HEILONGJIANG COAL-RICH CITIES REDEVELOPMENT PROJECT

Hegang District Heating Pipeline Retrofit Project

(EIB Project Number 20160496)

Pre-Appraisal Report

Joyne Zhou

June 5, 2017

This note summarizing reviews of the feasibility study reports (FSR) generated by Local Design Institute (LDI); meeting with ADB staffs, ADB PPTA consultant; site visits on district heat supply substations; interviews with the technical management personnel from the Promoter "Hegang Huisheng Water Supply and Heat Supply Limited Company", coordinator from Hegang Heat Supply Office and designer from LDI during the mission.

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1. BACKGROUND OF THE PROJECT

1.1 Introduction

Heilongjiang Coal-Rich Cities Redevelopment project consists of a number of subprojects in 4 cities in China, aims to revitalize economy and improve environmental and social sustainability in the east Heilongjiang Province, China.

The project consists of (i) building urban sewers and wastewater treatment plants, (ii) remediation and environmental cleanup of coal mining sites, (iii) developing electronic bus system in one of project cities; (iv) rehabilitation of heat supply pipes and utility water distribution pipes including reducing non-revenue water measures and (v) improvement of stormwater infrastructure and management system.

The objective of the assignment is to participate in the due diligence mission and perform a techno-economic due diligence, procurement, environmental and social impacts assessments.

The subproject Hegang District Heating Pipes Retrofit Project locates in Hegang Municipality, Heilongjiang Province, People's Republic of China (Figure 1). The Promoter is "Hegang Huisheng Water Supply and Heating Co., Ltd", a local state-owned heating supply company.

District heating inefficiencies are serious due to aging, leaking and erosive pipes, especially in Hegang. As the heating loads increases with high repair rates, the Promoter is suffering from aging, erosions and leakages of the primary and secondary district heat piping systems on safe operation and maintenance of current district heat supply piping systems within the serving areas. The city heat users are also suffering with severe cold seasons without sufficient heat supply.

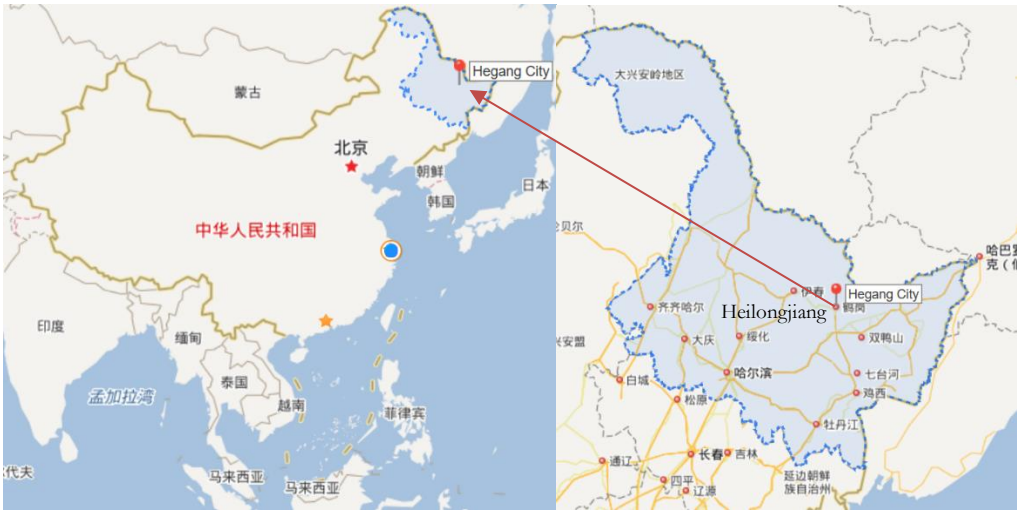

Figure 1 Project Location

<u>Climate Condition of Hegang City:</u>
Hegang city (E129°40' ~132°31', N47°4' ~48°9') is located in Northeast of Heilongjiang Province (Figure 1) within Climate Zone 7-Very Cold. The climate data of heating degree days, and air temperature distribution per NASA data is demonstrated in Figure 2 in next page.

Per local meteorological data, extreme highest temperature was recorded as 37.7℃; extreme lowest temperature was recorded as -34.5℃; annual average temperature is recorded as 3.5℃, with winter average wind speed: 3.1 m/s. The district heating supply period is defined as 184 days; district heating supply average outdoor temperature is -9℃; frost-free period is about 152 days.

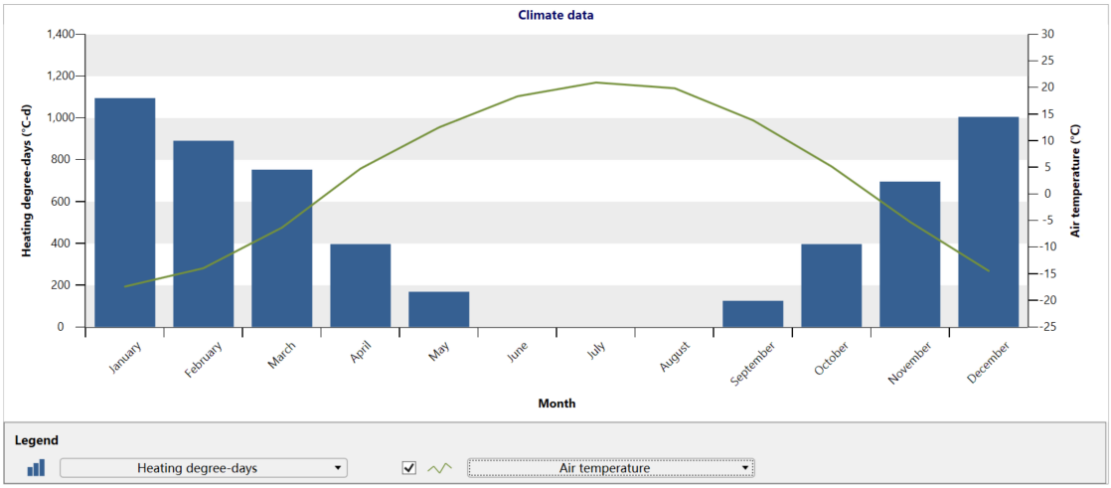

Figure 2 Climate Data (source: NASA)

Population Projection and Prediction:

According to the "Hegang City Urban Master Planning", the overall city population was 1.135 million in 2013, in which about 0.76 million coming from urban area; the foreseeing population in 2020 would reach 1.35 million, in which the urban population would increase to 0.8 million. The comprehensive population growth rate is 16‰.

Heat Supply Current Situation:

By the end of 2016, the total gross floor area is about 27.99 million sqm, about 73.1% (20.46 million sqm) have access to central heating supply networks, including combined heat and power (CHP) generation, district boiler rooms, and scattered small boiler room, and other ways. Please refer to attached table for details. "Hegang City Primary Piping Network Drawing" is also attached in Appendix A for reference.

Table 1 Hegang City Heat Supply Distribution Summary

No.	Heating Supply Mode		Serving Area (million sqm)
1	Central Heating	CHP	1,721
		District Boilers	325
2	Scattered Boilers	Residential	156
3		Commercial	21
4	Others		576
Total Gross Floor Area			2,799

Urban Heating Plan:
Per "Hegang City Urban Master Planning", Hegang city plan on central heating area extension, and try to involve more heat source and heat capacity in the long run. Please refer to Table 2 for details.

Table 2 Hegang Heat Supply Current Condition

No.	Heating Source	Condition	Heat Source	Operate by
1	North	Current	Longmei Hegang CHP Plant	Promoter
2			Hegang Heat Company (2nd Heat Source)	TBD
3		Future Plan	CHP Plant (locate in Longmei Hegang CHP Plant)	Promoter
4			Children's Park North District Boiler Room	TBD
5			Huaneng Hegang Power Plant	TBD
6	South	Current	Longmei Lida Coal Gangue Thermal Power Plant	Promoter
7		Future Plan	Wanlong Heat Company	TBD
8			Heyi Road South District Boiler Room	

1.2 Base of the Report

This pre-appraisal report represents the key findings of the Hegang project based on review of receiving documents, the interview with the Promoter as well as the responses to the project questionnaire prepared by the Promoter.

This report also provides preliminary synthesis of the existing project information to help:

- Delineate the scope of the Project;
- Clarify the technical details of the project, both current and future situation;
- Evaluate if the proposed scope and technologies comply with best available solution/technology for the city, specifying potential alternatives;
- Improve/confirm assumptions, in- and outputs of the energy savings /CO2 reductions calculations/baseline assumptions and expected savings against the baseline;
- Confirm compliance with existing regulations on heat and power generation/distribution;
- Update (feasible) project schedule;
- Confirm capability of promoter to implement and operate the project;
- Check any potential issues/deal breakers with regards to social and environmental impact.

