Due Diligence Report

August 2017

PRC: Integrated Development of Key Townships in Central Liaoning Project-Fuxin Old and Damaged Heat Network Energy-saving Reconstruction Subproject

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People's Republic of China
Fuxin Old and Damaged Heat Network Energy-Saving Reconstruction Project under Integrated Development of Key Townships in Central Liaoning Project (2901-PRC)

Prepared for the Asian Development Bank (ADB)

Prepared by the Government of Fuxin City

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I General

A. Overview

In September 2012, ADB approved the Integrated Development of Key Townships in Central Liaoning Project with a loan of $150million. The Project Agreement and Loan Agreement were signed Between ADB and Liaoning Province and the Ministry of Finance in January 2013 and the loan became effective in March 2013. The loan has a 25-year term, including a 5-year grace period. The Integrated Development of Key Townships in Central Liaoning project includes 4 components: 1) wastewater management improvements; 2) Regional heating network in Fuxin; 3) environmentally sustainable urban infrastructure development; 4) capacity development and institutional strengthening.

The original Fuxin heating subproject has been partially completed, and the Fuxin IA has decided not to continue the construction of the original subproject. Because the real estate development has been significantly slowed down based on the new state policies and the heating demands in the original area in Fuxin greatly decreased. To utilize loan savings, the Fuxin City Heating Power Corporation proposed the Fuxin Old and Damage Heat Network Energy-Saving Reconstruction subproject as a second component. The proposed subproject will rehabilitate 90 km of the heating network in fuxin urban area with a total investment of CNY98.9844 million.

The Integrated Development of Key Townships in Central Liaoning project was classified as Category A and an initial environmental examination (IEE) for the Project was completed and published in the ADB website in 2012. The subproject of Fuxin Old and Damaged Heat Network Energy-Saving Reconstruction Project has been classified as Category B on the basis of ADB Rapid Environment Assessment, as shown in Appendix I. As a result, this initial environmental examination (IEE) is requested by ADB to be prepared and submitted. Based on the Liaoning provincial and Fuxin municipal requirements, the domestic environmental impact reportwas approved by Fuxin Environmental Protection Administration on November 24, 2016, as shown in Appendix II.

B. Laws, Regulations, Guidelines, Standards and Specifications

The laws, regulations, guidelines, standards and specifications, national institutional framework, ADB's environment requirements and international conventions and agreements are the same as that specified in the IEE for Integrated Development of Key Townships in Central Liaoning project. The environment requirements of the subproject shall be compliance with the strict requirements of the laws, regulations, guidelines, standards and specifications where conflicts exist among the laws, regulations, guidelines and standards and specifications. The following are the applicable laws, regulations, guidelines, standards and specifications.

- *Environmental Protection Law of the People's Republic of China (Revised in 2014) (2015)*
- *Law of the People's Republic of China on Appraising of Environment Impacts (2016)*
- *Water Pollution Prevention and Control Law of the People's Republic of China (2008)*
- *Atmospheric Pollution Prevention and Control Law of the People's Republic of China (2015)*
- *Law of the People's Republic of China on Prevention and control of Environmental Pollution by Solid Waste (2015)*
- *Law of Environmental Noise Pollution Prevention and Control of the People's Republic of China (1997)*

- *Law of the People's Republic of China on Water and Soil Conservation (2011)*
- *Law of Land Administration of the People's Republic of China (2004)*
- *Law of Highway of the People's Republic of China (2004)*
- *Implementation Regulations of Land Administration Law of the People's Republic of China (2011)*
- *Specific Rules for Water Pollution Prevention and Control Law of the People's Republic of China (2000)*
- *Regulations for the Implementation of Law of the People's Republic of China on Water and Soil Conservation (1993)*
- *Water Law of the People's Republic of China (2016)*
- *Urban and Rural Planning Law of the People's Republic of China (2008)*
- *Emergency Response Law of the People's Republic of China (2007)*
- *National Environmental Emergency Plan (2006)*
- *Control Regulations on Environmental Protection of the Construction Project (1998)*
- *Interim Measures on Public Participation in Environmental Impact Assessment (2006)*
- *State Council's Decision on Implementing Scientific Development Approach to Enhance Environmental Protection (2005)*
- *List for the Management of Classification with the Evaluation on the Environmental Impact of the Construction Project (2015)*
- *Emergency Management Method of Emergent Environmental Incident (2015)*
- *Regulations of Liaoning Province on Environmental Protection (2010)*
- *Environment Protection Measures of Solid Waste in Liaoning Province (2002)*
- *Notification for Implementing Ministry of Environmental Protection's Interim Measures for Construction Projects Major Pollutants Total Emission Review and Management (2015)*
- *Environment Supervision and Administrative Measures of Construction Projects in Liaoning Province (2016)*
- *Water and Soil Erosion Protection Area in Liaoning Province (1998)*
- *Blue Sky Engineering Construction in Liaoning Province (2012)*
- *Dust Pollutant Protection Management Method in Liaoning Province (2013)*
- *Technical Guidelines for Environmental Impact Assessment - General Principles (HJ2.1-2011)*
- *Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment (HJ2.2-2008)*
- *Technical Guidelines for Environmental Impact Assessment - Surface Water Environment (HJ/T2.3-93)*
- *Technical Guidelines for Environmental Impact Assessment Groundwater Environment (HJ610-2016)*
- *Technical Guidelines for Environmental Impact Assessment - Acoustic Environment (HJ2.4-2009)*
- *Technical Guidelines for Environmental Impact Assessment - Ecological Impact (HJ19-2011)*
- *Technical Guidelines for Environmental Risk Assessment on Construction Project (HJ/T169-2004)*
- *Technical Specification of Ecological Environment Status Assessment (HJ/T192-2006)*
- *Technical Specifications For Regionalizing Environmental Noise Function (GB/T15190-2014)*
- *Technical Code on Soil and Water Conservation of Development and Construction Projects (GB50433-2008)*
- *Control standards for Soil and Water loss on Development and Construction Projects (GB50434-2008)*

C. Assessment Scope and Sensitive Receptors

The scope for environmental impact assessment of the subproject in both construction and operational periods is set out in Table I-1; The sensitive air and noise receptors are summarized in Table I-2.

Table I-1: Evaluation scope

Evaluation factors	Evaluation scope
Air	Pipe network on both sides within 200m
Noise	Pipe network on both sides within 200m
Surface water	Section of Xihe River located in the south of the pipe network
Ecological environment	Vegetation, green field and soil within pipe network construction area
Social environment	Directly affected districts: Haizhou District and Xihe District in Fuxin City

Table I-2: Ambient Air and Acoustic Sensitive Receptors within Assessment Area

Serial No.	Protected objectives	The distance to pipe network	Affected households /people	Major environment factors	Standards
1	Sino-France Residence	10m-200m	Estimated 77 HHs	Construction fugitive dust, noise	(GB3095-2012) Secondary standards; (GB3096-2008) Standards of corresponding functional areas;
2	Bureau of Mines Experimental Primary School	22m-200m	Estimated 200 P		
3	Dongfang Jiayuan	10m-200m	Estimated 35 HHs		
4	Ningzeyuan Community	15m-200m	Estimated 140 HHs		
5	Haixin International Community	5m-200m	Estimated 133 HHs		
6	Xuefu Yayuan Community	5m-200m	Estimated 30 HHs		
7	Jinhai Community	5m-200m	Estimated 150 HHs		
8	Liaoning Technical University	30m-200m	Estimated 1000 P		
9	Haizhou High School	10m-200m	Estimated 500 P		
10	Fuxin city No. 1 Middle School	5m-200m	Estimated 400 P		
11	Experimental Community	5m-200m	Estimated 196 HHs		
12	Hongqi Community	8m-200m	Estimated 45 HHs		
13	Xiyiyuan Community	8m-200m	Estimated 60 HHs		
14	Xihelu Primary School	3m-200m	Estimated 200 P		
15	Xihuayuan Community	5m-200m	Estimated 40 HHs		
16	Vienna Garden Community	30m-200m	Estimated 300 HHs		
17	Higher Vocational College of the city	5m-200m	Estimated 500 P		

18	No. 1 Vocational College	5m-200m	Estimated 300 P		
19	Experimental Middle School	5m-200m	Estimated 800 P		
20	Ximiaopu Community	8m-200m	Estimated 50 HHs		
21	Longxin Community	8m-200m	Estimated 35 HHs		
22	Hongyunhuacheng Community	8m-200m	Estimated 20 HHs		

D. Evaluation timeframe

The evaluation timeframe is the construction period. Construction period: August 2016-October 2020; operational period: no pollution occurred during operation of the pipe network; no maintenance personnel and pollutions were required during operation of thermodynamic points.

E. Evaluation standards

The evaluation standards of the subproject for air, noise, water, and wastewater are listed in Table I-3, Table I-4, Table I-5, Table I-6 and Table I-7.

Table I-3: Ambient Air Quality Standards

Serial No.	Pollutant	Time	Concentration limit (μg/m^3)	Standard	IFC-EHS standard (μg/m^3)
1	PM_{10}	Average per hour	/	*Ambient Air Quality Standards* (GB3095-2012), Grade II	N/A
		Average per 24h	150		75-150 (50 guideline)
		Annual average	70		70-30 (20 guideline)
2	PM2.5	Average per hour	/		N/A
		Average per 24h	75		N/A
		Annual average	35		N/A
3	SO_2	Average per hour	500		N/A
		Average per 24h	150		125-50(20 guideline)
		Annual average	60		N/A
4	NO_2	Average per hour	200		200 guideline
		Average per 24h	80		N/A
		Annual average	40		40 guideline

Table I-4: Exhaust Gas Emission Standard during Construction

Pollutants	Monitoring Concentration Thresold of Fugitive Emission

	Monitory point	Concentration (mg/m^3)
Particulate Matter (Dust)	Maximum concentration point outside the border	1.0

The Fuxin subproject proposed to reconstruct surface water of south side of old heat supply pipe network which is Xihe River and is located in the Xihe river section between Moon Bay and Dongliang Bridge Section. The function of water environment is grade V surface water. The applicable standard for surface water is GB3838-2002 *Surface Water Environment Quality Standards*, Category V.

Table I-5 Surface Water Environment Quality Standards

Unit: mg/L (excluding pH)

Item	COD	AMMONIA NITROGEN	PH	FLUORIDE	DISSOLVED OXYGEN	PERMANGANATE INDEX
(GB3838-2002) Category V standard	≤40	≤2.0	6-9	≤1.5	≥3	≤15

Table I-6: Acoustic Environment Quality Standards **Unit: dB(A)**

Noise criteria	Daytime	Nighttime
GB3096-2008 *Acoustic Environment Quality Standards*, Category 1	55	45
GB3096-2008 *Acoustic Environment Quality Standards*, Category 2	60	50
GB3096-2008 *Acoustic Environment Quality Standards,* Category 3	65	55
GB3096-2008 *Acoustic Environment Quality Standards*, Category 4a	70	55

Table I-6: Acoustic Environment Quality Standards **Unit: dB(A)**

Noise Category	GB3096-2008 *Acoustic Environment Quality Standards*,		IFC-EHS standard	
	Daytime	Nighttime	Daytime	Nighttime
Category 1	55	45	N/A	N/A
Category 2	60	50	55	45
Category 3	65	55	N/A	N/A
Category 4a	70	55	70	70

Table I-7: Emission Standard of Environment Noise for Boundary of Construction Site

Unit: dB(A)

Noise criteria	Daytime	Nighttime
Environment Noise Emission Standard on Building Construction Field (GB12523-2011)	70	55

II Project description

The Necessity of subproject construction. The subproject old heat supply pipe network reconstruction includes pipe networks of the second to fifth branch companies of Fuxin City Heating Company which all belong to Fuxin General Heating Company. The heat network mainline was first constructed on a large scale in 1982 which was in service for 13-30 years.The nominal pressure of valves disposed along the heat network is 1.0Mpa, and the compensator is old-fashioned stuffing or sleeve compensator. 2/3 of the network uses polyurethane to preserve heat, and the rest 1/3 uses rock wool or pearl stone tile. With the development of the city, draw-off point can not be used anymore. Thermodynamic points and underground indicator rooms of the network have been damaged severely and can only maintain its usage at present, and the inside and outside of the network have been eroded severely (mainly point erosion), which resulted in rushing to repair every winter since 1999, with the maximum repair time of over 16 hours and an increasing number of leaking point. Therefore, in order to solve the heating supply of Fuxin City fundamentally, reconstruction and rehabilitation of part of the existing heat network shall be considered and adopted.

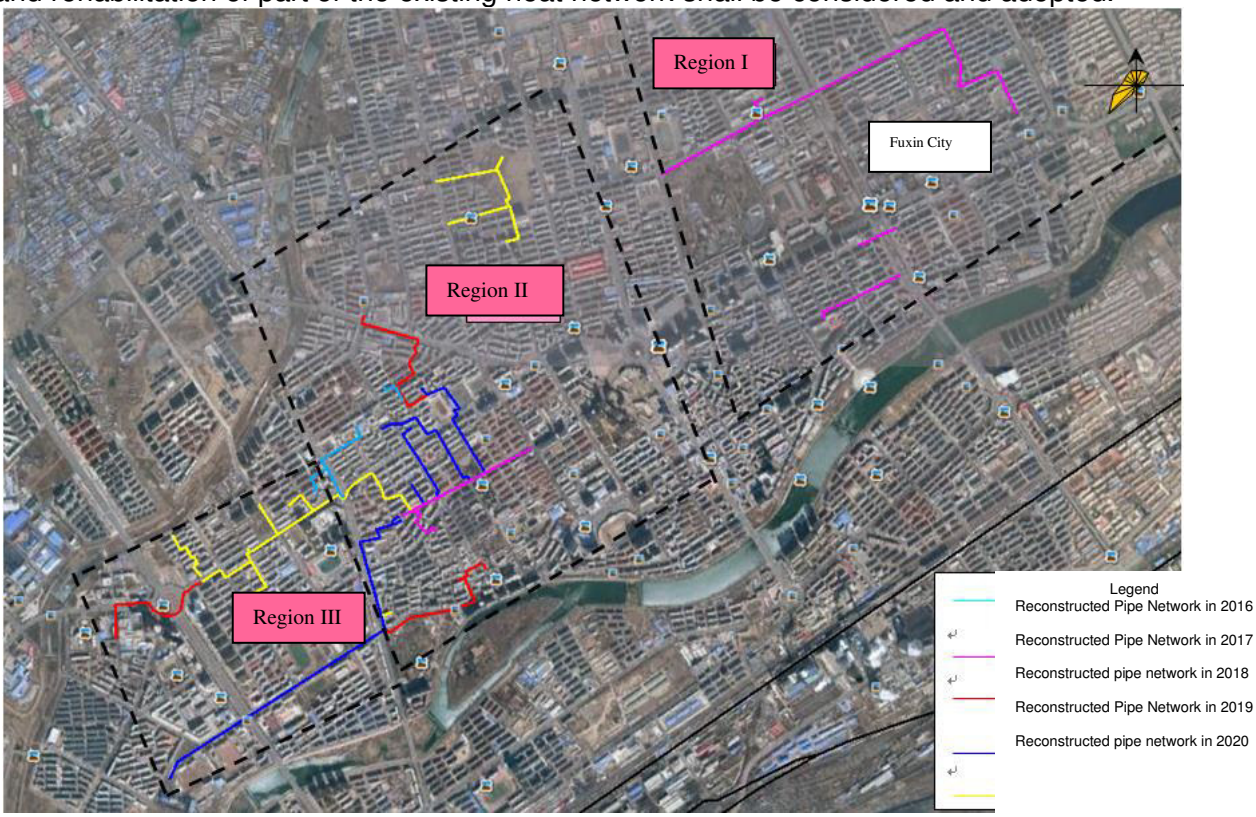

Figure II. 1: Distribution Map of Network of Fuxin Subproject

Heat Source: the subproject will connect with four existing heat sources, one is Fuxin Combination of Heat and Power Plant, and the others are the Fuxin IA's own boiers with capacity of over 80 tons/hour for each heat source. The existing four heat sources are operated in compliance with the permits and reqirements specified by the governments at different levels, such as operational permits, safety and environment permits. There are no operational issues for the existing four heat sources.

