimney	15
5		Flue	20
6		Flue gas online monitoring system	30
7	Wastewater Treatment	Septic tank and oil-water separator	35
8	Noise Treatment	Sound insulating set-ups and muffler	30
9	Solid Waste Treatment	Ash storage chamber, gypsum storehouse with anti-seepage measure, etc.	80
10	Environmental Risk Prevention Investment	Environment risk control measures	30
11	Dust control	One bag filter at ash storage room	10
12		One dust collector at limestone storage room	10
13		One dust collector at PC process workshop	15
14	Mitigation measures during construction phase	Mitigation measures implementation during construction phase	50
15	Others	Landscape, environmental monitoring	50
Total			1095

### 3.5 Project Current Status and Lay-out

At present, the project has been completed. Based on the on-site configurations, its general lay-out is divided into different functional areas, including boiler facility area, chemical water facility area, and expansion area.

#### (1) Boiler facility area

The boiler facility is located in the southeast of project site. Boiler supporting facilities is located in the south of the boiler facility while boiler room is in the north of boiler facility.

#### (2) Chemical water treatment facility area

The chemical water treatment workshop and associated outdoor facilities are located on the southwest side of the project site, mainly including chemical water

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treatment shop, the domestic water tank and fire water tank.

Coal storage shed and PC process workshop are located at southeast of chemicalwater treatment facility.

(3) Expansion area.

Expansion area is located in the north of projec site which will be used for office building, dormitory and maintenance workshop in the future.

The project site area is 66,667 m<sup>2</sup> and project layout is presented in Figure 3-3.

### 3.6Heat source

The project will install 2 × 35 t/h Micro-fine Coal Atomization boilers. In accordance with the boiler capacity, coal source and coal quality, the project has selected the Micro-fine Coal Atomization boiler. Specific model and parameters are proposed as follows:

- Rated evaporation capacity: 35 t/h
- Rated pressure of superheated steam: 1.6 MPa
- Rated temperature of superheated steam: 245 °C
- Feed-water temperature: 104 °C
- Design efficiency: 90%
- Temperature at the outlet of air pre-heater :140 °C
- Temperature at the inlet of air pre-heater: 20 °C
- Model of air pre-heater: tube-type
- Model of economizer:tube-type.

### 3.7Fuel

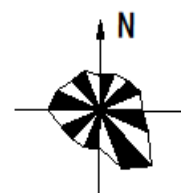
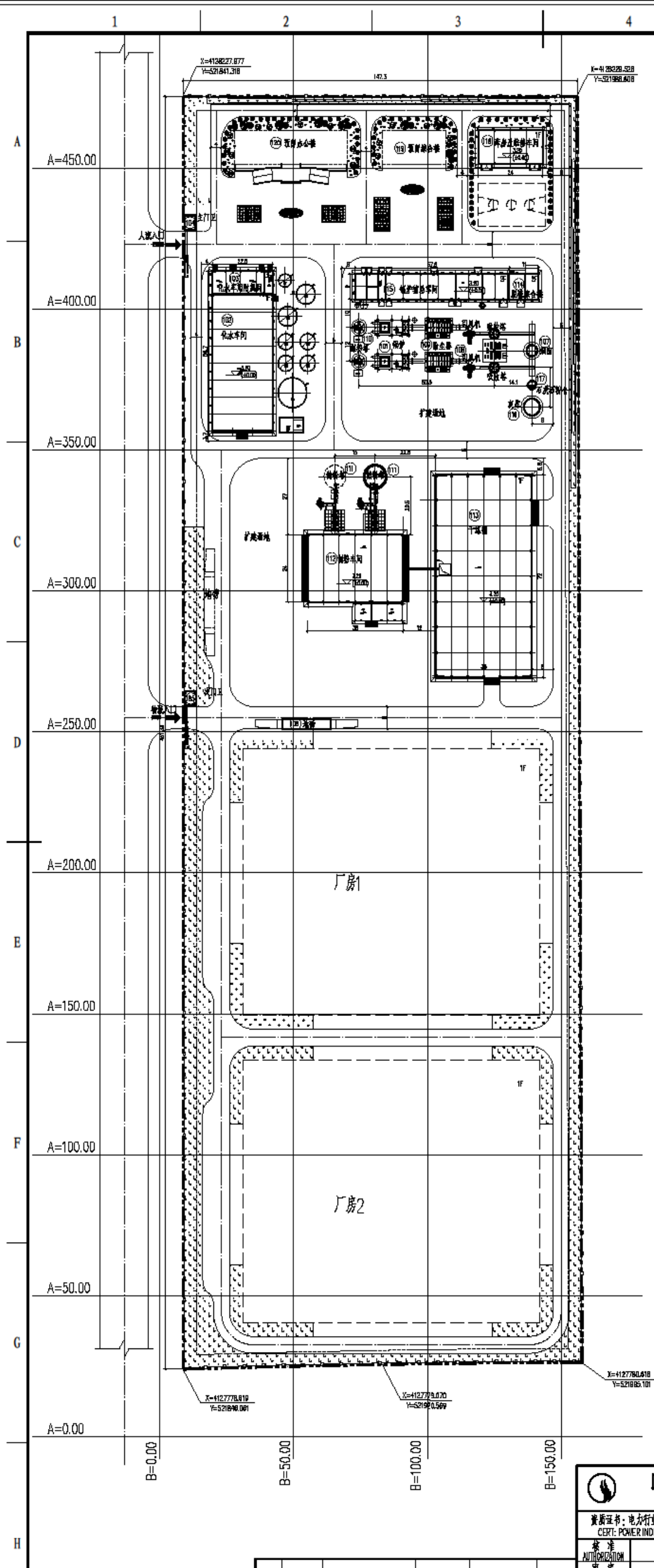
The project will use coal produced in Shenmu County of Shaanxi Province as the main fuel. The coal will be transported via highway. The quality data of coal dust pulverized from raw coal for boilers are shown in Table 3-5.

**Table 3-5 Coal analysis data**

No.	Item	Symbol	Unit	Design Coal	Actual coal
1	Carbon As Received basis	Car	%	72.5	56.11
2	Hydrogen As Received basis	Har	%	3.0	4.66
3	Oxygen As Received basis	Oar	%	7.0	7.0
4	Nitrogen As Received basis	Nar	%	1.0	1.0
5	Sulfur As Received basis	Sar	%	0.5	0.29
6	Ash As Received basis	Mar	%	10.0	27.0
7	Moisture As Received basis	Aar	%	6.0	3.94
8	Volatile Matter, Dry and Ash	Vdaf	%	33.0	37.40

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No.	Item	Symbol	Unit	Design Coal	Actual coal
9	Lower Heat Value As	Qnet.ar	MJ/kg	25.08	24.02



新建建筑物统计表

名称	层数	占地面积 m <sup>2</sup>	建筑面积 m <sup>2</sup>	建筑面积(计容) m <sup>2</sup>	备注(层高及开间尺寸)
101 值班室	1F	1141.2	1711.8	1711.8	
102 检修室	3F	199.8	599.4	599.4	
103 大门	1F	25.8	25.8	25.8	
104 大门	1F	25.8	25.8	25.8	
105 检修室	1F	981.2	1471.8	2453	层高8m
106 检修室	1F	2828	2828	5258	层高8m
107 检修室	1F/2F	108.3	160.6	160.6	
108 检修室	1F/2F	546.3	844.6	844.6	
109 检修室	1F	305	305	305	
合计:		5882.4	7772.8	11382	
110 检修室		18.8			
111 检修室		28.5			
112 检修室		80.4			
113 检修室		121.6			
114 检修室		34.2			
115 检修室		10.2			
合计:		265.6			
总计:		6228			

建筑物一览表

序号	名称	备注	序号	名称	备注
101	值班室		111	检修室	
102	检修室		112	检修室	
103	大门		113	检修室	
104	大门		114	检修室	
105	检修室		115	检修室	
106	检修室		116	检修室	
107	检修室		117	检修室	
108	检修室		118	检修室	
109	检修室		119	检修室	
110	检修室		120	检修室	

图例

图例	名称	图例	名称
虚线	规划红线	X=52135.921 Y=52668.984	规划红线
实线	现状红线	X=52135.921 Y=52668.984	现状红线
虚线	现状红线	X=52135.921 Y=52668.984	现状红线
虚线	现状红线	X=52135.921 Y=52668.984	现状红线
虚线	现状红线	X=52135.921 Y=52668.984	现状红线

主要技术经济指标表

序号	名称	单位	数量	备注
1	占地面积(包括红线内面积)	m <sup>2</sup>	32590.9	
2	厂房占地面积(包括红线内面积)	m <sup>2</sup>	32288.1	
3	构筑物占地面积	m <sup>2</sup>	6228	
4	总建筑面积	m <sup>2</sup>	7772.8	不计容积率面积
5	容积率	m <sup>2</sup>	5182.8	
6	厂房容积率	%	2844	
7	建筑密度	%	29.4	
8	绿化率	%	0.35	
9	厂房绿化率	%	4	参照厂址
10	绿化率	%	15	

说明:  
1. 经济指标数据, 本期以物流入口道路中心线为界。

## 山东省热电设计院

SHANDONG HEAT ENERGY AND ELECTRIC POWER DESIGNING INSTITUTE

资质证书: 电力行业(火力发电、新能源发电)乙级 CERT: POWER INDUSTRIAL(STEAM, NEW ENERGY) B	证书编号 CERT: NO	A237006460	设计阶段 DC PHASE
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2x35t/h 循环流化床锅炉集中供热中心项目

Figure 3-3 Project layout

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## **4 Description of the environment**

### **4.1 Location**

The project is located in Binhai New District of Guangrao County in Dongying City, Shandong Province. Guangrao County is situated in the south of Dongying City on the lower reaches of Xiaoqing River. The county spans from 36°56'09" to 37°21'23" north latitude and 118°17'04" to 118°57'11" east longitude. Guangrao neighbors Dongying District to the north, Linzi District of Zibo City to the south, Shouguang City to the east, Qingzhou City to the southeast and Bosing County to the west and is flanked to the northeast by Laizhou Bay of the Bohai Sea. Covering 1165.63km<sup>2</sup> in total (including Guangbei Farm), the county has an east-west extent of 60.1km and a north-south extent of 46.2 km. As part of Bohai Economic Rim, Binhai New District of Guangrao County sits along the coastal development zone of Jiaodong Peninsula as well as the Jiaodong-Jinan development axis. With a crisscross road network, the county is linked to other regions by Rongcheng-Wuhai Highway, Dongqing Highway, S319, S320 and the intended Binhai High-grade Highway. In addition, the proposed Delongyan Railway Project designates an area on the north shore of Zhimai River reserved for railway station, and the intended Huangda Railway and Bohai Rim Rail Transit will run through the edge of Binhai New District in the west. Another highlight is that Binhai New District is only 23km away from Dongying Airport.

### **4.2 Geography and Topography**

With elevations ranging from 5 to 20 meters (Yellow Sea 1956), Guangrao County is where West Shandong antecline and Liaoning-Hebei syncline on the North China Craton converge and its terrain tends downward gradually from the southwest to the northeast. With a gradient of 0.48%, the elevation of the southwest stands 30.5m and that of the northeast 2m. By topography, Guangrao is part of the North Shandong Plain with piedmont alluvial plain to the south of Xiaoqing River and alluvial plain built up by the deposits of the Yellow River to the north of Xiaoqing River. Micro-relief is the main landform feature of Guangrao which includes hummock, gentle slope, flat and shallow depression, river terrace, enclosed river valley and coastal bottomland.

### **4.3 Climate**

Located in the warm temperate zone, Guangrao County has a semi-humid continental monsoon climate with intense sunlight and four distinct seasons (dry and windy spring, hot and rainy summer, cool and clear autumn, cold and dry winter). Its annual sunshine duration is 2374.2 hours and average temperature 13.2°C (27.0 °C in the hottest month and -2.4°C in the coldest month) with 198 frost-free days in the year. Its average annual rainfall is 582.1mm

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of which most occurs in July and August and the highest annual rainfall on record is 892.7mm (2005). Its average relative humidity is 66% and maximum depth of permafrost is 61cm. Its barometric pressure is 756mmHg in summer and 770mmHg in winter.

#### **4.4 Geology**

Guangrao County is where West Shandong antecline and Liaoning-Hebei syncline on the North China Craton converge. Sitting on the metamorphic basement rocks, the sedimentary rock strata of Guangrao consist Archean, Mesozoic and Cenozoic from bottom to top. The east-west Qihe-Guangrao fault zone runs through the middle part of Guangrao County. The ascending northern segment of the fault zone is part of West Shandong antecline, the ascending western segment is part of West Shandong uplift fault, the descending eastern segment is part of Changwei sunken fault and the descending northern segment is part of Jiyang sunken fault of Liaoning-Hebei syncline. The northern part of Guangrao county is on the southern slope of Dongying depression and the central part extending from Shi Village to Ding Village is part of Guangrao uplift.

#### **4.5 Hydrogeology**

Due to the abovementioned geological structures, the county has three hydrogeological units each with distinct sedimentary environment and topographic features. The units are separated by Shi Village-Yanxu Village-Zhouzhuang Village, or known as the dividing line. To the south of the dividing line lies the tail of Zi River 's alluvial fan in the front of the northern foot of Tai-Yi Mountains with relatively thin quaternary rock strata that contain fresh water at all depths, and it is also where the project is located. From the north side of the dividing line up to Xiaoqing River lies the alluvial plain shaped by piedmont alluviation, deposits of the Yellow River and tidal erosion which has relatively thick quaternary rock strata containing salt water and fresh water or fresh water, salt water and fresh water from the surface to the deep layers. To the north of Xiaoqing River lies the tail end of alluvial plain formed by the Yellow River with quite thick quaternary rock strata that contain salt water from the surface to intermediate layers.

There are 12 rivers in different sizes in Guangrao County which are included in either Xiaoqing River system or Zhimai River system. Among them, Xiaoqing River, Zi River, Yang River, Zhinv River, Mianshui River, Yubei River, Leibui River and Luqinggou River are connected to Xiaoqing River system; and Zhimai River, Guangbeixin River, Wujiadagou River and Xiaohezi River are connected to Zhimai River system. Most of the rivers do not originate in the county and most river waters are of nonlocal source. Zhimai River and Xiaoqing River

are perennial rivers that flow eastward into the sea. Zi River and Qundai River are intermittent rivers that flow southward and join Xiaoqing River. Draining 585 km<sup>2</sup>, Xiaoqing River extends for 240km with 34km in the county which a flood carrying capacity of 360 m<sup>3</sup>/s; draining 1388 km<sup>2</sup>, Zhimai River extends for 48.2 km in the county with a flood carrying capacity of 649 m<sup>3</sup>/s. As a man-made watercourse, Guangbeixin River is 12.4 km long and drains 80 km<sup>2</sup>.

## 4.6 Natural Resources

### (1) Marine Resource

Bounded by Laizhou Bay of the Bohai Sea to the northeast, the county has 11.86 km of muddy coastline which is chiefly comprised of subaerial and subaqueous deltas. As the underwater extension of subaerial delta, the subaqueous delta has a natural gradient of 1/1600 and extends outward in the shape of a semi-ring from the outer edge of high-water mark to water between 10 and 15m, in which the beaches and the area within the 3-meter contour line accounts for 40% of the total coastal area. With very few bays and shallow water, the flat shore is absent of conditions for a good natural harbor. The width of intertidal zone ranges from 5000 to 7000m and the seabed is mainly composed of sand and mud providing an optimal environment for shellfish farming and harvesting. Flowing into the sea, Xiaoqing River and Zhimai River provide constant freshwater inflows.

### (2) Mineral Resource

The mineral resources in the county include petroleum, natural gas, brine and geothermal energy. It has 51 km<sup>2</sup> of proven oil and gas reserves with 66.28 million tons of oil reserve and 250 million m<sup>3</sup> of natural gas reserve.

### (3) Biological Resource

Thanks to the flat terrain, sufficient sunlight and moderate temperature, Guangrao County abounds in animal and plant resources. Unfortunately, as a result of intense human activities, there are not many natural vegetation and wild animals left.