1.3 Interviews and Site Visit

The consultant held meetings and site visits with the Promoter in Hegang city from March 27th to March 28th, 2017.

- Site Visit Photos were included in Appendix B for reference;
- Key Personnel Interviewed are listed in Table 3:

Table 3: Key Personnel Interviewed

Company	Personnel	Position
Hegang Huisheng Water Supply and Heating Co., Ltd. (Promoter)	Mr. Xu Licheng	Technical Specialist
China Northeast Municipal Engineering Design and Research Institute Co., Ltd.	Ms. Zhang Shuang	Project District Heating System Designer
Local Heating Supply Office	Mr. Wang Zongxiang	Project Coordinator

To date, the following documents are available:

- Project Feasibility Study Report, prepared by China Northeast Municipal Engineering Design and Research Institute Co., Ltd.; (in Chinese) (latest version April 20th);
- District Heating Supply Pipes Networks Drawings; (Appendix A);
- Site Visit Photos (Appendix B);
- Promoter's Business Register Certificates (Appendix C)
- Promoter Management Personnel List (Appendix D)
- Heating Supply Pipeline Retrofit Reasons Investigation Table (Appendix E)
- EIA Form (draft version dated on May 23th)
- Procurement Plan; (Appendix F version dated on April 12th, pending on updates)

Pending documents at current stage:
- Final FSR;
- Final EIA Form;
- Other Local Authority approvals (Urban Planning, Land Use, etc);
- Project team organization structure/chart;
- Operation and Maintenance General reference documents/records from Promoter;
- Bidding documents;

2. PROMOTER

2.1 Promoter Background

In January 19th, 2017, the Promoter, Hegang Huisheng Water Supply and Heating Co., Ltd., is reformed as 100% state owned and attached to Hegang Urban Administrative and Law Enforcement Bureau. The new established company has RMB 1 million of registered capital. Thus, the financial audit report, business revenue/assets/debts of the new reformed company are not available till now.

2.2 Project Organization and Management

The company used to be affiliated to Hegang Chengji Water Power and Heat Supply Group for years, providing water supply and heat supply services to large portion of urban areas in Hegang city. So far, the core heat supply and management team of Promoter has over 16 years' operation experience of the current heat supply piping networks with a total of 135 employees in the Hegang City, including 57 management personnel and 78 technical employees were listed (Appendix D) after reform.

The company and project team organization structure/chart is still pending for update and clear demonstration.

Considering of over 16 years' operation experience of the current heat supply piping networks, the implementation experience of the pipeline seems acceptable. However, as few referenced operation records and related audit files were collected, and lack of implementation, coordination experience on international bids and international project management, project delay and potential management issues should be concerned. Effective project management methods and organization structure should be defined prior to project implementation.

3. PROJECT TECHINAL FEASIBILITY:

Hegang City District Heating Supply Network Primary Pipeline Drawing: Appendix A.

Proposed Implementation Period: Year 2017, 2018 and 2019. Detailed schedule is still pending.

3.1 Project Scope of Works:

The project scope includes (i) replacing/retrofitting of total 72,406 meter (in groove length) pipes (serving 4.64 million heat supply area, mainly in Xiangyang, Xingshan, Gongnong, Xingan, Nanshan districts with heat supply load of 289 MW, with annual increased heat capacity of $3.05x10^6$ GJ;) (ii) establishing 8 pilot individual building district heating substations.

The latest preliminary implementation plan listed as:

- Retrofit of total 7,209 meter (in groove length) Primary Pipeline, in which:
  - 3,380 m scheduled in 2017;
  - 3,829 m scheduled in 2018;
  - DN1000 and DN800 pipes would be replaced by DN1200 for Primary Pipes;

- Retrofit of total 65,197 meter Secondary Pipeline, in which:
  - 2,917 m (Direct Buried) scheduled in 2018;
  - 29,911 m (Trench) scheduled in 2018;
  - 23,324.5 m (Direct Buried) scheduled in 2019;
  - 9044.5 m (Trench) scheduled in 2019;

Note that the thickness of the pipes shall be confirmed. If there were no compensator integrated, the thickness should be larger.

- Establish 8 Pilot Individual Building District Heating Substations, mainly in Xiangyang Heat Exchange Station Heat Supply area.

- After detailed investigation by promoter, the below heat exchange stations and serving communities were planned in the retrofit scopes:

Table 4: 2018 and 2019 Retrofit Plan (Community List)

2018 Retrofit Plan	2019 Retrofit Plan:
1. Xingshan;	1. Zhengxing;
2. Hongjun;	2. Mingyuan;
3. Xiangyang Govement;	3. Junde 2#
4. Guangming Garden;	4. Junde 4#;
5. Tiedong;	5. Xing'an Sankuo;
6. Xixiao;	6. Xing'an Center
7. Hongqi;	7. Lubei;
8. Longyu;	8. Lulin;
9. Jinbu Avenue;	9. Jixiu;
10. Gongdian;	10. Dalu 1#;
11. Jian'an;	11. LingBei 4#;
12. Xinhua Avenue;	12. Dongfeng;
13. Shuidian;	
14. Power Plant Small Network;	
15. Xinda;	

3.2 Pipes Retrofit Reasons and Investigation Survey:

After over 16 years' operation, the primary pipes have severe erosion/corrosion and leakage issues, resulted in unsafe operation and frequent accidents. It is more seriously for the secondary pipes, which has run over 16 years, even 32 years, facing severe corrosion and decay, pipe leakage and losses, even trench collapses. The highest record listed in FSR and investigation table is 77 times leakage within 19-year operation.

Besides, those aging pipes before year 2000 were insulated with hand-made of polyurethane thermal material, wrapped with fiber glass fabric, coated with asphalt material, which in poor insulation and lifespan. Last but not least, frequent accidents of the pipe compensators are one of the reasons for retrofit to ensure safety.

Table 5 briefly recorded some typical compensator accidents in the recent 2 years.

Table 5: Investigation on Recent 2 Years Compensator Accidents

No.	Pipe Diameter	Accident	Time	Operation Condition
1	DN800	Compensator weld cracking leaks	24 Nov 2015	Temperature: 90℃ Pressure: 1.11MPa
2	DN250	Compensator corrosion leaks	31 Mar 2016	Temperature: 63℃ Pressure: 1.05MPa
3	DN250	Compensator weld cracking leaks	30 Sep 2016	Temperature: 15.7℃ Pressure: 0.88MPa
4	DN1000	Leakage Compensator	08 Dec 2015	Temperature: 95℃ Pressure: 0.83MPa

As to define the current conditions of the aging pipes, detailed investigation survey is developed to diagnose and determine the detailed retrofit plan. Please refer to "Heating Supply Piping System Retrofit Reasons Investigation" in Appendix E.

3.3 Project Current Situation:

1) **<u>Heating Source (within the Project Scope)</u>**

- Longmei Hegang CHP Plant:
  - Phase I: built in 1988
  - Phase II: built in 1997

- Longmei Lida Coal Gangue Thermal Power Plant
  - Built in 2008 and operated since October 2009

The Promoter owned 85 Heat Exchange Stations, about 13 District Heat Substations, 71 Scattered Boiler Plants.