The anticipated benefits of Fuxin General Heating Company Old Pipe network Energy-Saving Reconstruction Subproject include reducing water loss rate and heat loss of pipe network to meet national energy saving and emission reduction requirements; ensuring the requirements for the synchronous development of heating supply business and the city to

improve people's living standard and city taste and protect the environment.

Urban overall plan.*Fuxin City Heating Supply Overall Plan* (2011-2020) requires that four heat sources of Fuxin General Heating Company gradually forms circular pipe network to supply heat to Fuxin City before 2020, and forms perfect circular pipe network when the conditions are right in 2020. The subproject is heating supply pipe network reconstruction and a major project to achieve the heat supply plan, and it will lay a solid foundation for the implementation of heating supply plan. Therefore, the project conforms to *Fuxin City Heating Supply Overall Plan* (2011-2020).

Fuxin subproject is included in the Fuxin City Heating Supply Overall Plan. Fuxin subproject includes: heating supply pipe network main pipeline (pipeline from the heat sources to thermodynamic points) is 20.9km long, the heating supply pipe network household pipeline (pipeline from thermodynamic points to the customers) is 74.3km long and includes 50 thermodynamic points. The subproject is located in the urban area of Fuxin City, Liaoning Province, the details of this project are in Table II-1, Table II-2, Table II-3 and Table II-4.

1. Basic content

Table II-1: Heat Supply Mains Network Reconstruction

Serial No.	Name of pipe section	Diameter of pipe before reconstruction (mm)	Pipe length (m)	Diameter of pipe after reconstruction (mm)
Reconstruction Project of the Second Branch Company				
1	Zhonghua Road to Xinxing Point	Φ325	288	Φ426
2	Pipeline entering into Voiture Section	Φ219	717	Φ273
3	Pipeline entering into Xinxing point	Φ325	221	Φ325
		Φ219	120	Φ325
4	Insurance branch line	Φ273	1510	Φ426
5	Entering into No.29 cubicle	Φ273	291	Φ325
6	Mine branch institute entry pipeline	Φ219	417	Φ273
7	Pipeline entering into Northern Community point	Φ325	189	Φ377
8	Pipeline entering into farm machinery company point	Φ273	201	Φ273
9	Pipeline entering into Land and Construction Department point	Φ273	244	Φ273
10	Yicheng Street to Security Department	Φ325	637	Φ426
11	Fifth district branch line	Φ325	733	Φ377
12	Main pipeline of Second Branch Company	Φ529	1766	Φ630
		Φ426	1867	Φ529
Reconstruction Project of the Third Branch Company				
1	Residential building of Power Industry Bureau branch line	Φ219	194	Φ377
2	Bayi Road and Sibao branch line	Φ325	862	Φ426
3	ICBC development point entry branch line	Φ273	466	Φ426
Reconstruction Project of the Fourth Branch Company				
1	ABC point entry pipeline	Φ219	270	Φ219

2	No. 11 Middle School entry pipeline	Φ219	238	Φ325
3	Pipeline entering into Design Institute point	Φ219	188	Φ325
4	Pipeline entering into Dongyuan Community 1# point	Φ377	130	Φ426
5	Dongyuan Community located in the entrance of the main line to complex line Φ529	Φ529	69	Φ720
6	Dongyuan Community main line to 1# point	Φ529	229	Φ630
7	Community 1# point to 2# point	Φ426	605	Φ529
8	Community 2# point to Dongyuan Primary School pitch point	Φ377	599	Φ529
9	Dongyuan Primary School pitch point to 3# point	Φ377	97	Φ529
10	Dongyuan Community pitch point to carpet point	Φ630	1733	Φ720
11	carpet point to No.1 middle school point pipeline	Φ529	791	Φ630
12	Third valve room to Renmin Avenue educational council station	Φ630	508	Φ630
Reconstruction Project of the Fifth Branch Company				
1	Hongqi primary school entry pipeline	Φ273	270	Φ377
2	Sanwei road to Hongqi Community pitch point	Φ325	725	Φ426
3	Pipeline entering into Mine 4# point	Φ325	212	Φ325
4	Pipeline entering into Zhonghua Road North point	Φ273	626	Φ377
5	Sanwei Road to pipeline entering into Experimental primary school heat exchange station point	Φ377	501	Φ377
		Φ325	542	Φ325
6	Main line of Fifth branch company renovating to Machine Tool I	Φ630	1890	Φ630

Source: Initial environmental examination (IEE)of Fuxin subproject in 2016

Table II-2: Statistical Summary Table of Branch Line Network Reconstruction

Serial No.	Pipe diameter (mm)	Pipe length (m)
1	Φ219	270
2	Φ273	1579
3	Φ325	1812
4	Φ377	2513
5	Φ426	4618
6	Φ529	3164
7	Φ630	5184
8	Φ720	1802
Subtotal		20942

Source: Initial environmental examination (IEE) of Fuxin subproject in 2016

Table II-3: Statistical Table of Household Line Reconstruction

Serial No.	Pipe diameter (mm)	Pipe length (m)
1	Φ76	7431
2	Φ89	4954
3	Φ108	49543

4	Φ159	12386
Subtotal		74314

Source: Initial environmental examination (IEE) of Fuxin subproject in 2016

Table II-4: Detail List for Thermodynamic Points Reconstruction Devices

Serial No.	Item	Device to be replaced
1	29# point	Every thermodynamic point needs to replace the same device. ①5 valves (2 water supply valves, 2 backwater valves and 1 coupling valve). ②2 pressure gauges (one for water supply and the other for backwater). ③2 thermometers (one for water supply and the other for backwater). ④1 dirt separator
2	Point type building	
3	Association of Science and Technology	
4	Mine institute branch	
5	Grain and oil	
6	Voiture Section	
7	Constructed uniformly new line	
8	Development zone	
9	West garden	
10	Xinxing	
11	Development zone branch	
12	Indicator room	
13	ICBC mine office	
14	Haizhou branch office	
15	Hengshan point	
16	Kaiyuan Road	
17	Mine 4#	
18	Kuangtuo	
19	Xiyuan Development Zone	
20	National People's Congress, CPPCC	
21	318 Community	
22	Northern New Line	
23	Fifth Bureau building	
24	North Zhonghua Road	
25	South Zhonghua Road	
26	Central South	
27	Tap water	
28	Newspaper office branch	
29	107	
30	Changqing	
31	Carpet	
32	Senior high school	
33	Chemical research	
34	Deliverance	
35	Jinfu	
36	South mine	

37	Ningzeyuan	
38	ABC	
39	East of People's Congress	
40	West of People's Congress	
41	Design institute	
42	No.11 middle school	
43	Community 1#	
44	Community 2#	
45	Community 3#	
46	Xinhua	
47	Xingsheng	
48	No.1 middle school	
49	Yijingyuan	
50	Hongqi point	

Source: Initial environmental examination (IEE) of Fuxin subproject in 2016

2. Pipe Material and Pipeline Accessories

①Selection of pipe material

When the diameter of the pipe DN≤150mm, the hot water pipeline shall choose seamless steel pipe, and the steel shall be 20#; when the diameter of the pipe DN>150mm, the hot water pipeline shall spiral welded steel pipe, and the steel shall be Q235B. The direct burial hot water pipeline adopts polyurethane composite insulating pipe, and every technical requirement shall perform GB/T29047-2012 standard.

②Selection of Valve

At the place that heat supply pipe network to be replaced, start point of main line and branch line and reserved development point shall be equipped with shut-off valve; transport main line of hot water pipe network shall dispose a shut-off valve every 1.5km; and the direct burial pipeline valve of this project adopts butterfly valve. The highest point of pipe network is equipped with bleeder, and the lowest point of pipe network is equipped with drain device. When the diameter of valve DN≤50mm, adopting gate valve; when the diameter of valve DN>50mm, adopting butterfly valve; when the diameter of valve DN≥350mm, the gate valve of pipeline is equipped with by-pass valve, the diameter of which is one tenth of the diameter of valve; when the diameter of valve DN≥400mm, adopting worm drive. Nominal pressure of valve adopts 1.6MPa.

③Selection of Compensator

The heat supply pipe network main line of this subproject adopts by principle a compensate direct burial installation method and direct burial sleeve compensator, with a pressure level P=1.6MPa. Branch line compensator reconstruction statistics see II-5.

Table II-5: Branch Line Compensator Reconstruction Statistics Aggregation

Serial No.	Specification of compensator	Number of compensator (piece)	Remarks
1	Φ219	5	
2	Φ273	32	
3	Φ325	36	
4	Φ377	50	
5	Φ426	92	

6	Φ529	53	
7	Φ630	111	
8	Φ720	36	
Subtotal		415	

3. Pipeline Construction Method

Earth excavation: adopting excavator to dig the soil into a mound and placing it on one side. Depth of excavation is about 2m, and width of groove is 2m at average.

Earthwork backfilling: adopting excavator to bulldoze, smooth and rolling. Because the underground water level by which the pipeline passed is uneven, diesel engine water pump can be used in the section with a relatively higher underground water level to drain off water.

Pipe installation: based on the operational method of combining manual labor with mechanical device, vehicle hoist is used to lift pipe fittings; positioning is conducted manually. The pipeline pavement basically follows the order of digging, installation, test and back-filling.

The pipeline runs through the road, depending on the road conditions. This subproject (heat network reconstruction and rehabilitation) will cross back and forth the existing roads at different locations (three main roads and other roads) for 36 times, mainly cross such roads as: Zhonghua Road, Kuanggong Avenue, Sanwei Road. The specific sites of construction can only be ascertained after being planned and approved. The road could be dug broken when running through such unimportant roads as gravel road and earth road. Bituminous road adopts manual digging with two phases of construction for not affecting the passage of the vehicles, the road will be immediately back-filled and tamped after being run through by pipeline, re-paving asphalt and recovering the original appearance.

Capability construction and institution strengthening.

This subproject will strengthen the urban management capability over infrastructure. Currently, Fuxin Municipal Government has no effective management tool to help in urban management over the infrastructure. The effective management concept will be introduced into such subproject, establishing basic management system, drafting management method, setting up and strengthening corresponding institutional implementation and management system for operating urban infrastructure, improving the overall management capability.

The project has such demonstrative characteristics of capability construction as follows: (i) Project management and financial management; (ii) Comprehensive development demonstrative research of Fuxin Municipal Government.

III Environmental description

Fuxin City is located in the northwest of Liaoning province, its straight-line distance away from the capital Shenyang is 147.5km, neighboring with Shenyang City in the east, bordering with Chaoyang City in the west, linking with Jinzhou City in the south, and connecting with Inner Mongolia in the north. It is 140km away from the Jinzhou port, which is the biggest gateway to the sea in the west of Liaoning Province. The whole area of Fuxin is shown as long rectangular shape, the mean axis obliquely intersects at the point of N 42°10′and E 122°0′. Fuxin City is 170km long from the east to the west, 84 km wide from the south to the north, with total area of 10,355km^2.

Fuxin City is located in the middle transitional belt between Inner Mongolia plateau and Northeast Liaohe Plain, belonging to low mountains and hills of west of Liaoning. Northwest part of the city is higher, while southeast part is lower; Southwest part of the city is higher, while Northeast part is lower. There are five municipal districts, including Haizhou, Xinqiu, Qinghemen, Xihe, Taiping, and Zhangwu County and Fuxin Mongolian Nationality Autonomous County, with a population of 1.92 million. Fuxin City has convenient transport and rich natural resources. Initially explore 38 kinds of proved mineral reserve and 228 mineral sites. Among them, coal has a huge reserve, and resource reserve reaches over 1 billion tons. There is also abundant limestone, pearl stone, bentonite, granite, and the reserve of fluorite, silica sand and zeolite ranks top in Liaoning Province, the reserve of gold is especially handsome.

Climate: Fuxin City is located in the temperate zone, belonging to the climate of sub humid continental seasonal wind. Its main climatic characteristics are: Spring is dry with a lot of gale, there is windstorm and floating dust; Summer is hot with a lot of low cloud, more precipitation, and quite some thunderstorm. Autumn is prone to sunny weather; Winter is cold with a lot of mist, there is snowfall. The extreme lowest temperature before 2005 is -27.1℃ (in December1992), the extreme highest temperature is 40.9℃ (in July 2000). The whole year is mainly in sunny and less cloudy weather except summer that is prone to cloudy rainfall.

The annual average No. of day with precipitation is 89.0 days (over 0.1 millimeter or longer than 2 hours), with 75.8 days of rainfall, 13.2 days of snowfall, the average precipitation is 484.2mm, but with the sharp difference in different years, the maximum year is 1994 with 803.8mm, and minimum year is 1999 with only of 273.4mm.