## 4.7 Environmental Baseline Monitoring

### 4.7.1 Ambient air

Ambient air quality monitoring data is collected from EIA report for Dongying Qirun Chemical Co., Ltd. (EIA approval No. 219, Dongying EPB) and Dongying Qirun Chemical Co., Ltd is 2 km away from the project site. Ambient air quality monitoring was conducted by Qingdao Jingcheng Detection Technology Ltd. Monitoring was undertaken continuously over a 7 day period from August 3 to 9, 2016. Monitoring results are summarized in Table 4-1.

**Table 4-1 Ambient air quality monitoring results, mg/m<sup>3</sup>**

Item	1-hour average concentration range	24-hour average concentration range
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Item	1-hour average concentration range	24-hour average concentration range
SO <sub>2</sub>	0.032-0.091	0.055-0.065
NO <sub>2</sub>	0.023-0.072	0.04-0.049
PM <sub>10</sub>	----	0.106-0.161
TSP	----	0.203-0.271
PM <sub>2.5</sub>	----	0.062-0.096

**Table 4-2 Applicable ambient air quality standard mg/m<sup>3</sup>**

Pollutants	Parameter	Standard	Note
SO <sub>2</sub>	1-hour average	0.50	Class II of <i>Ambient Air Quality Standards</i> (GB3095-2012)
	24-hour average	0.15	
NO <sub>2</sub>	1-hour average	0.20	
	24-hour average	0.08	
PM <sub>10</sub>	24-hour average	0.15	
TSP	24-hour average	0.30	
PM <sub>2.5</sub>	24-hour average	0.075	
NO <sub>x</sub>	24-hour average	0.10	
O <sub>3</sub>	8-hour average of top 8 hourly concentration	0.16	<i>Hygienic standard for design of industrial enterprises</i> (TJ36-79)
ammonia	once	0.20	

The results indicate that all results for TSP, ammonia, SO<sub>2</sub>, and NO<sub>2</sub> were in compliance with Class II PRC standards. However, part of PM<sub>2.5</sub> and PM<sub>10</sub> monitoring results exceeded the 24-hour average. The results indicate that the overall air quality at the surroundings of the project site is ordinary.

#### 4.7.2 Surfacewater

Surface water quality monitoring data is collected from EIA report for Dongying Qirun Chemical Co., Ltd. (EIA approval No. 219, Dongying EPB) and Dongying Qirun Chemical Co., Ltd is 2 km away from the project site. Surface water quality monitoring was conducted by Qingdao Jingcheng Detection Technology Ltd. Monitoring was undertaken at 4 sections in Xiaoqing River (three sections) and Guangbei Channel (one section).

Applicable standard is Class V of *Surface Water Ambient Quality Standard* (GB3838-2002).

The results indicate that COD, BOD<sub>5</sub>, total nitrogen, sulfate and chloride of Guangbei Channel and sulfate and chloride of Xiaoqing River exceeded the standard. Other parameters at all monitoring sections were in compliance with Class V of *Surface Water Ambient Quality Standard* (GB3838-2002).

#### 4.7.3 Groundwater

Ground water quality monitoring data is collected from EIA report for Dongying Qirun Chemical Co., Ltd. (EIA approval No. 219, Dongying EPB) and Dongying Qirun Chemical Co., Ltd is 2 km away from the project site. Ground water quality monitoring was conducted by

Qingdao Jingcheng Detection Technology Ltd. Monitoring was undertaken at 4 sections in Xiaoqing River (three sections) and Guangbei Channel (one section).

Applicable groundwater quality standard is Class III of *Ground Water Ambient Quality Standard* (GB/T14848-1993).

**Table 4-3** Class III of Ground Water Ambient Quality Standard (GB/T14848-1993)

No.	Unit	Item	Class III of GB/T14848-1993
1	----	pH	6.5-8.5
2	mg/L	Total hardness	≤450
3	mg/L	Total dissolved solids	≤1000
4	mg/L	Sulfate	≤250
5	mg/L	Chloride	≤250
6	mg/L	Permanganate index	≤3.0
7	mg/L	Nitrate nitrogen	≤20
8	mg/L	Ammonia nitrogen	≤0.2
9	mg/L	Volatile phenol	≤0.002
10	mg/L	Nitrite nitrogen	≤0.02
11	No./L	Total coliform	≤3.0

The results indicate that ammonia nitrogen, nitrite nitrogen, total hardness, total dissolved solids, sulphate, chloride, permanganate index and total coliform exceeded the standard. The results indicate that the ground water quality near the project site is bad and the possible reason is the project site is located at alkaline land area.

#### 4.7.4 Noise

Noise at the site boundaries was undertaken at four boundaries.

Monitoring results were presented in Table 4-4.

**Table 4-4** Noise monitoring results at site boundaries

Monitoring time		Monitoring results $L_{eq}$ dB (A)			
		No. 1 at east boundary	No. 2 at south boundary	No. 3 at west boundary	No. 4 at north boundary
2015.4.3	Daytime	42.3	43.6	44.0	43.4
	Nighttime	38.5	39.4	37.9	37.3

Applicable standard is Class III of *Emission standard for industrial enterprises noise at boundary* (GB 12348—2008). The limit is: 65 dB (A) at daytime and 55dB (A) at nighttime.

The results indicate that noise level at site boundaries were compliance with class III of *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008). There is no sensitive receptor within the 200-m scope from the project boundary, thus the project has relatively low impact on the surrounding acoustic environment.

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## **5 Environmental Impacts and Mitigation Measures**

### **5.1 Anticipated Positive Effects**

#### **(1) Regional Environmental Improvement**

This project aims to provide heat load for enterprises in the GBNA to substitute for these businesses' self-operated coal-fired boilers and effectively prevent industrial companies in the region from building small boilers on their own. The project makes use of Micro-fine Coal Atomization technology, which is able to raise the combustion efficiency to 98%, the thermal efficiency to over 90%, and the steam production of one ton of coal from 5 tons to more than 9 tons. Compared with the conventional coal-fired boilers, the project will result in annual energy savings equivalent to 48,721 tons of standard coal and improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO<sub>2</sub>) by 124.56 tons, nitrogen oxides (NO<sub>x</sub>) by 19.9 tons, particulate matter (PM) by 47.53 tons and carbon dioxide (CO<sub>2</sub>) by 121,461 tons. The project is beneficial to mitigating air pollution in the region and conducive to reducing secondary pollution during transportation of fuel and combustion products.

#### **(2) Local Economic Development**

The project offers steam source for centralized steam supply in GBNA. Its completion and operation will facilitate the cluster development of industrial initiatives and conserve energy. The project abides by the principle of “concentrated production, centralized pollution treatment and intensive development” set out in the local planning and serves as an integral part of circular development. By guaranteeing stable and high quality steam supply, it will help foster an improved environment for investors in GBNA and push forward regional development, making positive contributions to the regional investment promotion and economic growth.

### **5.2 Identification of Potential Impacts**

The project's potential impacts have been identified according to Environmental Impact Assessment Law of People's Republic of China and associated regulations, as well as requirements articulated in ADB's SPS 2009.

The identification results reveal that during construction phase, adverse environmental impacts are associated with potential soil erosion, construction noise and dust emissions generated in plant construction. In operation phase, the major negative environmental impacts are from the pollutants discharged from the project. In addition, transportation of fuel coal will also bring noise issue.

These impacts fall into three main categories: physical-chemical ones, biological ones and socio-economic ones. The impacts from design, construction and operation phases

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should be analyzed respectively. Potential impacts are further divided into the following categories: (1) direct impact, as a direct result of the project itself; (2) indirect impact, resulting from a series of activities triggered by the project, but not directly caused by the project; and (3) cumulative impact, which is generated from the combination of above two kinds of impact and grows as time goes by.

### **5.3 Anticipated Pre-construction Phase Impacts**

#### **(1) Land Acquisition**

This project is located in the established GBNA and involves neither land acquisition nor resettlement.

#### **(2) Cultural Relics and Rare Species under Protection**

The project is located in an industrial park. No cultural relics, historical sites, archaeological sites, or rare and endangered species are observed in the project site.

### **5.4 Anticipated Construction Phase Impacts and Mitigation Measures**

The project construction has been completed already. A spectrum of measures have been taken during the construction phase, including control and treatment measures for exhaust gas, wastewater and noise; solid waste treatment and disposal measures; soil and water conservation measures, strengthened environmental management, sound storage and management of hazardous waste, properly arranged construction plan, strict control of operation scope of the construction personnel and machinery, giving occupational health and safety training and protection to the workers, etc. During the construction period, through strict compliance to EIA requirements, this project imposed relatively limited impacts on soil, surface water, groundwater, ambient air, fauna and flora, and nearby residents, and such impacts have ceased with the completion of the construction phase.

### **5.5 Anticipated Operation Phase Impacts and Mitigation Measures**

The environmental impacts during operation phase are mainly from exhaust gas emissions (dust-laden exhaust gas and boiler flue gas), wastewater discharge, noise (primarily from water pumps and fans), and solid waste (fly ash and slag in general). Based on relevant laws and regulations of China, no prohibited substances such as Polychlorinated Biphenyls (PCBs) and asbestos are used in the project.

#### **5.5.1 Exhaust Gas**

##### **5.5.1.1 Dust-laden Exhaust Gas**

NCoal pulverizing system is installed in this project and annual PC consumption is 59,162 tons. PC preparation process is sealed and bag filters are installed at the top of PC workshop. The generated dust-laden exhaust gas goes through the filter material where the

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dust particles are filtered. The filter material collects coarse dust by collision under inertia effect, and traps fine dust by diffusion and sieving effect. Exhaust gas treated by bag filter is then emitted through exhaust funnel into upper air. As the dust collection efficiency of the bag filter is above 99.9%, the treated exhaust gas has a concentration of  $9.3 \text{ mg/m}^3$ , which stays within the maximum emission concentration limit ( $30 \text{ mg/m}^3$ ) set out in Table 2 of the *Integrated Emission Standards of Particulate Matter from Stationary Source of Shandong Province* (DB37/1996-2011).

#### 5.5.1.2 Boiler Flue Gas

The Micro-fine Coal Atomization technology used in this project enables a full-seal mode operation in the entire process, thus no soot can be seen. The control center adopts the centralized control system and realizes automatic operation and management of boilers. The efficient and stable operation of Micro-fine Coal Atomization boilers is therefore effectively guaranteed. PC purchased for the project is processed from raw coal to micron-sized coal dust through washing and selecting, grinding, and preparation. During such process, ash and sulfur content in the coal dust is substantially reduced and pollution is thus cut from the source. As the micron-sized PC is much finer than ordinary PC, coal use efficiency and combustion efficiency has been significantly improved.

In coal dust storage and feed process, Elion's Micro-fine Coal Atomization technology adopts fully-enclosed coal transportation equipment and powerful unloading device to avoid furnace shut-down and associated coal dust leakage caused by coal supply device failure such as blockage, thus reducing on-site pollution. The automatic ignition device in Elion's Micro-fine Coal Atomization boiler realizes immediate start and shutoff of boiler, and the cutting-edge low NO<sub>x</sub> burners achieve low-temperature combustion, which effectively cuts down NO<sub>x</sub> emissions. The vortex technology is well applied to transforming regular boilers into Micro-fine Coal Atomization boilers. Multiple vortex atomization enables thorough mix of PC and air; while adjustment of air distribution direction and volume can alter the flame size and shape to accommodate to changes in furnace and coal type. Such technological practice fosters breakthroughs in combustion performance of conventional boilers and raises burn-out rate and thermal efficiency to 98% and above 90% respectively, and the steam amount generated per ton of coal from 5 tons to over 9 tons.

SO<sub>2</sub>, dust and NO<sub>x</sub> are the main pollutants generated from combustion in boilers. Going through a series of treatment measures including SCR-SNCR combined denitration process, limestone-gypsum wet desulfurization process and bag filter, the emitted SO<sub>2</sub>, dust and NO<sub>x</sub> has the concentration of  $45.8 \text{ mg/m}^3$ ,  $9.3 \text{ mg/m}^3$ , and  $160 \text{ mg/m}^3$  respectively, all of which stay below the emission concentration limits of *Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB 37/2374-2013)

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and below those articulated in World Bank's Environmental, Health, and Safety General Guidelines.

#### (1) Sulfur Dioxide (SO<sub>2</sub>)

SO<sub>2</sub> is an irritant gas that is absorbed by the nose. It can be easily absorbed by the moist mucosal surface and generate sulfite and sulfuric acid. As SO<sub>2</sub> has strong stimulating effect on eyes and respiratory mucosa, inhalation of large amount can cause pulmonary edema, laryngeal edema, and vocal cord spasm and finally result in suffocation. Mild SO<sub>2</sub> poisoning will lead to symptoms of lacrimation, photophobia, cough, as well as burning pain in pharynx and laryngeal; while severe poisoning can trigger pulmonary edema within few hours. Inhalation of gas with extremely high concentration of SO<sub>2</sub> will cause reflex glottis spasm and then suffocation. Direct exposure of skin or eye to SO<sub>2</sub> will cause inflammation and burns. Long-term low concentration exposure will lead to headache, dizziness, weakness and other systemic symptoms as well as chronic rhinitis, pharyngitis, bronchitis, smell and taste loss, and so on.

The project uses the processes of limestone-gypsum wet flue gas desulfurization. Lime powder is prepared into slurry as absorber. The 2 boilers share one set of desulfurization facility, with desulfurization efficiency above 93.5%. SO<sub>2</sub> concentration in exhaust gas from boilers reaches 29.20 mg/m<sup>3</sup> after above desulfurization treatment, which stays within the emission concentration, limit (50 mg/m<sup>3</sup>) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

#### (2) Nitrogen dioxide (NO<sub>2</sub>)

Nitrogen dioxide is an irritant gas that can be absorbed by mucous membranes. NO<sub>2</sub> is corrosive and physiologically irritating. People with respiratory problems, such as asthma, are more susceptible to nitrogen dioxide. Exposure may cause impaired lung development in children. Long-term inhalation may cause lung structural changes.

At present, two denitration processes are widely accepted globally, namely, selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). Both SCR and SNCR are methods of converting nitrogen oxides (NO<sub>x</sub>) in the flue gas into harmless diatomic nitrogen (N<sub>2</sub>) and water through reduction reaction at a certain temperature, typically with the aid of a reductant such as ammonia or urea. Taking into account such factors as furnace model and fuel, as well as desulfurization process, the project adopts SNCR-SCR combined denitration technology, which integrates SNCR's advantage of saving investment and SCR's merit of high technical effectiveness. The project uses urea as reductant, which requires the highest investment and operating costs. However, it is not necessary to take any special precautionary measures during the transportation, storage and use of urea and no harm will be produced in such process. Therefore, urea has the best safety performance. Through the treatment, NO<sub>x</sub> concentration in boiler-released exhaust gas is 54.84 mg/m<sup>3</sup>, which is below

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the emission concentration limit ( $100 \text{ mg/m}^3$ ) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

(3) Dust and Soot (Total Suspended Particulate, TSP)

Human nose can block out particles with a diameter greater than  $10 \text{ }\mu\text{m}$ . Particulate matter with a particle size from  $2.5 \text{ }\mu\text{m}$  to  $10 \text{ }\mu\text{m}$  can enter the upper respiratory tract; however, some of them can be excreted through the sputum, thus posing a relatively small hazard to human health. Fine particles with diameter below  $2.5 \text{ }\mu\text{m}$  can be inhaled into bronchi and interfere with gas exchange in lungs, causing such diseases as asthma, bronchitis and cardiovascular diseases. Fine particles can also enter the blood through the bronchi and alveoli, with the harmful gases and heavy metals borne by them dissolving in the blood and bringing greater harm to human health. Long-term exposure to pollutant particles in the air increases the risk of developing lung cancer, even if the particle concentration is below the legal limit. These particles or other air pollutants may increase in concentration in a short term and give rise to risk of heart disease. European epidemiologists have discovered a clear correlation between lung cancer and airborne particles in some areas.