2) Promoter Heating Supply Current Situation:

Table 6: Retrofit Area Central Heating Supply Capacity and Consumption Parameter:

No	Project Scope/ Serving Area	Current Heat Supply Area (million sqm)	Retrofit Heat Supply Area (million sqm)	Retrofit Area Heating Capacity (MW)	Annual Heating Consumption of Retrofit area (GJ)	Heat Source
1	North	5.40	3.2	281.954	2,973,618.79	Combined Heat and Power Generation
2	South	5.03	1.3			
3	Others (East)	0.36	0.12	7.60	80,153.16	Scattered Boilers
Total		10.8	4.64	289.554	3,053,771.95	

Table 7: Existing Heat Source Summary: (Total Heating Capacity of 250 MW)

North Heat Source: Longmei Hegang CHP Plant (Operating by Promoter, Subtotal of Heating Capacity: 150MW)			
	Boiler type	**Capacity**	**Quantity**
1	WGZ75/39-11	75t/h	4
2	HG-220/9.8	220t/h	2
3	UG-220/9.8	220t/h	1
	Steam Turbine Model	**Capacity**	**Quantity**
1	FC25-3.43/0.35	25MW	1
2	C25-35/3	25MW	1
3	C50-8.83/0.118	50MW	2
North Heat Source: Longmei Lida Coal Gangue CHP Plant (Operating by Promoter, Subtotal of Heating Capacity: 100MW))			
	Boiler type	**Capacity**	**Quantity**
1	UG220/9.8-M6	220t/h	3
	Steam Turbine model	**Capacity**	**Quantity**
1	CB50-8.83/0.294/0.049	50MW	2

3) Heating Supply Current Design Parameters:

- Heating Supply Hour: 4416 hour, 184 days (October 15th to April 15th)
- Primary network:
  - North piping system network total length of 19.69 km;
  - South piping system network total length of 29.38 km;
  - Running over 16 years;

- Supply and return water temperature: 120℃/70℃
- Design Pressure: 1.6 Mpa

- Secondary network:
  - North piping system network total length of 51.15 km;
  - South piping system network total length of 64.79 km;
  - Running over 20 to 30 years;
  - Supply and return water temperature: 70℃/50℃
  - Design Pressure: 1.0 Mpa

4) Heat Metering Issue:

Per interviewing with the Promoter, large portion of the metering devices were broken, some of the main metering devices were out of calibration. Thus, it is difficult to collect the actual operation data, and hard to determine which pipes having potential risks before outbreaks or maintenance.

In general, as indicated by Promoter, it relies on manual checks, accidents records and routine maintenance to find piping problems rather than other options.

It is suggested to install heating metering devices at the end of energy user to apply dynamic adjustment method so as for better measurement and management, steady operation and efficiency improvement. However, the current FSR hasn't cover this proposed idea in current design scope due to tight schedule and budget.

5) Velocity Issue:

During discussion of the water velocity issues with the Promoter, the Promoter estimated that:
- Primary network: around 3 to 3.5m/s;
- Secondary network: 5m/s

It seems higher than expectation and causes energy losses, while LDI and Promoter explained that it was normal from their design and operation experience in local area.

6) Retrofit Design Parameter on Pipeline Anti-Corrosion Insulation:
- Coefficient of thermal conductivity at room temperature: ≤0.035 W/m`k
- Temperature Limits: 150 ℃

Note:
(i) the insulation thermal coefficient value per Chinese GB design standard. Normal level.
(ii) those aging pipes before year 2000 were insulated with hand-made of polyurethane thermal material, wrapped with fiber glass fabric, coated with asphalt material in poor insulation and lifespan.

3.4 Best Available Technologies and Potential Alternatives

Although the environmental, social and economic benefits of the Hegang District Heating Project are inherent as the piping system efficiency would be improved, the draft FSR does not offer comparison with other alternatives.

After review of the draft FSR, the current design referred to local regulations and design codes without renovation or any specification of potential alternatives. The FSR falls short in exploring alternative heat sources, such as biomass fuel, solar thermal heating; neither any description of other advanced practical measures for operation and maintenance.

While, the Promoter stated that they applied a corresponding control method to adjust the heat supply during operation, the draft FSR didn't mention it in detail as no related reference files were received for support.

After discussion with the Promoter and LDI on site, the pilot individual building district heating substations were proposed and had been added to current project scope. As to LDI and Promoter, they have rare project experience on the pilot individual building district heating substations studies or practice. LDI agreed to provide further analysis and studies on the pilot building heat substations.

The latest version of FSR has included the preliminary design plan for Pilot Individual Building District Heating Substations, and mentioned the several advantages as listed below:

- Effectively address the water loss rate, pressure loss and hydraulic disorder issues of the secondary heat piping system;
- Simple installation with relative small primary piping system in the community;
- Flexible adjustment and quick response to heat demand effectively;
- Reliable assembly system with little site commissioning works;
- Heat metering system integrated;

Last but not least, the draft FSR does not include a general plan for ex-post energy saving (and emission reduction) verification. A detailed analysis of monitoring and verification integrated with comprehensive metering system with associated control devices, intelligent demand control management platform would be recommended if feasible and accepted by the Promoter. Considering the two existing control centers, it may be value-added to involve the above metering and verification system and put into practice for future reference. Besides, mitigation measures and disposal plans should be established before construction so as to applied during construction phase when facing potential risks.

3.5 Energy Saving Parameters and Baseline Assumption

After several rounds of revision of the draft FSR, the baseline calculation of the heat loss rate per meter is based on below assumption, and refer to a technical code for urban heat supply piping system (CJJ/T81-2013).

- As for direct burial primary piping systems, assume the thermal insulation thickness reduced by 70% compared to original;
- As for direct burial secondary piping systems, assume the thermal insulation thickness reduced by 80%, 90% compared to original for those running over 10~20 years, over 20~30 years, respectively;
- As for trenched secondary piping systems, assume the thermal insulation thickness reduced by 90%, 95% compared to original for those running over 10~20 years, over 20~30 years, respectively;
- As for those pipes, running over 30 years, assume the thermal insulation thickness reduced by 97% compared to original.
- Per different heat loss rate estimation, adjust the coefficient accordingly and get the results;
- Average Heating Capacity Coefficient: 0.6634;
- Water Loss rate about 1% per year for secondary pipes;
- Standard Coal calorific value: 7000kcal/kg (7000×4.1816kJ=29271.2kJ≈29.271 MJ)

<u>Heat Loss Consumption Savings Assumption:</u>

- Primary Pipes (Direct Buried) Heat Loss Annual Rate Before Retrofit: 31,381.38 GJ/year
- Primary Pipes (Direct Buried) Heat Loss Annual Rate After Retrofit: 17,310.18 GJ/year

*** Savings: 14,071.2 GJ/year, about 480.11 tce**

- Secondary Pipes (Direct Buried) Heat Loss Annual Rate Before Retrofit: 285,661.164 GJ/year
- Secondary Pipes (Direct Buried) Heat Loss Annual Rate After Retrofit: 96,889.41 GJ/year

*** Savings: 188,771.754GJ/year, about 6,440.89 tce.**

Combining the above assumption and calculations, the draft FSR concluded with the energy saving result in annual Standard Coal Consumption Savings of 6921tce (ton of standard coal equivalent), which is equivalent to standard coal consumption of one 7MW boiler with efficiency rate 53% for about 1.45-year use.

Total Estimated Energy Savings After Retrofit: 202,842.954 GJ/year, about 6,921 tce

Considering lack of current heat consumption records, reference documents, malfunctioning meters, the actual loss rate for both primary and secondary piping system is not available from current FSR. The assumption and calculation methods has referred to local regulation and some project case studies.

4. ENVIRONMENTAL AND SOCIAL IMPACT INITIAL ASSESSMENT:

4.1 Environmental Impact Assessment

The draft Environmental Impact Assessment (EIA) Form is prepared by Heilongjiang Heida Environmental Sci-Tech Co., Ltd. (the EIA Consultant) in May 2017. The EIA form explained the assessment of impacts of dust, air pollutants, noise, waste water, sewage, solid waste and vegetation. The EIA form also stated that there would be small impact during the construction work if ecological precaution would be applied; and no further pollutants or potential risks to the environment during the operation period after retrofits. The latest version is pending on approval.

Based on review of the latest version of EIA Form, dated on May 23th, 2017, key findings are listed as following:

(1) EIA document is the "EIA Form", not the comprehensive "EIA Report", and yet not include "Public Participation Impact Questionnaire". So far, the EIA form is still pending for approval from Environmental Protection Agency (EPA). Thus, a further review is recommended;
(2) As the ageing pipes was insulated with poor material (some of which coated with asphalt material), and suffering severe leakage and corrosion, potential pollution risk may exist for the surrounding soil or surface/underground water. Especially, testing, mitigation measures, and disposal plans should be considered during construction phase and operation phase if necessary. While in FSR and EIA, no related discussion or definition were found.
(3) Till now, few operation and maintenance documents or reference procedures and methods were collected for review, thus it is still pending on defining safe, applicable, low environmental impact and best practice measures for future retrofit work; The EIA form assessment is rough and not deeply cover the related issues mentioned above;
(4) In March, it is not available to see the ageing pipes or leakage spots/areas during the heat supply period. While, from the accidents photo records, it obviously caused safe and health impacts to the emergency operators and surrounding environment. Therefore, an "Environmental Monitoring and Safety Management Plan" is recommended to develop so as to control the potential risks might exist during construction or operation period;
(5) Recycling and disposal plans for the demolished boilers, pipes, material and other accessory equipment were not mentioned in either FSR or EIA form, it should be included in the Environmental Monitoring and Safety Management Plan. Especially for those hazardous material or treatment, it should be approved by EPA.

