



# **Environmental impact report form of construction project**

**Project Name: Jinan Thermal Power Co., Ltd. Heat Supply  
Integration Energy Saving Project Utilizing Loan from EIB**

**Contractors (seal) Jinan Thermal Power Co., Ltd.**

**Compiled date : 2009.9**

**Tabled by State Environmental Protection Administration**



Assessment agents : Shandong Academy of Environmental Science

legal representative : Bian Xingyu

Project Name : Jinan Thermal Power Co., Ltd. Heat Supply Integration  
Energy Saving Project Utilizing Loan from EIB

File Type : Environmental Impact Report Form

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## Environmental impact report form of Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB

Responsible dean ( signature ) : Li Gang

### **The duty list of assessors and checker & approvers**

Duty	Signature	Professional title	Major	Certificate number	Job
Responsible officer	Yu Jun	Researcher	Water Supply and Drainage	Extraction A24020030800	Formulation
Check in premises	Wang Jing	Engineer	Environmental Engineering	Regional sociology A24020091000	Investigate
Scientific Committee check	Qin Xiaopeng	Senior Engineer	Environmental Engineering	Registry number -A24020033	Investigate

Check and issue	Li Gang	Researcher	Environmental Engineering	Registry number -A24020031	Check
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## **Description for drawing up**

### ***Environmental impact report form of construction project***

*Environmental impact report form of construction project* should be drawn up by units that have qualifications to do environmental impact assessment.

1. Project name—means the name that official approval to registration of the project, the name should not exceed 30. (Two English fields are equal to one character)
2. Location—means the exact address of the location of the project. Starting and finishing place is necessary for the highway and railway.
3. Category of employment—should be filled according to Chinese Standard.
4. Total investment—means the total investment of the project.
5. Mainly environmental protection objectives—mean the residential areas, school, hospital, heritage conservation, landscape and famous scenery, head-water point and eco-sensitive spot around the project. The protection objectives, characteristic, scale and the distance away from boundary should be given as much as possible.
6. Conclusion and Recommendations—analysis conclusions of the cleaner production, satisfaction to standards and volume control of the project should be given. The validity of the antipollution measures should be determined. The influence to the environment of this project should be explained. The conclusion of the environmental feasibility of the project should be given, meanwhile, other suggestions which can lower the influence to environment should be proposed.
7. Prequalified decision—it should be filled in by relevant administrative department. If there is not relevant administrative department, no is permitted
8. Examination and approval decision—it should be replied by the competent administrative department which is to be responsible for this project of environmental protection.



## Basic circumstances of the constructing project

Name	Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB				
Project developer	Jinan Thermal Power Co.,Ltd.				
Legal Representative	Hongjun Wei		Contacting person		Hui ren Zhou
Correspondence Address	Dikou Road No.2, Jinan Shandong				
Telephone	(+86)0531-85067283	Fax	(+86)0531-85067283	Postal code	250031
Place of Construction	Jinan (coverage with Tianqiao District, Lixia District, Huaiyin District and Shizhong District)				
Programmed Evaluation Department	National Development and Reform Commission		Approve Number		National development and reform commission (2009)number 200
Category	New <input type="checkbox"/> rebuilding and expansion <input type="checkbox"/> technical renovation <input checked="" type="checkbox"/>		Category and Code of industry		Heat Production and Supply D4430
Floor Area (m <sup>2</sup> )			afforested area ( m <sup>2</sup> )		
Total Investment (ten thousand Yuan)	52417	Environmental protection Investment (ten thousand Yuan)	896	Percentage	1.7%
Cost of Assessment (ten thousand Yuan)	7.0	Completion Date	December, 2011		

### The contents and scale of the project :

## I. The general situation of the development organization、Construction project profile and the necessity of the construction.

### 1.1 The general situation of the development organization

This project was undertaken by Jinan Thermal Power Co., Ltd. The company was merged by Jinan South Suburb Thermal Power Plant (including Jinjiling Thermal Power Branch Plant), Jinan North Suburb Thermal Power Plant and Jinan Minghu Thermal Power Plant in March 2008. It was a state-owned unincorporated enterprise financed by Assets Supervision and Administration Commission of Jinan. Steam, hot water and electricity were the primary business.

At the end of 2008, there were 2194 employees in the Jinan Thermal Power Co., Ltd.

Total assets of the company was 2.37 billion Yuan, net assets was 1.16 billion Yuan. In the company, there were 23 boilers with the total capacity of 1850 t/h and 13 electric generating sets with the total capacity of 161.5 megawatts. The area of the place where could be provided heat by the company is 2116 million square meters, provide 58.3% of the total heating area in the city. In 2007, sales revenue was 0.55 billion Yuan. In 2008, sales revenue was 0.696 billion Yuan. The company was mainly responsible for providing part of heat for civilian use in Jinan and industrial production and part of electrical supply. The east of heating area was Lishan road, the west was Erhuan West road, the south was Erhuan South road, and the north was southern shore of the Yellow River. Now, the company has covered heating, refrigeration, generating electricity, heating technology consultation, comprehensive utilization and skill training etc. It has developed into a comprehensive thermal Power Plant.

## 1.2 Construction project profile

This project mainly includes the following three sections:

- (1) Jinan Thermal Power Co., Ltd. substituting water pipeline for steam pipeline project);
- (2) Jinan Thermal Power Co., Ltd. automatic control system of heat supply network project
- (3) Jinan Thermal Power Co., Ltd. reconstruction. of electric motor frequency control project

**Project name:** Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB.

**Category:** technical renovation

**Location:** Jinan City (coverage with Tianqiao District, Lixia District, Huaiyin District and centric city).

**Project component and construction scale:** the following table 1 shows the primary construction content

**Total investment:** 524.17 million Yuan

**Employee:** No new persons were added in the project, and the workers were rearranged by Jinan Thermal Power Co., Ltd.

**Duty type:** 120 days per year, 24 hours per day, 2880 hours per year(when in winter)

**Table 1.2-1: Project component and construction scale**

Serial number	Name	Content
I	Jinan Thermal Power Co., Ltd. substituting water pipeline for steam pipeline project	
1	Substituting water pipeline for steam pipeline project of South Suburb Thermal Power Plant	water pipe line network and heat exchange station
2	Substituting water pipeline for steam pipeline project of North Suburb Thermal Power Plant	water pipe line network and heat exchange station
3	Substituting water pipeline for steam pipeline project of Minghu Thermal Power Plant	water pipe line network , heat exchange station and Initial heating station
4	Substituting water pipeline for steam pipeline project of Jinjiling Thermal Power Plant	water pipe line network , heat exchange station and Initial heating station
<input type="checkbox"/>	Jinan Thermal Power Co., Ltd. automatic control system of heat supply network project	Autonomous system of the heat exchanger the subsidiaries of the company
<input type="checkbox"/>	Jinan Thermal Power Co., Ltd. reconstruction. of electric motor frequency control project	The renovation of frequency converters of high-low pump high-low fan and pump of the company

**Note:** Jinjiling Thermal Power Branch Plant is not included in the Jinan South Suburb Thermal Power central plant. So they were listed separately.

### **1.3 The necessity of the construction**

#### **1.3.1 The necessity of substituting water pipeline for steam pipeline project**

With the acceleration of the pace of open and reform and the rapid development of urban construction in Jinan, the demand of the heating increased very rapidly in Jinan , thus new requirements for heating were proposed. Meanwhile, at the influence of the original industrial distribution in Jinan, Large numbers of industries and companies located at western and northern part of Jinan. The use of steam was also very concentrated. The steam was mainly supplied by Jinan North Suburb Thermal Power Plant and Jinan Minghu Thermal Power Plant. The corresponding steam piping network was also laid.

Along with the adjustment of national industrial policy and the improvement of residents' environmental awareness. Industries and companies moved out continually. The proportion of steam used in industry has become more and more little. Currently, the situation that heating has taken up dominant place has emerged in the whole heating area of Jinan Thermal Power



Co., Ltd... To carry on central heating mainly by steam pipe network can not already adapt to this situation.

The main drawbacks of supplying heating by steam pipe network:

- (1) A high heating supply index and a low utilization ratio of energy;
- (2) A serious heat loss of pipe network;
- (3) A heavy condensate water loss.

Plenty of resources have been wasted due to these drawbacks. These violated the goal that building the resource-conserving and environmentally friendly society.

Therefore, we can maximum merge the steam-water heating load into the new high-temperature water pipe network based on the steam pipe network and heat exchange installation. Substituting water pipeline for steam pipeline can be realized by this, thus eliminating the above drawbacks. So it is very necessary for realizing “energy conservation and cost reduction”.

### **1.3.2 The necessity of automatic control system of heat supply network project**

As required by “*simulation run of the system of pipe network and comprehensive evaluation technology*”(the third item of *Most optimum distribution of urban energy and pipe network system loading simulation technique* which is a issue of “the study of the city's infrastructure construction and key technology of running high efficiency” of 11th five-year plan state science and technology support projects), to aim at the energy infrastructure such as fuel steam and heating power, the simulated control strategy and simulated operation model of pipe network system which is made of heat source, pipe network and subscribers, the simulated technology of the fuel steam transport system, the strategy and simulation of operation of the broad scale heating network and the simulated technology of optimum operation of Thermal Power Plant which reflects the heating network dynamic characteristics will be studied. The evaluating indicator and system of energy efficiency, emitted to the environment, economic cost and bearing capacity will be raised. The software system of urban energy and pipe network system layout which is raised by the forth item explain the importance of the study on the application of software.

Take Jinan South Suburb Thermal Power Plant as an example. At the moment, in the high-temperature water pipe network of this plant, northern line, southern line and western line run parallel, the recycle pump worked in a same group. The adjustment was not adequately. The distribution of flow rate was not average. There was hydraulic disorder in the hot water

pipe network. Meanwhile, the operating temperature regulation of the high-temperature water pipe network was achieved by people. Namely that seasoned engineering technical persons regulate the operating temperature and valve opening according to the weather, adapting the heating load variation. A low efficiency and no-adequate adjustment were gotten by this way. So hydraulic disorder happened seriously, thus causing the waste of energy.

To resolve the above drawbacks, realize the commissioning and adjustment in operation and accidental adjustment of heating pipe network, thus attaining the goal that decreasing hydraulic disorder and improving operating efficiency. So it is very necessary to establish adjusting model of heating pipe network, and automatic control system of heat supply network project.

### **1.3.3 The necessity of the implement of electric motor frequency adjustment renovation**

The implement of frequency adjustment on fan and pump is an important energy-saving technology which was popularized in our country. Practices prove that the application of frequency converter on drive control of fan and pump devices can get significant energy-saving effect, which is an ideal control mode. By this way, we not only can improve the efficiency of devices, but also reduce the maintenance cost of devices greatly. This one-time investment for frequency adjustment devices will pay back in one or two years.

There were high-pressure (6 or 10KV) and 52 pump motors in Jinan Thermal Power Co. Ltd., whose total power is 22865KW and running mode is power frequency. The wind rate of fan was adjusted by damper, which result in a waste of energy and serious loss of devices. Power devices, such as fan and pump, almost adopt asynchronous motor direct drive, which has many defects, such as big startup current, mechanical shock, bad electric protection characteristics. In order to solve these defects, it is very necessary that the implement of electric motor frequency adjustment renovation.

In a word, in order to meet the increasing demand of Jinan city central heating and the reduction of the consumption of resources; realize the commissioning and adjustment in operation and accidental adjustment; solve the waste of energy and loss of devices, it is very necessary that the implement of electric motor frequency adjustment renovation.

**This project has been put into operation, which can reduce 30% loss during steam transport procedure in primary steam pipeline networks effectively and save energy, decrease the discharge of pollution and save the waste of condensate water and the consumption of fresh water.**

## II Industrial Policy Compliance

According to “*catalogue for the guidance of industries structure adjustment(2005)*” and “*catalogue for the guidance of industries structure adjustment(2007)*”(exposure draft), this project belongs to the encouraged nineteenth category (urban infrastructure and real estate) items 8: urban central heating construction and renovation engineering and the twenty-sixth category (environmental protection and resources saving comprehensive utilization) items 34: the development and application of those technologies of energy-saving, water-saving, environmental protection and resources comprehensive utilization, and this project conform to national industrial policy.

## III Process Scheme

### 3.1 Jinan Thermal Power Co., Ltd. substituting water pipeline for steam pipeline project

#### 3.1.1 Substituting water pipeline for steam pipeline project of South Suburb Thermal Power Plant

Jinan South Suburb Thermal Power central plant locates in the southern segment of Jianshe road in Jinan centric city. Construction scale: five 35t/h medium pressure and temperature steam chain grates with a B3-3.43/0.98, a B6-3.43-0.98 and a C12-35/10 turbo driven set and four 58 MW circulating fluid bed and high-temperature water boilers. 3 one-stage double-suction horizontal centrifugal pumps provide power for this.

The heating supply pipe network of South Suburb Thermal Power Central Plant was made of steam pipe network system and high-temperature water pipe network system. The heating area of steam pipe network system is about 2550 thousand m<sup>2</sup>, while the heating area of high-temperature water pipe network system is about 3940 thousand m<sup>2</sup>. The north of heating area is Jingshi road, the south is Erhuan South road, the east is Yingxiongshan road and the west is Erhuan West road.

##### 3.1.1.1 “Steam to water” project.

## 1 . Substituting water pipe network for steam pipe network along with Wenhua West Road

The pipe network connected to No.2 Affiliated Hospital of Provincial Hospital of Chinese Medicine in Jingba Road is needed to be laid to the north to the crossing of Wenhua West Road along the viaduct and to the east to Qilu Hospital and to the west to Municipal Science & technology Museum and Shandong Song and Dance Troupe.

**Table 3.1.1-1 Statistical Table of Pipelines for “Changing Steam into Water” along Wenhua West Road (Length of Single Pipeline)**

Pipe Diameter (DN)	Length (m)	Pipe Diameter (DN)	Length (m)
DN300	850	DN175	150
DN250	600	DN125	20
DN200	20		

## 2. Substituting water pipe network for steam pipe network in the middle segment of Jianshe Road

The currently existing high-temperature water network along Jianshe Road with the total heating area of 100,000 m<sup>2</sup> and the total load of 4.5 MW has laid to the heat exchanger station in Hongjian Garden with a distance of 470m from the heat exchanger station in Mingyuan Community. It is planed to carry out the program of “changing steam into water” for the heat exchanger stations in Mingyuan Community and City State Tax Bureau. The pipeline route: a pipeline of DN200 is laid from the heat exchanger station in Hongjian Garden in No. 75 in Jianshe Road to the north to the heat exchanger station in City State Tax Bureau in No.15 in Jianshe Road to realize changing steam into water for the heat exchanger stations in Mingyuan Community and City State Tax Bureau.

