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Report No: PAD1277

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$100 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

HEBEI CLEAN HEATING PROJECT

December 17, 2015

Energy & Extractives Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective December 1, 2014)

Currency Unit = CNY (Chinese Yuan)
CNY 6.15 = US$1

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ARAP	Abbreviated Resettlement Action Plan
BAU	Business As Usual
BLS	Building-level Substations
CBB	Consumption-based Billing
CHP	Combined Heat and Power
DA	Designated Account
DH	District Heating
EA	Environmental Assessment
ECOP	Environmental Codes of Practice
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FIRR	Financial Internal Rate of Return
FM	Financial Management
FMM	Financial Management Manual
FMS	Financial Management Specialist
FNPV	Financial Net Present Value
GDP	Gross Domestic Product
GRS	Grievance Redress Service
HOB	Heat Only Boiler
HPAO	Hebei Provincial Audit Office
HPFB	Hebei Provincial Finance Bureau
HPMO	Hebei Provincial Management Office
HRBEE	Heat Reform & Building Energy Efficiency
JV	Joint Venture
MOF	Ministry of Finance
O&M	Operations and maintenance
PIU	Project Implementation Unit
PLG	Project Leading Group
PM	Particulate Matter
SCADA	Supervisory Control And Data Acquisition
SLA	Subsidiary Loan Agreement
TSP	Total Suspended Particles
VSD	Variable Speed Drive
WACC	Weighted Average Cost of Capital

Regional Vice President:	Axel van Trotsenburg, EAPVP
Country Director:	Bert Hofman, EACCF
Senior Global Practice Director:	Anita Marangoly George, GEEDR
Practice Manager:	Julia M. Fraser, GEEDR
Task Team Leader:	Yuriy Myroshnychenko, GEEDR
Co- Task Team Leader:	Emmanuel Py, GEEDR

CHINA
Hebei Clean Heating Project

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Hebei Clean Heating Project (P148599)

PROJECT APPRAISAL DOCUMENT

EAST ASIA AND PACIFIC

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Basic Information		
Project ID P148599	EA Category A - Full Assessment	Team Leader(s) Yuriy Myroshnychenko,Emmanuel Py
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]	
Project Implementation Start Date 20-Jan-2016	Project Implementation End Date 30-Jun-2021	
Expected Effectiveness Date 31-May-2016	Expected Closing Date 30-Jun-2021	
Joint IFC No		

Practice Manager/Manager	Senior Global Practice Director	Country Director	Regional Vice President
Julia M. Fraser	Anita Marangoly George	Bert Hofman	Axel van Trotsenburg

Borrower: People's Republic of China

Responsible Agency: Foreign Debt Management Center, Hebei Provincial Department of Finance

Contact: Hui He Title: Director

Telephone No.: 0311-66651593 Email: hehui@vip.163.com

Project Financing Data(in USD Million)					
[X]	Loan	[ ]	IDA Grant	[ ]	Guarantee
[ ]	Credit	[ ]	Grant	[ ]	Other

Total Project Cost:	248.33	Total Bank Financing:	100.00
Financing Gap:	0.00		

Financing Source	Amount
Borrower	148.33
International Bank for Reconstruction and Development	100.00
Total	248.33

Expected Disbursements (in USD Million)

Fiscal Year	2016	2017	2018	2019	2020	2021	0000	0000	0000	0000
Annual	0.00	10.00	15.00	25.00	30.00	20.00	0.00	0.00	0.00	0.00
Cumulative	0.00	10.00	25.00	50.00	80.00	100.00	0.00	0.00	0.00	0.00

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Cross Cutting Topics

[X] Climate Change

[ ] Fragile, Conflict & Violence

[ ] Gender

[ ] Jobs

[ ] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Energy efficiency in Heat and Power	100		100
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Environment and natural resources management	Pollution management and environmental health	40

Environment and natural resources management	Climate change	10
Urban development	Other urban development	50
Total		100

Proposed Development Objective(s)

The project development objective (PDO) is to improve the efficiency and environmental performance of heating systems in selected areas within participating municipalities/counties of Hebei Province.