As the EIA is lack of detail in identification of the potential ecological impacts as listed above, further evaluation is needed.

4.2 Social Impacts

The EIA form doesn't assess much on the sections of social impact mitigation. During the construction periods, there would be traffic interruption, land acquisition and public space use in general. However, the above-mentioned sections were not involved in current FSR or EIA form.

As for this project, the retrofits of the existing aging pipes will address current heat supply piping system safety issue and improve piping system efficiency.

Since 2008 till now, the tariff of the Central Heat Supply Charge Fee remains the same, published by Pricing Bureau in 2005, as:

- Residential: RMB 22.62/sqm
- Commercial: RMB 37/sqm

As mentioned by local Heat Supply Office, no subside heat supply policies or any related plan would come out for the next 2 years or in the near future in concern of the low economic growth in Hegang city. Therefore, the project would benefit both Promoter and the government from energy savings in return and releasing the financial pressure after implementation.

Further, considering employment growth and population loss reduction, the project is positive for local social environment.

5. PROJECT FINIANCIAL STATUS

Total Project Work Investment Estimation: RMB 192.0535 million (70% Loan, 30% Counterpart Funds)

Calculated Financial Parameter: IRR: 5.44% with Financial Subsidy Funds, Payback Period: 15 years;

Design Lifespan: about 20 to 25 years if keep good maintenance;

Comprehensive Unit Cost Breakdown: From bill of quantities, the comprehensive unit cost of RMB 12,825/meter is mentioned for piping construction work, which need cost breakdown with sectional price for reference.

6. PROCUREMENT PROGRESS

Total project cost is about RMB 192,053,500 as refer to cost estimation table (4.12 version). Three procurement packages were listed in the table, include one NBF (HG-DH-W7, construction work planned for 2017), and two ICB packages (HG-DH-W8 and HG-DH-W9, both construction work, planned for 2018 and 2019).

So far, the FSR of the Project haven't got local authorities' approval yet. Thus, it is still pending and no progress updates of tendering agency selection or bidding documents establishment.

7. POTENTIAL RISKS

7.1 Technical Risks

- **Construction Quality:** As mentioned of the welding cracks, erosion, leakages, trench collapse were occurred during operation, construction quality should be concerned. Comprehensive training procedures should be provided to operators/works. Certified works on welding and relative dedicated technical work should be referenced to ensure safe and reliable operation.

- **Piping System Efficiency** The secondary pipe efficiency ratio is estimated from LDI would increase from 90.64% to 96.83% after retrofits. Ex-post verification methods were not mentioned in the FSR.

- **Pilot Individual Substation Project:** Not popular in China, thus (i) high initial investment with limit selection of equipment, (ii) LDI with few of design experience; (iii) lack of construction management experience and operation experience of Promoter;

- **Operation Settings and Procedures Unknown:** Not enough data/information were mentioned on current operation and maintenance procedures, pending on assessment.

- **Project Management Capability:** As lack of information, the Promoter's experiences on large retrofit projects management and supervision, international procurement procedures, and ex-post verification work after retrofits is unknown, no related documentation were collected.

- **Tight schedule:** Regarding to the tight schedule for ADB's approval, the data collected is much less than expected due to low efficiency of project organization and coordination.

7.2 Environmental and Social Risks

- **Construction Work:** During retrofit period, there would be lots of underground construction work and thus bringing traffic jams, noises, dust, air pollution, and social impact on residential area and public urban areas;

- **Strategic EIA Permit and Project EIA Permit:** FSR didn't mention much on strategic EIA permit and green construction management, which controlling the risks during construction work such as noises, dust, vehicle exhaust, powder material, landfills, water leakage and construction wastes disposal/treatment; Suggest providing EIA permits of Promoter's existing CHP plants for review; Involvement of local communities and other stakeholders were not described. Mitigation methods were not mentioned in detail.

- **Potential Environmental Impact and Mitigation Measures:** Regarding to poor insulation and coating material mentioned above, it may have potential pollution risk to the surrounding soil or surface/underground water during construction phases. Therefore, mitigation measures and disposal plans should be established before construction. While, there were none in current documents received.

- **Land Use Permit:** As pilot individual buildings heating supply substations were added in the project scope, land use permit and properties acceptance procedures should be fully concerned.

Due to poor quality of the existing piping system within the city, it shows positive social impact on retrofitting aging and leaking pipes to ensure safe and reliable heat supply to heat users. As well, positive image of the government could be established after replacing aging pipes, compensators, valves and prevent severe heat supply accidents or heat shut-down risks.

8. FINDINGS AND RECOMMENDATIONS

8.1 Summary of Findings

The proposed Project consists of two key components (i) replacing/retrofitting of total 72,406 meter (in groove length) pipes (ii) establishing 8 pilot individual building district heating substations.

The total investment of the Project is estimated to be approximately RMB 192.0535 million (70% Loan, 30% Counterpart Funds). Metering and control system is not covered.

Based on the draft FSR, EIA form, retrofit investigation survey and interviews with the Promoter in March and April 2017, preliminary opinions on the Project viability and outstanding issues are outlined below.

Original project construction period is planned from 2018 to October 2019. As to simplify and avoid repeated construction work in the same areas, the Promoter planned to start construction in 2017 to combine two split works together, so as to save costs, time and efforts, as well as to decrease the impacts to the surrounding environment. Thus, about 3,380 meters' pipes was rescheduled to 2017 for retrofit with local government count-part funds.

Given the energy saving and emission reduction expected with financial and economic returns in the FSR, the Project in general is positive and viable.

Nevertheless, there remains some issues need further discussion and files collection for confirmation:

- details/reference on future plan of heating supply policies or description after 2020, at least 2025, even 2030 plan should be discussed for reference.
- comprehensive quality survey (a simple survey is given) and safety analysis of the current poor-quality pipes;
- operation and maintenance records, current conditions for the proposed pipes and heat exchange station and future plan of those;
- Quality Management Plan for retrofit process and quality control;
- Environmental Monitoring and Safety Management Plan should be established with mitigation measures when facing environmental and safety risks during construction;
- Life Cycle Cost Analysis if available;
- Technical elaboration on the detailed, like shut off valve (installation of welding ball valves);
- Noticed of the following items which not describing in FSR:
    - expansion plan of adding heating capacity of 2 x 350MW for Longmei Hegang CHP Plant;
    - about 1.22 million area supplied by 43 small boilers (with low efficiency and beyond project scope) in the cities;

8.2 Recommendations

Based on the above findings, the Consultant recommends that:

- Suggest including future development plan till 2030 on population growth, heat user growth, heat supply subside policies (if available), heat supply sub-metering strategies (if available), sustainable and optimal methodologies on operation and maintenance, supervision, control center management strategies and auto demand feedback control, etc.

- Procurement strategies on preparation of reliable and optimal technical specification on construction material purchases, construction works and supervision capabilities, and commissioning procedures;

- Comprehensive Quality Survey or Quality Management Plan are expected instead of rough description;

- Suggestion on improving with:
  - Priority sorting with quantitate data or quality assessment/reference;
  - High repair frequency districts/areas assessment;
  - Routine inspection findings;
  - Maintenance challenges/limits if available;
  - Description of the connection mode/type between heat supply network to heat users, investment varies on direct or indirect connection modes; (at least portion analysis, the loss ratio is different);
  - Compensator accident detailed investigation results;

- Suggest providing documentations and records on current operation and maintenance records and procedures for reference;

- Further data request from Promoter on:
  - Project team organization structure/chart;
  - More details description/reference on current operation and maintenance conditions of the piping networks;
  - Training procedure for accidents/site emergency operators/workers.
  - Quality Management Plan;
  - Environmental and Social Management Plan if available;
  - Environmental Monitoring and Safety Management Plan including mitigation measures;
  - Safety and Health Management Manual if available;
  - Construction quality management manual/plan if available;
  - Operation costs, fuel costs;
  - Local subsidies policies;

- Further data request from LDI on missing details, such as:
  - Updated drawings;
  - Operation and Maintenance strategies/design;
  - Reference studies/reports;
  - Detailed feasibility studies on pilot individual stations, integrated with local climate and geological conditions, strategies on promotion, adaption or practical experience;
  - Cost breakdown needed for comprehensive unit cost for reference.