Due to rapid economic growth, industrial expansion and intensified urbanization, haze frequently hits China in recent years. China is the world's largest energy producer and consumer, the largest coal consumer and the largest emitter of environmental pollutants and greenhouse gases. Both production and domestic life is highly dependent on fossil fuels such as coal and oil. The share of coal in its energy consumption is much higher than that in developed countries. Unreasonable structures of energy production and consumption as well as pollutants emitted from such process are among the critical causes for haze formation. The war against haze has become one of the important tasks in China's Action Plan on Air Pollution Prevention and Control (generally referred to as the Action Plan or "Air Ten Plan").

The project installs bag filters to remove dust and control flue gas emission, with the dust removal efficiency no less than 99.9%. With these measures, dust concentration in exhaust gas from boilers remains  $4.83 \text{ mg/m}^3$ , within the emission concentration limit ( $10 \text{ mg/m}^3$ ) for Key Control Areas in Table 2 of the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

#### 5.5.1.3 Ambient Air Quality Standard

The Ambient Air Quality Standard (AAQS) is formulated to protect and improve living environment, ecological environment and human health, as well as to implement Environmental Protection Law and Atmospheric Pollution Prevention and Control Law of People's Republic of China. AAQS specifies functional zone categories, standards classification, average time and concentration limits, monitoring methods, data and statistics

validity, implementation, as well as supervision. Standard limits are designed for one or multiple specific averaging periods, typically 1 hour, 24 hours, or 1 year. This environmental impact assessment (EIA) applies Level II standards of the *Ambient Air Quality Standards* (GB3095-2012) (Table 5-2).

**Table 5-2** Limit of ambient air quality standard Unit: mg/m<sup>3</sup>

Pollutant	Averaging Time	Limit mg/m <sup>3</sup>	Notes
SO <sub>2</sub>	1 hour average	0.50	Class II of <i>Ambient Air Quality Standards</i> (GB3095-2012)
	Daily average	0.15	
NO <sub>2</sub>	1 hour average	0.20	
	Daily average	0.08	
PM <sub>10</sub>	Daily average	0.15	
PM <sub>2.5</sub>	Daily average	0.075	
TSP	Daily average	0.30	

#### 5.5.1.4 Exhaust Funnel Height and Inner Diameter

Design height of the exhaust funnel should meet requirements for air pollutant diffusion and be given considerations to the investment cost, with the ultimate purpose to ensure that the ground level of pollutant concentration shall not exceed the AAQS limits. In this project, exhaust gas from 2 boilers is emitted through one chimney of 45-m height and 1.5-m inner diameter. The chimney height satisfies the requirements on minimum allowable exhaust funnel height put forward by the *Integrated Emission Standards of Regional Air Pollutants of Shandong Province* (DB37/2376-2013).

#### 5.5.1.5 Emission Concentration

Air pollutant emissions are calculated based on formulas provided by the *Textbook on Thermal Power Plants* from *Textbook Series for Vocational Qualification Registration of Environmental Impact Assessment Practitioners*. In operation phase, the emission concentrations of SO<sub>2</sub>, dust and NO<sub>x</sub> generated from boiler with combustion of design coal and check coal (Table 5-3) are all within the emission concentration limits of *Emission Standards of Air Pollutants from Coal-Burning, Oil-Burning and Gas-Fired Boilers in Shandong Province* (DB 37/2374-2013)

**Table 5-3** Pollutants in the Project's Boiler Flue Gas

Item		Unit	Design Coal	Check Coal
Flue Gas Emissions	Wet Flue Gas Volume	m <sup>3</sup> /h	84365	76523
	Dry Flue Gas Volume	m <sup>3</sup> /h	79726	70491
SO <sub>2</sub>	Generation	Concentration	mg/ m <sup>3</sup>	916.4
		Rate	kg/h	73.06
		Volume	t/a	526.0
	Emission	Concentration	mg/ m <sup>3</sup>	45.8
		Rate	kg/h	3.65
				2.22

Item			Unit	Design Coal	Check Coal
		Volume	t/a	26.3	16.0
	Emission Standard		mg/ m <sup>3</sup>	200	
PM	Generation	Concentration	mg/ m <sup>3</sup>	9263.5	29654.1
		Rate	kg/h	738.55	2090.3
		Volume	t/a	5317.5	15050.5
	Emission	Concentration	mg/ m <sup>3</sup>	9.3	29.6
		Rate	kg/h	0.74	2.09
		Volume	t/a	5.3	15.1
	Emission Standard		mg/ m <sup>3</sup>	30	
NO <sub>x</sub>	Generation	Concentration	mg/ m <sup>3</sup>	320	320
		Rate	kg/h	25.51	22.56
		Volume	t/a	183.7	162.4
	Emission	Concentration	mg/ m <sup>3</sup>	160	160
		Rate	kg/h	12.76	11.28
		Volume	t/a	91.8	81.2
	Emission Standard		mg/ m <sup>3</sup>	300	
Mercury and its compounds	Emission	Concentration	mg/ m <sup>3</sup>	0.0019	0.0019
		Rate	kg/h	0.000151	0.000134
		Volume	t/a	0.0011	0.000964
	Emission Standard		mg/ m <sup>3</sup>	0.03	
Ammonia	Emission	Concentration	mg/ m <sup>3</sup>	8	8
		Rate	kg/h	0.6378	0.5639
		Volume	t/a	4.60	4.06

Source: domestic EIA .The emission concentrations are collected at full load operating conditions.

#### 5.5.1.6 Atmospheric dispersion modeling

The report undertakes atmospheric dispersion modeling for SO<sub>2</sub>, PM<sub>10</sub>, TSP, ammonia and NO<sub>x</sub> using SCREEN3, a US EPA and PRC approved screening mode to estimate the effects to ambient air quality of the project. SCREEN3 is a single source gaussian plume model that can calculate maximum ground level concentration of different pollutants from point source, torch source, area source and body source under normal condition and special condition such as downwash condition and shoreline fumigation condition. Various meteorological combination conditions including worst weather conditions are incorporated and preset in SCREEN3. The worst weather conditions may occur in the project area or not. Therefore, the SCREEN3 modeling result is the conservative calculation result for maximum impacts and range from one pollution source to ambient air quality.

The modeling result is presented in Table 5-4.

**Table 5-4 Modeling result Unit: mg/m<sup>3</sup>**

Distance from pollution source (m)	Parameter							
	SO <sub>2</sub>		NO <sub>x</sub>		PM		Ammonia	
	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)

Distance from pollution source (m)	Parameter							
	SO <sub>2</sub>		NO <sub>x</sub>		PM		Ammonia	
	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)
100	0.0007	0.00	0.0013	0.00	0.0001	0.00	0.0001	0.00
200	2.7730	0.55	5.1026	2.55	0.5624	0.12	0.4864	0.24
300	7.9180	1.58	14.5684	7.28	1.6060	0.36	1.3880	0.69
400	9.5250	1.91	17.5263	8.76	1.9320	0.43	1.6700	0.84
500	10.0700	2.01	18.5368	9.27	2.0430	0.45	1.7670	0.88
600	9.2940	1.86	17.1000	8.55	1.8850	0.42	1.6300	0.82
700	8.2100	1.64	15.1053	7.55	1.6650	0.37	1.4400	0.72
800	8.1140	1.62	14.9316	7.47	1.6450	0.37	1.4230	0.71
900	7.7780	1.56	14.3105	7.16	1.5770	0.35	1.3640	0.68
1000	7.6680	1.53	14.1105	7.06	1.5550	0.35	1.3450	0.67
1100	7.4950	1.50	13.7895	6.89	1.5200	0.34	1.3140	0.66
1200	7.4460	1.49	13.7000	6.85	1.5100	0.34	1.3060	0.65
1300	7.3660	1.47	13.5526	6.78	1.4940	0.33	1.2920	0.65
1400	7.1830	1.44	13.2158	6.61	1.4570	0.32	1.2600	0.63
1500	6.9370	1.39	12.7632	6.38	1.4070	0.31	1.2170	0.61
1600	6.7990	1.36	12.5105	6.26	1.3790	0.31	1.1920	0.60
1700	6.7270	1.35	12.3737	6.19	1.3640	0.30	1.1800	0.59
1800	6.6030	1.32	12.1474	6.07	1.3390	0.30	1.1580	0.58
1900	6.4430	1.29	11.8526	5.93	1.3070	0.29	1.1300	0.57
2000	6.2590	1.25	11.5158	5.76	1.2690	0.28	1.0980	0.55
2100	6.0600	1.21	11.1526	5.58	1.2290	0.27	1.0630	0.53
2200	5.8530	1.17	10.7684	5.38	1.1870	0.26	1.0260	0.51
2300	5.6440	1.13	10.3842	5.19	1.1440	0.25	0.9897	0.49
2400	5.4350	1.09	10.0000	5.00	1.1020	0.24	0.9532	0.48
2500	5.2310	1.05	9.6263	4.81	1.0610	0.24	0.9174	0.46
2600	5.0340	1.01	9.2632	4.63	1.0210	0.23	0.8827	0.44
2700	4.8440	0.97	8.9105	4.46	0.9822	0.22	0.8494	0.42
2800	4.6620	0.93	8.5789	4.29	0.9454	0.21	0.8176	0.41
2900	4.5140	0.90	8.3053	4.15	0.9154	0.20	0.7916	0.40
3000	4.4660	0.89	8.2158	4.11	0.9057	0.20	0.7832	0.39
3500	4.2760	0.86	7.8684	3.93	0.8671	0.19	0.7499	0.37
4000	4.0210	0.80	7.4000	3.70	0.8154	0.18	0.7052	0.35
4500	3.8110	0.76	7.0105	3.51	0.7728	0.17	0.6683	0.33
5000	3.8110	0.76	7.0105	3.51	0.7728	0.17	0.6683	0.33
MaximumGL C	10.17	2.03	18.71	9.36	2.062	0.46	1.783	0.89

Distance from pollution source (m)	Parameter							
	SO <sub>2</sub>		NO <sub>x</sub>		PM		Ammonia	
	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)	C <sub>i</sub>	P <sub>i</sub> (%)
Distance from the pollution source with maximum GLC	520							

Source: Domestic EIA. The emission concentrations are collected at full load operating conditions.

Note: P<sub>i</sub>= ratio of concentration to standard; C<sub>i</sub>= ground level concentration (GLC).

**Table 5-5 Modeling results for fugitive emission Unit: mg/m<sup>3</sup>**

Distance from pollution source (m)	Fugitive emission			
	Ammonia		Dust	
	C <sub>i</sub> (mg/m <sup>3</sup> )	P <sub>i</sub> (%)	C <sub>i</sub> (mg/m <sup>3</sup> )	P <sub>i</sub> (%)
100	1.1610	0.58	27.4800	6.11
200	1.1550	0.58	26.7800	5.95
300	1.0910	0.55	24.9700	5.55
400	1.0260	0.51	25.9500	5.77
500	0.8755	0.44	23.6900	5.26
600	0.7313	0.37	20.7200	4.60
700	0.6120	0.31	17.9100	3.98
800	0.5209	0.26	15.5800	3.46
900	0.4478	0.22	13.6300	3.03
1000	0.3897	0.19	12.0200	2.67
1100	0.3438	0.17	10.7000	2.38
1200	0.3056	0.15	9.5870	2.13
1300	0.2739	0.14	8.6480	1.92
1400	0.2473	0.12	7.8450	1.74
1500	0.2246	0.11	7.1540	1.59
1600	0.2052	0.10	6.5550	1.46
1700	0.1884	0.09	6.0320	1.34
1800	0.1736	0.09	5.5740	1.24
1900	0.1606	0.08	5.1700	1.15
2000	0.1491	0.07	4.8100	1.07
2100	0.1394	0.07	4.5050	1.00
2200	0.1308	0.07	4.2310	0.94
2300	0.1230	0.06	3.9850	0.89
2400	0.1159	0.06	3.7620	0.84
2500	0.1096	0.05	3.5580	0.79
2600	0.1037	0.05	3.3730	0.75

Distance from pollution source (m)	Fugitive emission			
	Ammonia		Dust	
	C <sub>i</sub> (mg/m <sup>3</sup> )	P <sub>i</sub> (%)	C <sub>i</sub> (mg/m <sup>3</sup> )	P <sub>i</sub> (%)
2700	0.0985	0.05	3.2030	0.71
2800	0.0936	0.05	3.0470	0.68
2900	0.0891	0.04	2.9030	0.65
3000	0.0850	0.04	2.7710	0.62
3500	0.0693	0.03	2.2630	0.50
4000	0.0580	0.03	1.8980	0.42
4500	0.0496	0.02	1.6240	0.36
5000	0.0431	0.02	1.4120	0.31
Maximum GLC	1.197	0.60	27.49	6.11
Distance from the pollution source with maximum GLC	87		98	

The modeling results indicate that the project's flue gas will have limited contribution to the SO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> TSP and ammonia 1-hour average concentration then the project has limited impacts to the ambient air quality in the assessment range. After accumulative analysis of combined worse case GLC of the project and background ambient air quality, the result indicates that the project's flue gas will have limited impacts on sensitive receptors and will not significantly change the ambient air quality of the sensitive receptors.

**Table 5-5 Accumulative analysis result, mg/m<sup>3</sup>**

Item	SO <sub>2</sub>	NO <sub>x</sub>	PM <sub>10</sub> *
Predicted downwind worst case GLC	0.01017	0.01871	0.002062
Background (average of baseline monitoring)	0.0585	0.04437	0.1343
Accumulative result	0.06867	0.06308	0.136362
Limit	0.5	0.25	0.15

Note: Because there is no 1-hour concentration standard for PM<sub>10</sub>, 3 times of worst case GLC is combined with background data to be compared with standard limit.

### 5.5.2 Wastewater

Wastewater generated by the project mainly includes: boiler effluent, chemical water facilities drainage, wastewater from desulfurization process, sewage from equipment circulating cooling process, as well as domestic sewage.

The domestic sewage is treated by the septic tank and then used for site greening. Wastewater from the desulfurization system is used for humidifying ash storage chamber. Concentrated water produced by the chemical water system is unpolluted wastewater, part of which will be used in desulfurization system and the rest will be discharged into municipal drainage network after neutralization and sedimentation. The boiler effluent is unpolluted

wastewater and will be discharged into municipal drainage network after neutralization and sedimentation. Effluent from water recycling system is unpolluted wastewater and will be used for spraying to control dust-fall in project site.

**Table 5-6 Predicted annual wastewater generation and emission**

Type	Quantity (m <sup>3</sup> /a)	Treatment method	Emission	Recycling quantity (m <sup>3</sup> /a)	Emission quantity (m <sup>3</sup> /a)
Chemical water facilities drainage	88900	Clarification	Part is recycled as Recyled as ash humidifying water and desulfurization system. The rest part is discharged to GBNA wastewater treatment plant	3929	84971
Boiler effluent	10080	—	Discharged to GBNA wastewater treatment plant	0	10080
Sewage from equipment circulating cooling process	1800	—	Discharged to municipal storm water sewer system	0	1800
Oily wastewater	2288	Oil-water separator	Discharged to GBNA wastewater treatment plant	0	2288
Wastewater from desulfurization process	1921	Neutralization and precipitation	Recyled as ash humidifying water and wet-type slag extractor	1921	0
Domestic wastewater	1200	Septic tank	Discharged to GBNA wastewater treatment plant	0	1200
Total	106189	—	—	5850	100339

Waste water quality of different wastewater is presented in Table 5-7.

**Table 5-7 Waste water quality of the project**

Type	Emission quantity (m <sup>3</sup> /a)	Concentration mg/L			Annual emission quantity t/a		
		COD	Ammonia	Petroleum	COD	Ammonia	Petroleum
Chemical water facilities drainage	84971	40	—	—	3.40	—	—
Boiler effluent	10080	40	—	—	0.40	—	—
Sewage from equipment circulating cooling process	1800	20	—	—	—	—	—
Oily wastewater	2288	420	30	5	0.96	0.07	0.01
Wastewater from desulfurization process	1200	400	30	—	0.48	0.04	—
Total	100339	52.3	1.1	0.1	5.24	0.11	0.01
Limit : Class 1A of table 1 of <i>Discharge standard of pollutants for municipal wastewater treatment plant</i> (GB18918-2002)		50	5	—	—	—	—

Annual project wastewater emission quantity is 13.94 m<sup>3</sup>/h (100339 m<sup>3</sup>/a) and annual

emission quantity of COD and ammonia are 5.25 tons and 0.11 tons respectively. The wastewater is discharged to municipal sewer then treated in GBNA wastewater treatment plant. After treatment, the wastewater can meet Class 1A of *Discharge standard of pollutants for municipal wastewater treatment plant* (GB18918-2002) (COD: 50 mg/L and ammonia: 5 mg/L), then discharged to Xiaoqing River.