**Table 3.1.1-2 Statistical Table of Pipelines for “Changing Steam into Water” in the Middle of Jianshe Road (Length of Single Pipeline)**

Pipe Diameter (DN)	Length (m)
DN200	470

## 3. “Changing steam into water” in West Line

There is a DN700 hot-water heating main pipe at Jingliu Road, which extends to the junction of Jingliu Road and Huaiyin Street. The pipe is planned to be changed into DN400 in diameter, and extend westward to Zhangzhuang Road, so that the previous steam pipeline will be replaced for the purpose of steam-to-water reconstruction.

There is a DN500 heating main pipe at Weishier Road. A DN350 pipeline is planned to be

installed, starting at the junction of Nanxinzhuang Street and Weishier Road, extending westward along Nanxinzhuang Street, for the purpose of steam-to-water reconstruction.

Similarly, a DN250 branch pipe will start from the junction of Nanxinzhuang Street and Weishier Road, and run westward. So that the previous steam pipeline will be replaced for the purpose of steam-to-water reconstruction.

The DN800 main pipe at South Suburb Plant will changed to DN700 and extend westward to Xishilihe East Street, then northwestward to Xishilihe Street, then southward along Liuchangshan Road-Jichuang Yichang West Road-Railway- Baimashan South Road-Yangjiazhuang. So that the previous steam pipeline will be replaced for the purpose of steam-to-water reconstruction.

**Table 3.1.1-3 Statistics of pipes at the West line of South Suburb Plant in the steam-to-water reconstruction (length of single pipe)**

Pipe diameter (DN)	Length (m)	Pipe diameter (DN)	Length (m)
DN700	5400	DN350	4650
DN600	500	DN300	4850
DN500	2470	DN250	500
DN450	500	DN125	600
DN400	4000		

### **3.1.1.2 The remolding method of the heat exchanger station**

There are 47 steam heat-exchange stations to be renovated. Alter the primary steam heating supply station to hot water heating supply station directly. Then join up the high-temperature water pipe network of thermal power plant.

### **3.1.1.3 The program of laying out pipe network**

The material of pipe was Q235-A. The pipe with pipe diameter below DN200 adopted seamless pipe, while the pipe with pipe diameter above DN200 adopted spiral seam electric welded steel pipe.

Directly buried pipeline adopted modified polyurethane to keep warm. High density polyethylene was coated on the surface of the pipe. The thermal compensation employed the compensated mode combined solenoid compensator and natural ecological compensation or the directly buried installation without expansion. The soil sealing of pipe line is 800mm. (the following process schemes are similar to these)

## **3.1.2 Substituting water pipeline for steam pipeline project of North Suburb**

## Thermal Power Plant

North Suburb Thermal Power Plant covers an area of 380 mus (including the extension field) the first-stage construction has put into operation in 1993. Construction scale: 3×130t/h high pressure coal-powder boiler, 2×12MW back-pressure turbo generator set, 1×12MW extraction condensing turbine and 1×5MW straight condensing turbine. The supporting construction that 200 thousand tons fly ash comprehensive utilization factory Cement Plant has put into operation in 1994. The second-stage construction has put into operation in 2006 and extended a 240t/h high temperature and pressure circulating fluid bed boiler and a 50MW extraction condensing turbine. The designed annual energy output is 3560 million KWh. The designed annual heat output is  $580 \times 10^4$  GJ. The north of heat supply area of this plant is Xiaoqing River, the south is Beiyuan Street, the west is Wuyingshan Road and the east is Xiluo River.

In this project, there are 41 steam heat-exchange stations will be renovated. Pipes that previously adopted steam heat of two area will be replaced:

### 3.1.2.1 The area to the north of Xiaoqing River and to the west of Jinpu Line

Lay a DN700 main heating pipe to the north in the direction of Jinpu railway to Majiazhuang; after changing to DN500, lay to the north in the direction of Biaoshan Road to the linen cotton machinery plant; after changing to DN400, continue to lay to the north to 2<sup>nd</sup> Ring North Road.

Lay a DN700 main heating pipe to the west along Binhe North Road to Taipingzha; after changing to DN600, lay along Qinghe North Road to Wuyingshan North Road and then lay to the north along Wuyingshan North Road to Jinpu Railway; after changing to DN500, continue to lay to the north to Luoan Road; after changing to DN450, continue to lay to the north to 2<sup>nd</sup> Ring North Road.

**Table 3.1.2-1 Statistics of pipes at the area to the north of Xiaoqing River and to the west of Jinpu Line in the steam-to-water reconstruction (length of single pipe)**

Pipe Diameter (DN)	Length (m)	Pipe Diameter (DN)	Length (m)
DN700	1350	DN450	500
DN600	1750	DN400	750
DN500	950	DN350	350

### 3.1.2.2 Planning of the Area of Wuyingshan North Road

A DN700 pipe starting from Wuyingshan North Road runs westward along North

Maanshan Road and reaches Lanxiang Road. After changing to DN600, it runs westward along Lishan Road and reaches Dongyu Street. After changing to DN500, it runs westward to the West Passenger Station, supplying heat to Settlement Area 1 and Settlement Area 2.

The original high temperature hot water pipeline in North Suburb Thermal Power Plant has laid along Beiyuan Street to Huanggang Road. To coordinate with the road construction, after turning the original high temperature hot water pipeline to DN600, it will be laid to 2<sup>nd</sup> Ring West Road and changed to DN500 and then laid to the first area and the second area of the planning area of Jinan West Railway Station.

**Table 3.1.2-2 Statistics of pipes at the area to the Area of Wuyingshan North Road in the steam-to-water reconstruction (length of single pipe)**

Pipe Diameter (DN)	Length (m)	Pipe Diameter (DN)	Length (m)
DN600	4000	DN500	2000
DN450	500	DN400	500

### **3.1.3 Substituting water pipeline for steam pipeline project and Initial heating station project of Minghu Thermal Power Plant**

There were 2×35t/h and 2×45t/h steam chain grates, 1×75t/h circulating fluid bed steam boiler, 1×3MW back-pressure turbo generator set, 1×6MW back-pressure turbo generator set and 1×12MW extraction condensing turbine in the Jinan Minghu Thermal Power Plant . At the moment, the rated total evaporation of all the boiler of the plant is 235t/h. the total capacity of turbo generator set is 21MW. The heat supply area is about 2600 thousand m<sup>2</sup>. The subscribers include Shandong provincial government, Shandong National People's Congress, Shandong People's Political Consultative Committee, Huaneng Hote, Qinghe Group and Yinzuo market etc, cover the government offices , enterprise and public institution and residence community.

#### **3.1.3.1 Initial Heating Station project**

Now, The heat supply area of Minghu Thermal Power Plant is about 2600 thousand m<sup>2</sup>, what is more, the reticulating water system of heating pipeline has been already remolded. The maximum capacity of heat supply of the plant has reached 3000 thousand m<sup>2</sup>. For realizing substituting high-temperature water supply system for steam heat supply system, a Initial

heating station project which capacity of heat supply is 3000 thousand  $\text{m}^3$  is needed. The installation equipments needed in the project are shown in table-3.1.3-1.

**3.1.3-1 Minghu Initial Heating Station devices list**

Number	Device name	Amount	Note
I	reticulating water system of heating pipeline		
1	Straight supply pump	2	$Q=800 \text{ m}^3/\text{h}$ , $H=36\text{m}$ , $N=110\text{kw}$
2	Straight supply steam-water plate heat exchanger	2	Area of heating exchange : $95 \text{ m}^2$ , design pressure 1.6mpa ,
3	circulating pump	1	$Q=1500\text{m}^3/\text{h}$ , $H=40\text{m}$ , rotating speed : 3000r/min ;
4	Dragging steam turbine	1	Power: 1.5MW , inlet steam pressure 3.5Mpa , exhaust steam pressure : 0.981MPa , inlet steam temprature: $435^\circ\text{C}$ , rotating speed : 3000r/min ;
II	High- temperature heating appliance		
1	circulating pump	3	Flow rate : $2400\text{m}^3/\text{h}$ , head : 90m , rotating speed : 3000r/min ;
2	Dragging steam turbine	1	Power: 1.5MW , inlet steam pressure 3.5Mpa , exhaust steam pressure : 0.981MPa , inlet steam temprature: $435^\circ\text{C}$ , rotating speed : 3000r/min ;
3	Electric motor	2	650kw , 10kv ;
4	High- temperature steam-water plate heat exchanger	10	Area of heating exchange $300 \text{ m}^2$ , design pressure 1.6mpa , test pressure 2.0mpa , design temperature : $150^\circ\text{C}$ .
III	Combination operation auxiliary equipment		
1	Backwater booster pump	2	Flow rate $1300\text{m}^3/\text{h}$ , head : 25m , rotating speed : 1480r/min ;



2	electromotor	3	650kw , 10kv ; 11kw , 380v ;
3	Frequency conversion water supply pump	1	Flow rate : 47 m <sup>3</sup> /h , head :44 m ;

### **3.1.3.2 The program of laying out hot water pipe network**

#### **1. The laying of pipe network for “changing steam into water” in Minghu Road**

The pipeline trend is from the southwest gate of Daming Lake along Minghu Road to the crossing of Minghu Road and Heibei Road, then to the north along Heibei Road to the crossing of Jingyi Road. The pipe diameter of the main pipe network needed to lay is DN400 and the length of the single pipe is 2800m.

#### **2. The laying of pipe network for “changing steam into water” in Baobei Road**

From Minghu Road, along Xichenggen Street, lay DN350 high-temperature water pipeline to the south to Sanlian Mall. According to the planning requirement, it is needed to add DN250 branch from Jiangjunmiao Street to the east to the community of Shengfuqian Street. The length of the single pipe of DN350 main pipe is about 1000m and that of DN250 branch is about 300m.

#### **3. The laying of pipe network for “changing steam into water” in Gongyuan Qianggen Street**

Add the branch from Minghu Road to the south to lay DN350 heat supply water pipeline and lay DN350 high-temperature water pipeline from Gongyuan Qianggen to Quancheng Road. The length of single pipe of pipe network is about 2,000m. The trend of pipeline is along Gongyuan Qianggen to the south through Provincial Statistic Bureau to Quancheng Road.

#### **4. The laying of pipe network for “changing steam into water” in Anchasi Street**

The current heating load in Anchasi Street is about 240,000 m<sup>2</sup> and the area capable of developing is about 80,000 m<sup>2</sup>. The heating area in this area will reach 320,000 m<sup>2</sup>. Combined

with the heating plan of “changing steam into water”, it is needed to lay DN250 high-temperature water network in Anchasi Street to Huangting Gymnasium in Quancheng Road. The length of the single pipe of heating pipeline is about 2,000m. The trend of pipeline is along Anchasi Street to the south to the heat exchanger station of Huangting Gymnasium.

### **5. The laying of pipe network for “changing steam into water” in Shunhe West Street**

Five heat exchange stations will be added in this area including the stations of Guanyi Street, Municipal Intermediate Court, Jingdu Hotel, Bank of Communications and Municipal Hospital of Traditional Chinese Medicine. The pipe diameter of main pipe network needed to be layed is DN 400 with the length of single pipe of about 2800m. The trend of the pipeline is starting from the crossing of Minghu West Road along Shunhe West Street to Jinlong Hotel in Jingqi Road with the branch in Jingsi Road turning to the east along Gongqingtuan Road to Insurance Company.

### **6. The laying of pipe network for “changing steam into water” in Minghu North Street**

The current users in Minghu North Road is the heat exchange stations of Lake Park, Beiguan White Crane, Minghu Tiandi ,White Crane and Huguang Shanse with the heating area of about 300,000m<sup>2</sup>. The high-temperature water pipeline has been laid to the heat exchange station of Beiguan North Road. The main pipe network is needed to be replaced with the pipe diameter of DN350 and the length of single pipe of 1,600m. The trend of pipeline is from the heat exchanger station of Beiguan North Road along Jiaoji Railway to White Crane Decorative City to the south across Jingyi Road, the north moat to Daming Lake to the east to Minghu Tiandi Community.

### **7. The laying of pipe network for “changing steam into water” in Guangyi Street**

It is needed to lay DN300 high-temperature hot-water heating pipe network to replace steam pipe network in Guanyi Street. The length of single pipe of heating water pipe network laid in this pipeline is 1,000m.

### **8. The laying of the initial high-temperature hot-water heating pipe network in the north of Shengchan Road**

It is needed to lay DN400 high-temperature hot-water heating pipeline to replace steam pipe network with the length of 600m. The current load along the line is 105,000 m<sup>2</sup>. The planning area of Qinghe Times New City in modification is 1.8 million m<sup>2</sup>. The trend of the pipeline is from the junction of Shengchan Road and Beiyuan Road to the north for 600m.