APPENDIX A: HEGANG CITY PRIMARY PIPING NETWORK DRAWING
(Please See Attached PDF)

鹤岗市诚基水电热力公司供热管网总平面图

N

500 1000 2000 单位

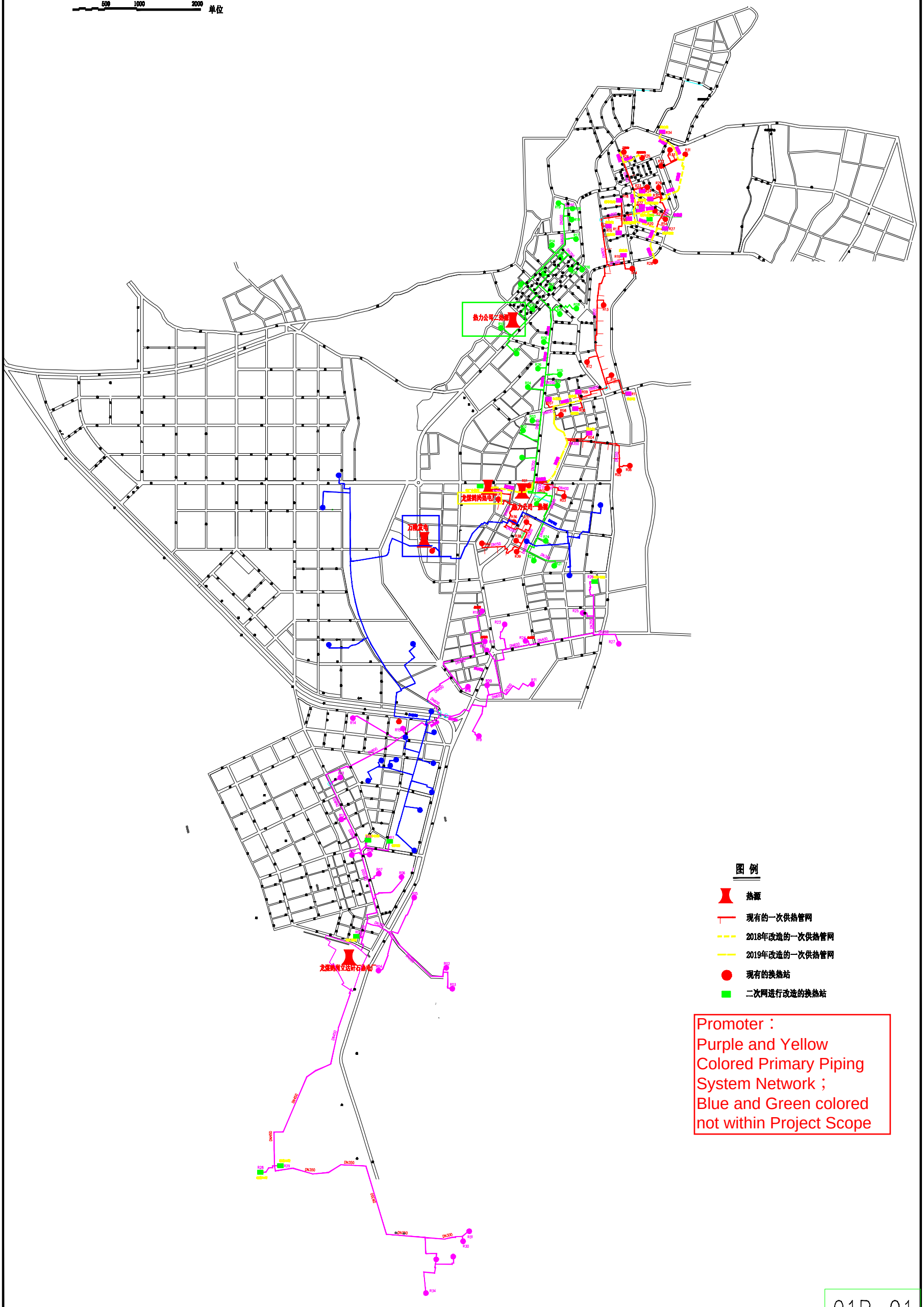

图 例

- 热源
- 现有的一次供热管网
- 2018年改造的一次供热管网
- 2019年改造的一次供热管网
- 现有的换热站
- 二次网进行改造的换热站

Promoter：
Purple and Yellow
Colored Primary Piping
System Network；
Blue and Green colored
not within Project Scope

01R-01

APPENDIX B: SITE VISIT PHOTOS
(dated on March 27th, 2017)

Photo 1: Pipes and Compensators

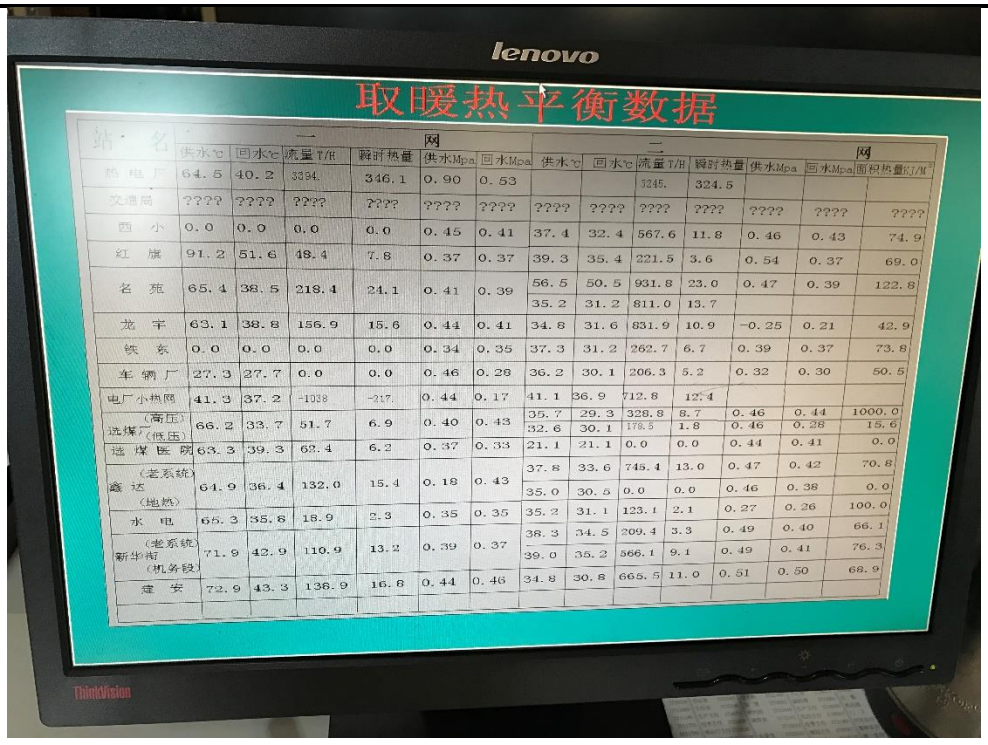

Photo 2: Heat Supply Balance Data Collection from Each Heat Substations

Photo 3: Pump Room

Photo 4: Heat Supply Substation Power Distribution Cabinet

Photo 5: Compensator Accident Representative Photo Records (from FSR): Welding Cracks

Photo 6: Compensator Accident Photo Records (from FSR): Welding Cracks

Photo 7: Compensator Accident Photo Records (from FSR): Leakages

APPENDIX C: PROMOTER'S BUSINESS REGISTER CERTIFICATES

营业执照

(副本)

统一社会信用代码 91230400MA1977Q0XD

名　　称	鹤岗市惠生供水供热有限公司
类　　型	有限责任公司（国有独资）
住　　所	鹤岗市向阳区水电新办公楼
法定代表人	王振波
注册资本	壹佰万圆整
成立日期	2017年01月19日
营业期限	长期
经营范围	自来水生产和供应，热力生产和供应，污水处理及其再生利用，管道工程建筑，工矿工程，管道和设备安装，物业管理服务。（依法须经批准的项目，经相关部门批准后方可开展经营活动）

登记机关

2017 年 01 月 19 日

APPENDIX D: PROMOER MANAGEMENT PERSONNEL LIST

惠生供水供热有限公司管理人员名单

一、管理人员 57 人。

李洪涛、徐立成、李德君、田宝钢、刘志勇、卜范成、何文革、任广新、芦保民、聂宝举、傅　琼、贺　刚、张春和、张景来、林宪军、王金胜、刘喜国、邹小舟、曹连军、王万忠、贺海涛、井洪义、王　磊、王　鹤、姚洪斌、周广峰、宋丽娟、邓　波、封安运、陈　涛、商铁钢、金国军、曹庆华、于志民、朱俊炉、肖　林、王海龙、孟广银、徐德水、毕玉海、姜渭贤、范忠义、孙明伟、王洪涛、冯鹤斌、宋玉滨、乔殿伟、杜明玲、宋全胜、金承福、文　颖、田　园、李荣才、刘　君、于永朝、李正发、阮盛斌。