Components

Component Name	**Cost (USD Millions)**
District Heating Subprojects	217.06
Institutional Capacity Building and Project Management Support	2.50

Systematic Operations Risk- Rating Tool (SORT)

Risk Category	**Rating**
1. Political and Governance	Low
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Moderate
7. Environment and Social	Moderate
8. Stakeholders	Substantial
9. Other (Counterpart Funding)	Substantial
OVERALL	Substantial

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	**X**	

Natural Habitats OP/BP 4.04		**X**
Forests OP/BP 4.36		**X**
Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11		**X**
Indigenous Peoples OP/BP 4.10		**X**
Involuntary Resettlement OP/BP 4.12	**X**	
Safety of Dams OP/BP 4.37	**X**	
Projects on International Waterways OP/BP 7.50		**X**
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Institutional Arrangements (Project Agreement (PA), Schedule, Section I.A)	**X**		CONTINUOUS

Description of Covenant

Hebei Province shall, throughout implementation: (a) maintain the Project Leading Groups (at the provincial, municipal and county level (as applicable)) and the Hebei Project Management Office; and (b) cause each Project Company to maintain a Project Implementing Unit.

Name	**Recurrent**	**Due Date**	**Frequency**
Annual Work and Financial Viability Plans (PA, Schedule, Section I.D)	**X**		Yearly

Description of Covenant

Hebei Province shall cause the project companies to prepare and furnish to the Bank for review and comments by December 15 in each year, beginning in 2016: (a) a draft Annual Work Plan, summarizing the implementation progress of the project for the said year and the project activities to be undertaken for the following calendar year, and (b) a draft Annual Financial Viability Plan.

Name	**Recurrent**	**Due Date**	**Frequency**
Safeguards (PA, Schedule, Section I.E)	**X**		CONTINUOUS

Description of Covenant

Hebei Province shall implement, and shall cause the Project Companies to implement, the Safeguards Instruments (ARAP and EMP) in a manner and substance satisfactory to the Bank.

Name	**Recurrent**	**Due Date**	**Frequency**
Dam Safety Report (PA, Schedule, Section I.E.5)	**X**		Yearly

Description of Covenant

Hebei Province, through Xingtai County, shall furnish to the Bank by March 31 of each year, beginning in 2016, a dam safety report prepared by the dam safety expert, including an action plan to address the findings and recommendations thereof.

Name	**Recurrent**	**Due Date**	**Frequency**

Mid-term review (PA Schedule Section II A.2)		15-Dec-2018	

Description of Covenant

Hebei Province shall prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank a consolidated mid-term review report for the Project, summarizing the results of the monitoring and evaluation activities carried out from the inception of the Project, and setting out the measures recommended to ensure the efficient completion of the Project.

Conditions

Source Of Fund	Name	Type
IBRD	Subsidiary Agreements (Loan Agreement, Schedule 2, Section IV.B.1 (b))	Disbursement

Description of Condition

Each of Chengde Municipality, Zhangjiakou Municipality, Pingshan County, and Xingtai Municipality has entered into a Subsidiary Agreement with the respective Project company prior to the withdrawal of the Loan proceeds allocated to the respective subproject under Component 1.

Source Of Fund	Name	Type
IBRD	Subsidiary Agreements (Loan Agreement, Schedule 2, Section IV.B.1 (c))	Disbursement

Description of Condition

All of Chengde Municipality, Zhangjiakou Municipality, Pingshan County, and Xingtai Municipality have entered into a Subsidiary Agreement with the respective Project company prior to the withdrawal of the Loan proceeds allocated to Component 2.