**Table 3.1.3-2 Statistics of total pipes of Minghu thermal power plant in the steam-to-water reconstruction (length of single pipe)**

Pipe Diameter (DN)	Length (m)	Pipe Diameter (DN)	Length (m)
DN400	6200	DN300	1000
DN350	4600	DN250	2300

**Table 3.1.3-3 Minghu Thermal Power Corporation's replacement heating station for steam station and the name of programmed station list**

Number	Name	Areas ( ten thousandm <sup>2</sup> )	Main equipment
1	Provincial government	10	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50A water supply pump
2	Shandong library	1.1	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
3	Provincial development and reform commission	2.8	BRB045-39 heat exchanger KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
4	The forth provincial government dormitory	0.3	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50B water supply pump
5	Jinan the No.1 People's Hospital	0.9	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50B water supply pump
6	Lunxin corporation for cultural media	0.6	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50B water supply pump
7	Luxin real estate agency dormitory	0.8	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50B water supply pump
8	Jinan Tongsheng Auction Company	0.4	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50B water supply pump
9	The third provincial government dormitory	1.3	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
10	Department of housing management in Lixia	1.0	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump

	District		KDBR40-50Bwater supply pump
11	Provincial statistics department	0.1	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
12	Municipal Construction company in Lixia District	0.7	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
13	Education bureau dormitory in Lixia District	0.6	BRB03-13 heat exchanger ; KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
14	Country tax bureau dormitory in Lixia District	0.4	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
15	Shan dong supply and sales company of light industry	0.6	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
16	Lishe Business Hotel	0.4	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
17	Shandong Yongan Real Estate Development Company	4	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
18	Switch Factory heating exchange station	0.6	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
19	District heating company in Shunjing street heating exchange station	2.5	BRB045-39 heat exchanger ; KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
20	Regional area in front street of provincial government	10	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50Awater supply pump
21	Sanlian group corporation home appliances	2.7	BRB045-39 heat exchanger KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
22	Wal-Mart super market	5.5	BRB08-78 heat exchanger KDBR125-50(I)A circulating pump KDBR50-50A water supply pump
23	Fengli mall	1	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
24	Shandong Post Hotel	2.8	BRB045-39 heat exchanger KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
25	Traditional Chinese medicine factory,	0.8	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
26	Provincial electric mall	0.6	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
27	Longquan hotel	1.2	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
28	Jinan audit	0.5	BRB03-13 heat exchanger

	administration dormitory		KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
29	Provincial People's Congress	1.5	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
30	Provincial statistic bureau	2	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
31	Jinan Huangguan holiday	4	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
32	Jinan Zhenzhuquan hotel	2.6	BRB045-39 heat exchanger KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
33	Shengli mall	2.0	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
34	New Department Store	4	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
35	Shandong world trade center	12	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50Awater supply pump
36	Heating exchange station in the first school	12.3	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50Awater supply pump
37	Hewu bureau of yellow river	3.6	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
38	Huangting	2.1	BRB045-39 heat exchanger KDBR80-50(I)A circulating pump KDBR40-50 ( I)B water supply pump
39	Huaneng mall	3.4	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
40	Provincial political consultative committee	4.8	BRB08-65 heat exchanger KDBR125-50A circulating pump KDBR40-50 ( I ) A water supply pump
41	The second provincial people's congress dormitory	0.9	BRB03-13 heat exchanger KDBR65-50(I)B circulating pump KDBR40-50Bwater supply pump
42	Guanyi street	50	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50Awater supply pump
43	Municipal intermediate people's court	5	BRB08-65 heat exchanger KDBR125-50A circulating pump KDBR40-50 ( I ) A water supply pump
44	Jingdu mall	10	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump

			KDBR65-50A water supply pump
45	Bank of communications	4	BRB045-52 heat exchanger KDBR125-50B circulating pump KDBR40-50 ( I)B water supply pump
46	Municipal traditional Chinese medicine hospital	1.7	BRB045-26 heat exchanger KDBR80-50(I)B circulating pump KDBR40-50 ( I)B water supply pump
47	Hu Panyuan	5.3	BRB08-78 heat exchanger ; KDBR125-50(I)A circulating pump ; KDBR50-50A water supply pump
48	Beiguan Baihe	14	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50A water supply pump
49	Baihe	2.6	BRB045-39 heat exchanger ; KDBR80-50(I)A circulating pump ; KDBR40-50 ( I)B water supply pump
50	HuGuang Shanse	4.2	BRB08-65 heat exchanger KDBR125-50A circulating pump KDBR40-50 ( I ) A water supply pump
51	Daming Lake garden	6	BRB08-78 heat exchanger KDBR125-50(I)A circulating pump KDBR50-50A water supply pump
52	Minghu Tiandi	6	BRB08-78 heat exchanger KDBR125-50(I)A circulating pump KDBR50-50A water supply pump

### 3.1.4 Substituting water pipeline for steam pipeline project, accessory pipeline networks and Initial heating station project of Jinjiling thermal power plant

Construction scale:  $2 \times 75\text{t/h}$  and  $2 \times 130\text{t/h}$  medium pressures and temperature circulating fluid bed boilers,  $1 \times \text{C12}$  extraction condensing turbine and  $1 \times \text{B12}$  back-pressure turbo generator set. The main load was heating load. Some was domestic hot water load, air-conditioning refrigeration load and part of heating load in production. The amount of subscribers was 144. The heating area was total up to 3 million  $\text{m}^2$ . The heating load in production technology and domestic hot water and refrigeration was  $36 \text{ GJ/h}$ ,  $147.51 \text{ GJ/h}$  respectively. Now it has not reached the final scale. A space was retained for expansion. Except for the construction land which was holed by  $2 \times 116\text{MW}$  hot-water boiler in long-term planning, a heating exchanger origin station can be built at a part of reserve land. The heat exchange between steam and water could be realized in the heating exchanger origin station.

What is more, altering the heat supply method which was used by the former steam-heat-supply subscribers and changing the corresponding heat-exchange stations.

### 3.1.4.1 Initial Heating Station

The maximum capacity of heat supply of Jinjiling Thermal Power Plant was 3.4 million  $m^2$ . To realize the substituting hot-water heat supply system for steam heat supply system, a initial heating station which capacity of heat supply of is 3.4 million  $m^2$  should be constructed. The support equipments needed in this project can be shown in table-3.1.4-1.

**Table 3.1.4-1 Jinjiling Initial Heating Station devices list**

Number	Device name	Amount	Note
One	reticulating water system of heating pipeline		
1	Straight supply pump	2	$Q=800 m^3/h$ , $H=36m$ , $N=110kw$
2	Straight supply steam-water plate heat exchanger	2	Area of heating exchange $95 m^2$ , Design pressure 1.6mpa ,
3	circulating pump	1	$Q=1500m^3/h$ , $H=40m$ ,rotating speed :3000r/min ;
4	Dragging steam turbine	1	Power 0.25MW , inlet steam pressure 1.0Mpa , exhaust steam pressure : 0.981MPa , inlet steam temperature $435^{\circ}C$ , rotating speed : 3000r/min ;
Two	High- temperature heating appliance		
1	High- temperature circulating pump	2	$Q=792 m^3/h$ $H=58m$ $N=150kw$
2	circulating pump	3	Flow rate : $2400m^3/h$ ,Head :90m ,rotating speed : 3000r/min ;
3	Dragging steam turbine	1	Power 1.5MW , inlet steam pressure 3.5Mpa , exhaust steam pressure : 0.981MPa , inlet steam temperature $435^{\circ}C$ , rotating speed : 3000r/min ;
4	Electric motor	2	650kw , 10kv ;
5	High- temperature steam-water plate heat exchanger	10	Area of heating exchange $300 m^2$ ,Design pressure 1.6mpa ,Test pressure 2.0mpa ,design temperature $150^{\circ}C$ 。
Three	Combination operation auxiliary equipment		As same as Minghu initial heating station

### 3.1.4.2 The program of laying out hot water pipe network and the remolding method of the heat exchanger station

#### 1. The laying of pipe network for “changing steam into water” in the periphery of middle city of Yangguang Shuncheng

The middle city and the periphery of Yangguang Shuncheng Community are located in the northeast side of Jingjiling Heat Source Branch Plant. Currently, there are five heat exchange stations with the heating area of about 800,000 m<sup>2</sup> (Yangguang Shuncheng Tuwu Heat Exchange Station, Xinxin Jiayuan Heat Exchange Station, Provincial Heat Exchange Station, Chonghuayuan Heat Exchange Station, Nanfengju Heat Exchange Station). According to 11<sup>th</sup> five-year plan of Jinan City, with the requirement of energy conservation and lower energy consumption, it is needed to change the middle part of Yangguang Shuncheng Community to high-temperature water users. It is planned to lay a main pipe with the pipe diameter of DN500 along the trend of the original steam pipeline and change the above 5 steam heat exchanger stations to the hot-water heat exchanger station.

## **2. Substituting water pipe network for steam pipe network along with Shuichang Road**

The currently existing users of Shuichang Road is heat exchange stations of South Suburb Water Plant, Gongjiao Mansion, Provincial Discipline Inspection Commission, Shizhong Real Estate with the heating area of about 100,000 m<sup>2</sup>. The load of long-range plan is the heating load of two communities including the north district of Yuhan Community and Yuhan south district with the area of about 100,000 m<sup>2</sup>. To coordinate with the implementation of the whole project of “changing steam into water”, the high-temperature water pipeline connecting the heat exchange stations of Gongjiao Mansion, dormitory of Provincial Discipline Inspection Commission, Shizhong Real Estate has been laid to the east end of Shuichang Road. In view of the long-range load along Shuichang Road, the pipe diameter of main pipe network needed to lay is DN300 with the length of single pipe of 920m. The trend of pipeline is from the crossing of Shungeng Road and Shuichang Road along Shuichang Road to the heat exchanger station of South Suburbs Water Plant.

## **3. the previous heat network along with Travel West Road**

Currently, there is a DN700 hot water pipeline laid to the south of Jinjiling Heat Source Branch Plant. It is planned to lay DN350 high temperature water pipeline that will replace steam pipe from Jinjiling Thermal power Plant along travel West Road to Jingya Hotel in Yingxiongshan Road with the length of single pipe of about 2,000m.

## **4. The laying of pipe network for “changing steam into water” along south outer ring**



A hot-water pipe (DN400) has been laid from Jinjiling Thermal Power Plant to Diequan mountain villa. As the requirement that the hot-water pipe networks of every branch plants should be connected of Jinan Thermal Power Group. A hot-water pipe (DN400) should be laid along with Erhuan South Road from Diequan mountain villa to Jinglu mountain villa on the Jianshe Road, connecting with the pipe network of Jinan South Suburb Thermal Power central plant on the Jianshe Road The length of a pipe is about 7400m.

The length of the pipe can be shown by table- 3.1.4-2. There are 9 heat-exchange stations should be renovated. Among them, 5 larger stations can be shown by table-3.1.4-3.

**Table 3.1.4-2 Statistics of total pipes of Jinjiling Thermal Power Plant in the steam-to-water reconstruction (length of single pipe)**

Pipe Diameter (DN)	Length (m)	Pipe Diameter (DN)	Length (m)
DN500	1850	DN300	920
DN400	7400	DN250	500
DN350	2400	DN200	50

**Table3.1.4-3 the schedule of the remodeling of the heat-exchange station of Jingjiling Thermal Power Plant**

Number	Name	Heat area Thousand m <sup>2</sup>	Mainly equipments
1	Tuwu	80	BRB08-104 heat exchanger KDBR200-50(I)C circulating pump KDBR50-32(I) water supply pump
2	Xinxin Jiayuan	100	BRB08-130 heat exchanger ; KDBR200-50(I)A circulating pump KDBR65-50A water supply pump
3	Shengzhi Shunhu community	300	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50A water supply pump
4	Zhonghuayuan	100	BRB08-130 heat exchanger KDBR200-50(I)A circulating pump KDBR65-50A water supply pump
5	Nanfengju	100	BRB08-130 heat exchanger ; KDBR200-50(I)A circulating pump KDBR65-50A water supply pump

## **II. Jinan Thermal Power Co., Ltd. heating network automatic control system project**

This project aims at existing, new and extending heating pipeline network, we can achieve goal of energy-saving, land-saving, water-saving and material-saving to varying degrees. The range of heating supplied by Jinan Thermal Power Co., Ltd. is 1244 ten thousand

m<sup>2</sup>; this project is automatic control project for 282 exchanger station in the heating range.

## **2.1 The component and function of this project**

This system includes many construction projects and computational analysis function which is stated as follows:

### **2.1.1 Build a hot water heating piping model**

Build piping model in software system, in the subsequent piping network computational procedure, this system directly calls model data based on graphics to analysis and compute piping network. This system is comprised by multiple fundamental data base, common thermal industry fundamental data is input into base database, in the subsequent modeling process, we can directly call base data to generate piping network model automatically. Though above procedure, we can fix position precisely, search heating network's object information varying from heating source to user, and we can precisely statistics all kinds of information of heating network, such as piping network load.

### **2.1.2 The construction of monitoring system**

### **2.1.3 Heating network working condition calculation**

The result of calculation includes heating network system's base data inquiry and display, the inquiry and print of heating network system's planar graph and pressure diagram and all computational data. Though the calculation of all kinds of working condition, the system will achieve following function:

- \*Optimize the plan and design of heating network, and reduce the cost of construction;
- \*Optimize the programme of operation, and reduce the cost of operation;
- \*Search users whose pipelines are not hot to improve the heating quality;
- \*Eliminate overheating to save energy;
- \*Optimize the programme of technology reform and reduce the cost of technology reform.

### **2.1.4 Sequential calculation**

System can calculate sequential heating network model working condition by building sequential time, temperature, heating source operating regulation and continuous curve. Though sequential calculation, the system will achieve following function:

- \*Optimize operating programme;
- \*Reduce the cost of energy and save the operating cost;
- \*Check up on economy runs index.

### **2.1.5 Integrate with SCADA**

This system can realize long-term running optimize programme, the prediction and optimize of load, the plan of fuel and optimize of buying heat, operation diagnosis, the organizing and deal with emergency response programme.

### **2.2 Development platform and tools**

Development platform: Select Oracle 10g as system's business process database management platform.

Tools: Object modeling tool-Rational Rose; Database modeling tool- Power designer;

Programming language-delphi7.0, Java/Jsp/Html; Relationship database management system-Oracle 10g.

### **2.3 Project management and implement**

The steering group of this project is in charge of determining significant arrangements. Project manager is responsible for the management of this project and coordination with user and the members of this project provides assistance for project manager.

### **2.4 Project implement plan**

The whole project management is divided four stages which include project start-up, plan, implement and termination.

### **2.5 The design program of heating network automatic control technology**

The whole control system is double stage control; the control center provides telemonitor and heat exchanger station. The monitor and control system software adopts Design Insight system software. Jinan Thermal Power Co., Ltd. project has 286 heat exchanger stations in total. We select three servers, three engineer stations, six operator stations and three printers in software configuration. If every heat exchanger station has 40 control centers, we need 11440 control soft wares. The number of control center and hardware configuration is extended by upgrading software authorization code. Main devices are list in table 2.5-1 in detail.