二、技术人员 78 人。

张国霞、赵　焱、石成和、姜井新、王继宇、房新良、李连学、徐晓峰、刘广海、王井武、张庆发、杨桂杰、徐亚民、崔存刚、葛增明、张青春、杜保全、张洪太、朱　君、刘志芳、李正义、彭红军、王光俊、王化昆、宋士伟、赵　耀、任长兴、司书恩、杨金庆、蔡云龙、曹　锋、陈忠宝、白亚军、郭　伟、陈志林、韩增亮、唐明光、郑鼎亮、吴宪明、孟照明、刘民生、单清长、徐峻基、高柏春、房进东、牟天鹤、张传东、李青荣、蔡晓峰、郭云鹏、王坤山、李孟春、王凤荣、李艳彬、张红梅、王　潇、左振续、万宏兴、赵美奇、任玉芳、赵喜增、曹淑清、刘海明、郝　勇、范文慧、张德平、张文婷、孙成义、陈庆柱、李继萍、陈志强、田忠宝、吴春芳、李淑红、高春和、王建波、于卫华、王爱清。

APPENDIX E: HEATING SUPPLY PIPELINE RETROFIT REASONS INVESTIGATION TABLE

Appendix E 2018 Heating Supply Piping System Retrofit Reasons Investigation

附件 E： 2018 年供热管网更换原因调查表

No	Piping location	Type	Length (m)	Retrofit Reasons
1	Primary Pipes 一次管网	Φ1220×10	3380	Built in 2000, severe erosion/corrosion, and leakages 腐蚀漏水严重
		Φ630×7	991	
		Φ377×7	1288	
		Φ325×7	975	
		Φ273×7	575	
2	Xingshan Substation 兴山换热站	DN250	494	Operation for 16 years, erosion/corrosion; leaking 3 times 运行 16 年，腐蚀，漏水 3 次
		DN200	102	Operation for 16 years, erosion/corrosion; leaking 4 times 运行 16 年，腐蚀，漏水 4 次
		DN150	91	Operation for 16 years, erosion/corrosion; leaking 3 times 运行 16 年，腐蚀，漏水 3 次
		DN125	277	Operation for 16 years, erosion/corrosion; leaking 6 times 运行 16 年，腐蚀，漏水 6 次
		DN100	405	Operation for 16 years, erosion/corrosion; leaking 9 times 运行 16 年，腐蚀，漏水 9 次
		DN80	25	Operation for 16 years, erosion/corrosion; leaking 3 times 运行 16 年，腐蚀，漏水 3 次
		DN50	5	Operation for 16 years, erosion/corrosion; leaking 2 times 运行 16 年，腐蚀，漏水 2 次
3	Hongjun Substation 红军换热站	DN400	171	Operation for 16 years, erosion/corrosion; Severe leakage 运行 34 年，腐蚀严重
		DN350	316	Operation for 34 years, erosion/corrosion; Severe leakage 运行 34 年，腐蚀、漏失严重
		DN300	501	Operation for 31years, erosion/corrosion; Severe leakage 运行 31 年，腐蚀、漏失严重

No	Piping location	Type	Length (m)	Retrofit Reasons
			96	Operation for 20 years, erosion/corrosion; Severe leakage 运行 20 年，腐蚀、漏失严重
		DN250	92	Operation for 18 years, erosion/corrosion; Severe leakage 运行 18 年，腐蚀、漏失严重
		DN200	42	Operation for 35 years, erosion/corrosion; Severe leakage 运行 35 年，腐蚀、漏失严重
		DN150	604	Operation for 20 years, erosion/corrosion; Severe leakage 运行 20 年，腐蚀、漏失严重
			65	Operation for 34 years, erosion/corrosion; Severe leakage 运行 34 年，腐蚀、漏失严重
		DN125	411	Operation for 20 years, erosion/corrosion; Severe leakage and Heat Loss 运行 20 年，腐蚀、漏失严重
		DN100	523	Operation for 20 years, erosion/corrosion; Severe leakage and Heat Loss 运行 20 年，腐蚀、漏失严重
			47	Operation for 34 years, erosion/corrosion; Severe leakage 运行 27 年，腐蚀、漏失严重
			32	Operation for 34 years, erosion/corrosion; Severe leakage and Loss 运行 34 年，腐蚀、漏失严重
		DN80	137	Operation for 20 years, erosion/corrosion; Severe leakage and Loss 运行 20 年，腐蚀、漏失严重
4	Tiedong Substation 铁东换热站	DN325	73	Operation for 16 years, erosion/corrosion; Severe leakage and Loss 运行 16 年，腐蚀严重

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN250	143	Operation for 16 years, erosion/corrosion; Severe leakage and Loss 运行 16 年，腐蚀严重
		DN200	228	Operation for 16 years, erosion/corrosion; leaking 4 times 运行 16 年，腐蚀，漏水 4 次
		DN150	253	Operation for 16 years, erosion/corrosion; leaking 2 times 运行 16 年，腐蚀，漏水 2 次
		DN125	415	Operation for 16 years, erosion/corrosion; leaking 4 times 运行 16 年，腐蚀，漏水 4 次
		DN100	433	Operation for 16 years, erosion/corrosion; leaking 7 times 运行 16 年，腐蚀，漏水 7 次
		DN80	957	Operation for 16 years, erosion/corrosion; Severe leakage and Heat Loss 运行 16 年，腐蚀、漏失严重
		DN70	267	
		DN50	418	Operation for 16 years, erosion/corrosion; leaking 3 times 运行 16 年，腐蚀，漏水 3 次
		DN40	63	Operation for 16 years, erosion/corrosion; Severe leakage and Heat Loss 运行 16 年，腐蚀、漏失严重
5	Xixiao 西小换热站	DN350	315	Operation for 16 years, erosion/corrosion; Severe leakage and Heat Loss 运行 17 年，腐蚀、漏失严重
		DN325	160	
		DN250	42	
		DN200	364	
		DN150	11	
		DN125	73	
		DN100	609	
		DN80	218	
		DN70	45	
		DN50	5	
		DN40	21	

No	Piping location	Type	Length (m)	Retrofit Reasons
6	Hongqi Substation 红旗小区换热站	DN325	74	
		DN250	51	Operation for 17 years, erosion/corrosion; Severe leakage and Heat Loss 运行 17 年，腐蚀、漏失严重
		DN200	217	
		DN150	60	
		DN125	112	
		DN100	14	
		DN80	39	
7	Jian’an Community 建安小区	DN300	179	Operation for 21 years, erosion/corrosion; Severe leakage and trench collapse 运行 21 年，局部腐蚀，地沟倒塌
		DN250	290	Operation for 30 years, Severe erosion/corrosion; 运行 30 年，腐蚀严重
		DN200	335	Operation for 24 years, Severe erosion/corrosion; 运行 24 年，腐蚀严重
			45	Operation for 22 years, Severe erosion/corrosion; 运行 22 年，腐蚀严重
		DN150	383	Operation for 22 years, Severe portion erosion/corrosion; leaking 2 times 运行 23 年，局部腐蚀，漏水 2 次
			65	Operation for 30 years, Severe portion erosion/corrosion; trench collapse 运行 30 年，局部腐蚀严重，地沟倒塌
		DN125	344	
			30	
		DN100	234	
			18	Operation for 21 years, Severe erosion/corrosion; 运行 21 年，腐蚀严重

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN80	292	Operation for 21 years, Severe portion erosion/corrosion; leaking 2 times 运行 21 年，局部腐蚀，漏水 2 次
		DN70	48	Operation for 30 years, Severe erosion/corrosion, leakage and loss 运行 30 年，腐蚀、漏失严重
		DN50	100	
		DN40	6	Operation for 23 years, Severe erosion/corrosion, leakage and loss 运行 23 年，腐蚀、漏失严重
8	Xinhua Avenue Substation 新华街（大系统）换热站	DN300	96	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
		DN250	95	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
		DN200	855	
			44	Operation for 16 years/运行 16 年
		DN150	526	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
			70	Operation for 16 years/运行 16 年
		DN125	32	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
			36	Operation for 20 years, Severe erosion/corrosion, trench collapse 运行 20 年，腐蚀严重，地沟倒塌