Gale is the most striking weather characteristic in Fuxin region, the annual average number of day with gale over 12 m/s is 11.6 days, the direction of wind with most days is southwest wind, then follows with north wind and northwest wind. Gale mainly occurs in spring, the biggest wind speed of southwest gale once reached 30m/s in 1967. The whole year usually has sound visibility except the hazy and misty weather in winter and summer as well as sandstorm in spring that affects visibility. The annual average number of day with visibility less than 4km is 172.0 days, among them, 23.0 days with visibility less than 1km.

The annual temperature of Fuxin City in 2015 is 9℃, the extreme highest temperature is 37.8℃, the extreme lowest temperature is -22.6℃, and annual relative humidity is 54%, annual average precipitation is 319.4mm, annual average wind speed is 2.9m/s, the leading direction of wind is SW, the biggest depth of frosty earth is 109cm, the annual biggest depth of accumulated snow is 9 cm, annual number of hour with sunshine reaches 2,597.8 hours.

Landform and physiognomy: Funxin City is located in the middle transitional belt of Inner Mongolian Plateau and Liaohe Plain, situated in the low mountains and hill area of west of Liaoning Province; the terrain of the whole region is high in the northwest, low in the southeast,

high in the southwest and low in the northeast. The mountains are located in the west and southwest parts, hills locate in the north and northwest, the plains mainly center in Zhangwu County and southeast of Fumeng County. The construction land of this project is located in the hinterland of Fuxin Basin, with the altitude of 120-180 meters its general terrain is relatively flat, the main land-form of surface manual constructed area.

Ecological resources: The forestry area of Fuxin City is 4.9998 million acres, the forest coverage rate is 32.29%. The stock volume of active forest reaches 10.23 million m^3. The subproject is far away from the forest area. It is located in well developed urban and central area in Fuxin City, and adjacent to residential and commercial area. There is no know rare or endangered flora and fauna, and no species with international, national or provincial protection status. There are no parks/nature reserves involven in the subproject areas.

Natural cultural resources: The pipeline network of such subproject will not run through any world heritage and historical preserve area. There are no local cultural sites, e.g., temples, burial grounds in the subproject areas.

Seismic intensity: The seismic intensity of Fuxin City is set up against earthquake with 6 magnitude It is at a low seismic risk according to the “China Dynamic Seismic Zone Indicator GB18306-2001”.

Water resource: Fuxin region is covered by Dalingriver and Liaohe river. Daling river system includes Xihe river and Mangniu river; Liaohe River water system includes Raoyang River, Liu River, Yangximu River and Xiushui River. Among them, the length of Raoyang River located within Liaohe River region in Fuxin is 114km with a river basin area of 3,689km^2; the length of Liuhe River in Fuxin is 188km with a river basin area of 1,739km^2; the length of Yangximu River in Fuxin is 77km with a river basin area of 1,495km^2; the length of Xiushui River in Fuxin is 17km with a river basin area of 293km^2. The watercourse length of Xihe River within Dalinghe River region is 86km with a river basin area of 2,242km^2; the watercourse length of Mangniu River in Fuxin is 41km with a river basin area of 897km^2.

Xihe River is the sole river that flows through urban area of Fuxin City, whose origin is the west slope of Luotuo Mountain in Fumeng County, flowing through Xinqiu, Fuxin County, Fuxin downtown area, Dongliang, Qinghemen, the distance of the flow section is 86.2km, finally flows into Daling river through Fuxingbao within Yi County, which is the 1st class tributary of Daling river, with annual runoff volume of 172 million m^3. Because it has become polluted water body by neighboring enterprises and residents in recent years, now the pipeline network has been constructed in the upper reach of Ajin Bridge to block the water flowing of the river in the upper reach, and artificially forms water viewing surface within the urban area, waste water discharged from urban factories, enterprises, institutions as well as living waste water of residents will flow into Xihe River through urban downstream of governmental pollutant discharge main pipeline network. The tributary of Xiheriver-Jiuyingzi River flows from the north to the south from the east of west district of new high-tech industrial development zone, flowing into Xihe River.

The phreatic underground water level of subproject areas are typically 2 meters to 5 meters and a little underground water might appear during the construction of the heat networks.

Surface water quality: Xihe River is one of the main rivers in Fuxin City, flowing through the downtown area of Fuxin, according to the monitoring materials of Fuxin municipal Environmental Monitoring Central Station in 2015, please refer to the sectional water quality

situation of Fuxin's Xihe River---Dongliang Bridge in Table III-1.

Table III-1: Environment Quality Table of Surface Water **Unit: mg/L**

Pollution parameters	COD	Ammonia nitrogen	PH	Fluoride	Dissolved oxygen	Permanganate index
Monitoring value (average value) (mg/L)	36.4	3.970	8.16	1.6	5.48	5.79
Surfacewater Environment Quality Standard (GB3838-2002), class V (mg/L)	≤40	≤2.0	6-9	≤1.5	≥3	≤15
I Value	0.91	1.985	——	1.07	——	0.386

Source: 2016 Initial Environmental Examination (IEE)

According to Table III-1, among several selected polluted factors, ammonia nitrogen and fluoride exceed the limits, all other selected items meet the demands of Category V of GB3838-2002 *Surface Water Environment Quality Standards*, the sectional part of Dongliang Bridge is already in the situation of pollution.

Dongliang Bridge of Xihe River is located in the downstream of Qingyuan Sewage Treatment Factory in Fuxin City and Fuxin Economic & Technical Development Zone Sewage Treatment Factory, the water quality of its sectional part is severely polluted, the reasons after analysis are as follows:, first, Fuxin is dry with little rainfall, natural runoff in the upper reach of Xihe River is quite rare, with little natural replenishing water which leads to the situation that discharged pollutant into Xihe River cannot be sufficiently diluted; Second, some enterprises from Fuxin City's sewage treatment factory to Dongliang Bridge region discharge untreated industrial waste water into Xihe or treated water that fail to pass standard; third, the relatively more polluted Heishui River streams into Xihe River, the living waste water of some residents is discharged into Xihe River without being treated.

Air quality: The urban environment air pollution of Fuxin City sources from soot and reentrainment of dust. The main contaminant is the inhalable particle, followed by sulphur dioxide. Judging from the spatial distribution of urban air pollutant, the traffic area is the most serious, industrial zone is inferior to it, and the mixed area between the residential and office areas is the slightest, and winter is the most serious, followed by spring, summer and autumn are the slightest seasons.

According to the monitoring of Environment Monitoring Central Station of Fuxin City in 2015, the current situation table of environment air quality in Fuxin's five monitoring sites are shown in Table III-2.

Table III-2 Current Situation of Air Environment Quality **Unit: ug/m^3**

Monitoring location	PM_{10}	SO_2	NO_2	$PM_{2.5}$	CO (mg/m$^{3)}$	O_3 (8h)
Annual average monitoring value	101	52	30	49	1.3	76
Standards	70	60	40	35	4	160
I Value	1.4	0.9	0.75	1.4	0.3	0.48

Source: 2016 Initial Environmental Examination (IEE)

According to the monitoring result shown in Table III-2, PM_{10}, $PM_{2.}5$ are beyond the limit, SO_2 and NO_2 meet the demand of secondary standard in GB3095-2012 Ambient Air Quality Standards. The reason of going beyond the limit is caused by reentrainment of dust.

Acoustic environment: According to the acoustic environment quality functional area division in Fuxin, the acoustic environment functional areas of this subproject shall belong to the 1,2,3,4a in the "*Acoustic Environmental Quality Standard (GB3096-2008)*". The baseline noise values shall refer to the noise monitoring data in "*Noise Monitoring Date of Fuxin City Functional Area in 2015*", as shown in Table III-3.

Table III-3: Noise Monitoring Date of Fuxin City Functional Area in 2015 Unit: dB(A)

City	Year	Quarter	Category 1		Category 2		Category 3		Category 4a	
			Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
Fuxin	2015	Q1	52.6	43.1	56.3	44.6	60.1	52.6	66.4	58.2
		Q2	47.3	43.8	55.3	48.6	56.6	49.9	66.1	57.2
		Q3	48.6	43.4	55.3	48.2	55.3	53.0	66.1	55.8
		Q4	52.5	42.8	56.2	45.5	59.5	51.9	65.9	57.3
		Annual average	50.3	43.3	55.8	46.7	57.9	51.9	66.1	57.1
		Standard	55	45	60	50	65	55	70	55

Source: 2016 Initial Environmental Examination (IEE)

According to Table III-3, Nighttime noise values for 4a functional area are higher than standards value. The reason of excessing the limit is that the neighboring roads are all trunk roads, which caused high noise values.

Socio-Economic Condition. There are 5 administrative districts in the city of Fuxin. The total area is 448 squre kilometers and the total population is 713,100. There will be over 100,000 people who will benefit from the proposed subproject, accounting for 14% of the total.

IV Potential environmental influence and mitigating measures

A. Positive environmental effect and environmental beneficiaries

Direct positive influence: the city grade will be improved through energy-saving and transformation towards pipeline network of such subproject, improving the level of people's living, bringing quite huge benefits to urban residents of Fuxin City. The transformation for energy-saving toward the old and worn-out pipeline network of heat supply will reduce the rate of water loss and heat loss of pipeline network, furthermore saving water resource to certain degree, saving the fuel of heat-supply factory's boiler, lowering the discharge of air pollutant.

Beneficiaries: the transformation of energy-saving toward old and worn-out pipeline network will improve the rate of water loss and heat loss of heat-supply pipeline network; Improve the demands for heat supply of approximate 0.15 million of local residents.

Climate change: the subproject of Fuxin City will reduce the discharge of exhaust gas, which will contribute in climate change mitigation. The transformation toward the old and worn-out pipeline network of heat supply will reduce the phenomena of air escaping, air giving off, dripping and leakage, therefore, saving water resource, saving the fuel for heating factory's boiler, saving burning coal about 2,941,/a, reducing the exhaust gas and dust of waste pollutant: 58t/a, carbonic deoxide: 7,332t/a, sulfur dioxide : 59t/a (resource: approved demostic FSR). Moreover, the future detail designs shall consider the depth of freezing soil and the appropriate application of heat insulation materials to avoid disasters from extreme weather events.

In order to mitigate the impact of climate change, in the stage of project planning and design, three principles shall be taken into account: 1) Long-term considerations (constructing infrastructure that is conducive to reducing GHG emissions?); 2) Repair and maintain the existing infrastructure; 3) Propose response plans towards climate emergency situation. Mitigating measures have already been incorporated into the EMP.

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B. The influence related to the site, planning and design of the project.

Land loss: The construction of the subproject will not occupy permenant land and only involve in temporaty land without any land loss. Moreover, the construction will be made within the existing ROW. The area of the temporary land ocupied during the construction is about 380,000m^2, including sidewalks, non-motorized vehicle lane and roadside lawn. The applications for temporary land usages will be submitted to the relevant department for approval together with amounts of sidewalk, non-motorized lane and lawn recovery costs. Gerenally, the applications are approved together with construction permits. The local public landscaping office shall be responsible for the recovery of lawn, while the local municipal office shall be responsible for the sidewalk and non-motorized vehicle recovery.

Asset acquisition and relocation: no asset acquisition and relocation.

Loss of natural and cultural resources: no loss in natural and cultural resources.

C. Environmental management measures before construction

All pre-construction environmental management measures are described in detail in Chapter VI Environmental Management Plan (EMP).

A number of environmental management measures will be implemented in the pre-construction phase to ensure that appropriate plans and documentation to determine environmental performance of construction and operation of subprojects are in place. These

include: (i) finalization of subproject sites and alignments; (ii) the finalization of subproject EIAs under PRC regulations and submission of EIAs to the local EPBs for approval processing; (iii) completion of two rounds of public consultations in each subproject locality on environmental issues, poverty, resettlement and the Grievance Redress Mechanism during the project design and EIA preparation; and (iv) the preparation of RPs for the Project in each subproject locality to required ADB and PRC standards.

Additional pre-construction measures for this project include: (i) updating EMP: Mitigation measures defined in this EMP will be updated and incorporated into the detailed design to minimize adverse environmental impacts; (ii) Land-take confirmation: The Resettlement Plan will be updated with final inventory and the results incorporated into the detailed design; (iii) Contract documents: Preparation of the environment section in the Terms of Reference for bidders for construction contracts, and environmental contract clauses for contractors, namely the special conditions (referencing the EMP and monitoring plan); (iv) Environmental Protection Training: Environmental specialists and/or officials from local EPBs will be invited to provide training on implementation and supervision of environmental mitigation measures to contractors; and (v) Spoil disposal sites and borrow pit locations will be finalized and identified in the construction tender documents, subject to approval by the local EPBs.

D. Anticipated environmental impacts and mitigation measures during construction

Dust. Dust pollution during the process of the pipe network earth excavation, backfilling, open-air stacking, loading, unloading and vehicle transport, become heavier in dry and windy season. Water spay at the construction site can effectively reduce dust pollution and the TSP pollution area can be restricted to within 20-50m. Provide a continuous, closed enclosure around the site area. Harden the site ground and pavement as part of the dust treatment measures. Piled earth at the construction site shall be covered with dust sheet. Vehicles used to transport materials like gravel, muck, earthwork, waste, etc shall be covered with canopies or tightly enwrapped, so to avoid any scattered or leaked materials that may cause dust pollutants.

Noise. Construction machinery is the main source of noise. Noise is from operation of excavators, loaders, mobile cranes, auto dump trucks as well as material loading and unloading, ramming, any other site personnel activities. Although noise is temporary, the following environmental mitigation measures shall be adopted in order to protect the sensitive areas and meet the noise standards of the construction site. No construction work during lunch time (from 12:00 to 13:30) or at night (from 22:00 to 6:00 next day). During the day time construction, the Contractor shall ensure 1) reasonable layout of construction machinery, especially at the sections near the residential area; effective enclosure of the construction sections, such as building construction fences; and no honking; 2) To use the construction machinery that produce low noise, and for those that produce high noise, take the necessary temporary vibration and noise mitigation measures; 3) To reinforce construction equipment maintenance, construction management, and construction morals and to completely eradicate the possibility of causing other noise pollution due to improper maintenance; 4) To schedule construction work in a reasonable way, to avoid multi large scale high noise equipment to be in operation at the same time period and at the same site. 5）During the construction period, the construction site is surrounded by a 2.5m high fence. The mobile sound barriers shall be set at close the sensitive area side in order to stop sound and reduce the impact on the surrounding residents for the construction site that it is closer to the sensitive area. To concentrate human resources and materials on the work so to speed up construction and reduce affected time. Use of temporary noise barriers in the construction sites will be considered, if necessary.