**Table 2.5-1 the list of system devices**

Serial Number	Name	Model Number	Quantity
I.the hardware configuration and model number in control center			
1	server	Power Edge C1430	3
2	engineer station	Precision(E5405)	3
3	operator station	Precision(E6550)	6
4	printer	Laser jet P2015n	3
5	hub	TL-SG1024	3
6	UPS	C3K	3
II. automatic system configuration and model number in heat exchanger station			
(I) Controller and accessories			
1	controller	ACX32.000/ALG	1
2	controller terminal	ACX90.12/ALG	1
3	Communication card	ACX52.22	1
4	Controller Operation panel	ACX84.910/ALG	1
5	Heating meter Communication card	ACX51.26	1
6	Controller extension module	ACX42.12/ALG	1
7	Extension module terminal	ACX90.14/ALG	1
8	Control cabinet		1
(II) Detecting and measuring meter			
1	Sensor of outdoor temperature	QAC2012	1
2	Sensor of water temperature	QAE2120.010	2
3	Sensor of water pressure	QBE9000-P16	6
4	Sensor of water level	QBE2002-P1	1
5	Heat Meters (include flow meter, Sensor of temperature, integrating meter)	7ME3340/UH50	1
6	Water supply flow meter	UH50-D46R-CN06-E00-NB00-M 2V	1
(III) Field operator device			
1	motorized valve	VVF45	1/2
2	control valve actuator	SKC62/SKB62	1/2
3	water supply control valve	VVG41.32+SQX62	1
4	circulating pump frequency converter	Exist in field	1
5	water supply pump frequency converter	Exist in field	1

## 2.6 The illustration of system function

### 2.6.1 SCADA system

Monitor Function—the operator can monitor any heat exchanger station from display frame. The frame can be divided into two parts: system frame and user frame.

Control Function —the function is realized by sending control instruction from control center to telemonitor heat exchanger station, which can be divided into three kinds (programmed control in time, Parametric Modifier, direct control) according to control principle.

Analysis Function—this function mainly includes trend analysis and pressure diagram

analysis.

Data Report—Thermal parameter in every heating station can be printed in system format or can be output batch data to Microsoft Excel.

Alarm and event log functions;

System security operations management - management of the safe operation is the management behavior of the system administrator for the protection of the safe operation of the system to determine the level of different operations with different levels of monitoring of rights, as well as the definition of the different scope and competence for specific operators;

Remote access functions.

### **2.6.2 Heat transfer station automatic control system**

Data Acquisition and Display - Collect all field instrument data, and display;

The description of Controlling loop function;

Security and interlocking; thermal station to start and stop; the implementation of balance control network; alarm.

## **Transducer reconstruction project of Jinan Thermal Power Limited Company**

The total motor power of Jinan Thermal Power Limited Company is 22865KW, and frequency operation mode is adopted in the current. It intends to transform fan and pump motor frequency in the project. The basic principles of speed control technology are based on the directly proportional relationship between the work of motor speed and power input frequency. And it works by changing the frequency of power supply to achieve the purpose of changing the motor speed.

### **3.1 Variable Valve Control**

Variable valve adjustment is to take advantage of changes in pipeline valve opening, to regulate the flow of pumps and fans. When variable valve adjustment, the pump or fan power will remain basically unchanged, pump or fan performance curve unchanged, but the pipeline resistance characteristic curve will change. A pump or fan performance curve with the new pipeline resistance characteristic curve of the intersection point is the new operating point.

### **3.2. Transducer Control**

Frequency adjustment is to use the method of changing the performance curve to change the operating point, and there is no additional resistance in variable-speed control. It is a more

satisfactory way to a regulation. Through the work of the power inverter to change the frequency, we can get the step less speed on AC motor. When pumps and fans using variable-speed control, its efficiency is almost unchanged, the flow changes by first power with the speed of rotation, and shaft power changes by third power. At the same time, the use of frequency regulation can reduce the pump and fan noise, reduce the wear and tear and extend the service life.

### **Fourth and Progress in the Implementation of Projects**

The total project construction period is for about 2 years, as shown in table 4-1.

**Table 4-1 List of Project Construction Schedule**

Implementation period	Progress of the project
September 2009 ~ February 2010	Preparative period
March 2010~June 2010	Engineering design
July 2010 ~ December 2011	equipment installation and debugging running

### **The Main Technical and Economic Indexes**

**Table 5-1 The Main Technical and Economic Indexes Table**

No.	Item	unit	indicators
1	The total planned project investment	ten thousand Yuan	52417
2	Bed liquidity	ten thousand Yuan	0
3	Dynamic investment	ten thousand Yuan	52417
4	Construction period interest on loans	ten thousand Yuan	1217
5	Financial internal rate of return of the project investment ( before income tax )	%	17.20%
6	Financial internal rate of return of the project investment ( after income tax )	%	13.99%
7	Financial net present value of the project investment (before income tax) ( $i_c=8\%$ )	ten thousand Yuan	42903
8	Financial net present value of the project investment (after income tax) ( $i_c=8\%$ )	ten thousand Yuan	26311
9	Project investment payback time (before income tax)	Years	7.18

10	Project investment payback time (after income tax)	Years	8.27
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### **The original project-related environmental issues:**

At present, in the existing heat transfer stations which match the heating pipe network well, measures such as a certain degree of noise, vibration and distance attenuation have been taken. There is less impact on the surrounding environment, and it can achieve the requirements of functional areas related to "urban regional environmental noise standards", so there is no problem of environmental pollution.

## **Profiles of the Natural Environment and Social Environment in the Site of Construction Projects**

### **Profiles of The Natural Environment (Topography, Geomorphology, Geology, Climate, Meteorology, Hydrology, Vegetation, Biodiversity, etc.):**

#### **I Location**

Jinan is the capital of Shandong Province- one of the largest economy province in east China coast, the province's political, economic, cultural, science and technology, education and financial center, is also approved as deputy provincial cities and coastal open cities by the nation. Jinan City is located at north latitude 36 degrees 40 minutes east longitude 117 degrees 00 minutes south of Tai Mountain, north cross the Yellow River, the low-lying South High North. The city's total area is 8177 square kilometers, and the urban area is 3257 square kilometers. Jinan dominates 6 areas including Lixia District, Shizhong District, Huaiyin District, Tianqiao District, Licheng District, Changqing District and 3 counties including Pingyin, Jiyang, Shanghe and Zhangqiu city. There are mainly the Yellow River and Xiaoqing River two major river systems in Jinan. There are Daming Lake and Baiyun Lake and so on. Jinan has a long history, is a historical and cultural city published by the State Council. Jinan owns many springs, known as the "Springs." The city tree of Jinan City is willow, and the city flower is the lotus flower.

South Suburb Thermal Power Plant of Jinan Thermal Power Limited Company is located in the southern section of Construction Road; North Suburb Thermal Power Plant is located in Xiaoqing riverside, north of the Xiaoqing River north road, east of Jinpu Railway; Minghu Thermal Power Plant is located in the Production Road, Lotus Hotel opposite; Jinjiling Thermal Power Plant is located in the southwest side of Jinji Hill, next to Shungeng Road in the west, next to Travelling Road in the south.

The project is located in downtown Jinan City, Shandong Province. Pipe network renovation project involves Central District, Lixia District, Huaiyin District and Tianqiao District, involving a wider scope.

#### **II Topography, Geomorphology and Geology**

Jinan is located in the transfer belt of low hills in south centre and alluvial plain in northwest of Shandong, north of the Tai Mountain, south of the Yellow River, and the terrain is low-South High-North. Small low hills in the south is 500 ~ 900m, the central hills elevation is



100 ~ 500m, and the northern part of the alluvial plain is 17 ~ 100m. Jinan urban area is located in the north of the central hills, in micro tilted plains and the Xiaoqing River, the Yellow River alluvial plain, and the terrain is low-South High-North. Due to the northern part of the riverbed of the Yellow River is higher than near the surface, the shape of the urban terrain takes on slightly Basin. The city's low mountains and hills area is 3266.8km<sup>2</sup>, accounting for 56.8 percent of the total area; Plain 2357.6 km<sup>2</sup>, accounting for 40.8 percent of the total area; surface 150.6km<sup>2</sup>, accounting for 2.6% of the total area..

Geotectonic position in this area is located in the southeast corner of Taiwan, China and North Korea quasi. In the north is north china down faulted basin, and in the south is part of two II-classes tectonic units of western Shandong fault uplift belonging to Jiyang depression, Zibo - Chipping depression and central Shandong uplift tectonic units of grade III. It crosses North-South western Shandong fault uplift and north china down faulted basin two tectonic units. Between these two tectonic units is Qihe - Guangrao fault zone. Geological structure is rather complicated. Ancient basement is mainly fold and structure of it is complicated. But the cap rock structure is relatively simple with monoclinic dominated. In addition the region faults develop, and control the Mesozoic and Cenozoic fault basin.

### **III Climate and Weather**

Jinan is located in mid-latitudes, is a warm temperate continental monsoon climate zone. Dry spring, hot and less rainy summer, refreshing autumn, cold and dry winter. Four seasons are obvious. In the coldest month in winter the average temperature is at 0 ° below, and the extreme minimum temperature is -19.5 °. The largest depth of permafrost is about 50 centimeters. Winter precipitation is in the 20 ~ 25 mm, scarce rain and snow throughout the winter, the northerly wind blowing frequency, dry and cold. Summers are hot and more precipitation, average temperature around 26 °, extreme maximum temperature above 40 °.

\* The annual average temperature: 14.2 °, the highest temperature: 42.7 °, minimum temperature: -19.7 °.

\* The annual average number of days of snow cover: 14.7 days, maximum 19 centimeters deep plot.

\* The annual average relative humidity: 58%.

\* Perennial dominant wind direction: the southwest, northeast winds.

\* The annual average rainfall: 685 millimeters, the largest annual rainfall: 1160 millimeters, the minimum annual rainfall: 320.7 millimeters.

\* The annual average number of days of ice: 86.7 days, the general began in mid-November, and finally in late March.

\* Maximum depth of permafrost: 500 millimeters.

## **IV Hydrological Overview**

### **4.1 Surface Water**

#### **4.1.1 Rivers**

Jinan City's rivers belong to the Yellow River and the Xiaoqing River two major river systems. In addition to Langxi River, Dongluo River, Xiluo River and Jinxiu River for perennial rivers, its tributaries, are for the excretion of seasonal rivers mountain torrents. In addition to the Yellow River the rivers in the city are mainly rainwater supply, and according to the hydrological characteristics they can be divided into sub-type of mountain rivers and Mid-levels district-based two types of rivers. Xiaoqing River belonging to Mid-levels type and the rest large rivers are basically the type of mountain rivers.

Xiaoqing River in Shandong Province is Xiaoqinghe flood, and is storm water drainage, navigation, irrigation, sewage and other integrated large-scale artificial river. Trunk from the western suburbs of Jinan City, running through Huimin, Zibo City and other places, a total length of 237 kilometers, with a total drainage area 10,572 square kilometers, is the only navigable river, the river water and land transportation in Shandong province,. Xiaoqing River from the main stream of the Xiaoqing River is from Zhu river of Jinan urban and extends westward to eastern bank of Yufu River embankment. The main stream of the river flows through Huaiyin, Tianqiao, the suburbs, Licheng and in Xiaojia village Shuizhai township Zhangqiu county flows out the city. With that it flows through Zouping County in Huimin District and by Gaoqing, Huantai, Boxing and Guangrao and flows into the Bohai Sea in Yangjiao ditch Shouguang County. The main tributaries of Xiaoqing River tributary of the Xiaoqing River in Jinan is more than in the right (South) offshore, belonging to flash floods and spring water; in the north shore tributaries smaller and less, are plain water drainage watercourse.

The Yellow River from Qinghe gate of old Pingyin County entered Jinan City habitat along the northern part of the urban winding northeast, flowing through Pingyin County, Changqing County, the suburbs of Jinan City, Licheng County and Zhangqiu county, and exit in Changjia village Yellow River township Zhangqiu county. The length of the river flowing through the city is 172.9 kilometers. Its offshoots are from the right bank of the river into it

including Langxi River, Longliu River, Yudai River, Pingyin River, Anluan River, Xiaolipu River, Nandasha River, Beidasha River, Yufu River nine rivers. In the Lower Yellow River the tributaries entering in Jinan are rain-oriented type. With the exception of Langxi River and Yufu River as the perennial rivers, the rest are seasonal rivers discharging mountain torrents.

#### **4.1.2 Lakes and Marshes**

Jinan City is Southern high terrain North low, under the steep relief, precipitation concentrated, and flash flood easily flashed. The source of the mountain river is short and it flows swiftly to lowland plains, and then because the flood fails to be discharged, lacustrine bog forms as a result of water retention. There is Baiyun Lake, Yazhuang Lake, Daming Lake, Dongping Lake four lakes belonging to shallow eutrophic freshwater lake type. Along the piedmont area, the distribution of a large number of relics in the history of limnology had been as shallow depressions.

Baiyun Lake is located in the border of Zhangqiu and Licheng south of Xiaoqing River, in the connection of the Piedmont and the Yellow River plains two hydro-geological area. It is 4 kilometers south of the Xiaoqing River and 3.5 kilometers east of Jnxiu Rivers. Lake is from east to west, rectangular, about 7.5 kilometers long, 2.5 kilometers wide, and the whole lake area is 17.4 square kilometers. Higher terrain around the lake, the ground 19 meters height, only north-eastern part of the lower, about 18 meters; Lake general ground elevation of about 17.4 meters, the lowest lake center 16.2 meters, 18.6 kilometers long dike, 7.5 square kilometers in general the lake surface, water depth of about 1 meter.

Daming Lake is located in the northwest of old Jinan city owning 46.5 hectares of existing lake, formed by more than 20 springs including Pearl spring, Xiaogan spring, Lotus spring, Wangfu pool and so on. Lake water from northeast effluent gate by Luoshui River injects Xiaoqing River. The water level regulation by Watergate, the general depth of 2 to 3 meters, level trough of water storage capacity of 830,000 cubic meters, the general reserve of only 320,000 cubic meters of water.

Jinan is north of Tai mountain and south of the Yellow River. Because of this special geographical environment and the multiple outbursts of the Yellow River lower reaches in the history along the vicinity a large number of shallow depressions distribute. In addition, the riverbed of the Yellow River deposition uplifts every year, so the coccyx water level of the original branch of the Yellow River rises. Hence in the lower reaches of the river low-lying land retention of water when flood, a vast expanse of water.

**In the operating period of the project it does not involve wastewater efflux.**

## 4.2 groundwater

Hilly and piedmont plain areas with distribution of limestone are water-rich areas, spring-intensive, which is deep-seated karst water, the general depth of few tens of meters to 200 meters; pure water, salinity of less than 0.5 grams / liter, is type of calcium and magnesium bicarbonate type of fresh water. The southern mountain with distribution of magmatic rock and metamorphic rock is depleted water district, which is weathering rock fissure water, buried in shallow (less than 10 meters), and there is very little water. Along the Yellow River Alluvial Plain is the middle water-rich area, and is loose rocks Quaternary pore water. Salinity increases from south to north, and it is brackish alkaline hard water.