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN100	461	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
			66	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重
		DN80	33	Operation for 29 years, Severe erosion/corrosion, trench collapse 运行 29 年，腐蚀严重，地沟倒塌
			62	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重
		DN70	193	Operation for 29 years, Severe erosion/corrosion 运行 29 年，腐蚀严重
		DN50	191	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重
		DN40	80	
9	Water and Power Substation 水电换热站	DN125	448	Operation for 16 years, erosion/corrosion, leaking 2 times 运行 16 年，腐蚀，漏水 2 次
			232	Operation for 28 years, Severe erosion/corrosion 运行 28 年，腐蚀、漏失严重
10	Power Plant Small Network 电厂小热网	DN400	292	Operation for 20 years, Severe erosion/corrosion, leakage 运行 20 年，腐蚀漏水严重
		DN350	587	Operation for 20 years, Severe erosion/corrosion 运行 20 年，腐蚀漏水严重
		DN250	30	Operation for 20 years, Severe erosion/corrosion 运行 20 年，腐蚀漏水严重

No	Piping location	Type	Length (m)	Retrofit Reasons
			20	Operation for 29 years, Severe erosion/corrosion, leaking 1 time 运行 29 年，腐蚀严重，漏水 1 次
		DN150	128	Operation for 20 years, Severe erosion/corrosion, leakage 运行 20 年，腐蚀漏水严重
			72	Operation for 29 years, Severe erosion/corrosion, leakage 运行 29 年，腐蚀漏水严重
		DN125	166	Operation for 20 years, Severe erosion/corrosion, leaking 2 times 运行 20 年，腐蚀严重, 漏水 2 次
		DN100	167	Operation for 20 years, Severe erosion/corrosion, leakage 运行 20 年，腐蚀漏水严重
		DN70	166	
11	Xiangyang Government Substation 向阳政府换热站	DN300	59	Operation for 32 years, Severe erosion/corrosion, leakage 运行 32 年，腐蚀严重
		DN200	189	
		DN150	241	
		DN125	118	
		DN100	27	
		DN80	18	
12	Lighting Garden 光明花园	DN300	115	Operation for 31 years, Severe erosion/corrosion, leakage 运行 31 年，腐蚀严重
		DN250	162	Operation for 16 years, Severe erosion/corrosion, leakage 运行 16 年，腐蚀严重
		DN200	413	Operation for 16 years, Severe erosion/corrosion, leaking 2 times 运行 16 年，腐蚀严重，漏水 2 次
		DN150	104	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN125	118	Operation for 16 years, Severe erosion/corrosion, leaking 3 times 运行 16 年，腐蚀严重，漏水 3 次
		DN100	43	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重
		DN80	139	Operation for 16 years, Severe erosion/corrosion, leakage 运行 16 年，腐蚀严重
13	Longyu Community 龙宇小区	DN300	226	Operation for 18 years, Severe erosion/corrosion, leakage 运行 18 年，腐蚀严重
		DN250	328	
		DN200	583	
		DN150	886	
		DN125	362	
		DN100	189	
		DN80	29	
14	Jinbu Avenue 进步街	DN350	165	Operation for 25 years, Severe erosion/corrosion 运行 25 年，腐蚀严重
		DN250	426	Operation for 25 years, Severe erosion/corrosion; leakage 3 times 运行 25 年，腐蚀严重，漏水 3 次
		DN200	834	Operation for 25 years, Severe erosion/corrosion; leakage 5 times 运行 25 年，腐蚀严重，漏水 5 次
		DN150	326	Operation for 25 years, Severe erosion/corrosion, leakage 运行 25 年，腐蚀严重
		DN125	611	Operation for 25 years, Severe erosion/corrosion; leakage 2 times 运行 25 年，腐蚀严重，漏水 2 次
		DN100	220	Operation for 25 years, Severe erosion/corrosion, leakage 8 times 运行 25 年，腐蚀严重，漏水 8 次

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN80	387	Operation for 25 years, Severe erosion/corrosion, leakage 5 times 运行 25 年，腐蚀严重，漏水 5 次
		DN70	84	Operation for 25 years, Severe erosion/corrosion 运行 25 年，腐蚀严重
15	Power Supply Substation 供电换热站	DN300	1027	
		DN250	190	
		DN200	1546	Operation for 25 years, Severe erosion/corrosion, leakage 3 times 运行 25 年，腐蚀严重，漏水 3 次
		DN150	935	Operation for 25 years, Severe erosion/corrosion 运行 25 年，腐蚀严重
		DN125	166	
		DN100	586	Operation for 25 years, Severe erosion/corrosion, leakage 3 times 运行 25 年，腐蚀严重，漏水 3 次
		DN80	151	Operation for 25 years, Severe erosion/corrosion 运行 25 年，腐蚀严重
		DN70	211	
16	Xinda(big system) 鑫达（大系统）	DN350	238	Operation for 16 years, Severe erosion/corrosion 运行 16 年，腐蚀严重
		DN250	987	Operation for 16 years, Severe erosion/corrosion,2016 trench retrofit 运行 16 年，腐蚀严重,16 年修建地沟
		DN200	256	Operation for 16 years, Severe erosion/corrosion, leakage 2 times 运行 16 年，腐蚀严重，漏水 10 次
		DN150	383	Operation for 16 years, Severe erosion/corrosion,运行 16 年，腐蚀严重
			68	Operation for 24 years, Severe erosion/corrosion, trench collapse 运行 24 年，腐蚀严重，地沟倒塌
		DN125	275	Operation for 16 years, Severe erosion/corrosion, leakage 2 times 运行 16 年，腐蚀严重，漏水 2 次
			74	Operation for 16 years, Severe erosion/corrosion, leakage once 运行 16 年，腐蚀严重，漏水 1 次

No	Piping location	Type	Length (m)	Retrofit Reasons
		DN100	505	Operation for 16 years, Severe erosion/corrosion, leakage 2 times 运行 16 年，腐蚀严重，漏水 2 次
			27	Operation for 24 years, Severe erosion/corrosion, trench collapse 运行 24 年，腐蚀严重，地沟倒塌
		DN80	36	Operation for 16 years, Severe erosion/corrosion, 运行 16 年，腐蚀严重

2019 Heating Supply Piping System Retrofit Reasons Investigation
2019年供热管网更换原因调查表

No	Piping location	Type	Length (m)	Retrofit Reasons
1	MingYuan Community 名苑小区换热站	DN400	297	Operation for 16 years, Severe erosion/corrosion, 运行16年，腐蚀严重
		DN300	205	
2	Junde 2# 峻德2#	DN250	366	Operation for 17 years, Severe rotten Leakage 16 times 运行17年漏水16次腐烂严重
		DN200	432	Operation for 17 years, Severe portion rotten Leakage 12 times 运行17年漏水12次腐烂严重
		DN150	503	Operation for 17 years, Severe portion rotten Leakage 19 times 运行17年漏水19次腐烂严重
		DN125	1097	Operation for 17 years, Severe portion rotten Leakage 56 times 运行17年漏水56次腐烂严重
		DN100	623	Operation for 17 years, Severe portion rotten Leakage 23 times 运行17年漏水23次腐烂严重
		DN80	793	Operation for 17 years, Severe portion rotten Leakage 39 times 运行17年漏水39次腐烂严重
3	Junde 4# 峻德4#	DN300	283	Operation for 16 years, Severe portion rotten Leakage 4 times 运行16年漏水4次腐烂严重
		DN250	32	Operation for 16years, Severe portion rotten Leakage 12 times 运行16年漏水12次腐烂严重

			847	Operation for 19 years, Severe portion rotten Leakage 77 times 运行 19 年漏水 77 次腐烂严重
		DN200	53	Operation for 16 years, Severe portion rotten Leakage 12 times 运行 16 年漏水 12 次腐烂严重
			243	Operation for 19 years, Severe portion rotten Leakage 12 times 运行 19 年漏水 12 次腐烂严重
		DN150	112	Operation for 16 years, Severe portion rotten Leakage 37 times 运行 16 年漏水 37 次腐烂严重
			620	Operation for 19 years, Severe portion rotten Leakage 61 times 运行 19 年漏水 61 次腐烂严重
		DN125	18	Operation for 19 years, Severe portion rotten 运行 19 年腐烂严重
		DN100	165	Operation for 16 years, Severe portion rotten 运行 16 年腐烂严重
			667	Operation for 19 years, Severe portion rotten Leakage 46 times 运行 19 年漏水 46 次腐烂严重
			44	Operation since 1989, Severe portion rotten 1989 年使用腐烂严重
		DN80	111	Operation for 16 years, Severe portion rotten Leakage 27 times 运行 16 年漏水 27 次腐烂严重