Team Composition

Bank Staff

Name	Role	Title	Specialization	Unit
Yuriy Myroshnychenko	Team Leader (ADM Responsible)	Senior Energy Specialist	Task Team Leader	GEEDR
Emmanuel Py	Team Leader	Infrastructure Specialist	Co-Task Team Leader	GEEDR
Yuan Wang	Procurement Specialist	Procurement Specialist	Procurement	GGODR
Fang Zhang	Financial Management Specialist	Financial Management Specialist	Financial Management	GGODR
Dianjun Zhang	Team Member	Operations Officer	District Heating	CFGA1
Gailius J. Draugelis	Team Member	Lead Energy Specialist	Energy Sector	GEEDR
Shanshan Ye	Team Member	Team Assistant	Team Assistant	EACCF
Shunong Hu	Safeguards	Senior Water	Dam Safety	GWADR

	Specialist	Engineer	Safeguards	
Tianxiu Kang	Team Member	Program Assistant	Program Assistant	EACCF
Yiren Feng	Safeguards Specialist	Senior Environmental Specialist	Environmental Safeguards	GENDR
Zhuo Yu	Team Member	Finance Officer	Disbursement	WFALN

Extended Team

Name	Title	Office Phone	Location
Kishore Nadkarni	Consultant - Financial Analysis		
Yongli Wang	Environment/Safeguard Consultant		Shengyang
Youxuan Zhu	Social Safeguards Specialist, Consultant		Washington, D.C.

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
China	Hebei	Xingtai		X	
China	Hebei	Pingshan		X	
China	Hebei	Zhangjiakou		X	
China	Hebei	Chengde		X	

Consultants (Will be disclosed in the Monthly Operational Summary)

Consultants Required ? Consultants will be required

I. STRATEGIC CONTEXT

A. Country Context

1. China has achieved rapid economic growth in recent decades, however, many imbalances remain. In the past decade, gross domestic product (GDP) grew by 9.9 percent per year with broadly effective macroeconomic management. Inflation has been kept broadly under control. China's real economy was affected by the global financial crisis from 2008 with regard to trade flows and foreign direct investment, however, a forceful fiscal and monetary stimulus helped keep China's growth rate at a high level. Per capita incomes have risen rapidly in urban and rural areas and millions of people have been lifted out of poverty. At the same time, approximately 200 million people still live below the World Bank poverty line,[1] with China having the second-largest number of poor among all countries (after India). In addition, some economic and social imbalances have emerged, in particular:

- widening disparities in regional development and incomes between urban and rural areas and between coastal and inland provinces; and
- growing local and global environmental challenges and high vulnerability to the adverse impacts of climate change.

2. The population of Hebei Province reached 73 million and ranked 6th among the other provinces in 2013. Despite its proximity to Beijing, its GDP per capita was CNY 39,984 and it was ranked 18th in 2014. The province is facing a major challenge in mitigating the environmental impacts of its economic growth. Hebei Province is a major center for manufacturing, including the energy-intensive heavy industry, and is a key source for fine particulate air pollution which is known to have major impacts on public health. The province is located in a major airshed that also includes the municipalities of Beijing and Tianjin and that is known collectively as the Jing-Jin-Ji region.

B. Sectoral and Institutional Context

3. China's energy sector faces three main challenges: energy security, environmental sustainability, and sector efficiency. By 2030, China is expected to import 75 percent of its oil and 50 percent of its natural gas, becoming the world's largest oil importer. The country is heavily dependent on fossil fuels, with coal accounting for about 70 percent of primary energy consumption. As a result, 85 percent of CO_2 emissions come from energy. The 12th Five-year Plan (2011–2015) aims to reduce energy intensity by 16 percent from year 2010's level. For the first time, it also set a target to reduce carbon intensity by 17 percent, contributing to an overarching goal of reducing carbon intensity in the economy by 40 to 45 percent from 2005 to 2020. China also announced in November 2014, a target to peak greenhouse gas emissions by around 2030 and to increase the share of non-fossil fuels in primary energy consumption to around 20 percent by 2030 compared to 9.8 percent in 2013. The 13th Five-year Plan (2016–2020) has not yet been issued, but is expected to extend the government's commitments on energy and carbon intensity. Many options are being discussed, including possible caps on the consumption of energy or coal or overall carbon emissions.