According to the regional hydro geological conditions and aquifer characteristics, the type of underground water and aquifer rock group in Jinan can be divided into the following four types:

(1) Loose rocks pore water occurs in Quaternary unconsolidated sediments, especially in the diluvial, alluvial sand and gravel layer. It mainly distributes in alluvial plains along the Yellow River in the north and central mountain flood alluvial plains, and in the larger valley plain are also a small number of distributions. Due to residual, diluvial slope exposed position is high, and the thickness is small, relatively poor water.

(2) Clastic rocks fracture pore water. This type of groundwater can be divided into categories of clastic rock fissures pore water and clastic rocks carbonate pore fissure water. The former mainly occurs in the Permian, Jurassic and Upper Tertiary stratigraphy, and there is sporadic distribution only in Xianggong village Zhangqiu County, Puji, Bu village, Wenzu, Mingshui, Sun village Licheng County, Guodian and so on; the latter mainly occurs in the Carboniferous coal-bearing strata and by the impact of coal is generally poorer water, mainly in Bu village, Wenzu and hill front of Mingshui. In addition, in the western suburbs of Jinan Changqing northern shore of the Yellow River is also distributed.

(3) Carbonate-type fracture-karst water. Such underground water also can be classified into two sub-categories: First, carbonate fracture-karst water, mainly occurs in the Ordovician, the Cambrian Fengshan EC bands thick limestone. It broadly distributes in Jinan, mainly in the limestone hills and piedmont zone insidious. Because of the thickness of limestone, and exposed a wide karst fissures, mutual connectivity, groundwater hydraulic closely, in the gravity there is often more unified regional level. Monoclinic structure in the south side of high, middle parts of the exposed strata, surface runoff loss for the karst water supply to runoff

area; in northern karst water runoff discharge zones, large spring rise or spring group often forms, constituting a large number of water sources. Second, carbonate rocks clastic rock karst water, mainly occurs in the Cambrian. Such distributed in the position over the previous one is slightly higher and south of some sub-categories, and the water content is less than the previous sub-categories.

(4) The fissure water of magmatic rocks, metamorphic rock types mainly occurs in magmatic rocks and metamorphic rocks weathering zone and tectonic broken belt. It mainly distributes in Duozhuang Zhangqiu County to the Great Wall Mountain of Shuangquan Changqing County, less water, and the water level with the terrain and seasonal changes in different, water quality good.

Groundwater recharge, runoff, discharge conditions and the occurrence, enrichment, Urban Habitat regional hydrogeological conditions are strictly controlled by the regional geological structure, geomorphology and other conditions. From the regional hydro-geological characteristics such as the distribution of aquifers and groundwater movement, there is a significant difference between the Yellow River - the Xiaoqing River alluvial plain and the hilly area north wing of Tai mountain.

## **V. Earthquake**

Jinan City geological conditions are better, the site soil distribution, layer stability, main silt and silty clay interbedded, the stability of a good venue, and the groundwater of concrete non-corrosive.

According to "*China's seismic intensity zoning map (2000)*", Jinan basic seismic intensity is six. According to the relevant provisions of "*thermal power plant design technology point of order*", the project built (structure) is to build objects by sixth security.

## **. Natural Resources**

### **6.1 Mineral Resources**

There are a variety of rich mineral resources in Jinan City. Some of the mineral resources have great potential, and the development, utilization and matching is in a high degree. For example, limestone, granite, hard refractory clay, dolomite, potash feldspar, iron ore and so on, more than a medium-size, is the advantage of mineral resources in Jinan City. The city's coal-bearing area is 200 square kilometers. 16 sites have been proved origin, to maintain reserves of 331,551,000 tons, long-term reserves of 545.29 million tons. Coal is the dominant

resources in Jinan and the state-owned, collective development production system have come into being. Zhangqiu County is one of China's major coal-producing county.

**Regional pressure mine problem does not exist in the project.**

## **6.2 Biological Resources**

There are 1175 species and varieties vegetation flora in Jinan, belonging to 149 families, of which there are 12 families and 18 species of ferns, 7 families and 21 species of gymnosperm, 106 families and 870 species of dicotyledonous, 24 families and 266 species of monocotyledon. And there are 382 species of wild plants accounting for 33 percent of plant species and 793 species of cultivated plants accounting for 67 percent of plant species. Jinan flora ingredients are dominated by North China ingredients, and there are also other subtropical ingredients, many of which are larger extent ecological species. In addition ingredients from the Northwest, Northeast, Japan and Occident exit too. Jinan wild animal resources belong to terrestrial animals, feeding animals and freshwater fauna. Its floristic element is North China and Huanghuai Plain.

The project areas are located in Jinan City with only a small amount of green vegetation and more scarce animal resources.

## **Profiles of the Social Environment (Social and Economic Structure, Education, Culture, Heritage Protection, etc.):**

### **I. The Social Environment Overview**

The project is located in Jinan City, with the pipelines laying rather broader scope. The social environment of Jinan City is as follows:

There are 6 Districts, 3 Counties and 1 City under Jinan domination. The total acreage is 8177 square kilometers, with a total population of 6,030,000, of which built-up area covers 220 square kilometers and a population 2,700,000.

In recent years, under the strong leadership of the central and provincial party committee, the city from top to bottom have taken Deng Xiaoping Theory and "Three Represents" as guidance, and the scientific development concept as a guide, thoroughly implement the Sixteenth Congress of the Chinese Communist Party , Third Plenary Session ten , the fourth , fifth, sixth plenary sessions spirit, full implementation of General Secretary Hu Jintao's "three walking in front " requirements and the deployment of provincial party committee, to play a provincial capital advantages, to promote the development of the capital of the economy,

social harmony and the party building. In 2006, the city's GDP achieved to 218.51 billion Yuan, which increased 15.7 % than last year. And the local finance general budget revenue was 12.84 billion Yuan, with an increase of 21.0% than last year. The total fixed asset investment in the whole society was 101.68 billion Yuan, an increase of 25.0%. The total retail sales of social consumer goods was 939.3 billion, an increase of 16.3%.The urban residents per capita disposable income was 15,340.2 Yuan, and farmers per capita net income 5480.0 Yuan, increased by 13.0% and 13.9% respectively. From January to May this year, the city completed large-scale industrial sales revenue 116.22 billion Yuan, profit taxes 12.03 billion Yuan, profit 6.86 billion Yuan, increased by 28.9%, 46.2%, 69.1% respectively; local finance general budget revenues is 6.433 billion Yuan, an increase of 25%; total fixed asset investment is 33.43 billion Yuan, an increase of 23.1%; total retail sales of social consumer goods is 43.58 billion Yuan, an increase of 16.7%.

## **II. The Overall of Urban Planning of Jinan City(2005-2020)**

### **2.1 The Scope of Planning**

Jinan city is identified as the urban planning area in this programming, which dominates 6 districts with an area of 3257 square kilometers. The scope of Center City Planning is bounded by East Juye River, west to South River, south to the southern two-Eagle's Mountain, Xinglong Mountain area and planning Jilai Highway, north to the Yellow River and the Jinan-Qing Highway, covering an area of 1022 square kilometers. City planning area is all of the administrative area of Jinan City, covering an area of 8177 square kilometers. The project is located in the center of City Planning.

### **2.2 Urban Character and Urban Functions**

It is the capital of Shandong Province, the famous spring city and national historical and cultural city, the South Wing of the Bo Sea region and the central city of middle and lower reaches of the Yellow River District. It has a good foundation. The urban functions need to continue to strengthen and improve are: the capital of Shandong Province, the state historical and cultural city, science and technology, educational and cultural center, the country's major transport hub, regional financial center, the country's major industrial base. It has potential advantages, and the city functions should focus on fostering and highlighting are: the modern service industry and headquarters economy, high-tech industries and advanced manufacturing.

## 2.3 The City Industry Layout

In accordance with the general idea of "raising the central area, strong urban areas, breaking the outer zone", we should actively push forward the regional industrial division of labor and collaboration development, accelerate the City industrial layout adjusting, change the state of aggregation function of the central city, actively guide the traditional industries transferring to the county (city) around the Center City, led the county (city) all-round development of economy and promotion and form a rational layout, clear division of labor, functional outstanding strengths spatial pattern of industrial development.

Around the "East-Extension, west-advance, south-controlled, north-span and middle-evacuate" urban space development strategy, the city of the domain industry starts planning an overall strategy of the implementation of the two wings, crossing the development, and forms the main urban areas that industry gathers to and three industrial accumulation zone of Qingdao in eastern and western Ji-Zheng and Ji-Yan in the north Huang River.

The main urban areas should: adapt to the main urban areas function in order to develop the modern service industry and new Distribution as the main body, gradually weaken industrial production function, positively develop urban-based industries and headquarters economy, attract effectively corporate headquarters, R & D center, sales center, management center located development, improve services and the level of development of social undertakings, promote the city's comprehensive service functions of an effective upgrade. At the same time, a moderate development of non-polluting, low-power, high-tech, high value-added software and other electronic information industrial city is also needful.

## 2.4 The Overall Layout of the City Center

Center City construction land concentrated in the appropriate region between the northern part of the Yellow River and the southern mountain-building, and land use development in the direction based on urban land in the status quo mainly expands to the East and West wings. The planning scope extends eastwards to the border, south-west to Changqing City. The planning scope of the Center City from 526 square kilometers extends to 1022 square kilometers.

Center City spatial structure is "one city two districts". "One City" is mainly urban areas, and "two areas" are the Western District and Eastern District. Main City is east of Yufu River, west of East Link freeway beltway and between the Yellow River and the southern mountain.



Western City is west of Yufu River. Eastern City is the region east of the East Link of the beltway City Expressway. Between the phase segregation of the main urban areas, the Western District and Eastern District is the green space.

## **2.5 Urban Infrastructure - Heating Planning**

Building a clean energy-saving city. Energy exploitation and conservation develop simultaneously with the conservation in the first place. Protect and rationally use energy according to the law, improve energy efficiency and achieve sustainable development.

Adhere to the coal-based, supplemented by other energy heating energy structure. Strive to improve the urban central heating popularity rate. Center City central heating popularity rate will be more than 70% and hot load will reach 6,900 megawatts in 2020.

(1) Build West Thermal Power Plant; transform Huangtai plant, Zhangqiu plant; maintain the existing scale of the Northern Suburb Thermal Power Plant. Four sources of heat is used as central heating system, and build a water pipeline network and the Southern Suburbs Thermal Power Plant, Zhangjin, Suncun peaking boiler room and so on.

(2) Build Changqing Thermal Power Plant with steam boiler room as the second net peak, and build the hot water pipe network system of Western District.

(3) The Southern Suburbs Thermal Power Plant, Jinjiling Thermal Power Plant and hot water boiler serve as the heating source in the building of the southern pipeline system.

(4) A regional coal-fired boiler room or decentralized clean energy and other heating methods are adopted in the edge region and the region the heating pipe network hard to reach, and the use of industrial waste heat and renewable energy heating are actively encouraged.

(5) "Water instead of vapor" is carried out for the status quo steam pipe network, and hot water heating pipe network is adopted. Steams, hot water pipes are directly buried.

The project located in Jinan urban area is water instead of vapor engineering, belonging to urban infrastructure construction projects. It will help energy-saving and emissions reducing, improve the utilization rate of resources, be conducive to build a resource-conserving and environment-friendly society and in line with the Jinan City overall planning.

## **III. Heat Planning of Jinan City (2005 -2020)**

### **3.1 Planning Scope**

Planning range of Jinan City is what is determined in Overall Plan "2005-2020". Center

city is east to East Juye River, west to South Dasha River, south to the northern margin of the southern mountains, north to the urban area boundary. The planning scope is 1807 square kilometers, of which 450 square kilometers of land is for center city construction purposes.

### 3.2 Heat Pipe Network Planning

Heating Range: the center of the city determined by the overall urban planning of Jinan, (including 1 city 2 district 1 corps);

Heating mode: full use of heating hot water pipe network in Center City, use of steam from the laying of a dedicated supply of steam pipes of power plant and boiler room for a small amount of industrial.

Hot water pipe network system: According to the Center City site space layout, the Center City hot water pipe network is divided into major hot water pipe network and the Western District hot water pipe network two parts.

The main heating source within the existing scope includes Huangtai Thermal Power Plant, East New Thermal Power Plant, Southern Suburbs Thermal Power Plant, Northern Suburb Thermal Power Plant, Ming Lake Power Plant and Jinjiling Power Plant, etc.

Planning a multi-network operation of the heat source heating system. Carry out the transformation of water vapor for the old city steam heating pipe network, and steam and hot water pipe network are directly buried. The transformation of water vapor includes:

- (1) Stop using the steam heating pipe network construction;
- (2) Heat exchangers stations are used in the transformation of the end of the steam pipe network. The end steam pipe network after heat transfer station will be changed into a hot water pipe network;
- (3) Combine with self-transformation of the steam pipe network. Some of the status steam pipes networks have been in operation for some years, pipeline corrosion, heat damage, and aging severe. That is to say the status steam pipe network has a self-renewal requirement. Pipe network should be associated with the transformation of the entire steam pipe into a hot water pipe;
- (4) Combine with the transformation path. Urban road use has a number of years. Combined with the transformation of road steam pipe will be replaced by hot water pipe.

**The project is water instead of steam pipe network engineering, hot network Automatic Control Systems Engineering and motor inverter renovation project. It is an energy-saving and emission-reducing project, in line with the Jinan heating planning.**

## Environmental quality condition

### **Construction Projects Location and Major Environmental Issues (Environmental Air, Surface Water, Groundwater, Acoustic Environment, Ecological Environment, etc.)**

The project is located in downtown Jinan City, involving Tianqiao District, Lixia District, Huaiyin District and City Central District. Jinan environmental quality monitoring data bulletin in 2007 is directly used as the status quo of environmental quality.

#### **I. Atmospheric Environment**

According to "the environmental quality bulletin of Jinan City in 2007", the major ambient air pollutants of Jinan City in 2007:  $PM_{10}$ ,  $SO_2$ ,  $NO_2$  annual average concentrations were  $0.118 \text{ mg/m}^3$ ,  $0.056 \text{ mg/m}^3$ ,  $0.023 \text{ mg/m}^3$ .  $SO_2$ ,  $NO_2$  reach national ambient air quality standard Class II, and  $PM_{10}$  exceed the national ambient air quality standard Class II of 0.2 times.  $PM_{10}$  is the primary pollutants for ambient air quality in Jinan City.