			405	Operation for 19 years, Severe portion rotten Leakage 19 times 运行 19 年漏水 19 次腐烂严重
4	Xingan Sankuo Substation 兴安三扩换热站	DN300	317	Operation for 19 years, Severe portion rotten Leakage 9 times 运行 19 年漏水 9 次腐烂严重
		DN250	89	Operation for 19 years, Severe portion rotten Leakage 6 times 运行 19 年漏水 6 次腐烂严重
		DN200	1158.5	Operation for 19 years, Severe portion rotten Leakage 51 times 运行 19 年漏水 51 次腐烂严重
		DN150	411	Operation for 19 years, Severe portion rotten Leakage 22 times 运行 19 年漏水 22 次腐烂严重
		DN125	1352	Operation for 19 years, Severe portion rotten Leakage 75 times 运行 19 年漏水 75 次腐烂严重
5	Zhengxing Substation 振兴换热站	DN350	279	Operation for 16 years, Severe portion rotten 运行 16 年，腐蚀严重
		DN250	440	
		DN200	260	
		DN150	216	
		DN125	133	
			72	Operation for 16 years, Severe portion rotten Leakage 17 times 运行 16 年，腐蚀严重，漏水 17 次
		DN100	265	Operation for 16 years, Severe portion rotten 运行 16 年，腐蚀严重
			5	Operation for 13 years, Severe portion rotten Leakage 2 times 运行 13 年，腐蚀严重，漏水 2 次

6	Lubei Substation 鹿北换热站	DN350	661	Operation for 18 years, Severe portion rotten Leakage 26 times 运行 18 年，腐蚀严重，漏水 26 次
		DN300	377	Operation for 18 years, Severe portion rotten Leakage 38 times 运行 18 年，腐蚀严重，漏水 38 次
		DN250	261	Operation for 18 years, Severe portion rotten Leakage 12 times 运行 18 年，腐蚀严重，漏水 12 次
		DN200	341	Operation for 18 years, Severe portion rotten Leakage 20 times 运行 18 年，腐蚀严重，漏水 20 次
		DN150	1027	Operation for 18 years, Severe portion rotten Leakage 37 times 运行 18 年，腐蚀严重，漏水 37 次
		DN125	722	Operation for 18 years, Severe portion rotten Leakage 14 times 运行 18 年，腐蚀严重，漏水 14 次
		DN100	589	Operation for 18 years, Severe portion rotten Leakage 14 times 运行 18 年，腐蚀严重，漏水 14 次
		DN80	223	Operation for 18 years, Severe portion rotten Leakage 6 times 运行 18 年，腐蚀严重，漏水 6 次
7	Lulin Substation 鹿林换热站	DN250	353	Operation for 16 years, Severe portion rotten Leakage on 39 positions 运行 16 年，腐蚀严重，39 处漏水
		DN200	161	Operation for 16 years, Severe portion rotten Leakage on 13 positions 运行 16 年，腐蚀严重，13 处漏水

			324	Operation for 18 years, Severe portion rotten Leakage on 35 positions 运行 18 年，腐蚀严重，35 处漏水
		DN150	178	Operation for 16 years, Severe portion rotten Leakage on 26 positions 运行 16 年，腐蚀严重，26 处漏水
			724	Operation for 18 years, Severe portion rotten Leakage on 165 positions 运行 18 年，腐蚀严重，165 处漏水
		DN125	229	Operation for 16 years, Severe portion rotten Leakage on 14 positions 运行 16 年，腐蚀严重，14 处漏水
			367	Operation for 16 years, Severe portion rotten Leakage on 45 positions 运行 18 年，腐蚀严重，45 处漏水
		DN100	127	Operation for 16 years, Severe portion rotten Leakage on 26 positions 运行 16 年，腐蚀严重，26 处漏水
			154	Operation for 18 years, Severe portion rotten Leakage on 13 positions 运行 18 年，腐蚀严重，13 处漏水
		DN80	16	Operation for 18 years, Severe portion rotten 运行 18 年，腐蚀严重
		DN65	347	Operation for 18 years, Severe portion rotten Leakage on 62 positions 运行 18 年，腐蚀严重，62 处漏水
8	Jisiu Substation 机修换热站	DN200	591	Operation for 17 years, Severe portion rotten Leakage 53 times 运行 17 年，漏水 53 次，腐烂严重

			64	Operation since 1990, Severe portion rotten Leakage 7 times 1990 年，使用漏水 7 次，腐烂严重
9	Dalu 1# 大陆 1#	DN300	140	Operation for 19 years, Leakage 11 times 运行 19 年，漏水 11 次
		DN250	179	Operation for 19 years, Leakage 8 times 运行 19 年，漏水 8 次
		DN200	118	Operation for 19 years, Severe portion rotten Leakage 16 times 运行 19 年，漏水 16 次腐烂严重
			173	Operation since 1989, Severe portion rotten 1989 年使用，腐烂严重
		DN150	800	Operation for 19 years, Severe portion rotten Leakage 57 times 运行 19 年，漏水 57 次腐烂严重
			217	Operation since 1989, Severe portion rotten 1989 年使用，腐烂严重
		DN125	414	Operation for 19 years, Severe portion rotten Leakage on 34 positions 运行 19 年，漏水 34 次
		DN100	829	Operation for 19 years, Severe portion rotten Leakage on 56 positions 运行 19 年漏水 56 次腐烂严重
			316	Operation since 1989, Severe portion rotten 1989 年使用，腐烂严重

		DN80	96	Operation for 19 years, Severe portion rotten 运行 19 年，腐烂严重
			81	Operation since 1989, Severe portion rotten 1989 年使用，腐烂严重
		DN65	77	Operation for 19 years, Severe portion rotten 运行 19 年，腐蚀严重
10	Xing'an Center 兴安中心	DN300	182	Operation for 19 years, Severe portion rotten Leakage 24 times 运行 19 年，漏水 24 次，腐烂严重
		DN250	325	Operation for 19 years, Severe portion rotten Leakage 13 times 运行 19 年，漏水 13 次，腐烂严重
		DN200	433	Operation for 19 years, Severe portion rotten Leakage 8 times 运行 19 年，漏水 8 次，腐烂严重
		DN150	1249	Operation for 19 years, Severe portion rotten Leakage 37 times 运行 19 年，漏水 37 次，腐烂严重
		DN125	1440	Operation for 19 years, Severe portion rotten Leakage 46 times 运行 19 年，漏水 46 次，腐烂严重
			89	Operation since 1990, Severe portion rotten 1990 年使用，腐烂严重
		DN100	490	Operation for 19 years, Severe portion rotten Leakage 8 times 运行 19 年，漏水 8 次，腐烂严重

		DN80	506	Operation for 19 years, Severe portion rotten Leakage 6 times 运行 19 年，漏水 6 次，腐烂严重
		DN65	407	Operation for 19 years, Severe portion rotten Leakage 14 times 运行 19 年，漏水 14 次，腐烂严重
11	Lingbei 4# 岭北 4#	DN300	101	Operation for 16 years, Severe portion rotten 运行 16 年，腐蚀严重
		DN200	145	
		DN150	220.5	
		DN125	315	
		DN100	353	
		DN80	202	
		DN65	79	
12	Dongfeng Substation 东风换热站	DN250	347	
		DN200	120	
		DN150	252	
		DN125	296	
		DN100	72	

APPENDIX F: PROCUREMENT PLAN (VERSION APRIL 12TH,2017)

Procurement Plan

项目和类别 Project and category	合同编号 Contract Number	主要内容描述 Key content description	合同金额	合同金额					采购方法 Procurement methods	亚行审查	公告日期	说明
			（元人民币） a Contract value (RMB)	（百万美元） b Contract value (1,000,000 USD)	ADB	EIB	ADB-EIB	Govt		（前审/后审）ADB review (Prior review/ post review)	（季度/年度） Expected date of advertisement (Quarter/ year)	Notes
												(Quarter/ year)
Version 4.12												
7	HG-DH-W7	城市供热老旧管网改造工程： 2017年一次网和二次网改造Civil Works of District Heating System Pipe Retrofit (Primary and Secondary pipes replacement in 2017)	20,000,000	2.90				2.90	NBF	N.A.	Q1/2017	
8	HG-DH-W8	城市供热老旧管网改造工程： 2018年一次网和二次网改造Civil Works of District Heating System Pipe Retrofit (Primary and Secondary pipes replacement in 2018)	76,916,125.16	11.15		11.15			ICB	Prior	Q4/2017	EIB
9	HG-DH-W9	城市供热老旧管网改造工程： 2019年一次网和二次网改造Civil Works of District Heating System Pipe Retrofit (Primary and Secondary pipes replacement in 2019)	49,110,898	7.12		7.12			ICB	Prior	Q4/2018	EIB
		Sum	146,027,023									

pending on Update