[1] US$1.25 per person per day.

4. Associated with these challenges is the need for China to develop greener approaches to urbanization. By 2030, China's cities are projected to add about 45 percent more residents (about 300 million) and about 60 percent more buildings (in square meters of floor area) compared with 2010. The energy needs of these citizens will need to be met through a series of coordinated actions—reducing demand as much as possible, using local clean energy sources where feasible, importing cleaner energy from outside city boundaries, and making coal use cleaner where it cannot be avoided.[2]

5. The bulk of total primary fine particulate matter ($PM_{2.5}$) in the Jing-Jin-Ji region comes from Hebei. In 2010, the region emitted a total of 1.6 million tons of primary $PM_{2.5}$, with 1.3 million tons from Hebei Province alone. Industrial processing and the residential building sector are the main sources of primary $PM_{2.5}$ in the region, accounting for 54 and 29 percent of pollution contributions, respectively. Sulfur dioxide (SO_2) and nitrogen oxides (NOx) are also major atmospheric emissions. Industrial boilers, industrial processes, the power sector, the residential building sector, and the heating sector contribute 39, 19, 17, 15, and 8 percent of SO_2 emissions, respectively. The transportation sector, industrial boilers, the power sector, heating and industrial processes are the main sources of NOx emissions, accounting for 28, 27, 24, 10 and 7 percent, respectively.[3]

6. In line with its industrial development, Hebei Province is rapidly urbanizing. Currently the urbanization rate is 48.1 percent (including migrants) and is expected to reach 58 percent by 2020. Part of the urbanization is expected to be from the growth of smaller county towns, which will find their primary source of population growth from rural-urban migration. While there is high uncertainty with respect to the pace and location of this migration, some county towns are certainly expected to grow and present an alternative to larger cities, where the cost of living may be unaffordable for lower income groups.

7. The heating sector offers some of the most direct opportunities for improving environmental quality in northern cities, including in Hebei, but also faces major challenges in central heating supply sector reform. The Bank study, "China: Enhancing the Institutional Model for District Heating Regulation—Outside Perspectives and Suggestions" (2012), identified the following sector issues: (a) lack of consistency in regulation; (b) lack of consistency in sector planning, high market fragmentation, and high variability in operator qualifications; (c) potential improvement in economic regulation and pricing; (d) underdeveloped consumer protection and social assistance; and (e) weak orientation towards energy efficiency.

8. District heating (DH) systems continue to be mostly fueled by coal. In more than 300 cities, where centralized heating in the winter is legally required, over 90 percent of the heat supply is fueled by coal. While the sector consumes only about 7.5 percent of coal, it does so in a short period of time during the heating season (between 4 and 5 months), contributing to the carbon intensity of energy use in China's cold northern provinces. In earlier stages of Chinese urbanization, cities invested in small, coal-fired boilers to provide space heating to new urban

[2] *Source: Urban-China: Toward Efficient, Inclusive and Sustainable Urbanization*. World Bank and State Council Development Research Center, 2014.

[3] *Source: Can Beijing, Tianjin and Hebei achieve their $PM_{2.5}$ targets by 2017?* Tsinghua University, Clean Air Alliance of China, and Energy Foundation, September 2015.

areas. Over time, these dispersed systems were replaced with larger DH systems supplied with larger coal-fired heat only boilers (HOBs) with improved emissions controls. As urban areas continued to expand, coal-fired boilers surrounded the city, with some smokestacks barely clearing apartment building rooftops. Relative to modern technologies, the initial DH systems in northern cities are often highly inefficient and are usually lagging in pollution controls. As a result, ambient $PM_{2.5}$ concentrations of cities north of the Huai River (the traditional boundary line for mandatory provision of heating by local governments) were estimated to be about 55 percent higher between 1981 and 2000. More significantly, these northern cities were found to have average life expectancies about 5.5 years lower, compared to cities where heating is not legally required.[4]