Earthworks and construction waste. The excavation materils will be paritlly used for backfill and the limited excess excavation materials will be transported/disposed in approved disposal site, though the impact on the surrounding environment is small. there will be no temporary

stockpile of excacation materials and soil statilization works will not be needed. In order to reduce impact for transportation of excavated soil and the discharge of domestic waste on the environment, the following measures shall be taken: The construction unit shall handle the process of spoil discharge according to the regulations. The transportation of construction vehicles should avoid traffic peak of sensitive sites. Transport must be limited to a specified period of time and travel according to the specified road. When transporting soil and waste, the transport vehicle must be loaded with the appropriate amount and covered with cover to avoid dust. Dust wastes should be stacked by septum. Domestic garbage of construction should be segregated from construction wastes, collected and transported to municipal solid waste landfill by health department, and the rest should be uniformly transported to the city landfill by the sanitation sector. Solid waste will be regularly transported off-site by the contractor for disposal at designated landfill sites in compliance with the Law on the Prevention and Control of Environmental Pollution by Solid Waste of PRC (2004) and scrap material and demolition waste disposal standards promulgated by the Ministry of Housing and Urban-Rural Development. Household garbage is collected at the fixed points, and collectively sent to the waste containers near the construction site and people hired by the environment and sanitation department will be responsible for the transportion to the disignated sanitory landfill.. Solid Waste. During the construction of the subproject, pipeline excavation shall be stacked on the side of the ditch. The management of backfill earth shall be strengthened such as the earth surface shall be compacted, regularly sprinkled and covered. The useless earthwork shall be carried away at the same time and shall not be stacked for a long time. Most of the excavation of the earth and stone should be used to backfill, and there is a small part of the useless soil shall be transported to the designated location by the municipal department with special vehicles. Household garbage will be collected through the nearby dustbin, and cleaned and transported by the sanitation sector to the government-designated landfill. Replaced pipeline, supporting valves and compensators, etc. shall be recovered by Fuxin City Heating General Corporation.

Construction wastewater/Surface Water. After the pipeline construction and installation, tap water is used to clean and flush and pressure test the pipeline. This process produces waste water. Because the pollutants in the wastewater are relatively simple and small in volume, their impact on the water environment is small, but this should still be managed. Due to the size and location of the subproject, there will be very small construction camps within the project site. Minimal non-construction wastewater is expected. This subproject produces very little non-construction wastewater . It is because the construction area is large. The personnel are widely scattered and no living areas at the construction site. The are nearby public sewers in the construction site, interim storage tanks and pipelines will be installed to convey wastewater to those sewers. In addition, the domestic wastes produced by workers from the construction site will be collected to the municipal garbage bins and transported out by local sanitary department. All the waste along with the heat network shall be transported out to the designated place after the construction is completed.

Construction wastewater is produced from the maintenance and cleaning of mechanical equipment and vehicles, maintenance water for mixing and curing concrete, cooling water, and lost water and soil during the construction period which is discharged as pollutants. The effluent, comprised mainly of inorganic wastewater, commonly contains no poisonous and harmful substance, except suspended solid, but, if discharged in an improper manner, still has the potential to impact existing water bodies. Some oil-containing wastewater can arise from machinery repairs.

Construction wastewater will not be discharged into the surrounding soil or into surface water systems. Sedimentation tanks will be built, and after settling out of solids the upper clear liquid will be recycled for spraying the construction site (dust control), and the waste residue in the tank will be cleared and transported to designated landfills. Oil- containing wastewater will require the installation of oil-water separators before the sedimentation tank.

Subsection construction will be adopted in the subproject. There is no living area in the

construction site. The sewage generated by the construction workers will be discharged into the municipal sewage pipe network near the respective construction area, and then discharged into the city sewage treatment plant for processing. Pipelines will be tested and washing with tap water after construction and installation of pipeline. Contaminants of pressure test wastewater are relatively simple, so the wastewater can be directly pumped to the municipal rainwater pipe network; The wastewater for cleaning equipment and tools shall be used for preventing dust after treated through ordinary sedimentation and grease trap.

The underground gushing mainly comes from shallow surface water when pipelines and trenches are excavated. The pipeline depth of the project is 3m. The depth of shallow water level is generally 2-5m within the project area. A small amount of underground gushing water caused by the construction shall be pumped to the municipal sewage pipe network, and then discharged into the urban sewage treatment plant for processing.

Machinery oil will be forbiden directly going into the water body. Waste mechanical oil and waste oil shall be treated after recycling. The mechanical oil and waste oil which is seep into the soil shall be treated after recycling.

E. Anticipated environmental impacts and mitigation measures during operation

The impacts during operation of the heating network is mostly associated with the heat sources. The existing heat sources are in compliance with required measures permits, The capacity-building component of the subproject will reduce the likelihood of accidents such as leaks, etc. The existing SCADA system was newly installed in 2010 and the monitoring should immediately alert any issues during the operation of the heating networks.

The operation of the heating pipe network and the heat point will have an impact on the surrounding environment when the pipeline have an accident such as fracture of pipeline caused by unqualified corrosion or welding, and steam leak accident caused by damaging pipeline. To reduce the impact, the following measures are to be taken:

- Strengthening the quality and supervision of construction, and the pipeline materials must comply with the relevant provisions of the state. If necessary, to take anti-corrosion treatment, outside of the pipeline shall be taken an anti-pressure protection measures.

- The pressure measurement and flow measurement instruments should be set at the service ports of the pipeline in order to discover the pipe network leak to avoid the impact on the surrounding ecological environment. Facilities and piping safety shall be checked regularly to ensure the normal operation of the project.

V Public participation and information disclosure

A. The legal basis for public participation

Information dissemination and public consultation work will be carried out in the future construction period of Fuxin subproject in accordance with the requirements of the HF 2006 No.28 *Interim Measures on Public Participation in Environmental Impact Assessment*. Public intervention and public supervision include: Public involvement in the network, informal communication with the affected people, a questionnaire survey, the public consultation meetings to be attended by the affected people. Affected personnel include local residents, local governments and industry organizations and so on.

B. Public consultation

1. Public consultation

The public consultation was conducted in August 2016, and the participants are residents from the areas along with the reconstruction and rehibilitation of the heat networks. The basic information of the participents are presented in Table V-1.

Table V-1: Basic Information of Investigated Personnel for Public Consultation

No.	Name	Gender	Education	Telephone Number	Address	Suggestion
1	Liu Gang	Male	High school	15542880086	Xindu Garden Community	Support
2	Zhang Liang	Male	High school	18698756601	Changqing Community6#	Support
3	Wei Hui	Male	University	18524181523	Xinhua Community1#	Support
4	Qu Shengli	Male	University	13795029522	Jindi Garden Community15#	Support
5	Liu Qiang	Male	University	18524181619	Ningzeyuan Community10#	Support
6	An Fengxia	Female	Middle school	13941862706	Liuhe B	Support
7	Xu Lianlei	Male	University	13470357177	Liuhe D	Support
8	Zhou Jian	Male	High school	18342828882	Zhichenghuifu 2#	Support
9	Zhao Haitao	Male	Primary school	15141872477	Xishan Road 6#	Support
10	Ma Xianli	Male	Middle school	15042515600	Xihuayuan Community 6#	Support
11	Li Hong	Male	High school	15542880168	Yuanding Community #	Support
12	Zhang Mei	Female	University	15542880111	Xindu Garden Community 15#	Support
13	Zhang Qingliang	Male	University	18641850599	Jindi Garden Community	Support
14	Zhang Lanlan	Female	University	13188308831	Xindusijicheng Community	Support
15	Liu Zhao	Male	High school	13795019111	Xindusijicheng Community 4#	Support
16	Jiang Hui	Male	University	18341895500	Xindu Garden 45#	Support

17	Bao Jianchen	Male	High school	—	No.1 Middle School 9#	Support
18	Luan Zhongmei	Female	University	15134046696	Changqing Community 8#	Support
19	Wu Hao	Male	University	18524181525	Dongyuan Community 2-10	Support
20	Wang Guijun	Male	University	15542880059	Dongyuan Community 46-2	Support
21	Jiang Lijun	Male	University	15941807676	Xindu Garden Community 41#	Support
22	Shi Zhu	Male	High school	13238218333	Jindi Garden Community 13#	Support
23	Hu Chengyu	Male	University	15841888788	Xindu Garden Community 15#	Support
24	Zhang Shengli	Male	Middle school	18641881118	Shuxiangjiayuan 1#	Support
25	Yu Na	Female	University	18241890090	Xinhua Community 56-2	Support
26	Tian Xiaofeng	Male	High school	15841836066	Qianjin Road 36-4	Support
27	Zhou Ling	Female	University	13941803323	Xindusijicheng Community 20#	Support
28	Wu Yingchao	Male	University	13470342492	Jindi Garden Community 5#	Support
29	Liu Shangqiu	Male	High school	13841823003	Zhonglin Community	Support
30	Wang Libo	Male	High school	18524181516	Jindijiayuan Community 5#	Support
31	Pei Hongtao	Male	University	18641851028	Jinfu 2#	Support
32	Miao Shi	Male	Middle school	18741838012	Agricultural Bank Development 53-4	Support
33	Pan Jinhui	Male	High school	18524181526	No.1 Middle School 1#	Support
34	Zu Donglan	Male	Middle school	15241899880	Xihuayuan Community 15#	Support
35	Zhang Hui	Male	High school	13841886261	Liuhe B	Support
36	Wu Yanchun	Male	Middle school	13941876444	Xihuayuan Community 12#	Support
37	Li Yupei	Male	High school	15141803424	Nursery 14#	Support
38	Wu Shan	Female	University	18241888954	Liuhe A	Support
39	Liu Xin	Male	High school	18341809944	Jindijiayuan Community	Support
40	Zhou Zhiyuan	Male	University	14741452911	Xindu Garden Community 20#	Support

Questionnaire results.EIA preparation organization made a questionnaire survey at the project site, details see Table V-2. The findings will be used in the design of complaint mechanisms. The purpose of public consultation is to ensure that the affected person is able to understand the existence of the complaint mechanism in the implementation phase

of the project and to agree with the manner in which this complaint mechanism is formed. The survey also indicated the expected environmental impact and the proposed mitigation measures. For details please refer to the environmental report and the EMP.

Table V-2: Questionnaire conclusion

Survey content		Number of people	Ratio (%)	Remarks
1. Do you know the situation of the project construction:	Yes	40	100	Single choice
	No	0	0	
2. Are you satisfied with current heating conditions:	Satisfied	32	80	Single choice
	More satisfied	7	17.5	
	Common	1	2.5	
	Not unsatisfied	0	0	
3. What do you think are the main environmental problems caused during the project construction: (Multiple choice)	Noise affects the residents during the construction period.	22	55	Multiple choice
	Construction dust pollution	9	22.5	
	Ecological environmental destruction	10	25	
	Travel inconvenience during construction	7	17.5	
	Landscape destruction	5	12.5	
	Other	11	27.5	
4. What measures do you think are taken to reduce the environmental pollution caused by the construction of the project:	Reinforce the management	22	55	Multiple choice
	Technical measures such as sound barrier	13	32.5	
	Other	9	22.5	
5. How the lives of the local residents will be affected upon completion of the project?	More good than harm	37	92.5	Single choice
	More harm than good	0	0	
	No effect	3	7.5	
6. How do you feel about this project?	Favor	40	100	Single choice
	Deny	0	0	
	Don't care.	0	0	

The statistics result of table V-1 shows that the people who were surveyed have gained certain amount of understanding on the project construction. All the surveyed people are in support of the project, the project construction has little effect on the living environment. At the same time, the surveyed people think that this project will produce construction noise pollution that will affect the surrounding environment. So the environment management shall be reinforced after the project has started, to ensure normal operation of the environmental protection measures and to maximally reduce the environmental impact on the surrounding areas.

2. Future public consultation

Public consultation will be conducted throughout the project to protect the local environment and communities. During the construction period, independent external environmentalist and project implementation environmentalist will conduct public consultation through formal questionnaires and informal exchanges. Public consultation

focuses on dealing with the residents' complaints during the construction, such as complaints on construction noise, dust pollution, environmental and relocation issues. Interim adjustments need to address public complaints and concerns.

The future public consultation and public participation will also include 1) affected residents or business representatives will be involved in the EMP inspection and monitoring in the construction period; 2) involvement in the assessment of environmental and socio-economic benefits and impacts; 3) public consultation after completion of the project

C. Complaint mechanism

A grievance redress mechanism (GRM) was established in Fuxin project city in compliance with ADB's SPS (2009) requirement to prevent and address community concerns and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations; (iii) improve mutual trust and respect and promote productive relationships with local communities; and (iv) build community acceptance of the project.

The GRM will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available. Opportunities for confidentiality and privacy for complainants will be honored where this is seen as important.

All of the concerns and suggestions expressed during two rounds of public consultation have been summarized and provided to the design institutes. The relevant concerns and suggestions have been considered in FSR revisions, and appropriate mitigation measures were defined in the domestic EIA, this IEE, and the EMP.

The procedure and timeframe for the grievance redress mechanism are described as follows:

- **Stage 1:** If a concern arises during construction, the affected person will submit a written or oral complaint to the contractor directly (the contractor's environment health and safety officer or any onsite construction personnel). Whenever possible, the contractor will resolve the issue directly with the affected person. Otherwise, the contractor will inform the Project Public Compliant Unit (PPCC) accordingly.

- **Stage 2:** If no appropriate solution can be found, the contractor has the obligation to forward the complaint to the PPCU within five (5) working days. The complainant may also decide to submit a written or oral complaint to the PPCU, either directly or via one of the GRM entry points (SpPMO, IA, community leader, local EBP). For an oral complaint, proper written records must be made. The PPCU will assess the eligibility of the complaint, identify the solution and provide a clear reply for the complainant within five (5) working days. The environment consultants of the loan implementation consultancy service will assist the PPCU in replying to the affected person. The PPCU will also inform the ADB project team and submit all relevant documents. Meanwhile, the PPCU will timely convey the complaint/grievance and suggested solution to the contractors or operators of facilities. The contractors during construction and the operators during operation will implement the agreed upon redress solution and report the outcome to the PPCU within seven (7) working

days.