#### **II. Surface water environmental quality**

According to "The environmental quality bulletin of Jinan City in 2007", seven monitoring sections are set up in Xiaoqing River Jinan paragraph, and 20 indicators are monitored monthly. Mulizhuang-section in the source water quality reaches the national surface water environmental quality standard Class III, and the remaining six sections have a number of indicators to monitor more than the surface water environmental quality standards Class V, belonging to the type of inferior V water body. Chemical oxygen demand, biochemical oxygen demand, ammonia nitrogen and total phosphorus annual average concentrations of Xinfengzhuang- exit cross-section exceed the surface water environmental quality standards Class V, and excessive in multiples were 0.8 times, 0.9 times, 9.5 times and 2.5 times, so the water is still characteristics of organic pollution.

#### **III. Groundwater quality**

According to "the environmental quality bulletin of Jinan City in 2007", it maintains a good status of groundwater quality. 23 indicators were monitored respectively in Dayangzhuang and the eastern suburbs waterworks. And the average annual value of the

indicators meets the national groundwater quality standard Class III.

#### IV. The sound environment

According to "*The environmental quality bulletin of Jinan City in 2007*", in 2007 in Jinan urban regional environmental noise diurnal average equivalent sound levels 53.2dB, and night-time average equivalent sound levels 43.0dB. Compared with the previous year, it drops 0.7dB in the daytime and 1.4dB in the night. It maintains a good quality acoustic environment in urban region.

#### The Main Environmental Protection Objectives (Listed in the List and the Level of Protection):

The project is located in Jinan City. The main targets for the protection of sensitive are enterprise business units and the residential area around network and so on. See Table 16.

**Table 16 the main list of sensitive conservation objectives around the projects**

Serial number	Name	Direction	Shortest distance ( m )	population ( person )
<b>1 the Thermal Power Plant Project in Southern Suburbs</b>				
1	Jinan High School	north	20	4500
2	Railway Southern Dorm	south	35	1200
3	Railway Area	north	20	1600
4	Science and Technology Community	south	35	150
5	Shandong University of Traditional Chinese Medicine First Affiliated Hospital	north	20	450
6	Jinan Railway Center for Disease Control and Prevention	south	50	210
7	Chinatown Congee House	east	15	200
8	West Village of Shandong University	east	30	1600
9	Baotou Spring Community	north	30	1500
10	Qilu Hospital	north	20	500
11	Shandong Medical University	south	20	15000

12	Shandong Theater	north	20	200
13	Xujia Garden	north	20	1400
14	Science and Technology Museum of Jinan	south	30	100
15	Jinan National Hospital	north	15	150
16	Shandong Province Drug Institute	north	15	60
17	Gannan Community	south	50	2300
18	Hongjian Garden	west	15	2000
19	Liangjiazhuang residential area	east	15	7500
20	Cement factory dorm	south	50	2000
21	city administration enforcement station	east	15	500
22	Guanyu Ming Court	west	15	1500
23	Urban Construction Hotel	east	15	100
24	Desheng Home	east	15	2500
25	Jinan Inland Revenue dorm	west	15	1800
26	Jianyuan Garden	west	15	3000
<b>2 Northern Suburb Thermal Power Plant Project</b>				
1	Mental Hospital	southwest	120	450
2	Hongye Community	southwest	140	1300
3	Majiazhuang residential area	east and west two sides	15	6500
4	Luokou New Village	west	110	3400
5	Xiangmolijiazhuang	north	25	1450
6	Jinniu Community	north	25	2300
7	Jinan Zoo	south	50	450

8	Jinge Garden	north	50	2400
9	Jinge Kindergarten	north	150	260
10	Tianheyuan Community	north	20	1500
11	Tianqiao District Jinniu Primary School	north	35	350
12	Yuan Zhuang Community	east	25	2600
13	Lujiazhuang	west	100	1450
14	Jinan Tianzhi Hospital	east	15	530
15	Xihouzhuang	west	50	1200
16	Wangluzhuang	west	30	1000
17	Yao Mountain High School	west	60	600
<b>3 Minghu Thermal Power Plant Project</b>				
1	Daming Lake Scenic Area	north	20	500
2	Provincial Control Room	north	20	230
3	Provincial Government	south	30	1500
4	Shandong Province Institute of macro-economic	south	30	120
5	Children's Library in Shandong Province	north	20	100
6	Shandong Province Library	north	20	210
7	Jinan Daming Lake Road Primary School	south	30	500
8	Shandong State Hospital	south	30	320
9	Jinan Art School	north	25	1500
10	Lake Guest House	south	30	420
11	Houzai Gate Community	north	20	1350
12	First People's Hospital of Jinan City	south	20	600

13	Luxin Media Investment Building	south	30	450
14	Ming Lake Community	south	60	5000
15	Lixia District Internal Revenue Service	south	30	180
16	Provincial Authority Station dorm	north	20	3500
17	Changsheng Community	east	50	2000
18	Unions Management Institute of Shandong province	east	50	1800
19	Ming Lake Road Subdistrict Office	west	20	35
20	Caishizhuang	north	30	300
21	Cultural Affairs of Lixia District Department	north	30	140
22	Jinan fortieth High School	east	30	650
23	The second living room café	west	15	120
24	Sanlian Mall	west	15	450
25	Province Official Residence Front Street Community	east	20	1900
26	Provincial People's Congress dormitory	east	10	800
27	Provincial Control Room dorm	west	10	1200
28	Hibiscus Street residential area	east	10	1000
29	Shandong Statistics Bureau dorm	west	10	600
30	Eastern area of Ming Lake Community	east, west	10	3500
31	Quancheng High School in Shandong Province	east	15	500
32	Ming Lake Streets Government Office Building of Lixia District	west	15	750
33	Education Bureau of Lixia District Jinan City	east	15	110
34	Zhenzhu Spring Primary School of Jinan City	east	10	500
35	River Affairs Bureau office of the Yellow River in Shandong Province	east	10	200

36	The Yellow River Affairs Bureau Huangting dorm of Shandong province	east	10	450
37	Lixia District People's Hospital of Jinan City	south	40	200
38	Jinguan Garden	east	50	2600
39	Celebrity Court	east	30	1500
40	North Tan Community	west	30	2400
41	Zhijin City Community	east	30	5000
42	Tiantan Hospital of Jinan	west	70	400
43	Jihua Building	east	15	600
44	Juxian Street residential area	west	40	3000
45	Huanggang dorm	west	50	1200
46	Haojia Lane residential area	east	40	1500
47	Jinan City Court Judge Training Center	west	30	600
48	Jinan Municipal Public Security Bureau Security Police detachment quarters	west	30	850
49	The People Shopping Center and the Sun Gold Shop	west	60	600
50	Jinan City Commercial Bank	west	30	60
51	Ginza Crystal Mansion	east	40	5000
52	Jinan Municipal Public Security Bureau gangue Bridge quarters	west	30	1250
53	Jinlong Building	east	15	350
54	Five Dragons Pool Park	north	30	120
55	Chinese Medicine Hospital of Jinan City	south	50	600
56	Hui people District	south	20	1500
57	Insurance Companies Life Insurance Company	south	20	450
58	Dazhaozhuang	south	30	1500



59	Ming Lake Court	north	50	1200
60	Ming Lake Shores Court	south	30	2500
61	Baihe Garden	north	60	3600
62	British Grand International Trust	south	50	800
63	Guanyi Subdistrict Office	south	50	2400
64	Experimental High School dormitory	south	50	1200
65	Weijiazhuang Community	south	40	2000
66	Fuya Home	west	10	280
<b>4 Jinjiling Thermal Power Plant Project</b>				
1	Technical schools of Jinan City real estate	west	200	6000
2	Women's Federation Cadres School	southwest	320	4500
3	Tuwu resettlement Housing	southwest	50	3500
4	Sun City	east,west	20	30000
5	Xinxin Home	east,west	50	5000
6	Provincial-sun Lake Community	east	40	3200
7	Sun City South Wind House	west	50	2500
8	Sun City Zhonghua Court	southeast	50	3000
9	Provincial People's Congress three quarters	east	50	2300
10	West Baliwa residential area	west	80	3400
11	Shandong Institute of Socialism	east	50	8000
13	Unity Building	east	50	1200
14	Shandong Construction Engineering Shun Court	south	20	1500
15	The fourth soldiers rest house	west	50	600

16	Authorities of Jinan City Training Center	south	50	850
17	Ginza Bilingual Kindergarten	west	100	150
18	north district of Yuhan	north	30	5000
19	south district of Yuhan	south	30	6000
20	Provincial Commission for Discipline Inspection Quarters	west	30	300
21	Railway Area	north	30	5000
22	Special Education Center	north	30	500
23	City real estate	South and north two sides	20	5000
24	Weidongxindu	north	20	5000
25	Jinglu Villa	south	20	1500
26	Jinan University West Campus	north	50	15000
27	Maple Leaf Hotel	north	60	620
28	Medical schools in Shandong Province	south	80	1200
29	Shanjingyuan District	north	20	850
30	Xinyunwosen Villa	south	50	1240
31	Fire Safety Training Center of Jinan City	west	20	800
32	Fengyueting Villa	west	20	1450
33	Railway Nanyuan Area	south	100	2400
34	Jingya Hotel	west	20	500

## Evaluation of Applicable Standards

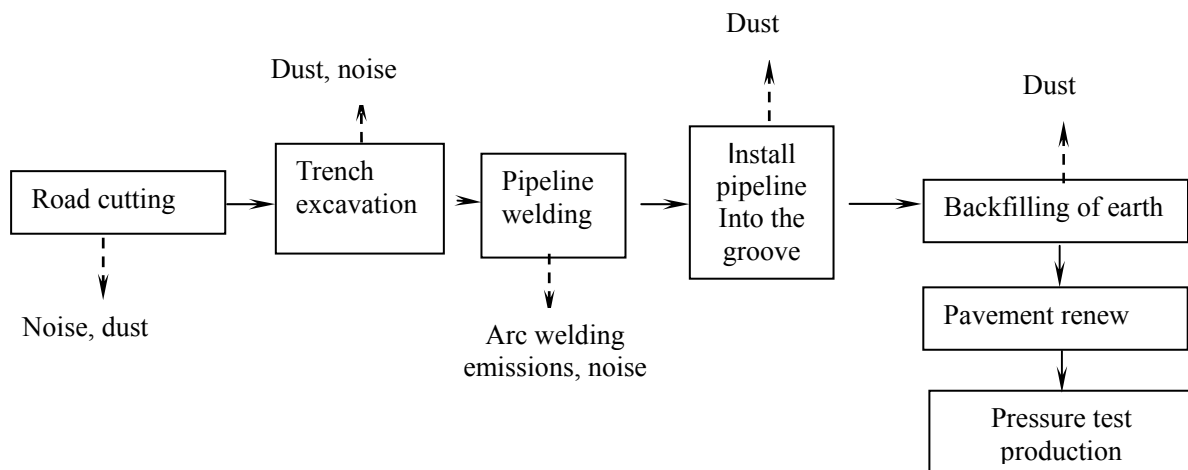
Environmental Quality Standard	<p>(1)GB3095-1996 "<i>Ambient Air Quality Standard</i>" Class Ⅱ is implemented for Ambient air.</p> <p>(2)GB3096-2008 "<i>Voice of the Environmental Quality Standard</i>" Class 1, Class 2 and Class 4 District Standards are implemented for environmental noise.</p> <p>(3)GB/T14848-93 "<i>Groundwater quality standards</i>" Ⅲ and Ⅳ criteria are implemented for groundwater.</p> <p>(4)GB3838-2002 "<i>Surface Water Environmental Quality Standard</i>" Ⅲ Class Standard is implemented for surface water.</p>
Pollutant emission standards	<p>(1)GB12348-2008 "<i>Noise standards at boundary of industrial enterprises</i>" classⅡ, classⅢ and class Ⅳ District Standards are implemented for environmental noise.</p> <p>(2) "<i>Construction Boundary Noise Limits</i>" (GB12523-90) is implemented for construction noise.</p> <p>(3)GB16297-1996 "<i>Integrated emission standard of air pollutants</i>" classⅡ is implemented for exhaust steam.</p> <p>(4) "<i>General industrial solid waste storage, disposal, pollution control standards</i>"(GB18599-2001).</p> <p>(5) "Water pollutant discharge standard of Xiaoqing River in Shandong Province" (DB37/656-2006).</p>
Total control Indicators	There are no COD <sub>cr</sub> and SO <sub>2</sub> emissions in the operation period, so there is no need to apply for total control Indicators.

## Analysis of Construction Project

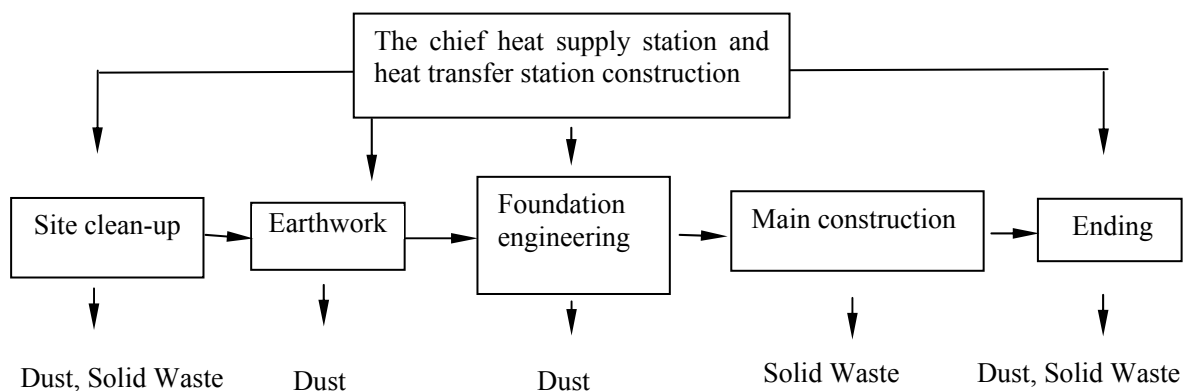
### Process Outlined (Icon)

#### Construction period:

Pipeline and the heat transfer station construction process and sewage produced processes showed in Figure 1 and Figure 2.



**Figure 1:** Pipeline construction and sewage produced processes diagram



**Figure 2:** The chief heat supply station and heat transfer station construction technique process diagram

**Operation Period:**

Operation period of this project is simple, no longer to carry out that process icon.