9. Recently, DH systems supplied from combined heat and power (CHP) plants with stricter emission standards have been promoted by the central government as cleaner and more efficient alternatives to earlier DH models. Several thermal power plants are now being converted to CHP for this purpose. Some cities have secured natural gas to fully or partially replace coal for heating. More advanced cities are starting to optimize the energy mix for DH systems by: (a) using CHP to provide base-load and gas-fired boilers, where gas is available, to provide peak-load heating in integrated systems; (b) using low temperature waste heat and water cooling systems from industry; (c) identifying distributed solutions, combining gas/renewable where feasible (that is, using thermal collectors for hot water preparation) and (d) strengthening demand-side measures through building energy management and consumption-based billing (CBB). However, consumers and heat suppliers have been slow in responding to market-based energy costs because heating, unlike water and electricity, is largely billed according to the floor area rather than the meter.

10. As part of implementation of the Hebei Air Pollution Control and Prevention Plan, Hebei Province has banned the construction of coal-fired HOBs for DH. Alternatives, including CHP-based DH systems, are largely left up to cities to identify and develop. Many new and densifying urban areas in county towns also have no experience in developing DH networks. Some have turned to local industries to supply and finance waste-heat-based systems, but the local industries also lack experience in designing and operating DH networks. Some small cities have constructed gas systems, only to be cut off at peak load periods when heating is most needed due to shortages or have had to provide significant subsidies to maintain affordability levels. Without guidance, cities, especially county towns, are facing a major challenge in finding feasible alternatives. Through the project, Hebei Province will provide the necessary support to the participating municipalities and towns. Also, it will help participating heating companies to enhance their institutional and operational performance.

C. Higher Level Objectives to which the Project Contributes

11. The proposed project is consistent with the World Bank's Country Partnership Strategy (CPS) FY2013–2016 with China, which includes greener growth as one of its three strategic

[4] *Source: Evidence on the Impact of Sustained Exposure to Air Pollution on Life Expectancy from China's Huai River Policy.* Chen, Y., A. Ebstein, M. Greenstone, and H. Li. 2013. PNAS Proceedings of the National Academy of Science, http://www.pnas.org/cgi/doi/10.1073/pnas.1300019110.

themes and shifting to a sustainable energy path as one of its key pillars. By supporting the Hebei Air Pollution Control and Prevention Plan, the project will also contribute to the Bank's corporate objective of ending extreme poverty and boosting shared prosperity with sustainability. In Hebei's cold climate, DH is a vital urban service but its dependence on coal-fired HOBs and outmoded operations makes it inefficient and polluting. Urbanization is also driving up the need for urban services, including heating. By helping to stem increases in heating-related pollution, the project will support efforts to improve air quality in the project cities. This can have a beneficial impact on the urban poor, who usually are least able to cope with exposure to air pollution. In the three participating cities, GDP per capita is below the average for the province. By supporting investments that help avoid construction of coal-fired HOBs or to eliminate small boilers, the project contributes to raising the effectiveness of Hebei's air quality policies and saves energy resources that help underpin sustainable economic development.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

12. The project development objective (PDO) is to improve the efficiency and environmental performance of heating systems in selected areas within participating municipalities/counties of Hebei Province.

Project Beneficiaries

13. Project beneficiaries are the customers of the participating DH companies of project cities that will benefit from access to rehabilitated and newly constructed DH systems. Residents of participating cities will indirectly benefit from avoided emissions. Other beneficiaries include the Hebei Provincial Government, the participating local governments and district suppliers, including (a) three municipal governments (Chengde, Zhangjiakou, and Xingtai) and a county government (Pingshan); (b) two municipal DH companies: Zhangjiakou Dongyuan Heating Company and Chengde Heating Group Company; (c) a county-level DH company: Pingshan County Urban Heating Company—a state-owned enterprise under the Pingshan County Heating Office; and (d) a private new joint venture (JV) company, established for this project in Xingtai Municipality, the RISUN Anneng Heating Company Ltd.