### 5.5.3 Noise

The permanent noises of this project mainly consist of mechanical noise generated from equipment operation and aerodynamic noise produced by various fan and steam pipes. The noise sources of the project are presented in Table 5-8.

**Table 5-8 Main project noise sources Unit: dB(A)**

No.	Name	Number	Noise level at the source	Mitigation measures	Location	Noise level after mitigation measures
1	Induced draft fan	2	85	Noise elimination	Outdoor	70
2	Blower	2	90	Noise elimination and sound insulation	Boiler room	70
3	Roots blower	2	85	Noise elimination and sound insulation	Boiler room	70
4	Pump	14	95	Damping and sound insulation, located at semi-ground pump station	Pump station	75
5	Mixer in mixing pool	1	80	Sound insulation	Desulfurization workshop	65
6	Pump for desulfurization equipment	4	80	Damping and sound insulation	Desulfurization workshop	60
7	Centrifuge	1	85	Damping and sound insulation	Desulfurization workshop	65
8	Air compressor	2	90	Damping and sound insulation	Air compressor room	70
9	Boiler exhaust noise	---	110	noise elimination	Boiler room	95
10	Blow pipe	---	120	Noise elimination	Boiler room	100

Given the existence of multiple noise sources, higher sound level and compact layout, a spectrum of noise reduction measures have been adopted to lessen the project's impacts on the surroundings. (1) Low-noise equipment will be used as far as possible, and noise reduction measures such as noise elimination, shock absorption, insulated enclosures and sound dampening materials on exterior walls will be implemented, high efficiency mufflers will be installed at the boiler exhaust vent, fans will be installed with insulated enclosures, pump

station will be laid semi-ground, work and rest places will be far away from the strong noise sources and layout of workshops will be reasonable planned to reduce noise

Table 5-9 shows the contribution of the main noise equipment to the noise prediction sites and the evaluation results.

**Table 5-9 Contribution of Noise Equipment to site boundaries Unit: dB (A)**

Prediction Sites		East Boundary	outh Boundary	West Boundary	North Boundary
Daytime	Contribution	53.7	37.1	52.5	47.5
	Baseline	42.3	43.6	44.0	43.4
	Accumulated value	54.0	44.5	53.1	49.0
	Limit	65	65	65	65
Nighttime	Contribution	53.7	37.1	52.5	47.5
	Baseline	38.5	39.4	37.9	37.3
	Accumulated value	53.8	41.4	52.7	47.9
	Limit	55	55	55	55

The prediction results indicate that the daytime and nighttime noise level at four boundaries can meet the Class 3 Standard of *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008). There is no sensitive receptors within the 200-m scope from the project boundaries, thus the project has relatively low impact on the surrounding acoustic environment.

#### **5.5.4 Storage, Transportation and Disposal of Ash, Slag and Desulfurization Gypsum**

Solid waste of the project is coal slag from boiler, ash from dust removal system, desulfurization gypsum, waste oil from oil-water separator and domestic waste. Solid waste of the project is presented in Table 5-10.

**Table 5-10 Treatment method of solid waste unit: tons**

Item	Annual quantity (designed coal)	Annual quantity (actual coal)	Type	Treatment method
Ash	5309.6	15027.9	General solid waste	Sold out as building material
Slag	590.8	1672.3	General solid waste	
Gypsum	2059.8	907.8	General solid waste	Sold out as building material
Domestic waste	7.5	7.5	General solid waste	Collected by local sanitary department
Waste oil	7.0	7.0	Hazardous waste, HW08	Combustion in boiler

Item	Annual quantity (designed coal)	Annual quantity (actual coal)	Type	Treatment method
Total	7974.7	17622.5	—	—

Treatment methods of all solid waste are presented below:

(1) Collection, classification, storage and treatment of various types of solid wastes are separate. One 200m<sup>3</sup> ash storage room will be installed to storage ash from boilers. One 20mx30m slag storage room will be installed for slag storage with a capacity of 30 days slag storage. Ash and desulfurization gypsum of the project will be 100% sold as construction material. Waste oil from oil-water separator will be combusted in boilers. Domestic waste will be collected by local sanitary department.

(2) Solid storage room will be tamped by clay and seepage-proofing treated by ground hardening measures with cement mortar to reduce the impacts to ground water and surrounding environment.

(3) If solid waste can not be temporarily stored at project site for some reasons, the solid waste will be transferred to leased storage places for temporary storage. If the issue is solved, the stored solid waste will be transferred and treated in time.

Ash, slag and desulfurization gypsum belongs to general waste. The project has signed contract with Guangrao Commercial and Trading Co., Ltd. to sell all the ash and gypsum as raw material for cement production. The total ash, slag and gypsum generated by the project amounts to 17,606.0 ton/year; based on a price of RMB 6.0 yuan/ton, they can create RMB 105,600 yuan each year.

### 5.5.5 Occupational Health and Safety

Compared with conditions in general industrial enterprises, the operation of this project involves lower temperature and pressure, a high degree of automation, and a quite safer operating system. In the normal course of production and operation, this project has a relative high safety level. The project operator is expected to take proper measures to protect employees' occupational health and safety of workers, including:

(1) Operation phase EHS plan will be developed and implemented and workers will be trained regularly on their implementation.

(2) The EHS plan will be aligned with relevant government regulations and guidelines on COVID-19 prevention and control, or with international good practice guidelines as updated in the future<sup>3</sup>. The plan shall be reviewed by I&G in consultation with local public health

<sup>3</sup> See e.g.: World Health Organization. 2020. Considerations for public health and social measures in the workplace in the context of COVID-19. Geneva. Available at: <https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19>. HM Government. 2020. Working safely during COVID-19 in construction and other

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inspectors, local medical officers, or other relevant health specialists, with a recommendation forwarded to the subborrower for clearance. The plan will include COVID-19 prevention and control measures, including disinfection/cleaning of offices, and operation sites, on-site temperature checks, social distancing measures, mandatory use of personal protective equipment such as facemasks, provision of handwashing stations and hand sanitizers etc., and procedures to be adopted in the event any worker is infected with COVID-19.

(3) Provide personal protective equipment (PPE) to the employees based on their job responsibilities and circumstances.

(4) Regularly check the heating supply system and repair defects in time.

(5) A Technical Safety Division is set up in the plant headquarter to take charge of safety education, safety supervision and safety performance evaluation for the whole plant. One safety supervisor is assigned to monitoring boiler operation and one to electricity operation to inspect safety performance of the plant.

(6) Comply with provisions on vocational health, safety and safe production in related laws of the People's Republic of China.

### **5.5.6 Abnormal Operating Conditions**

The main environmental impact of this project is brought by air pollutants emitted in the boiler flue gas. Should any failure occur in desulfurization, denitration and dust removal device, non-compliance in air pollutant emissions would appear. With the help of estimation model, it is anticipated that under abnormal operating conditions, the pollutant emission concentrations would be very high and exceed the emission limits to varied extent. However, no sensitive receivers such as residential area are located within the outreach of maximum ground level concentrations of air pollutants. As the maximum pollutant concentrations in downwind direction of flue gas emission surpass limits in Level II standards of the Ambient Air Quality Standards (GB3095-2012), once the abnormal operating conditions occur, air quality in sensitive receivers' locations in project adjacent area will be affected. During the project operation, there should be strengthened maintenance and management of environmental protection facilities to avoid occurrence of abnormal operating conditions to the maximum extent. In case of any such occurrence, efforts should be made to minimize the duration of abnormal operating conditions.

The Elion Guangrao Subcompany has developed the Emergency response plan for

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outdoor work. Guidance for employers, employees and the self-employed. Available at: <https://assets.publishing.service.gov.uk/media/5eb961bfe90e070834b6675f/working-safely-during-covid-19-construction-outdoors-110520.pdf>. The Canadian Construction Association–COVID-19 Standard Protocols. Available here: <https://www.cca-acc.com/wp-content/uploads/2020/04/CCA-COVID-19-Standardized-Protocols-for-All-Canadian-Construction-Sites-04-16-20.pdf>

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environmental emergencies (Appendix 1) and established a relatively sound emergency response mechanism.

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## **6 Alternatives Analysis**

All the project alternatives are usually compared during feasibility study phase, with the purposes to minimize adverse environmental impacts and improve environmental benefits based on satisfaction of environmental standards. Common selective factors include: (1) energy efficiency; (2) emission reduction rate; (3) land use; (4) impacts on goals for environmental protection; and (5) resettlement etc. In addition, “absence of this project” is often analyzed as an alternative.

### **6.1 No Project Alternative**

No Project Alternative aims to identify the potential impacts when this project has never been implemented. At present, a quantity of enterprises has settled in GBNA. These businesses have continuous and stable production and thus maintain stable heat load, with thermal energy primarily used for heating and drying. However, development of regional steam provision capacity cannot catch up with the pace of steam demand growth, and steam supply is unable to satisfy the soaring demand for heat load. In absence of this project, all industrial enterprises would have to build self-operated small-scale boilers for steam supply. Such self-built small boilers usually have lower combustion efficiency and higher pollution emissions, which is not conducive to improvement of regional environmental quality. In addition, decentralized storage and transportation of fuel coal and ash/slag by enterprises will bring negative impacts to local area as well. On the basis of strictly verifying current heat load for production in each and every industrial enterprise and giving due consideration to their short-term development plan, this project performs centralized steam supply to GBNA. Such centralized steam supply will raise coal use efficiency, reduce pollutant discharge, and improve regional environmental quality. The project is in favor of facilitating local investment, boosting regional economic development and safeguarding public health. Therefore, “Absence of This Project” is not a reasonable option.

### **6.2 Project location**

This project is located in the planned area for steam supply which belongs to industrial land. The site selection is in conformity of provisions in GBNA planning and land use plan. In addition, the site selection has incorporated full consideration of steam demand of both existing enterprises and newly settled businesses in GBNA as well as the range of heat-supply service. The project location is reasonable. It is beneficial to energy conservation and guarantees the safe and reliable operation of steam supply system.

### **6.3 Fuel/Energy Alternatives**

Multiple fuels or energy sources can be used to generate heat or as source for indirect

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heating, including: natural gas, solar power, wind power, geothermal power, biomass, coal and so on.

### **6.3.1 Natural gas**

Natural gas is a clean, environmentally friendly, and high-quality energy source that contains almost no sulfur, dust, and other harmful substances. It produces less carbon dioxide than other fossil fuels when burning, reduces emissions of sulfur dioxide and dust by nearly 100%, reduces carbon dioxide emissions by 60% and nitrogen Oxygen emissions by 50%, all of which help lessen the formation of acid rain and mitigate global warming. China's natural gas reserves are mainly distributed in the basins in Central and Western China. At present, demand for natural gas in China is increasing year by year. However, the general quality of natural gas reserves is not satisfactory and the resource use is often affected by geographic factors. At the same time, the cost of fuel natural gas is higher than that of fuel coal. Thus, natural gas is not suitable to be the fuel for centralized steam supply in GBNA.

### **6.3.2 Solar power**

Solar power is the most critical basic energy source among various renewable energies and the most abundant energy available to human beings. The energy embedded in solar radiation striking the earth surface annually is up to  $1.05 \times 10^{18}$  kWh ( $3.78 \times 10^{24}$  J), equivalent to  $1.3 \times 10^6$  billion tons of standard coal. China has a vast land territory and the majority of the territory lies in mid-latitude zone, with a large solar elevation angle. The annual radiation amount ranges from 80 kcal/cm<sup>2</sup> to 220 kcal/cm<sup>2</sup>.

Currently, solar power is generally applied in two ways: electricity generation and water heating. The solar water heater is only good for domestic water use. Solar power heating still suffers from disadvantages of low efficiency, high price and large area requirement. As this project supplies steam to industrial enterprises in GBNA, there are certain requirements on steam temperature and pressure. Therefore, solar heating solution does not apply to this project.

### **6.3.3 Wind power**

Wind power is the use of air flow through wind turbines to generate energy in various forms such as electricity, thermal energy and mechanical energy for the purposes of power generation, water lifting, navigation assistance, cooling and heating, etc. Wind power volume depends on wind speed and air density. China lies on the verge of the Pacific Ocean, with strong monsoon and a coastal line stretching more than 18,000 km, and multiple mountain ranges inland change the distribution of air pressure, all of which fosters widely distributed wind power resources. The first step of wind power heating requires the conversion of wind power into electricity, which has relatively higher costs. In addition, wind power output

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fluctuations will render the continuous reliable heating impotent. Therefore, additional backup heating sources such as coal, natural gas or electricity storage system are needed if wind power is used as fuel, which substantially reduce the economic efficiency.

#### **6.3.4 Geothermal Power**

Most of the geothermal power comes from the renewable heat in the depths of the earth, which starts from the earth's molten magma and the decay of radioactive material. A small portion of the geothermal power comes from the sun, accounting for about 5% of the total geothermal energy; and the surface geothermal energy is primarily originated from the sun. The deep groundwater cycle and invasion of magma at significant depth into the earth crust brings heat from deep underground to near-surface. The use of geothermal energy has great geographical constraints and requires available geothermal resources in project adjacent areas. However, no available geothermal energy source has been observed in project surroundings.

#### **6.3.5 Biomass**

Biomass energy refers to the chemical energy that plant chlorophyll converts from solar power and then stores in the biomass. The current technology for bio-energy use includes thermochemical conversion of solid biomass into flammable gases and tar; biochemical conversion of biomass into biogas and alcohol through microorganism fermentation; and physical conversion of biomass into high-density solid fuel through densification molding technology. Biomass energy mainly consist of agricultural residual, forest production and processing waste, industrial wastewater, municipal solid waste, etc.

However, current practice of applying biomass energy to heating or power generation has the following problems: (1) absence of systematic framework for raw biomass collection and energy production; (2) excessive investment costs; (3) higher fuel costs than coal; and (4) sources of raw materials are subject to seasonal restrictions. Thus, biomass energy is not a feasible option for fuel.

#### **6.3.6 Coal**

The project uses coal produced in Shenmu County of Shaanxi Province as the main fuel. Shenmu area in Shaanxi Province is a coal accumulation center of in Shenfu Jurassic coalfield. The coal reserve has an area of over 4,500 km<sup>2</sup>, accounting for 60% of the county's total area, with the proven reserve exceeding 50 billion tons. The coal seam has a simple geological structure and stable storage. The coal deposit is shallow and easy to be mined. With excellent quality, extra-low ash content, extra-low phosphorus content, extra-low sulfur content, and high calorific value, Shenmu coal belongs to high volatile weak caking or non-caking long flame coal, which is environmentally friendly. At present, Shenmu County

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has 13 key state-owned coal mines, 8 local state-owned coal mines, and 128 township coal mines. The fuel supply is sufficient to support long-term stable operation of boilers of the project.

## **6.4 Boiler Alternatives**

### **6.4.1 Grate-fired Boiler**

Grate firing refers to the combustion of fuel staying fixed on grates, also known as fixed-bed combustion method. It has features of slow combustion and clearly phased combustion process. Given these combustion features, regular grate-fired boiler has the following characteristics: (1) Poor adaptability to coal type. Grate-fired boiler is only suitable for combusting high volatile bituminous coal with caloric value over 4,000 kcal. (2) Low combustion efficiency. There is huge heat loss due to incomplete combustion in the furnace, in particular the combustion of low-quality coal, resulting in high carbon content in slag and energy waste. (3) Low heat transfer performance in furnace. The heat transfer mainly relies on simple radiation and thus boiler's thermal efficiency is quite low, merely reaching 75% on average. (4) The gaps between grates and large coal feed hopper lead to severe coal leakage and air leak. (5) Heavy structure. The structure causes large steel consumption and easy failure in grate movement, which will cause damages and even destroy the motor.