- **Stage 3:** In case no solution can be identified by the PPCU, or the complainant is not satisfied with the proposed solution, the PPCU will organize, within two (2) weeks, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, contractor, facility operator, local EPBs, PPMO, SpPMO, IA). The hearing shall identify a solution acceptable to all, and formulate an action plan. The contractors during construction and the operator during operation will implement the agreed-upon redress solution and report the outcome to the PPCU within the agreed upon timeframe.

The PPCU shall accept complaints/grievances free of charge. Any cost incurred should be covered by the contingency of the project. The grievance procedures will remain valid throughout the duration of project construction and until project closure.

VI Institutional requirements and EMP

A. Introductions

The environmental management plan (EMP) is covers all stages of the Fuxin subproject from the implementation stage to the pilot stage and the operation stage. It is committed to environmental impact monitoring and implementation activities of the environmental mitigation measures. The relevant part of the EMP will be included in the construction, operation and management of the Fuxin subproject.

The environmental protection measures have the following objectives: 1) to reduce environmental impact; (2) to meet and comply with the national environmental standards and ADB safety standards; 3) to provide compensation or the compensation or offset for the loss of environmental resources; And 4) to strengthen environmental resources

The implementation of the environmental mitigation plan will be used to evaluate the actual environmental impact vis a vis the predicted environmental impact in the respects of their range and extent. And come up with the performance appraisal of the environmental protection measures and make a report on whether the measures comply with the relevant rules and regulations.

B. EMP implementation responsibilities

Organization of the project, see Table VI-1. The table lists the main responsibilities associated with the project environmental management.

Table VI-1 Environmental Management Organization Responsibilities

Project Implementation Institution	Environmental Management Roles and Responsibilities
Provincial Project Office - Liaoning Urban Construction and Reconstruction Project Office (LUCRPO)	*Conduct coordination and overall management to ensure the smooth implementation of the project.* • Supervise the work of the subproject office; • Hire a loan implementation environmentalist to assist in the monitoring, tracking and reporting of the EMP; • Sort out the environmental monitoring report provided by the subproject and provide it to ADB. • Supervise the project complaints coordination team in the project complaint mechanism (PCCU).
Subproject office: Fuxin Municipal Project Office	*Overall guidance and supervision of the subproject preparation and implementation* • Prepare the final draft of the EMP for Fuxin subproject; • Together with the implementation institution, and with the assistance of the design unit, prepare the EMP and include it into the construction contractor's tender documents. • Supervise the implementation institution responsible for the implementation of the EMP; • Track and follow up with the implementation of the EMP and report it to the provincial project office;

	• Set up the complaint mechanism at the Fuxin subproject office and set up a special project complaints coordination group.
Implementation institution Fuxin City General Heating Company	*Ensure the smooth implementation of related projects* • Together with the subproject office, prepare the EMP and include it in the construction contractor's tender documents; • To employ the construction supervision company to manage the construction requirements in accordance with the procedures and regulations of the People's Republic of China and the ADB; • Implement the approved EMP; • Monitor the environmental performance and report to the subproject office; • Participate in the capacity building and training programs; • Trial operation of the established equipment.
Facility operator Fuxin City General Heating Company	*Ensure smooth and continuous operation and maintenance of the related subprojects.* • Conduct trial operation of the completed facilities together with the implementation organization; • Operate and maintain the established facilities, including environmental management, monitoring and reporting responsibilities.

Provincial Project Management Office (PPMO) - Liaoning Urban Construction and Reconstruction Project Office (LUCRPO) is responsible for the implementation coordination of the project and the overall supervision. The provincial project office will coordinate and assist the Fuxin subproject office with the implementation of the EMP.

In the project design phase, the subproject office and the implementation institution will send the EMP to the design unit to include the mitigation measures in the detailed design. Then the EMP will be passed to the construction contractor through the tender procedure. In order to ensure that the contractor will abide by the provisions in the EMP, the subproject office and the implementation institution shall, with the assistance and technical support of the loan implementation environmentalist, include the following technical specifications in the tender procedure: 1) the bidder shall prepare the budget for a series of environmental management requirements in the proposal; 2) Environmental provisions in the terms of the contract; 3) the main content in the domestic IEE, IEE report and the EMP. The subproject office will prepare a semiannual report on the progress of the environmental protection. The provincial project office collects the report and submits it to the ADB.

The project implementation organization shall establish an environmental management unit to coordinate environmental issues related to the Fuxin subproject on its behalf. The environmental management unit shall be responsible for 1) to implement the EMP and formulate the implementation details. 2) to monitor the implementation of the mitigation measures during construction; 3) to conduct internal monitoring and measurement and coordination for the regulation compliance of the construction supervision company. 4) to implement the Contractor's training plan; 5) to include the environmental management, monitoring and mitigation measures in the construction and operation management plan; 6) to report the performance of the EMP to the subproject office; And 7) to arrange for the

environmental monitoring review and respond to any adverse effects that are not predicted in the initial environmental examination Report

The subproject will appoint a specific person as the environmental supervisor to review the overall implementation of the environmental management regulations in the EMP. Their work will be coordinated and assisted by the environmental management team in the implementation institution, and will also be assisted by the loan implementation environmentalist. The construction contractor and the construction management company contracted with each of the implementation organizations will be responsible for the day-to-day supervision, monitoring and evaluation of the implementation of the mitigation measures. The subproject office will receive reports of all these activities and submit them to the provincial project office.

At the phase of the project operation, the EPB and the Fuxin subproject office will supervise the implementation of the environmental management and mitigation measures of the subproject operators The cost of mitigation measures at this phase will be borne by the associated facility operators. The environmental supervision company contracted with and paid by the local EPB and the implementation institution will do regular and random environmental compliance review to ensure that the project implementation and the operation phase complies with China's environmental standards and systems Environmental supervision company will represent the local EPB to carry out the actual environmental compliance monitoring and supervision.

The Liaoning provincial government will provide financial and administrative autonomy to the operational organization for the operation of the project facilities. Due to the limited environmental management capacity of the implementation organization, Relevant training has been arranged and summarized in Table VI-8.

C. Roles of the loan implementation environmental consultant

The loan implementation environmental consultant may be a company or an individual, contracted with the provincial project office and provide assistance in the pre-construction, construction and initial operation phases. The loan implementation expert will provide advice to the provincial project office, subproject office, implementation institution and the contractor in all aspects of project environmental management and monitoring. The loan implementation expert will: 1) assist the Liaoning provincial government and the provincial project Office to design the environmental management part of the project performance monitoring system; 2) assist the provincial project office and the subproject office to update the EMP and the environmental monitoring plan; 3) check the implementation of the environmental protection measures specified in the EMP and review the implementation of EMP on site; 4) review of internal compliance monitoring reports and semi-annual environmental performance reports; 5) prepare a semi-annual environmental monitoring review report; 6) provide training on the implementation and monitoring of environmental management for subproject office and implementation institution; 7) identify any environmental-related implementation issues and necessary corrective actions and reflect them in a corrective action plan; and 8) conduct a site inspection as required.

D. Role of external independent environmental consultant/Expert

Main tasks of the external independent experts are as follows: 1) verify the internal environmental monitoring system and environmental monitoring data of the project undertaker; 2) review the project management office and the environmental monitoring

semi-annual report prepared by the consulting company in implementation period; 3) investigate the relevant environmental problem, take samples and observe on site through field visits; 4) point out the problems in the implementation of the environment, the implementation of EMP and the corrective measures to be taken; 5) prepare a report on the implementation of the EMP and submit it to the owners and ADB.

E. Summary of potential impacts and reduction measures

Table VI-2 summarizes the potential impacts of subprojects during the construction in the initial environmental examination report and corresponding reduction measures to minimize these impacts. In the initial environmental examination report, the Fuxin Subproject Implementation Agency has prepared the Environmental Management section for the projects within its jurisdiction. These are already included in the total EMP, and the environmental monitoring plan in this section includes the Fuxin subproject field and environment. (See Tables VI-2 and VI-5).

The following reduction measures will be included in the tender documents, construction contracts and on-site management plan. The effectiveness of these measures will be carefully observed through environmental monitoring to confirm whether to proceed or to improve.

Table VI-2 Summary of potential impacts and reduction measures.

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
Pre-construction					
1.1 Feasibility research and design phase	Initial environmental examination	According to legal requirements, make sure that the initial environmental examination report has been prepared for the Fuxin subproject.	The IEE units and technical assistance panel on behalf of the implementation institution	Implementation institution /local EPB	Included in the feasibility research and design phase
	Pipeline selection of energy-saving designs is to conserve water and air pollutant emissions	Select polyurethane composite buried insulation tube for hot water directly-buried pipe, whose quality is in line with the national (GB / T29047-2012) standard on "high density polyethylene protective tube polyurethane foam prefabricated buried insulation tube" and ensure that per	Design units and implementation institution	Subproject office	Included in the detailed design phase

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		kilometer pipeline temperature drop is below 0.2℃. Pipeline selection of energy-saving designs can save water resources, boiler fuel of heating plant, coal dust, carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides and other pollutants emissions.			
	Device selection of energy-saving designs is to conserve water and air pollutant emissions	Select energy - saving pumps with the required efficiency of about 80%; Select efficient heat exchanger with heat transfer coefficient of 4,000W / m^2 • ℃ or so; Use softened water replenishment for hot water network to prevent equipment and pipeline scaling and improve thermal efficiency; Use make-up pumps with frequency conversion. Peak-shaving heat source plant uses variable speed pump to operate.	Design units and implementation institution	Subproject office	Included in the detailed design phase
1.2 Implementation support	Set up the position for implementation support	Sign a contract with a loan implementation environmentalist	Provincial project office	Liaoning Provincial Government	Included in the detailed design phase
		Contract a construction supervision company	Subproject office	Provincial project office	Included in the detailed design phase

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
	Establish environmental units at different levels of supervision	Nominate / appoint an environmental supervisor inside the PMO. Establish an environmental management unit within each implementation institution and arrange suitable and experienced staff.	Subproject office, implementation institution	Loan implementation environmentalist	Included in the detailed design phase
1.3 Construction preparation phase	Update the EMP	The reduction measures specified in the EMP will be updated and included in the detailed design to minimize adverse environmental impacts.	Local design units, subproject office, implementation institution	Provincial project office, the loan implementation environmentalist, the local EPB	Included in the detailed design phase
	Contract document	Prepare the environmental aspects of the task syllabus for the bidder. Prepare environmental contract terms for contractors, that is, special terms (eg., refer to EMP and monitoring form)	Local design units, subproject office, implementation institution	Provincial project office, the loan implementation environmentalist, the local EPB	Included in the detailed design phase
	Provide comprehensive and timely responsive complaint procedures	Formulate and implement complaint mechanism (GRM). Establish a project coordination group inside the project office.	Subproject office and implementation institution	*Provincial PMO, ADB*	
	Construction site plan	Prepare on-site environmental management and supervision manuals, including emergency preparedness and emergency response plans, and on-site environmental health and safety programs	The primary contractor for each subproject	Implementation institution	Included in the construction contract

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		for real-time agency approval. The plan includes guidelines and direction for hazardous and pollutant substance management.			
	Environmental protection training	Environmentalist and / or officials from local EPB will be invited to provide training on contractors' implementation and supervision of environmental mitigation measures.	Implementation unit/local EPB	Subproject office	For EMP cost, see Table IX. 8.
Construction					
2.1 Water	Test pressure and rinsing wastewater	Discharge into municipalsewersor municipal rainwater pipe network	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8
	Wastewater from construction camps (where applicable)	Latrines and seepage pits will be installed in any camps. After project completion, the sites will be vacated only after waste has been effectively treated or removed.	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8
	Wastewater from washing aggregates, pouring and curing concrete, machinery repairs	i. Settling ponds, oil-water separators. ii. Recycled water will be used to spray for dust control. iii. Residue will be removed from site and disposed in municipal landfills.	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8
	Wastewater for cleaning equipment and tools	It shall be used for preventing dust after treated through ordinary sedimentation and grease trap.	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8
	Underground gushing water	It shall be pumped to the municipal sewage pipe network, and then discharged into the urban sewage treatment plant for processing	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
2.2 Air	Dust from Construction Activities	i. Should provide a continuous, closed enclosure around the construction site. ii. Harden the construction site ground and pavement as part of the dust treatment measures. iii. When earthwork is under construction, watering and other dust suppression measures should be taken. iv. If engineering dregs and the like fail to clear within 48 hours, a temporary storage field should be set up in the construction site and fence, cover and other dust control measures should be taken. v. Transport vehicles shall not leave the workplace until its mud is removed and rinsed thoroughly. Air compressors and other equipment prone to producing dust shall not be used to clean the dirt of vehicles, equipment and materials.	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		vi. Dust screen or dust cloth shall be used for covering earthwork piled in the site, and it should be regularly watered. vii. When construction machinery is in the excavation, soil loading, soil piling, road cutting, crushing and other operations, watering, spray and other measures should be taken. viii. Sprinkling water, covering and other measures should be taken for the backfilled trench. ix. When digging the ground or cleaning the construction site, you should sprinkle water on the ground. x. Vehicles used to transport materials like gravel, muck, earthwork, waste, etc shall be covered with canopies or tightly enwrapped, so to avoid any scattered or leaked materials that may cause dust pollutants.			
	Construction machinery	i. Construction	Contractor	Implementation	For EMP cost, see

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
	exhaust	machinery must use high quality fuel to reduce machinery and vehicle exhaust emissions. ii. In the construction period, you should arrange reasonably for operation according to the construction schedule. The traffic flow of a certain place should not be concentrated and too large, as far as possible to reduce the concentration of pollutants.		institution /local EPB	Table IX. 8
2.3 Noises	Noise created by vehicles and construction machinery	The following safeguards will be implemented: i. Noise levels from equipment and machinery to conform to PRC-GB12523-2012. ii. Install portable noise shields near sensitive receptors such as schools and residential areas. iii. At construction sites, noise-generating construction work will be stopped between 20:00 and 06:00 hours. In unexpected cases where construction noise needs to continue into the night, the construction unit must reach an agreement with APs and provide	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		compensation. Iv. During the construction period, the construction site is surrounded by a 2.5m high fence. The mobile sound barriers shall be set at close the sensitive area side in order to stop sound and reduce the impact on the surrounding residents for the construction site that it is closer to the sensitive area.			
2.4 Solid waste	Domestic waste from construction camps	i The contractors will provide appropriate waste storage containers. ii Trash collection bins will be regularly sprayed with pesticides to reduce flies. iii Wastes will be stored away from water bodies and will be regularly hauled to a suitable landfill or designated dumping site. Agreements will be signed with local authorities for waste disposal, where appropriate, through local facilities and to approved disposal sites.	Contractor	Implementation institution /local EPB	For EMP cost, see Table IX. 8
	Construction wastes could have adverse impacts on surrounding environments.	Construction wastes that cannot be reused will be regularly transported off-site for disposal, and not allowed to accumulate on site over long periods.	Contractor	Implementation institution /local EPB	For environmental management cost, see Table IX8.