**The Main Polluting Process:****Construction Period:****1. Major pollution processes of exhaust gas**

(1) Dust caused by the construction process of earthwork excavation, on-site stacking, earthwork backfilling.

(2) Dust left behind during the delivery of earthmoving vehicles.

(3) Harmful gases and welding fume caused by electric welding machine during the stage of pipeline welding.

(4) Exhaust gas from construction machinery, transportation machinery and equipment, the main pollutant are NOX, THC.

**2. The main pollution process of wastewater**

The construction period is expected to peak of 200 people per day. With reference to “*Environmental impact assessment norms of highway construction project (for trial implementation)*”, the domestic waste water volume of the builder generated daily is 60L / d. On this basis, the living waste water daily average volume is 12m<sup>3</sup> / d.

**3. The main noise polluting process**

(1) Construction machinery is the main noise source, mainly occurred in the ducts excavation, small piling, concrete mixing, and transportation of earthwork, concrete pavement crusher, roller and drilling process. The noise level is about 80 ~ 95dB (A) .

(2) Noise generated by transport vehicles.

**4. The main polluting process of solid waste**

(1) Construction spoil stone, abandoned pipelines and abandoned heat exchanger.

(2) Domestic waste generated by the builder.

**Operation Period:**

The project includes water instead of vapor pipe network engineering, heat supply network automatic control systems engineering, electrical inverter renovation project, and the

project does not add labor quota, calls Jinan Thermal Power Plant Factory Co., Ltd. staff directly. Therefore, the impact to surrounding environment is less after the project completed, and the main impacts are from variety of pumps, motors and heat exchangers and other equipment running noise in heat exchanger station (chief heat supply station). The noise level is about 80 ~ 90dB (A).

## The Major Pollutants Produce and Estimated Emissions Situation of the Project

Content Types	Emission sources (No.)	Pollutant name	The concentration and production before treatment(units)	Emission concentration and emissions (units)
Atmospheric pollutants	Earth excavation, pipe welding and vehicle transport	Dust, welding fumes and a small amount of NO <sub>x</sub> , hydrocarbons and CO, etc.	Unorganized emissions	--
	Operating period	--	--	--
Water pollutants	Construction waste	COD <sub>Cr</sub> , SS and oil	COD 300mg/L BOD <sub>5</sub> 150mg/L SS 150mg/L	Into the municipal pipe network or treatment for the dust after treatment
	Operating period	--	--	--
Solid Waste	Earth excavation, structure construction, etc.	Construction waste, scrap pipe and waste heat exchanger	Recycling or utilization	Reasonable disposition
	Operating period	--	--	--
Noise	Construction period: Monomers are in general sound level 80dB (A) above such as concrete mixer, excavator, road breakers, broken up, etc.			
	Operating period: The sound pressure level of equipment noise such as the first stop of heating and various water pumps of heat exchanger stations, heat exchangers and electrical equipment is about 80 ~ 90dB (A) around.			
Others	Nothing			

### The Main Ecological Impact

The eco-environmental impact of the project is mainly the impact of the construction period.

The project pipeline laying operations are short-term temporary land, and construction sites are mostly urban roads. In the excavation process it will cause the exposed surface and increase soil erosion and soil and water loss. Project construction has little effect on the city vegetation.

The main natural scenic spots close-up of this project is Daming Lake, Jinan Zoo, and Five Dragons Pool and so on. Taking measures after the construction was less affected on natural scenic areas such as environmental protection objectives.

Comprehensive analysis, the project during the construction has little effect on the

ecological environment of urban areas, and also through the adoption of the corresponding ecological protection and restoration measures, especially through the construction management and strengthening protection and restoration of the construction period. The impact of this project construction on the ecological environment is acceptable.



## **Environmental Impact Analysis**

### **I. Construction Period Environmental Impact Brief Analysis**

The environmental impact of construction period mainly includes construction dust's impact on environmental air, noise, waste water, solid waste's impact on surrounding environment. Concrete analysis shows as follows:

#### **1.1 Environmental Air Impact Analysis**

##### **1.1.1 Raising Dust Impact Analysis**

Construction vehicle transport all can generate raising dust, most section of the road is grooved during pipeline network construction procedure, so there will be a mass of backfill and part spoil on the ground, when a wind arise, they will form raising dust. So the surrounding resident and enterprise and public institution along the construction line all have fence, and avoid high winds weather to the greatest extent; the raising dust in construction field and construction road can be prevented by regular watering and sweep-out measures. So the every construction field need has a sprinkler and a vehicle with top cover to transport building rubble and earthwork, the transport vehicle can not overload and appointed man sweep out the transport road to prevent spilling construction solid waste. During dry season, watering must be done once in the morning and afternoon to keep road surface wet. Cement and pale grey must be stack in sealed type. Strengthen the management of construction site, if the management measures is appropriate, the amount of raising dust will reduce by 50~70%, which will greatly reduce the impact on surrounding environment.

We should choose the construction organization with certain strength and adopt commercial mixer cement and enclosed transport vehicle. We should strengthen management and construction in civilized manner, loading and unloading building material carefully. For temporary and fragmentary mixer cement site, we should move to the low-lying filling Site appointed by municipal administration departments.

During construction period, the restraining dust measures shows as follows:

(1) Fix fence in construction field and regular watering every day to prevent generating floating dust, when heavy wind arise, we need increase watering amount and add number of times.

(2)Transport channel in construction field should be cleaned, washed in time to reduce raising dust generated by automobile.

(3) The transport vehicle should run in low speed in the construction field or run in restricted speed to reduce the amount of generating dust.

(4) The field where earthwork stacks should be chose reasonably and not be in principal windy direction, concrete mixer should fix in a shed, the cement and sand spilled by mixer should be often cleaned, construction spoil should be move in time and the outbound vehicle should covered with tarpaulin to reduce spilled along the road.

(5) Avoid dusting raw or unprocessed materials, such as the cement, sand, lime is stacked in the open air.

(6) All multi- materiel which is in construction field should be covered with canvas and is transported with automobile with fan cover.

(7) Construction organization should implement cleaning institution for road before construction field environment. Some spoiled dust and building materials should be cleaned in time.

The above measures are taken, construction period has less impact on surrounding environment air, and the construction period is short. The impact will disappear along with the end of construction period.

### **1.1.2 Construction machine off-gases and electric welding flue gases impact analysis**

Construction vehicle and construction machine will generate some waste gas during running process. The concentration of waste gas has great relationship with vehicle model number, fuel type and vehicle condition. We adopt low energy consumption, Low pollution and emission construction vehicle and machine, these vehicles out of waste gas emission limits should fix Tail gas cleanup unit. Strengthen the management and maintain of vehicle and machine to reduce air pollution caused by vehicle and machine condition.

Electric welding flue gases is mainly generated in pipeline installed and welded stage, welding machine will generate welding fume and harmful gas in running procedure, these gases are fugitive emission, the amount of flue gas is small and construction field is plain, which is beneficial for flue gases spread.

By analogy and reckon, dust concentration around construction field can arrive the “*Integrated atmospheric pollutant discharge standard*”, the new extension and renovation secondary standard in GB16297-1996.

## 1.2 Noise Environmental Impact Analysis

The noise of building operations is major pollution factor during construction period, these noise mainly come from construction machine and transport vehicle, this main devices that generate noise are concrete mixer, grab, pavement breaker, triturate and so on. A single machine sound level is generally above 80 dB (A), which will take some influence on the environment. The mechanical equipments vary from different stages during construction period. The noise source's characteristics also have differences, so it is difficult to precisely calculate construction field noise. "Noise Level Limits Standard in Building Operations" (GH12523-90) proposes different requirement for different construction period. No construction in nighttime during piling period. The influence range of construction machine is 60m in daytime and 180m in nighttime referred to the same type of construction machine's noise influence predictable conclusion.

Because enterprise and public institution and resident district around the project have many sensitive objectives, so the noise has great influence on these objectives. According to the Regulations of "Noise Level Limits Standard in Building Operations" (GH12523-90), we must strictly observe relevant regulations during construction period. Meanwhile, constructional organization should pay attention to control construction time and reasonable arrange construction order and arrange all construction machine and transport vehicle in daytime, notify the organization disturbed by construction ahead of time and report construction progress and measures for reducing noise, and ask for public's common understanding.

Noise control and measures adopted during construction period are shown as follows:

(1) Arrange construction time reasonable: when construction organization formulate work plan, they should avoid many strong noise devices work at the same time as far as possible and the surrounding environment sensitive time to noise, reduce the construction in nighttime. Incise the road and excavate pipe should arrange in daytime as far as possible and strong noise should not use in late night (22:00-06:00). Speed up construction progress and cut down days for construction.

(2) Lay out construction field: Set up construction field away from sensitive goal, avoid the influence on closed sensitive object and set up temporary noise barrier to reduce pollution.

(3) Lower equipment sound level: construction organization select low noise equipment as far as possible; Reduce noise by vent-pipe blow-down silencer and separating the vibration component of engine; maintain and conserve powered mechanical equipment to reduce the

noise which is caused by these loose components; Shut down idling equipment immediately; transport vehicle speed-down when they enter site and reduce whistle.

(4) Build temporary sound barrier: the mechanical equipment that has relatively stationary position should set up in shed as much as possible and set up single-side sound barrier.

The above measures is taken, construction period has less noise impact on surrounding environment sensitive object, meet the standards (GB3096-2008)for acoustic environmental quality for different function areas.

### **1.3 Water environmental impact analysis**

The discharge of domestic sewage in the worker's living district of job location is mainly waste water during the construction period. The major contaminations are COD、BOD<sub>5</sub>、SS etc. The amount of water is about 12m<sup>3</sup>/d in rush hours. The water quality characteristics of wastewater are COD300mg/L, BOD<sub>5</sub>150mg/L and SS150mg/L. The existing domestic installations around the construction site should be employed as far as possible. The waster water should be drained into municipal sewage plant the through the municipal network to be treated. Moreover, the construction party will treat water by the movable miniature one integrated domestic wastewater treatment facility. The treated water should meet the comprehensive discharge primary standard of sewage, and then be used for falling dust during the construction period.

Construction unit should strengthen the water management and reduce the consumption of fresh water and put a stop to the fugitive emission of water. Moreover, for eliminating the rainwater's influence to pulverulent construction materials and avoiding the materials to flow into the neighboring rivers through the channels and then effect the environmental quality of surface water, the construction materials, especially pulverulent construction materials should be covered by shed or stored in the existing unoccupied buildings in the factory during the rainy season for avoiding being washed out by the rainwater and then polluting the water environment.

### **1.4 Solid waste environmental impact analysis**

The solid wastes are mainly the home scrap of workers, the brick rubbish due to the construction of earthwork, aggregate, the original abandoned pipeline and heat-exchanger and the loss of the materials including sand rock, concrete during transportation and the loss and

abandon of building stone, clinker and building materials during paving and finishing. The procreant solid waste should be piled up on the fixed-point and regulated. The recyclable waste should be recycled while the unrecyclable waste should be cleared and transported by city sanitation department for the treating. So there is little influence to the surrounding environment.

What is more, the soil is spilled when it be loaded and transported by vehicles. The soil stained with wheels will lead to highway with soil. So we should pay attention to handle the spoil of construction road. The spoil should be cleared in time.

The home scrap is piled up on the fixed-point and then be cleared and transported by city sanitation department regularly.

So the solid waste produced in the construction period will not cause great influence to the surrounding environment.

### **1.5 Ecological environmental impact analysis**

In the construction period, the influence to ecological environment is mainly caused by heat-exchanger stations (including heating exchanger origin stations) and construction of pipe network. The aiming project will lead to surface baring and hardening thus effecting the ecological environment. But due to the construction sections mostly belong to highway, the site of original heating exchanger stations and the yards of heat source plants, there is little influence to the urban vegetation. In this area, no rare or endangered and extraordinary species exist. So the development of this project will not lead to the reduction of species in this area. There is little influence to the biomass and species in the whole area.

### **1.6 Transportation impact analysis**

In the construction period, the transportation of equipments and materials will effect the road normal operation. The construction will make vehicles be hinder. At the same time, the stacking soil and construction materials will narrow the road. The dust is blowing in a sunny day while the road will be silting and slippery in a rainy day, which will lead a jam and chaos to the traffic. A serious traffic jam happened easily.

The construction unit should consider this factor when plan the program, the cutting, pipe laying and backfill will be finished as soon as possible. Toward to the very hectic road, the work time should keep away from the rush hour. (For example: people should work at night to guarantee a free flow of traffic in daytime)

## **1.7 Townscape impact analysis**

In the construction period, the cutting of urban roads, the spoils and waste slag and stacked along the way, in a rainy day, the spoils, dregs and construction materials which are washed by rainwater and roller compacted by vehicles will mire the road. All factors will influence the townscape and nattiness.

Summing up the above, because this project will last 18 months, there will be a certain influence to the surrounding environment, and the influence will disappear when the construction period ends. Builders should be asked adopt corresponding prevention and cure measures to reduce the influence to the surrounding residents and enterprise and public institutions in the construction as far as possible. Advocate work in a civilized manner and organize a conference of construction unit , highway department and home owners. The problems which influence the environment will be coordinated and solved in time.

### **. Environmental impact analysis in the operation period**

During the operation period, the major pollutions are all kinds of water pumps, electric motors and heat-exchangers in the initial heating stations and heat-exchanger stations. The noise which caused by the work of these equipments will take an influence on the surrounding environment. The sound level is about 80~90dB (A).

Measures should be adopted during all parts from noise source to receptor (resident) to control the heat-exchanger station noise, namely the principle that control pollution in the overall process. No receptor (resident), so measures should be adopted to source and the route of transmission. Source control mainly includes of machine set, the route of transmission control mainly includes vibration isolation of pipe and support. Aim at the characteristic of noise source, the following measures should be carried out.

1. The noise of equipments made by manufacturing companies is not more than the designed standard value when we order the equipments.
2. When the equipment and pipeline are designed, we should pay attention to the shake proof and attack proof thus alleviating drumming noise.
3. An isolated foundation and measures taken to prevent the vibration are necessary for the water pump and electric motor.
4. Choose the heat-exchanger station site reasonable. Keep away from the sensitive objectives. Take measures such as sound insulation and absorption on the heat-exchanger

room.

By carrying on the above measures, the quality of noise meets “*Noise Standard for Industrial undertaking* (12348-2008)” for different function areas.