### **6.4.2 Circulating Fluidized Bed Boiler**

Circulating fluidized bed boiler is an efficient, low polluting and clean combustion technology developing over the past decade. It boasts of such advantages as high combustion efficiency, large adaptability to coal types, low concentrations of harmful components in flue gas, wide load adjustment range, comprehensive use of ash and slag, etc. This technology has been developing rapidly in China and the world given the growing energy shortage and environmental protection requirements.

Due to the strong circulation disturbance inside the gas-solid bed in the circulating bed, the heat and mass transfer processes in the furnace are strengthened. As a result, the fresh fuel particles are heated to the furnace temperature ( $\approx 850\text{ }^{\circ}\text{C}$ ) as soon as they enter into the furnace. Combustion and heat transfer at the furnace height can be carried out at a constant temperature, thus extending the combustion time. The fuel is circulated back to the furnace through separator for several times, prolonging the residence and reaction time of the fuel particles and reducing heat loss from incomplete combustion. The circulating fluidized bed boiler can achieve combustion efficiency of 88% up to 95%, which is quite close to that of PC-fired boiler. Because of its unique combustion method, circulating fluidized bed boiler has the following advantages that differentiate it from other boilers:

- (1) Circulating fluidized bed boiler can accommodate to a wide range of fuels, for

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instance various types of coal, including low volatile, low calorific value, conventional inferior fuels and even some special low quality fuels.

(2) Circulating fluidized bed boiler has little requirement on fuel preparation. Fuel prepared by a simple single-stage crusher will meet the design requirement for furnace use. In the existence of centralized coal feeding device, a 100 t/h boiler only needs one coal feed point to maintain operation. Such feature is in favor of the future capacity enlargement of boiler unit.

(3) The combustion process is stable. Due to high temperature of original fuels on bed, the thorough mixture of gas and solid and that of fuel particles on the bed, as well as the relatively low share of new fuels in total fuels on bed (less than 5%), there are no obvious changes of furnace temperature.

(4) Circulating fluidized bed boiler boasts of high combustion efficiency. Recovery and separation of fuel particles guarantees continuous combustion of fuel. For large particle size fuel, the sufficient residence time in furnace ensures combustion effect. Therefore, the carbon content in slag is low.

(5) Adjustment of operating parameters can ensure stable combustion under different operating load and conditions.

However, problems exist in circulating fluidized bed boiler's actual operation. High combustion efficiency can only be achieved as long as the coal in use and operating parameters conform to the boiler design. At present, changes of fuel coal type highly frequently take place in real operation of circulating fluidized bed boilers, and operation under designed conditions is hard to realize. The operation cannot give timely response when the fuel coal is different from design coal, and the operating parameters cannot be identified and adjusted accordingly. Therefore, it is difficult to maintain stable and safe boiler operation and directly leads to the lessened thermal efficiency and increased power consumption of the boiler system.

### **6.4.3 Micro-fine Coal Atomization Boiler**

Micro-fine Coal Atomization boiler is built on the German technology for superfine PC combustion and introduces vortex technology in aviation sector into the operation. The prepared micro-fine PC is efficiently atomized for multiple times and fully mixed with air for combustion. Micro-fine Coal Atomization operation has the advantages of low emission, low coal consumption, high thermal efficiency, and high cost-effective performance, known as "two lows and two highs" advantages, thus is widely acknowledged in the market and among users. At present, Elion's Micro-fine Coal Atomization technology application projects have been implemented in many provinces and municipality including Shandong, Hebei, Tianjin, Jiangsu, Jiangxi, and Zhejiang, and the corresponding technology is relative mature.

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Micro-fine Coal Atomization boiler boasts of the following advantages:

(1) Centralized supply of PC is used, i.e. coal is pulverized in centralized mills and then distributed to the boilers, which guarantees the stable quality of fuel coal.

(2) Micro-fine Coal Atomization boiler creates a friendly working environment. The boiler is operating in a fully-enclosed system in which coal is automatically fed in, fly ash is discharged in a centralized way, and no fly ash is leaked.

(3) The boiler can be started and shut down easily. Immediate start and shutoff of boiler system is achieved, i.e. 30-second ignition will initiate boiler operation and cut off coal supply will lead to boiler shutoff at once.

(4) Boiler system is under high level monitoring. Automatic monitoring and adjustment of operating parameters maintains the best operating conditions, and at the same time reduce labor intensity and human impacts on boiler operation.

(5) Micro-fine Coal Atomization boiler has a high efficiency and excellent energy saving performance, with full combustion of PC, good heat exchange result, small coefficient of excess air, and high thermal efficiency. Large power consuming equipment is connected with frequency converters and remarkable energy conservation results are achieved.

(6) The boiler system contributes to land saving. As there is neither coal-bunker bay nor slag site beside boiler, reduction in land use area and investment is achieved.

(7) The main fans use energy-efficient technologies (e.g. selecting variable moving blade axial flow fan as blower and stationary blade adjustable axial flow fan as draft fan) to save energy.

(8) Distribution of pipelines for flue gas, air blow and PC is optimized to reduce local resistance loss and conserve power.

In general, by comparing processes of three common coal-fired boilers and with proper consideration of local steam demand and heat load scale, it is concluded that Micro-fine Coal Atomization boiler is a reasonable option for the project.

## **6.5 Desulfurization Alternatives**

At present, there are dozens of flue gas desulphurization (FGD) technologies. FGD can be achieved by three major types of processes, including wet FGD process, semi-dry FGD process and dry FGD process, the differences among which are the water input in desulfurization process and the form of desulfurization product. Wet FGD technology is relatively mature, with high efficiency and simple operation.

### **6.5.1 Magnesium Oxide FGD Process**

Magnesium oxide FGD process is also known as magnesia FGD slurry process, which employs magnesia slurry (magnesium hydroxide) as absorbent to scrub sulfur dioxide in the

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flue gas and generate magnesium sulfite and magnesium sulfate. These sulfates will be dehydrated, dried, and then calcined. A small amount of coke is added in the calcining furnace to reduce magnesium sulfate and the sulfates and sulfites decompose into high-concentration sulfur dioxide and magnesium oxide. Magnesium oxide turns into magnesium hydroxide after reaction with water and is reused in the system as absorbent. High-concentration sulfur dioxide can be used to produce sulfuric acid or sulfur. At present, technology for Magnesium oxide FGD process has become mature and been applied to large-scale industrial installations. Corresponding desulfurization rate exceeds 90%.

Magnesium oxide FGD process is a desulfurization process which is secondary only to calcium-based FGD process in terms of technical maturity. It is widely used worldwide, with more than 100 projects in Japan, application in 95% of power plants in Chinese Taiwan, and application cases in the United States and Germany. The magnesia reserve in China is remarkable and the current proven reserve amounts to 16 billion tons, taking up to around 80% of the world's total reserve. The magnesia resources are distributed in Liaoning, Shandong, Sichuan and Hebei provinces. Therefore, magnesium oxide can definitely be used as a desulfurizer in the FGD system.

### **6.5.2 Double-alkali Scrubbing Process**

Double-alkali scrubbing process uses sodium-based scrubbing reagent in the absorption tower to remove sulfur dioxide in the flue gas. As sodium-based scrubbing reagent is strong, the solution formed after scrubbing sulfur dioxide has high solubility and will not create supersaturated crystallization to block the facility. Desulfurization products are discharged into regeneration tank to react with calcium hydroxide and regenerate the sodium-based scrubbing reagent which is sent back to the scrubbing tower for reuse. Double-alkali scrubbing process reduces investment and operation costs, which is more suitable for desulfurization renovation in medium and small-sized boilers.

### **6.5.3 Limestone-gypsum FGD Process**

Limestone-gypsum wet FGD process is the most technically mature and extensively applied conventional flue gas desulfurization process at present. It has a spectrum of advantages, including high desulfurization efficiency, mature technology and reliable operation, rich sources of desulfurization agents, low price, and high utilization rate. According to the *Notice on Issuing the Technical Policy on Pollution Prevention and Control of Thermal Power Plant* (Ministry of Environmental Protection Announcement No. 1 of 2017) and the *Guideline on Available Technologies of Pollution Prevention and Control for Thermal Power Plant* (Draft for Comments), wet FGD process which uses limestone slurry to scrub SO<sub>2</sub> and form gypsum is the best available technology to cope with all coal types and achieve

ultra-low SO<sub>2</sub> emission.

**Table 6-1 Comparison of Common Wet FGD Processes**

No.	Item	Limestone-gypsum FGD Process	Magnesium Oxide FGD Process	Double-alkali Scrubbing Process
1	Requirements for absorbent	Lime powder (purity ≥ 80%, and 90% should be 200 mesh powder)	Magnesia powder (purity ≥ 85%, and 90% should be 200 mesh powder)	Lime powder (purity ≥ 80%, and 90% should be 200 mesh powder) Soda ash (purity ≥ 90%)
2	Advantages	(1) Cheap absorbent (2) Mature technology and easiest and most reliable operation (3) Desulfurization efficiency > 90% (4) Byproduct (gypsum) can be used as cement additive (5) Stable operation (6) Easy to use (7) Low operation costs	(1) Advanced and mature technology, reliable equipment, high cost-effectiveness, excellent desulfurization results, and remarkable economic benefits from magnesium sulfate heptahydrate recovery (2) Desulfurization efficiency > 90% (3) Mature process and reliable operation (4) Recovered byproduct can be used to produce magnesium sulfate heptahydrate as fertilizer additives, reducing secondary pollution and generating economic benefits (5) Much smaller amount of slag than other processes and easy follow-up operation	(1) Mature technology and reliable operation (2) Use of sodium based alkali as desulfurization agent creates better reaction environment in the desulfurization tower than that of limestone-gypsum FGD process (3) Desulfurization efficiency > 90%
3	Disadvantages	High quality requirement for byproduct (gypsum) as cement additive	The one-time investment is slightly higher than those of double-alkali scrubbing process and limestone-gypsum FGD process	Water content in byproduct is high and actual operation requires large quantity of sodium based alkali replenishment, causing excessive operation costs

The above comparison shows that limestone-gypsum FGD process has such features as mature technology, stable operation, high desulfurization efficiency, high degree of byproduct utilization, and low one-time investment, facilitating its wide use in China. Therefore, the project's selection of limestone-gypsum wet FGD system is reasonable and feasible.

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## 6.6 Dust Removal Alternatives

Fly ash generated from PC combustion enters into the rear part of the boiler with flue gas, and then is removed by various dust removal collectors to a maximum extent. Based on their operating principles, dust collectors can be divided into dry dust collector, wet dust collector, electrostatic precipitator and bag filter.

### 6.6.1 Electrostatic Precipitator

Electrostatic precipitator (ESP) uses high-voltage electric field to trigger ionization in flue gas to separate dust with induced electrostatic charge from the airflow. Four inter-related physical processes are involved in applying electrical power to capture dust in flue gas in ESP: (1) ionization of flue gas, (2) electrostatic charge of dust particle, (3) movement of charged dust particles toward electrode, and (4) charged dust collection. ESP's dust removal efficiency is influenced by multiple factors such as temperature and flow rate of the flue gas, ESP's working condition, and space between dust collection plates.

Compared with other dust collectors, ESP has lower energy consumption and high dust removal efficiency for removing dust particles of 0.01 – 50µm in size. It can be applied to high temperature and pressure flue gas. Practice shows that the greater the amount flue gas treated, the more cost-effective the ESP investment and operation becomes.

The main advantages of ESP include:

(1) ESP has high dust removal efficiency, with capability of capturing superfine particulate with a diameter greater than 0.01 µm. The desired dust removal efficiency can be achieved through selection of different operating parameters in design.

(2) ESP has small pressure drop which is usually below 20 mmWc. Compared with cyclone dust collector, its total power consumption is relatively small even with power consumption of the power supply unit and rapper unit being considered.

(3) ESP has a high acceptable operating temperature. For instance, the SHWB model can be operated at a maximum acceptable temperature of 250 °C, and other models can accept temperature ranging 350 – 400 °C or even higher.

(4) ESP is capable of treating a wide range of air volume fully under automatic control.

ESP has the following major disadvantages:

(1) ESP has complicated structure which imposes higher requirements on equipment transfer, installation, maintenance and management.

(2) ESP has certain requirements to dust resistivity. Therefore, ESP is selective and unable to guarantee high dust removal efficiency on all types of dust.

(3) ESP is susceptible to operating conditions such as gas temperature and operating temperature. Treatment of same type of dust particles will generate different results under different operating temperature and humidity.

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- (4) ESP needs large one-time investment, and horizontal ESP takes up a large area.
  - (5) ESP's practical performance in some enterprises cannot achieve the designed performance.

### **6.6.2 Bag Filter**

Bag filter is a type of dry dust collector. It is suitable for capturing small, dry, and non-fibrous dust. The filter bag is made of textile cloth or non-woven felt to use the filtering effect of fiber fabric to handle dust-laden gas. When the dust-laden gas enters the bag filter, large and heavy particulates will settle and fall into hopper due to gravity effect; and the finer dust-contained gas will be cleaned when passing through filter materials which will block the fine dust.

Bag filter's high dust removal efficiency is firmly related to its dust removal mechanism. The dust-laden gas goes into the inlet duct in the lower part of the dust collector and is directed by the baffle plate to the hopper where coarse dust will settle due to collision with baffle plate and gas velocity decrease. The remaining fine dust particles flow with gas into the filtration chamber where the dust and ash is blocked due to inertia, diffusion, blockage, capture, and electrostatic effect of the filter fabric. The cleaned gas flows out of the chamber and is discharged via outlet duct. Accumulated dust on the filter bag is removed by reverse blowing approach and then falls into hopper to be further emitted through double rotary valves to the discharge device. Bag filter's high dust removal efficiency is also attributed to the filter materials whose performance is directly linked with bag filter's overall performance and operation life. Bag filter has the following advantages:

- (1) High dust removal efficiency, which generally surpasses 99%, and relatively higher sorting performance on superfine dust with submicron particle size.
- (2) A wide range of gas treating capacity.
- (3) Simple structure and easy maintenance.
- (4) Lower cost than the electrostatic precipitator with same dust removal efficiency.
- (5) Ability to operate at 200 °C when high temperature resistance filter materials such as glass fiber and PTFE are used.
- (6) Insensitive to dust characteristics and free of impacts from dust and resistance.

In summary, analysis of dust removal efficiency, operational stability, investment and equipment space shows that bag filter is better than the electrostatic precipitator. This project's selection of bag filter is reasonable.

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## **7 Information disclosure and public consultation**

### **7.1 Information disclosure**

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. It can directly reflect the public's perceptions of environmental quality in the project's area of influence

Elion Guangrao Subcompany has undertaken public consultation and information disclosure in 2015 in accordance with the *Regulations on the Administration of Construction Project Environmental Protection* (1998), *Interim Guidelines on Public Consultation for EIA* (2006) and *Note on Enhance of Supervision and Management of Public Consultation for EIA of Construction Project* (2012, No. 138, Shandong EPB). The Information disclosure methods were questionnaire distribution, information posted at bulletin board, leaflet distribution and information disclosed on websites.

The project's information will be disclosed by the following methods;

- (1) Domestic EIA was disclosed on the Dongying EPB's website;
- (2) This IEE will be disclosed on the ADB website ([www.adb.org](http://www.adb.org));
- (3) Copies of domestic EIA will be provided as required;
- (4) All environmental monitoring reports will be disclosed on the ADB website ([www.adb.org](http://www.adb.org)).

### **7.2 PRC and ADB Requirements for Public Consultation**

#### **7.2.1 PRC Requirements**

Relevant provisions in the PRC *Environmental Impact Assessment Law* (2015) and the *Regulations on the Administration of Construction Project Environmental Protection* (No. 253 Order of the State Council, 1998), *Interim Guidelines on Public Consultation for EIA* (2006) and *Technical guideline for environmental impact assessment of construction project General Programme* (HJ 2.1-2016) require that for an environmental Category A project, full EIA reports are required including two rounds of public consultations.

#### **7.2.2 ADB Requirements**

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.

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.