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		Household garbage will be collected through the nearby dustbin, and cleaned and transported by the sanitation sector to the government-designated landfill. Construction wastes shall be transported to the designated location by the municipal department with special vehicles. Replaced old pipes, old valves, old conpensators shall be collected and recovered by Fuxin City Heating General Corporation			
2.5 Soil erosion and ecology	Erosion from construction sites	The following safeguards will be implemented for all construction-related earthworks: i. Construct interception ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage. ii. Limit construction and material handling during periods of rains and high winds. iii. Stabilize all cut slopes, embankments, and other erosion-prone working areas while works are going on. iv. All earthwork disturbance areas shall be stabilized within 30 days after earthworks have ceased at the sites.	Contractor	Implementation institution /local EPB	For EMP, see Table IX. 8
2.6 Community	Social management	i. Work out traffic control plan in	Implementation	Subproject office	For EMP, see Table

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
Health and Safety		advance, and issue a circular. Set reasonably the similar and cross road merging along the rout of pipeline construction and temporary bypass channel, to shorten closed construction period of the main cross-road furthest; ii. Leave service roads for the units along the two sides of the pipeline, markets, residential areas and other road network junctions to dredge pedestrians and vehicles so as to prevent traffic congestion, or by other means to inform the relevant units in advance to take the other roads, and set obvious signs of the temporary detour route at the main intersection ; iii. Arrange reasonably for construction time, forbidding construction during lunch time and night. Notice residents nearby when performing strong noise operation.	institution		IX. 8
	Traffic	i. Along the road	Contractor,	Impleme	For EMP,

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
	management	construction sections, pipeline excavation is on both sides of the road, a very small number of sections occupying the traffic lane. Temporary stacking earth is as far as possible placed on both sides of the road, not taking up the road. ii. When the pipeline goes through the road, if taking the slotted way, it is easy to block the road vehicles, having a greater impact on traffic conditions, but the construction period of the pipe network crossing project is no more than 7 days, so the impact on traffic from the pipe network construction should be controlled within 7 days. iii. Immediately backfill and compact after going through the road, resurface asphalt to recover.	implementation institution	ntation institution, transport agency	see Table IX. 8
	Community security	i. Announce pre-notice of construction by radio and television before construction. ii. A construction	Contractor, implementation institution	Implementation institution, transport agency	For EMP, see Table IX. 8

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		billboard shall be set up at each construction site, including construction content, the schedule, persons in charge and complaint telephone.			
Health and Safety of Workers					
2.7 Unexpected environmental impact		If unforeseen environmental impacts occur during the implementation of the project, the implementation institution shall update the EMP and shall design environmental protection measures and use resources to address these impacts.	Implementation institution	Subproject Office	Included in construction costs and unforeseen costs
Operation period					
3.1 environmental impact.		The impacts during operation of the heating network is mostly associated with the heat sources. The existing heat sources are in compliance with required measures permits, The capacity-building component of the subproject will reduce the likelihood of accidents such as leaks, etc. The existing SCADA system was newly installed in 2010 and the monitoring should immediately alert any issues during the operation of the heating networks. Pressure measurement and	Implementation institution and operators	Subproject office	Included in operating costs

Project / medium	Environmental issues and impacts	Reduction measures and / or safeguards	Implementing party	Supervision party	Cost
		flow measurement instruments should be set at the service ports of the pipeline in order to discover the pipe network leak to avoid the impact on the surrounding ecological environment. Facilities and piping safety shall be checked regularly to ensure the normal operation of the project.			
3.2 Unexpected environmental impac		If unforeseen environmental impacts occur during the project operation period, the implementation institution shall update the EMP and shall design environmental protection measures and use resources to address these impacts.			

Source: Initial environmental examination report of Fuxin subproject

F. Project preparation evaluation

Before the construction, the loan implementation specialist will evaluate the project's preparation for environmental management based on a series of indicators (Table VI-3) and report it to ADB and PMO. The evaluation will indicate that environmental commitments are being implemented, that the environmental management system is in place before the start of the construction or that correct action recommendations are made to ensure that all requirements are met.

Table VI-3: Project Preparation Evaluation Index

Index	Standards	Evaluation
Approval and publicity of initial environmental examination report	• The initial environmental examination report is approved by ADB and publicized on ADB's project website.	Yes No
The measures implemented in	• Table IX. The measures specified in Table IX.2 and the measures specified on	Yes No

Index	Standards	Evaluation
the detailed design stage	detailed design stage are included in the detailed design of each project	
Environment Management Plan	• The EMP is updated after detailed design and is approved by ADB and the local EPB.	Yes No
Observe the terms of the loan	• The borrower complies with the terms of the loan related to the project design and EMP.	Yes No
Consultation and complaint mechanism	• Complete meaningful consultation	Yes No
	• Complaint mechanism (including project coordination group) discusses / shares information with relevant stakeholders.	Yes No
Environmental supervision is in place	• Establish environmental management team inside the implementation institution • The contracted loan implementation environmentalist • Contracted environmental monitoring experts • The contracted construction supervision company • Established compliance monitoring plans	Yes No Yes No Yes No Yes No Yes No
Bidding documents and contracts about environmental security assurance	• Bidding documents and contracts about environmental activities and security assurance are included to be loan guarantee.	Yes No
	• Bidding documents and contacts about influence cutting down measures and environmental management regulation in EMP are included.	Yes No
Contractors' preparation	• Site environmental management and supervision manual includes emergency preparedness and response plans for construction plant, site environmental health and safety plan. • Appointed environmental, health and	Yes No Yes No Yes No

Index	Standards	Evaluation
	safety officials • Written internal environmental monitoring plan	
Financial support for EMP	• Funds are reserved, according to financial plan, to support the implementation of EMP.	Yes No
Extra noise prediction model	• Comprehensive predictive analysis is made on the sensitive sites along the pipe network. • Funds are reserved for cutting down noise for the affected housings.	Yes No Yes No

During the project implementation, adverse impact may be made on environment, and applicable cutting down measures are regulated to avoid or minimize these potential influences. Performance indicators, including quality control on sewage discharge, underground water, surface water, soil and air quality, noise and other relevant public heath indicators, are regulated to measure the effectiveness of the cutting down measures. A series of indicators and environmental performance of measured projects are listed on the below table VI-4.

Table VI-4: Cutting down Measures' Monitoring Index and Relevant Standards

Phase	Subproject	Index	Standards
Construction	Pipeline network	Dust	Grade II, Ambient Air Quality Standards (GB3095-2012)
	Pipeline network	Construction machinery noise limitation	Construction Noise Limitation (GB12523-2011)
Operation	None	None	None

G. Environment monitoring

a) Monitoring plan

Project monitoring plan will be concentrated on the environment within the range of influenced by the project. Detailed comprehensive environmental monitoring plan is concluded on the below Table VI-5. Monitoring range, monitoring parameter and frequency are taken into account in the plan.

Internal environmental monitoring/supervision. Internal environmental monitoring and supervision officials will be employed or arranged among the staffs from each contractor during the implementation period of the project; Environmental management groups of the implementation institution shall be responsible for their internal monitoring and supervision.

Environmental supervisors of the subproject office and the local EPB shall be responsible for suggestion, monitoring and supervision to ensure the cutting down measures regulated in EMP being reasonably implemented. In the initial period of the project implementation, the environmental management group of the implementation institution shall write more internal monitoring plan details of the construction period and operation period with assistance from loan implementation environmentalist when necessary, to promote and clarify their application. Similarly, the environmental monitoring group and loan implementation environmentalist shall include any change into the implementation plan according to the feedback of EMP and the adjustment mechanism. Contractors (weekly), construction supervision company (monthly) and implementation institution (monthly) shall have internal monitoring and supervision and report to ADB every half year.

Compliance monitoring. The signed and paid approved environmental monitoring center of the implementation institution shall implement the construction period, operation period and incidental compliance monitoring. Compliance monitoring shall be made 4 times every year; and the environmental supervision company shall write semi-annual compliance monitoring report, which shall be submitted to the subproject office and local EPB for examination. Monitoring requirements are listed on Table VI-5, including monitoring parameter, quantity and locations of monitoring sites and monitoring frequency and time duration.

Table VI-5: Environmental Monitoring Plan

Category	Parameter	Location	Implementation institution	Supervision institution	Time and frequency
Construction					
1.1 Construction campsite domestic wastewater quality	pH, SS, DO, NH_3-N, TP, BOD_5, COD_{Cr}, Escherichia coli, oil	Internal monitoring will be conducted at all construction sites and domestic wastewater discharge areas. Compliance-related impact monitoring will be conducted at selected camp sites.	Internal monitoring: Contractors, IA	IA	Random spot check of the domestic wastewater effluent sites (at least monthly)
			Compliance-related impact monitoring: Licensed EMC	Local EPB	Twice per year
1.2 underground water	pH, Oil	Internal monitoring will be	Internal monitoring: Contractors, IA	IA	Random spot check

Category	Parameter	Location	Implementation institution	Supervision institution	Time and frequency
		conducted at all construction sites. Compliance-related impact monitoring will be conducted at selected sites			
			Compliance-related impact monitoring: Licensed EMC	Local EPB	Twice per year
1.2 Construction wastewater and wastewater pollution mitigation measures	PH, SS, Oil	Internal monitoring will be conducted at all construction sites. Compliance-related impact monitoring will be conducted at selected sites	Internal monitoring: Contractors, IA	IA	Random spot check of the wastewater effluent sites
			Compliance-related impact monitoring: Licensed EMC	Local EPB	Twice per year
1.3 water quality of the nearest water body	pH, SS, DO, NH_3N, TP, BOD_5, COD_{Cr}, Total coliform, oil	Internal monitoring will be conducted at all construction sites. Compliance-related impact monitoring will be conducted upstream and downstream of the	Internal monitoring: Contractors, IA	IA	Random spot checks
			Compliance-related impact monitoring: Licensed EMC	Local EPB	Four times per year

Category	Parameter	Location	Implementation institution	Supervision institution	Time and frequency
		construction sites			
1.4 precautionary measures on atmospheric pollution	By dust cover and watering Maintenance and status of vehicle and equipment TSP, SOx, NOx	Internal monitoring shall be made on all construction sites and sensitive spots External monitoring shall be made on campsite and sensitive spots.	Internal monitoring: Contractor, implementation institution	Implementation institution	Construction sites shall be randomly checked.
			External monitoring: Approved environmental monitory company	Local EPB	Twice every year during the construction period and two samples in each site every time
1.5 control measures on noise pollution	Leq (dB[A))	Sensitive spots shall be nominated in each subproject.	Internal monitoring: Contractor, implementation institution	IA	Randomly, at least one time every month, one day every time and two samples every day: One by day and one by night
			External monitoring: Approved environmental monitory company	Local EPB	Randomly, at least one time every month, one day every time and two samples every day: One by day and one by night
1.6 Sanitation and disease	Feasibility and medical suggestion on health condition, sanitary condition and clean water,	Construction sites, project campsites and immigrant ereas	Internal monitoring: Contractor, implementation institution	Implementation institution	Random inspection
			External monitoring: County disease	Local EPB	Once a year

Category	Parameter	Location	Implementation institution	Supervision institution	Time and frequency
	HIV/AIDS consciousness		prevention and treatment department		
Operation: Heat Network Reconstruction and Rehibilitation subproject					
Category	**Parameter**	**Location**	**Implementation institution**	**Supervision institution**	**Time and frequency**
2.1	None	None	None	None	None

Source: Requirements from ADB; Initial environmental examination report of subproject
BOD_5 = 5-day biological oxygen demand, CCl_4 = carbon tetrachloride, COD_{Cr} =chemical oxygen demand, DO = dissolved oxygen, EMC = environmental monitoring center, EPB =EPB, FB = forestry bureau, Fe = ferrum, L_{eq} = equivalent sound level, Mn =manganese, NH_3-N =nomadic nitrogen, NO_x =nitrogen oxides, SO_x = sulfur oxides, SS = suspensoid, TSP = total suspended particulates, WRB = water resources bureau;
* Local EPB = county, district or municipal EPB

External monitoring: to respond the requirements of Safeguard Policy Statement (SPS) (2009), the project environmental performance shall be verified by external experts. External experts, who are external to lenders, shall discontinuously take part in the project. External experts may be loan implementation experts, who shall not take part in the regular project implementation. External experts shall verify the monitoring information provided by the lender. During the verification period, external experts may carry through their examination by site inspection, sampling and/or visual inspection. External experts shall discuss with lender / consultants to provide correct actions and reflect these results in their environmental monitoring inspection reports.

Compliance monitoring quality assurance (QA)/quality control (QC).QA/QC shall proceed according to the following regulations, to ensure the monitoring veracity.

i) *Environmental Monitoring Quality Assurance/Quality Control Regulations* released by State Environmental Protection Administration in July 2006

ii) *Environmental Water Monitoring Quality Assurance/Quality Control Manual (Version II)* published by National Environmental Monitoring Center in 2001

iii) *Environmental Air Quality Assurance/Quality Control Manual* published by National Environmental Monitoring Center in 2001

The standard monitoring methods required by these manuals are shown on the below Table VI-6.

Table VI-6: Environmental Air, Noise and Water Standard Monitoring Method

Media	Monitoring parameter	Method (standard, number)
Air	TSP (mg/m3)	(GB/T15432-1995) Weighing method
	PM_{10} (mg/m^3)	Specific Sampling Weight Method (HJ/T93-2003)
	SO_2 (mg/m^3)	Spectrophotometry HJ482-2009

	NOx (mg/m3)	Saltzman method (GB/T15435-1995)
Noise	Equivalent continuous A sound (Leq)	Acoustimeter (GB12524-90)
Surface water	PH value	Glass electrode method (GB6920-86)
	COD_{Mn} (mg/L)	Permanganate index (GB11914-89)
	Petroleum (mg/L)	Infrared spectroscopy (GB/T16488-1996)
	SS (mg/L)	Weight method (GB11901-89)
	Escherichia Coli (no./L)	Membranous filter (GB/T575.12-2006)
Underground water	pH value	glass - electrodes method (GB6920-86)
	Oil (mg/L)Oil(mg/L)	Infrared spectra (GB/T16488-1996)

Note: mg/m^3 = milligram /cubic meter; mg/L=milligram/ liter; no. /L = number/Liter.