## Plan to carry out prevention and cure measures and Expected govern Effect of construction project

Content Type	Emission Source ( Number )	Contamination Name	Measures	Expected Effect
atmospheric pollutant	Excavate cubic meter of earth and stone, seal pipeline and vehicle transport	Raising dust, jointing soot and a little NOx, hydrocarbon and CO	Watering to reduce dust and set up fence measures	Drop the effect to the lowest
	Operation period	--	--	--
Water pollutant	Waste water during the construction period	CODcr、SS and the kind of oil	Make use of the existing domestic sewage treatment equipments one integrated domestic wastewater treatment facility then used for falling dust	No emission
	Operation period	--	--	--
Solid waste	The cutting of earthwork, structure construction	Building waste, abandoned pipeline and heat-exchanger	multipurpose use	Handle reasonable
	Operation period	--	--	--
Noise	Construction period : Concrete mixer, grab, pavement breaker, triturate and so on. A single machine sound level is generally above 80 dB (A), and take these measures that include laying out construction field and arrange construction time reasonable, build temporary sound barrier to meet the regulations of “ <i>Noise Level Limits Standard in Building Operations</i> (GH12523-90)”.			
	Operation period : Water pumps, electric motors and heat-exchangers in the initial heating stations and heat-exchanger stations. The noise which caused by the work of these equipments will take a influence on the surrounding environment. The sound level is about 80 ~ 90dB(A). By carrying on the measures that include sound insulation and absorption, shake proof, the quality of noise meets “ <i>Noise Standard for Industrial undertaking</i> (12348-2008)” for different function areas.			
Others	No			

### Ecological protection measures and expected effects:

The construction period lasts very short. The influence to the surrounding ecological



environment is limited. Define the construction range and route, which can not be enlarged according to one's wishes. Operate following regulations. The construction will avoid the rainy season and heavy windy day. In the construction, the project should be finished section by section. The cutting, the transportation, the cover and the press should be finished at the same time. No loosen group will be left. The section which vegetation was destroyed in the construction should be resumed in time. The measures alleviating the water loss and soil erosion should be carried out. After the construction, the original ecological environment will be resumed. There is little influence to the surrounding ecological environment.

## Conclusion and Suggestion

### I. Conclusion

#### 1. Construction project profile

This project mainly includes Jinan Thermal Power Co., Ltd. comprehensive energy-saving renovation project (namely substitute water pipeline for steam pipeline project), Jinan Thermal Power Co., Ltd. thermo-network automatic control system project and Jinan Thermal Power Co., Ltd. electric motor frequency reconstruction project. This project was undertaken by Jinan Thermal Power Co., Ltd. The company was merged by Jinan southern suburb Thermal Power Plant, Jinan northern suburb Thermal Power Plant and Jinan Minghu Thermal Power Plant in the March 2008. It is a State-owned unincorporated enterprise financed by Assets Supervision and Administration Commission of Jinan. Steam, hot water and electricity are the primary business.

This project locates Shandong Jinan Centric City. The pipe network covers Tianqiao District, Lixia District, Huaiyin District and Centric City. The total investment was 521.58 million Yuan. Environmental protection investment was 8.96 million Yuan, taking up 1.7% of total investment. The character of construction is technical renovation. Duty type: 120 days per year, 24 hours per day and 2880 hours per year. No new persons were added in the project, and the workers were rearranged by Jinan Thermal Power Co., Ltd. The total length of pipeline is 70.53km.

#### 2. Project Industrial policy Compliance

According to “*Catalogue for the guidance of industries structure adjustment(2005)*” and “*catalogue for the guidance of industries structure adjustment(2007)(exposure draft)*”, this project belongs to the encouraged nineteenth category (urban infrastructure and real estate) items 8: urban central heating construction and renovation engineering and the twenty-sixth category (environmental protection and resources saving comprehensive utilization) items 34: the development and application of those technologies of energy-saving, water-saving, environmental protection and resources comprehensive utilization, and this project conform to national industrial policy.

### 3 Current situation of environmental quality

According to “*Jinan environment quality bulletin in 2007*”, the major contaminations SO<sub>2</sub> and NO<sub>2</sub> in environment air reach national secondary standard. PM<sub>10</sub> exceeds 0.2 times as much as national secondary standard.

Seven monitoring sections are set up in Xiaoqing River Jinan segment. Only in the headstream section (Muli Village), the water quality reaches national environmental quality standards for surface water third standard. In other sections, there are several indexes that have exceeded national environmental quality standards for surface water fifth standard. They belong to the inferior fifth standard water.

The groundwater qualities in Jinan keep in a good condition. 23 indexes are monitored in Dayang Village Water Plant and Eastern Suburb Water Plant. Every average monitoring data per annum all reach national environmental quality standards for groundwater third standard.

In 2007, the equivalent sound level is 53.2dB in the daytime, while the equivalent sound level is 43.0dB at night in Jinan. Compared to the last year, the level drops 0.7dB in the daytime and 1.4dB at night. The acoustical environment quality in Jinan keeps in a good condition.

### 4 Environmental impact analysis during construction period

(1) The main waste gases that are generated during construction procedure include the raising dust generated by excavating cubic meter of earth and stone, stacking in the field, backfilling cubic meter of earth and stone and tail gas of transport vehicle, and jointing flue gases generated by welding pipeline. By carrying out these measures that include regular watering in construction field and transport, cleaning in time, earthwork stacks in closed type, setting up fence, managing the transport vehicle strictly, we have little impact on surrounding environment.

(2) The construction noise is the principal pollution factor during construction field, which mainly come from the construction machine and transport vehicle. By taking these measures that include laying out construction field and arrange construction time reasonable, build temporary sound barrier, we have the lowest noise impact on surrounding environment

(3) The discharge of domestic sewage in the worker's living district of job location is mainly waste water during the construction period. The existing domestic installations around the construction site should be employed as far as possible. The waste water should be drained into municipal sewage plant through the municipal network to be treated.

Moreover, the construction party will treat water by the movable miniature one integrated domestic wastewater treatment facility. The treated water should meet the comprehensive discharge primary standard of sewage, and then be used for falling dust during the construction period. Construction unit should strengthen the water management and reduce the consumption of fresh water and put a stop to the fugitive emission of water. So there is little influence to the surrounding environment.

(4) The solid wastes are mainly the home scrap of workers, the brick rubbish due to the construction of earthwork, gravel, the abandoned original pipeline and heat-exchanger and the loss of the materials including sand rock, concrete during transportation and the loss and abandon of building stone, clinker and building materials during paving and finishing. The procreant solid waste should be piled up on the fixed-point and regulated. The recyclable waste should be recycled while the unrecyclable waste should be cleared and transported by city sanitation department for the treating. So there is little influence to the surrounding environment.

(5) In the construction period, the influence to ecological environment is mainly caused by heat-exchanger stations (including heating exchanger origin stations) and construction of pipe network. The aiming project will lead to surface baring and hardening. But due to the construction sections mostly belong to highway, the site of original heating exchanger stations and the yards of heat source plants, there is little influence to the biomass and species in the whole area.

What is more, there is a certain influence to the transportation and townscape.

Summing up the above, because this project will last 24 months, there will be a certain influence to the surrounding environment, and the influence will disappear when the construction period ends. Construction unit is asked adopt corresponding prevention and cure measures to reduce the influence to the surrounding residents and enterprise and public institutions in the construction as far as possible. Advocate work in a civilized manner and organize a conference of construction unit, highway department and home owners. The problems which influence the environment will be coordinated and solved in time.

## **5 Environmental impact analysis in the operation period**

During the operation period, the major pollutions are all kinds of water pumps, electric motor's and heat-exchangers in the initial heating stations and heat-exchanger stations. The noise which caused by the work of these equipments will take an influence on the surrounding

environment. The sound level is about 80~90dB (A). Choose low noise equipments. Keep away from the sensitive objectives. Sound insulation, shockproof and sound absorption should be adopted to reduce the influence to the surrounding environment.

## **6 Conclusion**

This project has been put into operation, which can reduce 30% loss during steam transport procedure in primary steam pipeline networks effectively and save energy, decrease the discharge of pollution and save the waste of condensate water and the consumption of fresh water.

This project is conform to national industrial policy and belongs to the encouraged category. The relative measures is taken during the construction period, the influence to the surrounding environment will arrive lowest. The period is very short. And the influence will disappear as the end of the construction period. During the operation period, the major pollution is noise caused by all kinds of equipments in the initial heating stations and heat-exchanger stations. Sound insulation, shockproof and sound absorption will be adopted the influence to the surrounding environment is few. It is feasible from environmental protection standpoint if the measures above could be finished in the construction and operation period.

## **II. Measures**

1. Watering in construction field and transport, cleaning in time, earthwork stacks in closed type, setting up fence, managing the transport vehicle strictly.

2. Arrange construction time laying out construction field and reasonable, reduce temporary the area of temporary occupation and lower device's noise and build temporary sound barrier,

3. Construction unit should strengthen the water management and reduce the consumption of fresh water and put a stop to the fugitive emission of water.

4. The building solid waste and home scrap produced in the construction period will be handled reasonable.

5. The construction will avoid the rainy season and heavy windy day. Range the construction speed reasonable. The measures alleviating the water loss and soil erosion should be carried out. The cutting, the transportation, the cover and the press should be finished at the same time. No loosen group will be left.

6. In the heat-exchanger station and initial heating station, the low noise equipment is adopted. Prevention and treatments such as shock absorption, sound insulation and sound absorption will be carried on.

### **III. Suggestions**

1. Construction unit should get well with the surrounding enterprise and public institutions and residence community and create a harmonious atmosphere.

2. Improve efficiency of construction. Short the construction period.

3. Management should be strengthened to ensure all environmental protection measures carrying out.

4. Person specifically appointed for controlling the noise and fly dust in the construction period. Improve the environmental protection consciousness of workers.

5. Construction unit should keep away from sensitive objective when the location of new heat-exchanger station is chosen.

## Examination and approval decision:

### **Jinan Environmental Construction Bureau [2008] NO.227**

I. The primary construction contents of Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB were the heat and power cogeneration comprehensive energy-saving renovation project (namely substituting water pipeline for steam pipeline project), automatic control system of heat supply network project and reconstruction of electric motor frequency control project. According to environmental impact analysis conclusion and impact report suggestion (Environmental impact report form in Jinan [2008], No.192), if the environmental protection measures required by report form and examination and approval document of our bureau were put into practice, this construction would be agreed.

II. The following major work should be done in the construction of this project

1. The ecological restoration work should be done well in the construction area. The regulation measures about the spoiled soil in the construction should be carried out for enabling the soil to resume utilizable situation. And the eco-function of the soil would be resumed step by step.

2. Fix fence and cover in construction field and storage space. Control strictly blowing dust and waste gas produced in the loading and unloading, transportation and stacking of materials. Measures such as: watering for dust suppression, covering the transport vehicles with tarpaulin, fixing fence around construction field, arranging construction time and order reasonable should be carried out during the removal period. The waste solid such as spoil and construction waste should be cleaned in time and disposed properly. Pollution prevention work should be done well in the transportation.

3. Choose the low-noise construction machineries and techniques. Control the construction noise strictly. The noise in the construction period should meet the standards required by “*Noise Level Limits Standard in Building Operations (12523-90)*”. When constructed around the sensitive objectives, temporary noise barrier were set up to reduce pollution and construction time was arranged reasonable.

4. Heat transfer station must be reasonable layout with low-noise equipment and vibration, noise and other noise reduction measures. Plant community noise should achieve the relevant requirements of “*Noise standards at boundary of industrial enterprises (GB12348-90)*”, to avoid noise nuisance to the public.

III. Ecological protection and pollution control facilities together with the main project design, construction and production in the simultaneous time -the “*three at the same time*” system should be strictly implemented in the project. Apply for Construction Project Environmental Protection Acceptance to Shandong Environmental Protection Bureau in accordance with the procedures after the Projects completed, and only after qualified admission it can be put into use.

IV. Please Municipal Environmental Monitoring Station strengthens the day-to-day supervision and inspection of the construction projects.

Operator: Zhang Ruihai

(seal)

September 26, 2008



# Environmental protection approval registration form of construction project

Organization filling form ( seal ): Shandong Academy of Environmental Science Compiler ( signature ): Lijun Li Project Operator ( signature ):

[illegible]

Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB

	Solid waste of industry															
	Characteristic contamination relative with this project															

**Notes:** 1. increase or decrease emission: ( + ) means increase while ( - ) means decrease. 2. ( 12 ): Note that the mitigation values by the balance of region for this project in the area where the project locates. 3. ( 9 ) = ( 7 ) - ( 8 ), ( 15 ) = ( 9 ) - ( 11 ) - ( 12 ), ( 13 ) = ( 3 ) - ( 11 ) + ( 9 ). 4. Measuring unit: discharge amount of waste water—ten thousand tons per year; discharge amount of waste gas—ten thousand Nm<sup>3</sup> per year; discharge amount of solid waste of industry—ten thousand per year; concentration of emission of water contamination—milligrams per liter concentration of emission of air contamination—milligrams per l cubic meter ; discharge amount of water contamination—ton per year; discharge amount of air contamination—ton per year;

Main indicators of ecological damage control	Influence and major measures		Name	Grade or type and quantity	Degree of influence (serious,average,s mall)	Ways of influence (occupation, partition or both)	Quantit y of prevent ion and mitigati on of influen ce, or type and quantit y of protecti ve measur es	Hazard preventio n investme nt (RMB10, 000)	Investment for newly-built and functional zoning adjustment(RMB 10,000)	Ex-situ conservat ion investme nt (RMB10, 000)	Project protection and control investment (RMB10,000)	Other			
	Aim of ecological protection														
	Natural reserve														
	Water source protection zone														
	Major wetlands														
	Scenic area														
	World natural and cultural heritage site														
	Rare animals														
	Rare plants														
	Type and form	Prime farmland													
Land occupied															

Jinan Thermal Power Co., Ltd. Heat Supply Integration Energy Saving Project Utilizing Loan from EIB

	(km <sup>2</sup> )	Temporary occupation	Permanent occupation	Temporary occupation	Permanent occupation	Temporary occupation	Permanent occupation							
	Area													
Mitigation and recovered area after environmental assessment												Amount of reduction of water loss and soil erosion(ton)	Control rate for water loss and soil erosion(%)	
Noise abatement	Engineering prevention (RMB10,000)	Noise barrier(RMB10,000)	Sound proof window (RMB10,000)	Noise reduction by afforestation(RMB10,000)	Low noise equipment and technique(RMB10,000)	Other								
		60	5											