### **7.3 Public consultation of the project**

#### **7.3.1 Information disclosure on website**

##### **(1) First information disclosure**

The first information disclosure was undertaken from March 30, 2014 to April 11, 2015. The information included project name, project content, name and contact information of construction companies, name and contact information of EIA Institute, EIA procedures and content, type of EIA notification notice and request for questions, suggestions and feedback from the public.

##### **(2) Second information disclosure**

The second information disclosure was undertaken from June 12, 2015 to June 21, 2015. The information included

- a) Project introduction;
- b) Potential environmental impacts;
- c) Mitigation measures;
- d) Key conclusions of the EIA report;
- e) Method to get questions, suggestions and feedback from the public; and
- f) Contact information to get abridged versions of the EIA report.

#### **7.3.2 Questionnaire survey**

Questionnaire survey was undertaken from March 28, 2015 to April 20, 2015. A total of 90 questionnaires was distributed and 90 completed questionnaires were received, a recovery rate of 100%. Table 7-1 presents summary information on the questionnaire respondents.

**Table 7-1 Summary data on questionnaire respondents**

Parameter		No.	Percentage (%)
Sex	Male	53	58.9%
	Female	37	41.1%
Age	20-30	43	47.8%
	31-40	29	32.2%
	Above 40	18	20.0%
Education level	High school, including technical secondary school or below	16	17.8%
	Bachelor degree, junior college or above	68	75.6%

	No information	6	6.7%
Occupation	Civil servant	2	2.2%
	Worker/farmer	40	44.4%
	Self-employed entrepreneurs	7	7.8%
	Scientific and technical worker	32	35.6%
	Businessman	9	10.0%
Survey locations	Management committee of GBNA	44	48.9%
	Guangrao Binhai Hospital	18	20.0%
	Dongguanzhuang Village of Dingzhuang Town	9	10.0%
	Shandong Wanning Group	11	12.2%
	Guangrao Huabang Chemical Co., Ltd	6	6.7%

The summary data indicated that the respondents covered a range of ages, education levels and occupation. The respondents were surroundings residents and workers from surrounding enterprises and can reflect the public attitude to the project.

Public consultation questionnaire results were presented in Table 7-2.

**Table 7-2 Public consultation questionnaire results**

Question	Answer	No.	Percentage (%)
1. Do you know the content of the project construction?	Understood	70	77.8
	Barely understood	19	21.1
	Not understand	1	1.1
2. After the mitigation measures are implemented, what is the impacts level of the project to ambient air quality in your opinion?	Slight effect	71	78.9
	Little effect (acceptable)	19	21.1
	Large effect	0	0
	Seriously impact	0	0
3. After the mitigation measures are implemented, what is the impact level of the project to surface water quality in your opinion?	Slight effect	71	78.9
	Little effect (acceptable)	19	21.1
	Large effect	0	0
	Seriously impact	0	0
4. After the mitigation measures are implemented, what is the impact level of the project to ground water quality in your opinion?	Slight effect	76	84.4
	Little effect (acceptable)	14	15.6
	Large effect	0	0
	Seriously impact	0	0
5. After the mitigation measures are implemented, what is the impact level of the project to acoustic environment in your opinion?	Slight effect	75	83.3
	Little effect (acceptable)	15	16.7
	Large effect	0	0
	Seriously impact	0	0
6. After the mitigation measures are implemented, what is the impact level of the project's solid waste to environment in your opinion?	Slight effect	70	77.8
	Little effect (acceptable)	20	22.2
	Large effect	0	0
	Seriously impact	0	0

7. What is the impact level of the project to ecology environment in your opinion?	Slight effect	72	80.0
	Little effect (acceptable)	18	20.0
	Large effect	0	0
	Seriously impact	0	0
8. Do you think risk control measures of the project are feasible and reliable??	Yes	75	83.3
	No	10	11.1
	No idea	5	5.6
9. Do you think the project's mitigation measures can reduce the impacts to environment	Yes	74	82.2
	No	6	6.7
	Uncertain	10	11.1
10. What are the major environmental concerns of this project in your opinion?	Water pollution	18	20.0
	Air pollution	61	67.8
	Noise pollution	6	6.7
	Other	5	5.6
11. Do you think construction of this project can improve local economic development or not?	Yes	89	98.9
	No	0	0
	Limited effect	1	1.1
	Uncertain	0	0
12. After comprehensive analysis about advantages and disadvantages of this project, do you agree with the construction of this project?	Yes	88	97.8
	No	0	0
	No opinion	2	2.2

Based on the questionnaire survey results, the top three environment issues respondents identified are air pollution (67.8%), water pollution (20.0%) and noise pollution (6.7%). 98.9% of the respondents indicated that the project will improve local economic development and 97.8% of respondents indicated that they support the proposed project. Overall support for the project is very strong.

#### 7.4 Public consultation meeting

Based on requirements from Environment and Social Management System (ESMS) and ADB SPS 2009, the project should undertake public consultation meeting.

With the assistance of ADB's environment specialist, public consultation meeting was undertaken at Elion Guangrao Subcompany's meeting room by Elion Guangrao Subcompany on November 3, 2017. 30 participants were invited to attend this meeting. During the meeting information was presented about the project information including project content, project status, potential environmental impacts, environmental risk control measures and proposed mitigation measures by the staff from Elion Guangrao Subcompany. The following process was question & answer process and no question or suggestion from public was received.

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At last, participants were asked to complete a questionnaire and a sample of completed questionnaire and participants list were presented in Figure 7-1. A total of 30 completed questionnaires were received. Table 7-2 presents summary data on the questionnaire respondents while Table 7-3 presents a summary of the questionnaire results

38.9% of the respondents worked within a 3 km radius of the project while 26.7% lived within a 3 km radius of the project. Before this public consultation, 86.7% of respondents knew about project before this public consultation meeting. The top concerned environment issues were ambient air (66.7%), noise (23.3%), ground water (16.7%), risk by chemicals and hazardous chemicals (13.3%), surface water (10%) and solid waste (3.3%). The top environment issues of the operation of Elion Guangrao Subcompany identified by respondents were ambient air (53.3%), noise (30%) and others (20%). 86.7% of respondents indicated that they were satisfied or very satisfied with the environment protection measures of Elion Guangrao Subcompany. 53.3% of respondents knew that production process of Elion Guangrao Subcompany can result in chemical risk and 93.3% of respondents knew how to respond to emergency. 86.7% of respondents indicated that they accepted the impacts to surroundings environment and residents by production process of Elion Guangrao Subcompany. The top critical areas that the project should focus on were exhaust air efficiency treatment (53.3%), protection for community health and safety (3.3%), protection to workers health and safety (20%), chemicals handling (6.7%), wastewater treatment (16.7%), ground water protection (10%), soil protection (3.3%), noise disturbing to residents (10%) and make use of recyclable resources to reduce solid waste (40%). Before this public consultation, 16.7% of respondents didn't understand environmental impacts of the project. After this public consultation, 100% of respondents understood negative and positive environmental impacts of the project. 100% of respondents indicated that they understood anticipated adverse health and safety impacts of the project during operation. 86.7% of respondents indicated that they understood the proposed mitigation measures during the project operation while 13.3% didn't understand. 93.3% of respondents accepted or barely accepted the impacts to ambient air quality and ecology environment by this project while 3.3% didn't accept and 3.3% had no idea. 94.5% of respondents accepted or barely accepted the impacts to surface water, ground water, acoustic environment, community health and safety and solid waste impacts by the project while 5.5% didn't accept.

The top concerns of this project identified by the respondents were ambient air (56.7%), risks associated with chemicals and hazardous chemicals (23.3%), noise (23.3%), groundwater (10%), soil (10%), surface water (6.7%). and others (10%). 100% of respondents indicated that they support the proposed project.



Public consultation photographs

公众参与调查表				
姓名	性别	年龄	职业	文化程度
王明	男	40	农民	小学
李强	男	35	工人	初中
张华	女	30	教师	大学
赵伟	男	25	学生	高中
孙丽	女	20	无业	初中

问题	回答	是	否	评论
1. 你的居住地点与本项目的距离?	1km以内			
2. 你的工作地点与本项目的距离?	1km以内			
3. 在你看来, 你所在地区的主要环境问题是什么?	空气质量			
4. 亿利洁能科技(广德)有限公司现有生产设施对周围环境影响有哪些?	空气质量			
5. 你对亿利洁能科技(广德)有限公司采取的环境措施满意吗?	满意			
6. 你知道亿利洁能科技(广德)有限公司现有生产设施对周围环境影响有哪些?	知道			

Sample of completed questionnaire

亿利科技 2.2 亿元委托贷款项目广德项目 公众参与调查表				
姓名	性别	年龄	职业	文化程度
王明	男	40	农民	小学
李强	男	35	工人	初中
张华	女	30	教师	大学
赵伟	男	25	学生	高中
孙丽	女	20	无业	初中

问题	回答	是	否	评论
1. 你的居住地点与本项目的距离?	1km以内			
2. 你的工作地点与本项目的距离?	1km以内			
3. 在你看来, 你所在地区的主要环境问题是什么?	空气质量			
4. 亿利洁能科技(广德)有限公司现有生产设施对周围环境影响有哪些?	空气质量			
5. 你对亿利洁能科技(广德)有限公司采取的环境措施满意吗?	满意			
6. 你知道亿利洁能科技(广德)有限公司现有生产设施对周围环境影响有哪些?	知道			

All completed questionnaires

亿利科技 2.2 亿元委托贷款项目广德项目 公众参与调查表				
序号	姓名	性别	职业	文化程度
1.	王明	男	农民	小学
2.	李强	男	工人	初中
3.	张华	女	教师	大学
4.	赵伟	男	学生	高中
5.	孙丽	女	无业	初中
6.	陈伟	男	工人	初中
7.	李强	女	农民	小学
8.	张华	女	工人	初中
9.	赵伟	女	工人	初中
10.	孙丽	女	农民	小学
11.	陈伟	女	农民	小学
12.	王明	女	工人	初中
13.	李强	男	农民	小学
14.	张华	男	工人	初中
15.	赵伟	男	工人	初中
16.	孙丽	男	农民	小学
17.	陈伟	男	农民	小学
18.	王明	男	农民	小学
19.	李强	男	工人	初中
20.	张华	女	农民	小学
21.	赵伟	男	工人	初中
22.	孙丽	男	农民	小学
23.	陈伟	男	工人	初中
24.	王明	男	农民	小学
25.	李强	男	工人	初中
26.	张华	女	农民	小学
27.	赵伟	男	工人	初中
28.	孙丽	女	农民	小学
29.	陈伟	男	工人	初中
30.	王明	男	农民	小学
31.	李强	男	工人	初中
32.	张华	女	农民	小学
33.	赵伟	男	工人	初中
34.	孙丽	女	农民	小学
35.	陈伟	男	工人	初中
36.	王明	男	农民	小学
37.	李强	男	工人	初中
38.	张华	女	农民	小学
39.	赵伟	男	工人	初中
40.	孙丽	女	农民	小学

Sign in table

Figure 7-1 Public consultation photographs, questionnaire and sign in table

Table 7-1 Public consultation questionnaire

Public consultation questionnaire of Elion entrusted loan project

Name		Sex	A. Male B. Female	Age	
Occupation	A. worker B. farmer C. civil servants D. Self-employed entrepreneurs E. Other ( )	Education level	A. Never attend any school B. Primary school C. Junior school D. High school E. Technical secondary school F. Junior college or above	Nationality	A. Han B. Other ( )
Please answer the following questions					
Question		Answer		Yes	Comments
1. Distance between your living place and project site		<1 km			
		1-3 km			
		3-5 km			
		> 5km			
2. Distance between your working place and project site		<1 km			
		1-3 km			
		3-5 km			
		> 5km			
3. In your opinion, what are the major environment pollution issues in your areas?		Ambient air			
		Noise			
		Surface water			
		Ground water			
		Soil			
		Solid waste			
		Odor			
		Risks associated with chemicals and hazardous chemicals			
		Other concern			
4. Which are the impacts to surrounding environment by Elion Guangrao Subcompany during existing production process?		Ambient air			
		Noise			
		Surface water			
		Ground water			
		Soil			
		Solid waste			
		Odor			
		Risks to community health and safety			
		Other concern			
5. Are you satisfied with environment protection measures of Elion Guangrao Subcompany?		Very satisfied			
		Satisfied			
		Barely satisfied			
		Very disappointed			
		Do not understand			
6. Are you aware of chemical risks to the community associated with existing process of Elion Guangrao Subcompany?		Yes			
		No			
7. If any emergency, such as chemical spill, leaks, and explosion, occurs, do you know how to respond?		Yes			
		No			
8. Do you consider the impacts of existing production process of Elion Guangrao Subcompany to surrounding environment and your lifestyle are acceptable?		Yes			
		No			
		I do not know			

9. Before the survey, did you hear about the proposed subproject components by of Elion Guangrao Subcompany?	Yes		
	No		
10. Before the survey, did you understand environmental impacts associated with the proposed subproject components by of Elion Guangrao Subcompany?	Understand		
	Barely understand		
	Do not understand		
11. After knowing about the EIA findings, is it clear to you all the potential positive and adverse impacts of the proposed subproject components by of Elion Guangrao Subcompany?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
12. In your opinion, what should be the most critical area that the subproject should focus on?	Exhaust air efficiency treatment		
	Controlling fugitive emissions		
	Wastewater treatment		
	Groundwater protection		
	Soil protection		
	Chemicals handling		
	Odor control		
	Make use of recyclable resources to reduce solid waste		
	Noise disturbing to residents		
	Protection for community health and safety		
	Protection to workers health and safety		
	Others		
13. Do you understand all the anticipated environmental adverse impacts of the subproject during operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
14. Do you understand all the anticipated health and safety adverse impacts of the project during operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
15. Do you understand the proposed mitigation measures during the project operation?	Clearly understand		
	Somewhat understand		
	Barely understand		
	Do not understand		
16. Do you accept the impacts to ambient air quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
17. Do you accept the impacts to surface water quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
18. Do you accept the impacts to ground	Accept		

water quality by this project?	Barely accept		
	Do not accept		
	Have no idea		
19. Do you accept the impacts to acoustic environment quality by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
20. Do you accept the impacts to solid waste pollution by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
21. Do you accept the impacts to ecology environment by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
22. Do you accept the impacts to environment, health and safety by this project?	Accept		
	Barely accept		
	Do not accept		
	Have no idea		
23. What are the major concerns of this subproject	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks associated with chemicals and hazardous chemicals		
	Other concern		
24. Which is your top concern of this subproject?	Ambient air		
	Noise		
	Surface water		
	Ground water		
	Soil		
	Solid waste		
	Odor		
	Risks associated with chemicals and hazardous chemicals		
	Other concern		
25. Do you support the project?	Yes		
	No		
	I do not know		

**Table 7-2 Summary data on questionnaire respondents**

Parameter	Indicator	No.	%
Sex	Male	20	66.7
	Female	10	33.3
Age	Below 30	10	33.3
	31-40	9	30.0
	Above 40	11	36.7
Nationality	Han people	29	96.7
	Other	1	3.3
Education level	Never attend any school	0	0.0
	Primary school	4	13.3

	Junior school	4	13.3
	High school	7	23.3
	Technical secondary school	1	3.3
	Junior college or above	14	46.7
Occupation	Worker	18	60.0
	Farmer	10	33.3
	Civil servants	1	3.3
	Self-employed entrepreneurs	1	3.3
	Others	0	0.0