The environmental monitoring and supervision activity result/data shall be applied to evaluate: 1) the actual environmental influence range and strength compared with the predicted influence and standard before the project was implemented; 2) the environmental cutting down measure's performance and effectiveness or whether following relevant environmental regulations or not; 3) influence trend; 4) the comprehensive effectiveness of the EMP implementation; and 5) the extra cutting down measures and correct action requirement, if any unmatched situation occurs

b) Mitigation measures and monitoring cost

The environmental management listed to implement EMP and the cost of influence cutting down measures are listed on the below Table VI-7. The table also includes environmental monitoring cost. These shall be included in the construction contract number and supporting capital budget. It shall be pointed out that although the implementation institution carries through external and compliance monitoring on behalf of the EPB, the implementation institution needs to pay the cost. During the implementation of the project, the required cost can be adjusted according to the actual requirements. If unexpected environmental impacts are found during the implementing of the environmental monitoring, it is necessary to update the initial environmental examination (IEE) and the EMP in time, and propose cutting measures to reduce the impact on the environment.

The implementation institution will be responsible for all compliance monitoring costs and will ensure necessary budget paying to the environmental monitoring company. The cost of internal monitoring during the construction period shall be borne by the implementation institution and the contractor; that during operation should be borne by the implementation institution. Before implementing the monitoring, the environmental management team of the implementation institution will submit a more detailed breakdown assisted by the loan implementation environmentalist. During the implementation of the Subproject, the budget will be adjusted according to the actual requirements.

The contractor will bear the cost of all the cutting measures during the construction period, which will be included in the tender documents and the contractor contract. The implementation institution will be responsible for the costs associated with the cutting measures during the operation period and the costs associated with the environmental monitoring during the construction and operation periods. The project as a whole will bear the costs of training and loan implementation experts. The training budget will be included

in the construction and operation contracts. The training budget during the operation period will be included in the budgets of operations and maintenance.

Table IV-7: Estimation of Environmental Protection Investment

Period	Investment Project		Amount (RMB 10k)
Construction	Air	Dust prevention (sprinkler, fence)	10
	Solid waste	Set up temporary trash, clean and remove waste and building garbage	10
	Ecological environment	Ecological remediation	20
	Environment monitoring	Environmental monitoring in construction period	5
	Environment supervision	Environmental supervision in construction period	15
Operation period	—	—	—
Total			60

H. Public consultation, public participation and information dissemination

a) The public consultation during the project preparation period

The public consultation has been completed, seen from Chapter V in the initial environmental examination report. Conduct the direct public participation as a sustainable factor in the development of the Subproject. These activities will be implemented by the implementation institution in the preparation of feasibility report and the initial environmental examination (IEE) and by the experts of technical assistance according to Chinese technical guidance principle of national EIA and ADB's SPS 2009.

b) Future public consultation plan

Public consultation and public participation will be conducted in detailed design, construction and operation periods. Future public consultation plan includes: 1) the monitoring impact and cutting measures in the stage of project construction and operation; 2) evaluating the environmental and economic benefits and social impact, and 3) the public interviews after the completion of the Subproject.

The plan of public participation is part of the project implementation and management plan. The implementation institution is responsible for the public participation during project implementation. The costs of public participation activities during the implementation period is included in the project funds. The implementation institution will bear the costs of public participation during the operation period.

Table VI-8: Public Consultation Plan

Organizer	Methods	Time/ frequency	Theme	Attendees
Project preparation				

Organizer	Methods	Time/ frequency	Theme	Attendees
EIA authors (agency)	Questionnaire and interview	During the work at EIA site	Project priorities, impacts, attitudes and opinions on the project	The residents in Subproject area and construction area
Technical assistance experts, ADB	On-site inspection, public consultation	Formal consultation of two rounds	Comments and suggestions of affected people and stakeholders	Representatives of affected people and stakeholders
Technical assistance experts, subproject office	Establish a complaint mechanism arrangements in each country	Ongoing	The complaint way and solutions of environmental problem during the construction and operation periods	Affected persons, representatives of affected people and other stakeholders
Construction				
Implementation institution, subproject office	Public consultation and on-site inspection	Once a year above	If necessary, adjust the cutting measures, impact and recommendations of constructions	Workers and residents in the construction area
	Expert seminars or conferences	If necessary, based on the public consultation	Evaluation and recommendations of cutting measures, public opinion, correspondingly adjusting cutting measures	Experts of different industries and medias
	Public seminars	Once a year above	If necessary, adjust the cutting measures, impact, comments and recommendations of constructions	Representatives of residents and social sectors
Trial Operation				
Subproject office, implementation institution, operator	Site inspection	Many times, according to the result of the environmental auditing of the project completion	Comments and suggestions on the operation impacts, the public opinion of correct actions	Local residents and social sectors, EPB
Operation				
Implementation institution	Public consultation and on-site inspection	Once a year above	Effectiveness of cutting measures, operation impacts,	Residents near the project site

Organizer	Methods	Time/ frequency	Theme	Attendees
			evaluation and recommendations	
	Public seminars	If necessary, based on the public consultation	Effectiveness of cutting measures, operation impacts, evaluation and recommendations	Representatives of residents and social sectors
	Public satisfaction survey	Once a year above	Comments and suggestions	Project beneficiaries

c) Institutional strengthening and training

The project preparation and start-up phase has confirmed that the project is mainly aimed at small town, which have limited capacity for sustainable environmental management. However, most under-construction urban roads in major cities in China have more long-term and extensive experience in the intervention, and small towns need assistance in dealing with the challenges posed by these developments. In order to the effective implementation of EMP, it must strengthen the ability of project office, implementation institution and construction supervision company and contractor, and all parties involved in the cutting measures and environmental performance monitoring must understand the goals, methods and regulations of project environmental management. Obviously, the implementation institution and local EPB will be responsible for massive responsibility and workload if it aims at ensuring the environmental safety. Therefore, the most important part of capacity building in environmental management has been at this direction. During the preparation of the project, the implementation institution and their IEE agencies have obtained the assistance through the form of the draft review of IEE, training sessions and seminars on specific environmental issues. The implementation institution, contractors and operators will enhance their capabilities through environmental management training.

Liaoning provincial EPB, the local EPB and loan implementation environmental consultant should provide training based on their roles in the project. However, the focus of training (>50% training budget) is to ensure that the contractors are able to master the environmental safety regulations and to implement all constructions in accordance with the appropriate environmental security. Institutional strengthening and training programs are shown in Table VI-9.

The supervision personnel of subproject office, implementation institution (including environmental management group), the contractor, the local EPB and contractor will accept the training of environmental management, environmental monitoring and supervision, cutting plan, emergency plan, the formulation of environmental policy, and other environmental management technical aspects. It will provide training to the implementation institution and local EPB to their respective roles. However, the focus of training (>50% training budget) is to ensure that the contractors are able to master the environmental safety regulations and to implement all constructions in accordance with the appropriate

environmental security. Institutional strengthening and training programs are shown in Table VI-9.

The training funds will be included in the budget of project operation and maintenance during the project operation period. The predictable costs of institutional strengthening and training are shown in each subproject management in Category 1.2 (Before Construction) and 3.7 (Operation Period) in Table VI-7.

Table VI-9: Institutional Strengthening and Training

Capacity building	**Organization**	**Contents**	**Period**
Environmental management capability	Subproject office, implementation institution	Establishment of environmental management unit	Before and during project implementation
	Provincial project office, subproject office	Loan implementation experts contracted and in service	Before and during project implementation
	Provincial project office, subproject office, implementation institution	Establish project coordination group. Development and implementation of complaint mechanism	Before and during project implementation
	Subproject office and implementation institution	Develop bidding documents, including the regulations of EMP	Before and during project implementation
	Implementation institution	Sign a contract and work with construction supervision company	Before and during project implementation
Training	**Participant**	**Contents**	**Period**
Environmental laws, regulations and polices	Provincial project office, subproject office, implementation institution/the operator, the contractor	(i) Environmental laws and system (ii) Environmental policy and plan (including ADB's SPS) (iii) Basic environmental management (iv) Emergency preparedness and response	Before project implementation
EMP implementation	Provincial project office, subproject office, implementation institution and contractor	(i) Duties and responsibilities of project construction, management and environmental protection. (ii) Environmental protection task in project construction (iii) For example: During project	Before and during project implementation

Capacity building	Organization	Contents	Period
		implementation (iv) Each environmental report (v) The improvement of EMP and correct actions	
Environmental health and safety	Provincial project office, subproject office and the contractor	Environment, health and safety of subproject construction (i) Protective regulations and equipment (ii) Safe workplace environment (iii) Community safety	Before and during project implementation
Implementation of complaint mechanism	Provincial project office, subproject office, project coordination group, access point of complaint mechanism	(i) Structure, responsibility and time frame of complaint mechanism (ii) Type of complaint, qualification review (iii) Gender response for complaint mechanism (iv) report program	Before project implementation
Risk treatment	The implementation institution/ operator, contractor	(i) Risk management method (ii); Environmental accidents, risks and cutting measures (iii) Emergency response team, procedures and actions	Before project implementation
Environmental health and safety	Implementation institution and equipment, the operator	Environment, health and safety of subproject operation (i) Protective regulations and equipment (ii) Safe workplace environment (iii) Community safety	Before and during project implementation
Environmental monitoring, supervision and reporting	Implementation institution/operator, contractor, the local EPB	(i) Monitoring and supervision methods, data collection and processing, data interpretation and reporting system (ii) Requirements of	Before project implementation

Capacity building	Organization	Contents	Period
		environmental reporting	

d) Reporting and monitoring

Monthly report. The subproject office will collect data and report from the implementation institution, environmental monitoring companies and construction supervision company, which are responsible for monitoring the contractors implementing the cutting measures. These data will be included in monthly progress report of subproject. The report will show that: 1) the situation of project construction; 2) implementing environmental cutting measures; 3) monitoring activities; 4) the monitoring data of air, noise and water; 5) analysis according to monitoring data of relevant standards; 6) situations in violation of environmental regulations; 7) requiring any additional cutting measures and correct measures; 8) ongoing environmental training; 9) report of occupation health and safety (eg: accident during the construction); 10) major events and problems happened during the reporting period and actions taken later; 11) received complaint from the public and how to solve these complaint through the complaint mechanism. Monthly report will be submitted to the local EPB.

Semi-annual environmental performance report, external environmental monitoring verification report. Every subproject office will merge their monthly reports and submit a semi-annual subproject performance report to provincial project office. Provincial project office will merge all semi-annual subproject performance reports into the overall performance report and submit it to ADB. Loan implementation environmentalists help compile the performance report. External monitoring will review all reports, including internal and compliance monitoring reports and semi-annual environmental performance reports, and compile a semi-annual environmental monitoring verification report. The report shall confirm that the project complies with the EMP and Chinese legislative standards, to confirm any issues related to environmental implementation and the necessary corrective actions. External monitoring will send the report as an appendix to the borrower's environmental performance report, or as a separate report at the same time.

Environmental acceptance monitoring and audit report. The implementation institution should collect data / report from all the contractors and construction supervision company no later than one month after each subproject completes the construction project, and submit the report of the completion of construction cutting to subproject office and the local EPB. The report will show the completing cutting measures and time, scope and effectiveness of maintenance, and point out the future cutting measures and monitoring requirements during the operation period. In addition, within two months after the completion of the project, the environmental acceptance monitoring and audit reports 1) will be compiled on the basis of the Chinese Environmental Approval Regulations of Project Completion (State EPB, 2001) ; 2) will be reviewed for approval of the EPB of Liaoning province; 3) will be reported to ADB by provincial project office finally.

In addition to reviewing the semi-annual environmental performance report of project office and the semi-annual environmental monitoring verification report of loan implementation environmentalist, the ADB delegation will inspect the progress and implementation of the project at site two times a year. To the environment issues, inspection will focus on: 1) Monitoring data; 2) the implementation situation of the project performance indicators of environment part in the loan files, environmental compliance situation, the implementation of EMP, environmental institutional strengthening and training; 3) the environmental performance of the contractors, loan implementation environmentalist and implementation institution; and 4) the operation and performance of the complaint mechanism. It will record the Contractor's performance in environmental protection and impact reduction and will be considered in the future loan evaluation of bid.

Table VI-10: Report Plan

Report		**Source**	**Arrival**	**Reporting frequency**
Implementation date				
Internal monitoring and supervision	Internal monitoring report of construction contractor	Contractor	Implementation institution	Monthly
	Monthly internal monitoring report of implementation institution	Implementation institution	Subproject office and the local EPB	Monthly
	Semi-annual internal environmental monitoring and supervision report based on monthly report	Subproject office	Provincial project office	Twice a year
External monitoring and supervision	Semi-annual external environmental monitoring and supervision report based on monthly report	Environmental monitoring company on behalf of the EPB (funded by the implementation institution)	The local EPB, subproject office and provincial project office	Twice a year
Reporting to ADB	Semi-annual progress report based on internal and external reports.	Provincial project office	ADB	Twice a year
Operation period				
Internal Monitoring	Daily environmental monitoring report	Implementation institution /operators	The local EPB and subproject office	Monthly
External monitoring and supervision	Environmental compliance reporting	Environmental monitoring company on behalf of the EPB (funded by the	The local EPB, subproject office and provincial project office	Quarterly

Report		Source	Arrival	Reporting frequency
		implementation institution)		
Reporting to ADB	Semi-annual report based on all internal and external monitoring and supervision reports during the operation period	Provincial project office	ADB	Annually (3 years after the starting of operation)

e) Feedback and adjustment mechanism

It will use feedback reporting to systematically evaluate the effectiveness of cutting measures and monitoring plans. If necessary, it will adjust the EMP. The subproject office will play a key role in the feedback and adjustment mechanism.

If during the period of supervision and monitoring, it finds real difference with EMP or any subproject changes which may lead to large adverse environmental impact or increase the number of affected person, the subproject office should immediately consult to the local EPB and ADB and set up an environmental assessment team for the additional environment evaluation and go on a further public consultation when necessary. The revised initial environmental examination (IEE) (including the revised EMP) shall be submitted to the environmental authorities for approval and ultimately submitted to ADB. The revised EMP will be transferred to the contractor and the implementation institution for conducting the feedback and adjustment mechanism of EMP see figure VI.1.

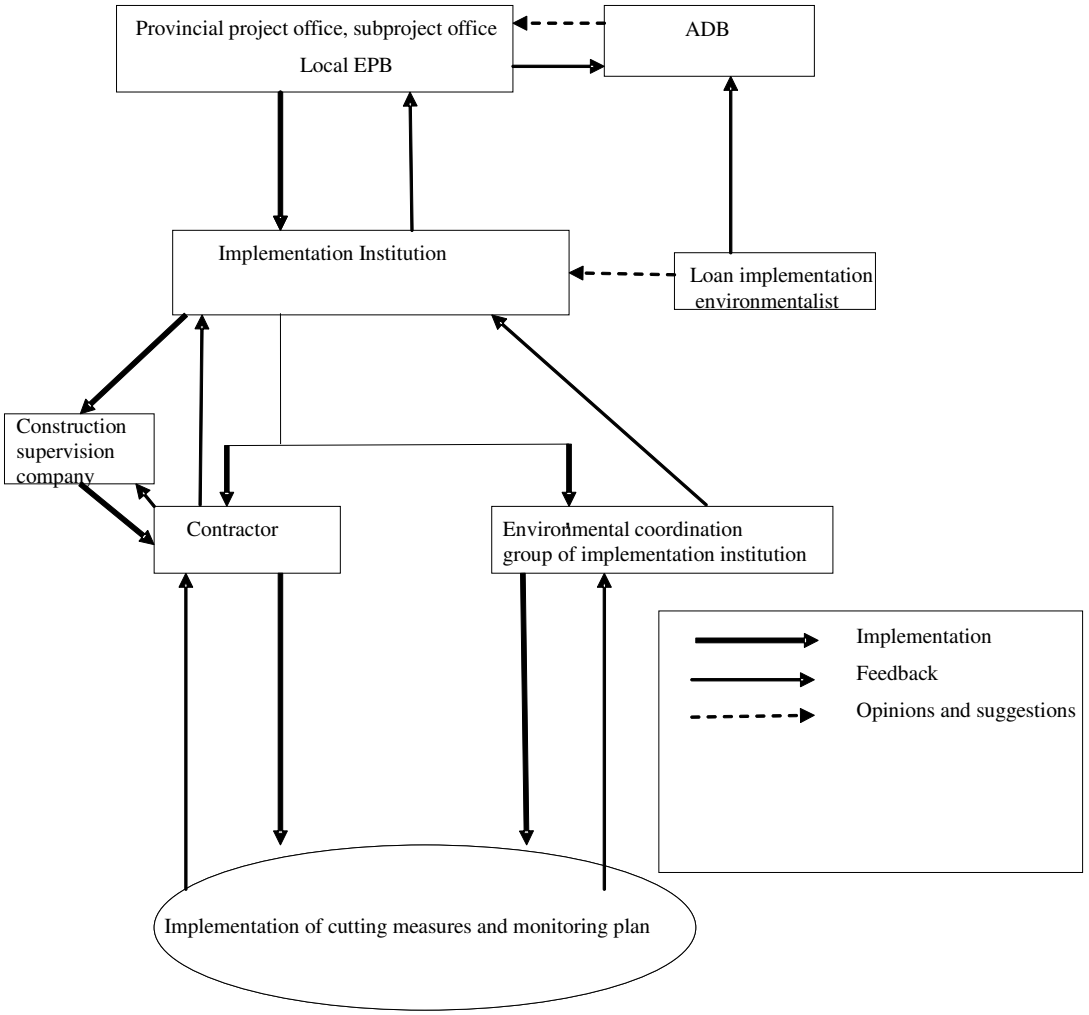

Figure VI. 1: Feedback and adjustment mechanism of EMP

VII Conclusions and suggestions

Fuxin subproject will help improve the living standards of the beneficiaries through the energy-saving transformation of the old pipe network of heating, improve the comprehensive utilization of energy, and bring benefits for the environment and social economy of Fuxin city at the same time.

The initial environmental examination (IEE) of Fuxin subproject points out the potential environmental impact in the implementation of the project. Preliminary design and construction drawings design will reflect the potential and obvious environmental impacts in order to avoid or reduce negative environmental impacts. The environment impacting the survival during the construction period, but these impacts are temporary characteristics, will be controlled through on-site strict management, which are also reflected in EMP.

A. Environmental assessment conclusion

Fuxin subproject will support Fuxin city heating overall development plan already obtained approved, the subproject is part of Fuxin city heating overall development plan, included in the feasibility report, this project will improve the current situation of infrastructure in Fuxin. The subproject meets ADB's loan policy to China state, which makes the market more efficient through infrastructure development, promoting the sustainable development. The updated and reformed heating pipe network will reduce the water loss rate, reduce the pipe network heat loss and improve the quality of life.

Fuxin subproject area does not belong to the national key control areas of soil erosion, not at or close to other sensitive areas or other legal protection areas. The subproject is expected not to destroy the habitat of natural animals or to leading to reduction in biodiversity or damage in environment.

During the construction period, the potential environmental impacts include air, noise, surface water, solid waste, ecology and so on. In general, the environmental impact during the construction period is regional and short-term, which can be effectively controlled through the use of good construction management, occupational health and safety plans and environmental mitigation measures. This project does not involve the destruction of cultural heritage, if any cultural heritage are found in the construction, it will be implemented strictly in accordance with the relevant provisions.

During the operation period, the transformed heating pipe network will improve the tastes of the city, improve the living standard of the people, and bring greater benefits to the residents of Fuxin. The transformation for energy-saving toward the old and worn-out pipeline network of heat supply will reduce the rate of water loss and heat loss of pipeline network, furthermore saving water resource to certain degree, saving the fuel of heat-supply factory's boiler, lowering the discharge of air pollutant.

B. Environmental health and safety

The potential impact of the community and occupational health and safety have been analyzed, and puts forward the corresponding mitigation measures in the initial environmental examination (IEE). These measures include 1) construction management, to avoid producing damage and bringing danger to the community; 2) emergency response plan; 3) community training and education on road safety awareness. The project undertaker of Fuxin project will develop emergency response mechanism to deal with the leakage of hazardous materials, and train the emergency response team members before

the implementation of the project.

C. Climate change

Due to the transformation of the heating pipe network, the limited boiler fuel of heating-saving plant in Fuxin subproject will be able to make a small contribution to climate change.

D. Risk and Assurances

Through design features, it implements and operates plan to avoid major environmental risks, but the project undertaker shall promise and firmly implement the following measures.

- The project undertaker and road operations unit will compile the appropriate emergency mechanism;
- The mitigation measures of dust, noise , surface water, solid waste and construciton wastes, communit and workers health and safety during the construction and operation period should ensure implementation;
- The design parameters for considering climate change shall be adopted by the owner and the design institute.

The Liaoning provincial government and Fuxin municipal government will take all-around effective measures of the initial environmental examination (IEE) and EMP, ensuring effectively meeting the requirements of environmental management and environmental monitoring plan during the project implementation period; and ensuring the timely submission of environmental management and supervision report with requirements of ADB. The application and maintenance of the appropriate complaint mechanism in Fuxin will be part of the environmental monitoring and management commitment. .

During the implementation of the loan, the environmental consultants will be responsible for the coordination of the above work in the implementation phase of the project, and assist in the interpretation and clarification of the negative environmental impact mitigation and monitoring work.

E. The content of next step monitoring and environmental management

An developed EMP will be used in the design, construction and operation period of the project. The EMP will ensure the environmental protection of the proposed project, as well as a part of the integrated environmental management document.

F. Conclusion

Fuxin subproject will bring obvious benefits to the residents in the project area, especially vulnerable groups. The design features and operational plan of the subproject will reduce the environmental negative impact, while ensuring the implementation of design features. Through the design features, operating system and construction safety measures, and through the EMP and the sustained environmental monitoring program, it will mitigate the potential environmental impact successfully.

Appendix 1: Rapid Rating Form of Environment Category

A. Environmental category selection

A. Environmental classification

Problems of selection	Yes	No	Remarks
A. Site selection of subproject Whether the subproject area is close to or in any of the following sensitive areas?			
▪ Cultural heritages		√	
▪ Protected area		√	
▪ Wetland		√	
▪ Mangrove		√	
▪ Estuary			
▪ Buffer zone of protected area		√	
▪ Special conservation area for biodiversity		√	
B. Potential environmental influence Whether the subproject can make			
▪ Historical/ cultural areas damaged; Embankment, digging, filling and quarry damage to landscape?		√	
▪ Whether valuable and rare ecological environment are damaged (for example: sensitive area or protected area)?		√	
▪ Whether the sustainability of relevant sanitation and solid waste disposal systems, and the interaction relationship with other municipal services are affected?		√	
▪ Whether rapid urban population growth, commercial and industrial activities and increasing waste production cause excessive heavy loads to man-made and natural systems, resulting in overwhelmed system management capacity and degradation of surrounding environmental conditions?		√	
▪ Whether the water features of the surface road intersection waterway are changed; whether the sediment deposition in the stream becomes aggravated due to the serious loss of soil and water at the construction site?	√		
▪ Are there some problems in water resource (for example: available water resource supply is consumed/ downgraded, water quality of surface and underground gets degraded, pollutant-holding water bodies get polluted)?		√	

Problems of selection	Yes	No	Remarks
▪ Whether the surface water quality is degraded due to sediment runoff and workers' camp sanitary garbage and construction chemicals?		√	
▪ Whether the local atmosphere is polluted due to rock breakage, cutting and filling operations and chemicals generated from asphalt processing?	√		
▪ Whether there are noise and vibration pollutions produced by blasting and other construction projects?	√		
▪ Are there any social problems, such as upper respiratory problems and discomfort caused by inconvenience of living conditions in the subproject area?		√	
▪ Is there any dangerous driving condition in original streets caused by construction activities' disturbance?		√	
▪ Is it possibility that construction personnel may spread infectious diseases to the local people, due to poor construction camps and on-site hygiene conditions and waste disposal conditions?	√		
▪ Is it the temporary birthplace for mosquitoes with bacteria?		√	
▪ Is there any chaos or compulsory removal in permanent occupation area?		√	
▪ Whether the increasing amount of motor vehicle traffic adds the possibility of accident risk, and whether there are casualties due to toxic materials spilling in the accidents?	√		
▪ Whether the volume of traffic results in heavier noise and atmosphere pollution?	√		
▪ Whether the risk of water pollution is increased due to oil, grease and fuel leaks and other materials emitted by road vehicles?	√		
▪ Is there any chaos or compulsory removal?		√	

B. Environment categories

[]Category A:
■Environmental impact assessment (EIA) (as Appendix B)
■EMP, including budget plan (see it in Section C)
■Public consultation (at least twice)
■Publicize for 120 days before submitting to the Board of Directors for review

[X] Category B:
■Initial Environmental Examination (IEE)

■Public consultation
■EMP, including budget plan
■Publicize for 120 days before submitting to the Board of Directors for review

[] Category C:
■Significance of reviewing environment

Appendix 2: Reply to Initial Environmental Examination (IEE)

Opinions on the approval of the environmental impact report form of the energy-saving renovation project of the old pipe network of Fuxin City General Heating Company

FHS Form (2016) No. 44

Fuxin City Thermal Power Company intends to perform the old pipe network renovation project of the 2nd-5th branches of Fuxin municipal heat supply network, including the transformation of heat supply pipeline, mains with the length of about 20.9km, heat supply network household line with the length of about 74.3km, 50 thermal points and 415 trunk compensators, commenced from August 2016 to October 2020 when the service is completed; the construction period is from June to September every year. The total investment of the project is 98.9844 millon yuan, including 300,000 yuan of environmental protection investment.

Fuxin Development and Reform Commission issued FFG F[2016] No. 177 to approve this reconstruction project to start the preliminary work The project conforms to the national industrial policy and the overall plan of urban heating of Fuxin City. Upon the research of our Construction Project Review Committee, the project is feasible in environmental protection if it strictly implements environmental measures and makes polluted emissions reach the standards. The following detailed requirements are raised:

I. Based on the *Environmental Impact Report* listed construction content, in the construction site, nature, size, technology, pollution prevention, preventing ecological damage and other major changes, it needs re-environmental impact assessment.

II. When the pipe is reconstructed, it is required to have a reasonable arrangement of construction methods and progress; take good measures to prevent dust at construction sites. At construction sites near sensitive spots, notice the construction time and capacity before the construction, set warning sign in the construction period, spray water in time to prevent dust during the construction; set up preventing dust screen and facilities in residential areas, schools and sensitive areas. Backfill and recover the original roads and land using function after finishing the construction.

III. Arrange in a reasonable manner for construction time and choose low-noise equipment and take temporary vibration and noise reduction measures. It is forbidden to use noise equipment that have strong noise damage to people, for example saws, from 18:00 to 22:00 and perform the works that have noise pollution at 22:00 to 6:00 on the next day. If it is necessary to construct at night for continuous operations due to special needs, it should apply to the EPB before 15 days of the construction. The construction proceed upon the approval hereto.

IV. In the process of the construction, it should avoid trees and timely recovery and replant the roads with damaged plants: Implement the principles of layered excavation, layered stacking and layered backfill. Restore the land and vegetation after the construction. Use vegetation to protect land and prevent water and soil from loss.

V. The construction waste produced in the construction should be cleaned and carried away in time in accordance with *Provisions on the Administration of Municipal Construction Waste* (Ministry of Construction No. 139). Reformed and removed old equipment should be used comprehensively and those that cannot be used should be sent to environmental protection departments for unified treatment, which should not cause the secondary pollution. The spoil generated from the project construction is about 57,000m^3 and is required to be cleared in time as it is produced. And it should be used to earthwork balance in the area under the guidance of urban construction department and is forbidden to build abandoned spoil ground.

VI. Strict implementation of water pollution prevention and control measures. Engineering

test waste water should be discharged into the municipal pipe network and is strictly prohibited to discharge casually to pollute environment.

VII. The project should strictly implement the "Three Simultaneous" system of environmental protection. After the completion of the project, environmental protection acceptance check must be applied to the municipal EPB as stipulated. Only the project being qualified in acceptance can be formally put into operation. Those who violates the provisions of these requirements should bear the corresponding legal responsibility.

VIII. Fuxin Environmental Supervision Bureau, Haizhou, Xihe and Development Zone Branch are requested to be responsible for the project "three questions" supervision and inspection.

Official Seal

Nov. 24, 2016

Special seal of administrative examination and approval of Fuxin Environmental Protection Administration