**Table 7-3 Public consultation questionnaire results**

Question	Answer	No.	Percentage (%)
1. Distance between your living place and project site	<1 km	3	10.0
	1-3 km	5	16.7
	3-5 km	11	36.7
	> 5km	11	36.7
2. Distance between your working place and project site	<1 km	9	30.0
	1-3 km	9	30.0
	3-5 km	10	33.3
	> 5km	2	6.7
3. In your opinion, what are the major environment pollution issues in your areas?	Ambient air	20	66.7
	Noise	7	23.3
	Surface water	3	10.0
	Ground water	5	16.7
	Soil	0	0.0
	Solid waste	1	3.3
	Odor	0	0.0
	Risks associated with chemicals and hazardous chemicals	4	13.3
	Other concern	0	0.0
4. Which are the impacts to surrounding environment by Elion Guangrao Subcompany during existing production process?	Ambient air	16	53.3
	Noise	9	30.0
	Surface water	0	0.0
	Ground water	0	0.0
	Soil	0	0.0
	Solid waste	0	0.0
	Odor	0	0.0
	Risks to community health and safety	0	0.0
	Other concern	6	20.0
5. Are you satisfied with environment protection measures of Elion Guangrao Subcompany?	Very satisfied	21	70.0
	Satisfied	5	16.7
	Barely satisfied	4	13.3
	Very disappointed	0	0.0
	Do not understand	0	0.0
6. Are you aware of chemical risks to the community associated with existing process of Elion Guangrao Subcompany?	Yes	16	53.3
	No	14	46.7
7. If any emergency, such as chemical spill, leaks, and explosion, occurs, do you know how to respond?	Yes	28	93.3
	No	2	6.7
8. Do you consider the impacts of existing production process of Elion Guangrao Subcompany to surrounding environment and your lifestyle are acceptable?	Yes	29	96.7
	No	0	0.0
	I do not know	1	3.3

9. Before the survey, did you hear about the proposed subproject components by of Elion Guangrao Subcompany?	Yes	26	86.7
	No	3	10.0
10. Before the survey, did you understand environmental impacts associated with the proposed subproject components by of Elion Guangrao Subcompany?	Understand	14	46.7
	Barely understand	13	43.3
	Do not understand	2	6.7
11. After knowing about the EIA findings, is it clear to you all the potential positive and adverse impacts of the proposed subproject components by of [name of subproject plant]?	Clearly understand	9	30.0
	Somewhat understand	17	56.7
	Barely understand	4	13.3
	Do not understand	0	0.0
12. In your opinion, what should be the most critical area that the subproject should focus on?	Exhaust air efficiency treatment	16	53.3
	Controlling fugitive emissions	4	13.3
	Wastewater treatment	5	16.7
	Groundwater protection	3	10.0
	Soil protection	1	3.3
	Chemicals handling	2	6.7
	Odor control	0	0.0
	Make use of recyclable resources to reduce solid waste	12	40.0
	Noise disturbing to residents	3	10.0
	Protection for community health and safety	1	3.3
	Protection to workers health and safety	6	20.0
	Others	2	6.7
13. Do you understand all the anticipated environmental adverse impacts of the subproject during operation?	Clearly understand	9	30.0
	Somewhat understand	10	33.3
	Barely understand	11	36.7
	Do not understand	0	0.0
14. Do you understand all the anticipated health and safety adverse impacts of the project during operation?	Clearly understand	6	20.0
	Somewhat understand	11	36.7
	Barely understand	13	43.3
	Do not understand	0	0.0
15. Do you understand the proposed mitigation measures during the project operation?	Clearly understand	6	20.0
	Somewhat understand	11	36.7
	Barely understand	9	30.0
	Do not understand	4	13.3
16. Do you accept the impacts to ambient air quality by this project?	Accept	18	60.0
	Barely accept	10	33.3
	Do not accept	1	3.3
	Have no idea	1	3.3
17. Do you accept the impacts to surface water quality by this project?	Accept	18	60.0
	Barely accept	8	26.7
	Do not accept	3	10.0
	Have no idea	1	3.3
18. Do you accept the impacts to ground water quality by this project?	Accept	16	53.3
	Barely accept	10	33.3
	Do not accept	4	13.3
	Have no idea	0	0.0
19. Do you accept the impacts to acoustic environment quality by this project?	Accept	15	50.0
	Barely accept	13	43.3

	Do not accept	2	6.7
	Have no idea	0	0.0
20. Do you accept the impacts to solid waste pollution by this project?	Accept	16	53.3
	Barely accept	12	40.0
	Do not accept	1	3.3
	Have no idea	1	3.3
21. Do you accept the impacts to ecology environment by this project?	Accept	16	53.3
	Barely accept	12	40.0
	Do not accept	2	6.7
	Have no idea	0	0.0
22. Do you accept the impacts to environment, health and safety by this project?	Accept	17	56.7
	Barely accept	9	30.0
	Do not accept	2	6.7
	Have no idea	2	6.7
23. What are the major concerns of this subproject	Ambient air	17	56.7
	Noise	7	23.3
	Surface water	2	6.7
	Ground water	3	10.0
	Soil	3	10.0
	Solid waste	3	10.0
	Odor	0	0.0
	Risks associated with chemicals and hazardous chemicals	7	23.3
	Other concern	3	10.0
24. Which is your top concern of this subproject?	Ambient air	16	53.3
	Noise	5	16.7
	Surface water	3	10.0
	Ground water	2	6.7
	Soil	1	3.3
	Solid waste	6	20.0
	Odor	0	0.0
	Risks associated with chemicals and hazardous chemicals	7	23.3
	Other concern	3	10.0
25. Do you support the subproject?	Yes	30	100.0
	No	0	0.0
	I do not know	0	0.0

## 7.5 Future Consultation Activities

The subborrower will continue to undertake public consultation activities and conduct regular community liaison activities during the operations phase as needed. Ongoing consultation will ensure that public concerns are understood and dealt with in a timely manner. During operation phase, if complain is received or unexpected adverse environmental impacts occurs, the subborrower will undertake public consultation activities by questionnaire survey, household interview, seminar and public consultation meeting.

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## **8 Grievance redress mechanism**

### **8.1 Introduction**

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, the subborrower 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.

The ADB's SPS requires the subborrower 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.

### **8.2 Current Practice in the PRC**

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.

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.

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### **8.3 Proposed Project GRM**

The overall approach of the GRM is to deal with grievances at a local level first in an efficient manner, and escalate to higher level of authority if the grievance cannot be resolved. The construction phase of the project has already completed and no complain was received. Public grievances will most likely relate to environmental issues encountered during operation phase. If complain is received during operation phase, EHS department of Elion Guangrao Subcompany will identify if the complain is reasonable. Reasonable complain means: (1) the complain is associated with the project; and (2) the complain can be addressed through the GRM. Unreasonable compliance means: (1) the complain is obviously not associated with the project; (2) the complain can not be addressed through the GRM; and (3) the complain is better to be addressed through process of other company or community. If the compliance is rejected, reason and conclusion for rejection will provided to the complainer.

### **8.4 GRM process**

The GRM will be implemented through five escalating steps which is presented in Figure 8-1, advancing to the next level only if the grievance was unable to be redressed at the previous level:

(1) Step 1: If a concern arises, the AP should try to resolve the issue of concern directly with the EHS department of the subborrower (Elion Guangrao Subcompany) via GRM access points. If the concern is resolved successfully no further follow-up action is required. Nonetheless, EHS department shall record any complaint and actions taken to resolve the issues. If no solution is found within 10 working days or if the complainant is not satisfied with the suggested solution under Step 1, proceed to Step 2. The AP may also skip step 1 and directly file the complaint with the subborrower;

(2) Step 2: The AP will submit the grievance to the subborrower, who will record the grievance, assess its eligibility and report back to the AP within 5 working days. If the grievance is eligible, proceed to step 3;

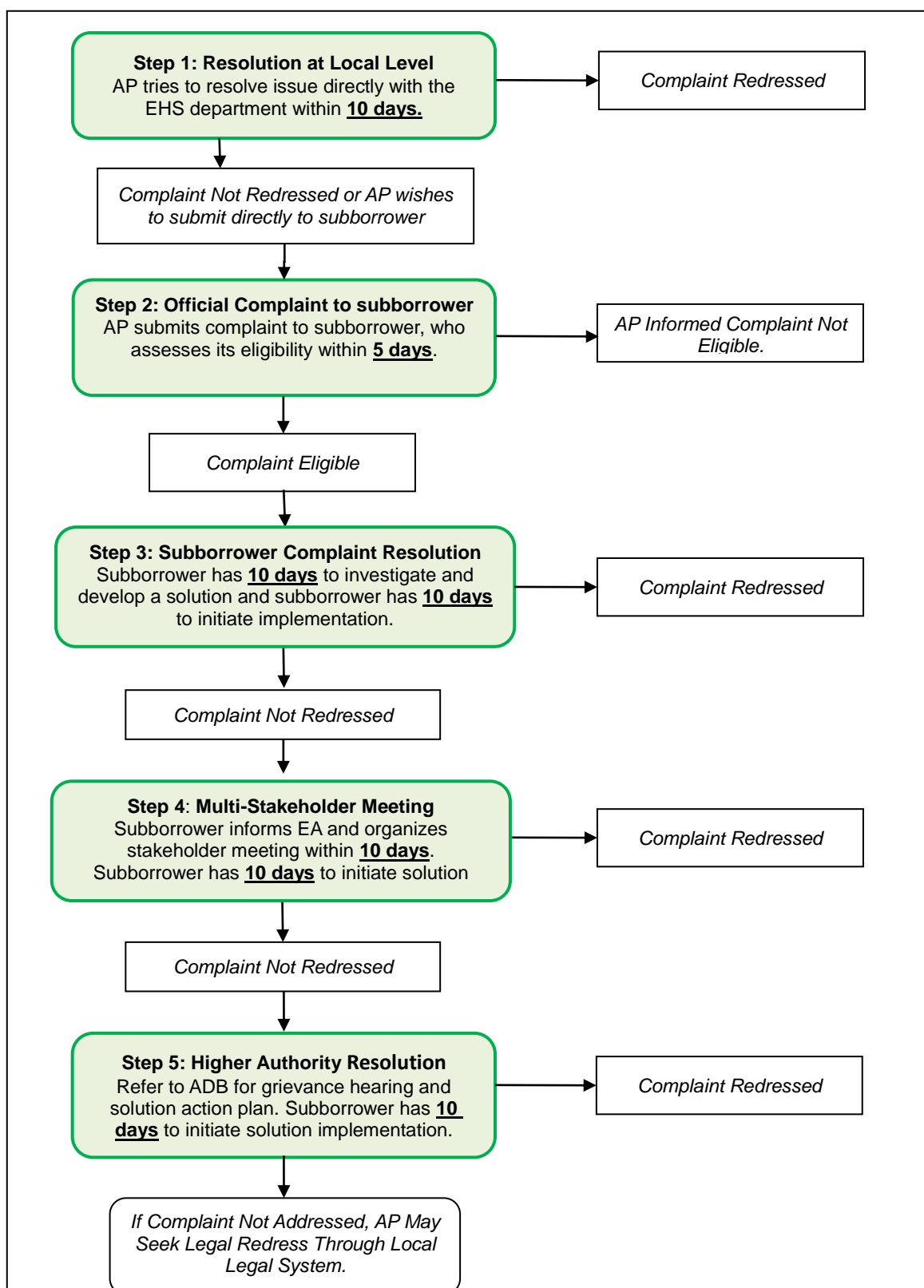
(3) Step 3: The subborrower will investigate the complaint, and consult with the local EPB and other stakeholders as appropriate to identify a solution. The subborrower. will give a clear reply to the AP within 10 working days with the suggested solution, and the subborrower will ensure that implementation of the agreed-upon redress solution begins within 10 working days. If no solution is found or if the complainant is not satisfied with the suggested solution under Step 3, proceed to Step 4;

(4) Step 4: The subborrower will inform the EA as to the grievance, and will organize a multi-stakeholder meeting within 10 days, where all relevant stakeholders, including the

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complainant, the EA, subborrower and local EPB, can discuss the issue. The multi-stakeholder meeting will aim to find a solution acceptable to all, and identify responsibilities and an action plan. The subborrower will ensure that the implementation of agreed-upon redress solution begins within 10 working days of the completion of the multi-stakeholder meeting;

(5) Step 5: If the complainant is not satisfied with the suggested solution under Step 4, the grievance will be directed to ADB. ADB will direct the EA to organize a hearing process and shall determine a solution acceptable to all. Based on the hearing results, an action plan shall be developed and the subborrower will ensure that the implementation of the agreed-upon redress solution begins within 10 working days of the completion of the hearing.



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**Figure 8-1: Five Step Subproject GRM.**

The grievance procedures will remain valid throughout the duration of the project construction and until project closure. If a concern arises, the AP can provide feedback to resolve the issue and complaints/grievances lodged by the AP is free of charge. Any cost incurred should be covered by the subborrower.

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## **9 Environment Management Plan ( EMP )**

### **9.1 Objectives**

This is the Environmental Management Plan (EMP) for the proposed Guangrao 2x35t/h Micro-fine Coal Atomization Steam Supply Subproject. The Project will provide district steam supply to the enterprises in GBNA. 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 SPS 2009. Organizational responsibilities and budgets are clearly identified for execution, monitoring and reporting.

#### **9.1.1 Implementation Arrangements**

I&G will be the EA. The EA will form an ESMS Department including an ESMS manager.

Elion Guangrao Subcompany is the subborrower with one EHS department consists of one manager and two staff. The subborrower is responsible for: (1) pollutants emission monitoring; (2) implementation of capacity building plan; (3) incorporation of environment management, environmental monitoring and mitigation measures into EMP during operation phase, (4) regularly report to EA on EMP implementation; and (5) efficiently response to emergency.

Guangrao EPB is responsible for: (1) project is compliance with relevant environment regulations; (2) supervision of project pollutants emission; and (3) GRM implementation. Guangrao EPB also participates in environment compliance monitoring of the project.

ADB will conduct regular review mission to provide environmental due diligence on environmental issues. I&G will prepare environmental monitoring reports semi-annually and submit them to ADB. ADB will review the reports and disclose them on ADB's website. If the project is incompliance with the EMP's requirements,

appropriate corrective actions will be provided by ADB and following actions will be implemented as required by ADB.

The roles and responsibilities of the participating agencies related to EMP implementation are presented in Table 9-1.

**Table 9-1** Roles and responsibilities of the agencies for EMP implementation

Organization	Role and Responsibility
I&G	<p>Will serve as the EA and establish an ESMS department with qualified full time staff. ESMS department is responsible for the implementation of all subprojects, including:</p> <ul style="list-style-type: none"> <li>➤ Formulating subproject management and operating procedures, implementation plans, and budget;</li> <li>➤ Ensuring subproject's compliance with loan and project agreements, and with the safeguards requirements as specified in the ESMS;</li> <li>➤ Participant in capacity building and training activities;</li> <li>➤ Overseeing the implementation of different subproject outputs;</li> <li>➤ Monitoring the subproject's physical and financial progress, and compliance with subproject's reporting requirements, ensuring subproject progress reports are prepared and submitted to ADB on time;</li> <li>➤ Addressing complaints received from APs;</li> <li>➤ Coordinating the activities of and meeting the requirements of the ADB review missions;</li> <li>➤ Supervision implementation of EMP and EMoP;</li> <li>➤ Conducting regular site visits and safeguard review missions in accordance with the requirements set forth in the ESMS;</li> <li>➤ Preparing and submitting consolidated semi-annual and annual environmental monitoring reports as required by the ESMS to ADB;</li> <li>➤ Requiring subborrowers to prepare corrective action plans in the event of noncompliance with EMP or EMoP.</li> </ul>
Subborrower	<p>Main responsibilities include:</p> <ul style="list-style-type: none"> <li>➤ Contracting and administering contractors and suppliers.</li> <li>➤ Ensuring compliance with EMP, EMoP, engaging external environmental safeguard consultants if needed;</li> <li>➤ Preparing subproject progress reports for submission to the ESMS department of I&amp;G;</li> <li>➤ Operation and maintenance of the subproject;</li> <li>➤ Coordinating with and assisting the PMO in developing subproject management procedures and detailed implementation plan, and monitoring achievement thereof;</li> <li>➤ Preparing semi-annual and annual environmental monitoring reports and submit to ESMS department of I&amp;G.</li> </ul>
Environmental	A qualified independent environmental monitoring company will be recruited to

Organization	Role and Responsibility
Monitoring Company	implement the ambient monitoring portion of the EMoP.
ADB	<p>Responsible for the following:</p> <ul style="list-style-type: none"> <li>➤ -Providing the EA and ESMS department with guidance to ensure smooth subproject implementation and achieve the desired development impacts and their sustainability;</li> <li>➤ -Conducting regular review missions;</li> <li>➤ -Monitoring the implementation of EMP and EMoP;</li> <li>➤ -Monitoring status of compliance with loan and project covenants, including safeguards;</li> <li>➤ -Reviewing environmental monitoring reports and disclosing them on ADB website;</li> <li>➤ -Regularly updating the subproject information documents for public disclosure at ADB website, including the safeguards documents.</li> <li>➤ -Requiring EA to develop corrective action plan for any non-compliance issues.</li> </ul>

### 9.1.2 Institutional Strengthening and capacity building

The institutional strengthening and capacity building focus on the safeguards requirements of relevant PRC laws and regulations and ADB's SPS 2009. Institutional strengthening and training program are presented in Table 9-2 including developed EHS plan, training topic, training content, budget and numbers of participants.

**Table 9-2 Institutional strengthening and training program**

Training Topic	Trainers	Attendees	Contents	Times	Days	# Persons	Budget (USD)	Funding sources
Operation Phase EHS Plan Training	Consultant	Subborrower	<p><b>ADB and PRC laws, regulations and policies</b></p> <ul style="list-style-type: none"> <li>➤ ADB's safeguard policy statement</li> <li>➤ Project applicable PRC environmental, health and safety laws, policies, standards and regulations</li> <li>➤ International EHS management practice</li> </ul> <p><b>GRM</b></p> <ul style="list-style-type: none"> <li>➤ GRM structure, responsibilities, and timeframe</li> <li>➤ Types of grievances and eligibility assessment</li> </ul> <p><b>Implementation of Operation Phase EMP</b></p> <ul style="list-style-type: none"> <li>➤ Impacts and mitigation measures</li> <li>➤ Monitoring and reporting requirements</li> <li>➤ Non-compliance and corrective actions</li> </ul>	1	2	20	<p><b>Training Development</b> Fixed costs: \$2000 per</p> <p><b>EHS Plan Training Course Development</b> (fees and per diem) 2days x \$400/day = \$800</p> <p><b>Course Delivery</b> (fees and per diem): 2 days x 400/day = \$800</p> <p>Total = \$ 3,600</p>	Counter part Financing
	Total			1	2	20	\$ 3,600	

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## **9.2 Potential Impacts and mitigation measures**

The potential impacts of the project during operation phase have been identified and appropriate mitigation measures developed (see Chapter V of the IEE). Detailed impacts and mitigation measures are presented in Table 9-3.

## **9.3 Environmental monitoring plan**

An environment monitoring plan (EMoP) to monitor the environmental impacts of the Project and assess the effectiveness of mitigation measures is presented in Table 9-4. The EMoP includes noise, wastewater and flue gas monitoring undertaken during operation phase. The environmental monitoring will follow PRC's regulation, laws and technical specifications.

The data and results of environmental compliance inspection and monitoring activities will be used to assess: (1) the extent and severity of actual environmental impacts against the predicted impacts and baseline data collected before the project implementation; (2) performance or effectiveness of environmental mitigation measures or compliance with pertinent environmental rules and regulations; (3) trends in impacts; (4) overall effectiveness of EMP implementation; and (5) the need for additional mitigation measures and corrective actions if non-compliance is observed.

**Table 9-3 Environmental impacts and mitigation measures**

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
Exhaust gas	Boiler flue gas	<ul style="list-style-type: none"> <li>➤ Proper operation and maintenance of desulphurization, denitration and dust removal equipment</li> <li>➤ Installation of online monitoring equipment which is connected to local EPB</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget
	Dust-laden exhaust gas in ash storage room	<ul style="list-style-type: none"> <li>➤ Water spray during coal transportation, load and unload process for dust control</li> <li>➤ Ash and slag transportation in sealed trucks</li> <li>➤ Water spray in ash and slag storage rooms for dust control</li> <li>➤ Regular monitoring of fugitive flue gas emission</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget
Noise	Impacts to sensitive area by noise from fan, air compressor and pump	<ul style="list-style-type: none"> <li>➤ Installation of noise enclosure, barrier or shield to reduce noise;</li> <li>➤ Reasonable landscape inside and outside the project site to reduce noise;</li> <li>➤ Appropriate noise PPE will be provided to the workers who are likely to be exposed to high noise level environments;</li> <li>➤ Install silencer on air vents of boiler and fan and noise enclosure on equipment to reduce noise;</li> <li>➤ Conduct noise monitoring if needed and implement extra noise control measures such as noise barrier.</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget
Solid waste	Unreasonable treatment of coal slag may result in soil and	<ul style="list-style-type: none"> <li>➤ All ash and slag will be temporally stored at the project site, then sold to local construction material enterprises as material;</li> <li>➤ Permanent storage of ash and slag at project site is</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
	water pollution	prohibited.			
Wastewater	Emission of production wastewater and domestic wastewater	<ul style="list-style-type: none"> <li>➤ Wastewater will be recycled as much as possible after treatment;</li> <li>➤ Domestic wastewater is recycled as landscape water after treated by septic tank;</li> <li>➤ Part of wastewater from the chemical water treatment system is used for dry ash humidifying system, wet-type slag extractor system and desulfurization system. The reset is discharged to GBNA wastewater treatment plant combined with boiler effulence and circulating cooling sewage water, finally discharged to Xiaoqing River after treatment.</li> <li>➤ Desulfurization wastewater will be reused in dry ash humidifying system and wet-type slag extractor system.</li> <li>➤ Concentrated water produced by the chemical water system is unpolluted wastewater, part of which will be used in desulfurization system and the rest will be discharged into municipal drainage network after neutralization and sedimentation;</li> <li>➤ Domestic waste is treated by septic tank, then discharged to GBNA wastewater treatment plant, finally discharged to Xiaoqing River after treatment.</li> <li>➤ Ground wash wastewater and pump cooling water is treated by</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
		oil-water separator, then discharged to GBNA wastewater treatment plant, finally discharged to Xiaoqing River after treatment.			
Occupational Health and Safety	Risks to Workers	<ul style="list-style-type: none"> <li>➤ Project operation phase EHS including fire prevention and control will be developed and implemented, and workers will be trained regularly on their implementation.</li> <li>➤ The EHS plan will be aligned with relevant government regulations and guidelines on COVID-19 prevention and control, or with international good practice guidelines as updated in the future (footnote 3). The plan will include COVID-19 prevention and control measures, including disinfection/cleaning of offices and operation sites, on-site temperature checks, social distancing measures, mandatory use of personal protective equipment such as facemasks, provision of handwashing stations and hand sanitizers etc., and procedures to be adopted in the event any worker/staff is infected with COVID-19.</li> <li>➤ The project will be designed in strict compliance with relevant PRC fire, health and safety standards;</li> <li>➤ Fire-alarm and suppression systems will be installed and tested regularly to ensure it functions properly;</li> <li>➤ PPE, including goggles, gloves, safety shoes, will be provided</li> </ul>	Subborrower	EA, Guangrao EPB, ADB	Operational budget

Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
		<p>to workers;</p> <ul style="list-style-type: none"> <li>➤ Authorized personnel must have appropriate PPE at all times.</li> </ul>			
Emergency	Emergency Response Plan	<p>Project emergency response plans will be established in accordance with the “National Environmental Emergency Plan” (24 January 2006) and other relevant PRC laws, regulations and standards. The plan must be established and in place before the plant is operational.</p> <p>Indicative plan requirements are as follows:</p> <ul style="list-style-type: none"> <li>➤ Procedures for responding to different types of emergency situations will be identified in the response plan.</li> <li>➤ Emergency exercises will be conducted and they should include different emergency scenarios.</li> </ul> <p><b>Training Requirements</b>  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:</p> <ul style="list-style-type: none"> <li>➤ Initial training to all employees before the project is put in operation;</li> <li>➤ When new equipment, materials, or processes are introduced.</li> <li>➤ When emergency response procedures have been updated or revised.</li> </ul> <p><b>Annual Emergency Simulation</b></p>	Subborrower	EA, Guangrao EPB, ADB	Operational budget

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Item	Potential impacts	Mitigation measures	Responsibility		Funding sources
			Implemented by	Supervised by	
		<p>Simulated emergency exercises will be conducted at least annually.</p> <p><b>Communication with Public Officials</b>  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 project site.</p>			

**Table 9-4 Environmental monitoring plan**

Item	Parameter	Location	Frequency	Implemented by	Supervised by	Funding sources
Boiler flue gas	SO <sub>2</sub> , NO <sub>x</sub> and PM	Boiler chimney	Online continuous monitoring	3 <sup>rd</sup> party environment monitoring company	EA	Operational budget
Dust-laden exhaust gas of ash and slag storage room	Fugitive emission of TSP and PM <sub>10</sub>	Site boundaries	Semi-annual	3 <sup>rd</sup> party environment monitoring company	EA	Operational budget
Noise at the	Noise monitoring at the	Site boundaries	Semi-annual	3 <sup>rd</sup> party	EA	Operational budget

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site boundaries	site boundaries			environment monitoring company		
Wastewater	Compliance inspection of wastewater treatment measures	Wastewater emission point	Semi-annual	3 <sup>rd</sup> party environment monitoring company	EA	Operational budget
Occupational health and safety	Compliance inspection of development and implementation of EHS plan	Project operation site	Semi-annual	Subborrower	EA	Operational budget

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## 9.4 Reporting requirements

The subborrower will submit annual EMP implementation reports during operation phase to the EA on the implementation and compliance with the EMP. EA will review the reports and submit them to ADB. All the reports will be disclosed on ADB's website.

The environmental reporting requirements are summarized in Table 9-5.

**Table 9-5 Reporting Requirements**

Report	Prepared by	Submitted to	Frequency
Environmental monitoring reports	Subborrower	EA reviews and submits to ADB	Annually

## 9.5 Performance indicators

Performance indicators (Table 9-6) have been developed to assess the implementation of the EMP. These indicators will be used to evaluate the effectiveness of environmental management.

**Table 9-6 Performance Indicators**

No.	Description	Indicators
1	Staffing	1) 3rd party environmental monitoring entity engaged
2	Budgeting	1) Environment mitigation cost during operation is sufficiently and timely allocated. 2) Environment monitoring cost is sufficiently and timely allocated. 3) Budget for capacity building is sufficiently and timely allocated.
3	Monitoring	1) Compliance monitoring is conducted by I&G as per EMP and EMoP. 2) Operation phase ambient and effluent monitoring is conducted by 3rd party environmental monitoring entity.
4	Supervision	1) I&G reviews the implementation of EMP; 2) ADB reviews consolidated environmental monitoring reports.
5	Reporting	1) Annual EMP implementation reports during operation phase are prepared by the subborrower are submitted to I&G; 2) Annual environmental monitoring reports are prepared by I&G and submitted to ADB
6	Capacity Building	1) Training on ADB safeguard policy, EMP implementation, and GRM is provided during project implementation

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No.	Description	Indicators
7	Grievance Redress Mechanism	1) GRM contact persons are designated at all subborrowers and I&G, and GRM contact information disclosed to the public before construction 2) All complains are recorded and processed within the set time framework in the GRM of this IE
8	Compliance with PRC standards	1) Subproject complies with the PRC's environmental laws and regulations and meets all required standards.

## 9.6 Feedback and adjustment mechanism

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 EA will consult with the subborrower and propose appropriate changes to the EMP monitoring and mitigation plan.

Any major EMP adjustments will be subject to ADB review and approval and ADB may pursue additional EIA and, if necessary, further public consultation. The revised EIA with ADB confirmation is subject to reposting on the ADB's website as the ADB public communications policy requires.

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## **10 Conclusions**

### **10.1 Project benefit**

The project will provide district steam supply to enterprises in GBNA to instead of small coal-fired boilers owned by the enterprises. To mitigate environmental impacts, the project will use Micro-fine Coal Atomization technology to increase combustion efficiency of boilers, then coal consumption of will be reduces compared to traditional coal fired boilers. The project's implementation will: (i) significantly reduce heat cost; (ii) reduce coal consumption and pollutants emission; and (iii) improve air quality in GBNA.

When compared to the equivalent production of heat through traditional coal-fired boilers, once operational the project will: (i) result in annual energy savings equivalent to 48,721 tons of standard coal, thereby providing a global public good by avoiding the annual emission of 121,461tons of carbon dioxide (CO<sub>2</sub>), a greenhouse gas; (ii) improve local air quality through the estimated annual reduction of emissions of sulfur dioxide (SO<sub>2</sub>) by 124.56 tons, nitrogen oxides (NO<sub>x</sub>) by 19.9 tons, and particulate matter (PM) by 47.53 tons; and (iii) eliminate the negative impacts of coal transportation through urban areas by truck.

### **10.2 Negative impacts and mitigation measures**

Potential negative environmental impacts during operation phase include flue gas, waste water, noise and solid waste. The flue gas includes flue gas of boilers and dust-laden flue gas and is treated by dust removal, desulfurization and denitrogen measures before emission and can meet relevant standards. The report undertakes atmospheric dispersion modeling for SO<sub>2</sub>, PM<sub>10</sub>, TSP, ammonia and NO<sub>x</sub> using SCREEN3, a US EPA approved screening mode to estimate the effects to ambient air quality of the project. Based on the modeling result, the project will have very limited effects to the ambient air quality. The wastewater of the project includes boiler effluent, chemical water facilities drainage, wastewater from desulfurization process, sewage from equipment circulating cooling process, as well as domestic sewage will be

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treated by different methods according to wastewater quality. Most of the treated wastewater will be recycled or reused and only few will be discharged to municipal sewer. Solid waste of the project is ash, slag and desulfurization gypsum which is 100% sold out.

Based on the information collected by the domestic EIA Institute and domestic EIA report and environmental due diligence, the project is comply with requirements of PRC laws and regulations and standard and the project's impacts during operation phase is acceptable.

### **10.3 Risk and guarantee**

Micro-fine Coal Atomization technology used by the project is a proven technique with a lot of operation practices in many domestic cities. Thus the project will have no technical risk. Desulfurization, denitrogen and dust removal technology used by the project is also proven techniques which are widely used in the domestic and overseas. But the project still has some risks associated with incorrect implementation of mitigation measures and environment monitoring during operation phase. Therefore, the following measures will be implemented to control the risks: (1) Budget for EMP implementation and environment monitoring will be sufficiently and timely allocated; (2) ADB will conduct regular review missions; and (3) Guarantee terms will be incorporated in loan agreement.

### **10.4 Overall conclusion**

Based on the domestic EIA report and environmental due diligence, if mitigation measures in EMP is efficiently implemented and monitored, identified environmental impacts of the projects can be reduce to acceptable level. The project is environmentally feasible. The project will use advanced Micro-fine Coal Atomization technology to provide district steam supply to the enterprises in GBNA. The project's implementation will: (i) improve regional air quality; (ii) bring environment benefits; and (iii) bring economy benefits to local development.

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**Appendix I Emergency response plan for environmental emergencies (cover pages)**

**亿利洁能科技（广饶）有限公司  
突发环境事件应急预案**

**编制单位：亿利洁能科技（广饶）有限公司**

**编制人：张福恒、李文涛、杨基平、夏同达**

**发布人：赵瑞**

**批准日期：2017 年 8 月 22 日**

**执行日期：2017 年 8 月 22 日**

**亿利洁能科技（广饶）有限公司**

**编制日期：2017 年 8 月**

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## 突发环境事件应急预案批准页

编制：（人员签名）	2017 年 8 月 10 日
评估：（人员签名）	2017 年 8 月 21 日
复核：（人员签名）	2017 年 8 月 22 日
批准：（人员签名）	2017 年 8 月 22 日

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## 突发环境事件应急预案发布令

为贯彻《中华人民共和国突发事件应对法》及其它国家法律、法规及有关文件的要求，有效防范应对突发环境事件，保护人员生命安全，减少单位财产损失，本单位特组织相关部门和机构编制了《亿利洁能科技（广德）有限公司突发环境事件应急预案》，该预案是本单位实施应急救援的规范性文件，用于指导本单位针对突发环境事件的应急救援行动。

本突发环境事件应急预案，于 2017 年 8 月 22  
日批准发布，2017 年 8 月 22  
日正式实施。本单位内所有部门均应严格遵守执行。

主要负责人：\_\_\_\_\_  
年 月 日