14. Not counting commercial facilities, public buildings, and the like, an estimated 714,900 people will directly benefit from the project by the time of its completion. This includes about 429,800 persons who will gain access to DH and 285,100 persons who will benefit from rehabilitated and hence more energy-efficient DH systems.

PDO Level Results Indicators

15. The success of the project will be measured by the following key performance indicators:

- Projected lifetime energy savings (MWh)
- Number of people that gained access to more energy-efficient cooking and/or heating facilities (number)
- Direct project beneficiaries (number), of which female (percentage)

- Project-level aggregated avoided CO_2 emissions (tons)
- Project-level aggregated avoided total suspended particles (TSP) emissions (tons)

III. PROJECT DESCRIPTION

A. Project Components

16. The project consists of an investment component, District Heating Subprojects, and a technical assistance component, Institutional Capacity Building and Project Management Support.

Component 1: District Heating Subprojects (estimated cost US$217.06 million equivalent; indicative US$89.67 million IBRD financing[5]).

17. Component 1 will finance the construction and rehabilitation of DH facilities in the four project cities/counties (four subprojects) with a total heating area of 38.7 million m^2, including 13.5 million m^2 of new buildings. Each subproject is tailored to fit the needs of the participating city/county, but will also have common features aiming to modernize operations and make them more efficient.

18. The component builds on the Bank's previous engagement in the DH sector in China and supports the implementation and scale-up of DH best practices that might not be adopted by the project sponsors without Bank support. These include (a) enabling the heating supply system to operate in demand-driven mode with automatic temperature control and variable flow operation. This will allow the system to respond more efficiently to individual customer requirements, saving on pumping and energy costs, compared to traditional supply-driven operating modes, especially in the secondary network; (b) requiring heat metering across the supply chain (at least up to the substation) to enable good network management and gradual implementation of CBB; (c) promoting building-level substations (BLS) to demonstrate energy efficiency and heating quality benefits associated with linking substations to fewer buildings compared to conventional designs and preferences for larger substations; (d) optimizing project design, especially in network investments, and implementation to reduce costs and ensure quality; and (e) promoting the use of waste heat from CHPs and industry. A detailed description of the subprojects is provided in annex 2. The following paragraphs summarize each subproject.

19. **Subproject 1.1. Chengde District Heating and Energy Efficiency Subproject (estimated cost US$30.57 million; US$18.09 million IBRD financing).** The subproject is located in the Shuangqiao (old town) District of Chengde, a city in northeast Hebei Province. It will rehabilitate DH facilities that serve the existing DH area of about 12.3 million m^2 and expand DH to an additional 2.5 million m^2. The latter will include replacement of six small coal-fired boilers that serve about 87,000 m^2 of existing buildings and approximately 2.4 million m^2 of new buildings. The main investments will comprise (a) extension of a DH primary network by about 5 km; (b) renovation of approximately 3 km of the primary network and 57 km of a

[5] These costs don't include physical contingencies, interest and commitment charge, front-end fee, and initial working capital requirement, all of which are detailed in paragraph 24.

secondary network; and (c) construction of 20 group substations and 114 BLS. The implementing entity is the Chengde Heating Group Company Ltd., a state-owned enterprise that is the largest DH company in Chengde.

20. **Subproject 1.2. Zhangjiakou District Heating Subproject (estimated cost US$64.28 million; US$29.89 million IBRD financing).** The subproject is located in Qiaodong District of Zhangjiakou in northwest Hebei Province. It will rehabilitate DH facilities that serve the existing DH area of about 3.5 million m^2 and expand DH to additional 5 million m^2. The latter will include connection to DH of about 2.6 million m^2 of existing buildings, which are currently served by 99 small coal-fired boilers, and 2.4 million m^2 of new buildings. The main investments will comprise (a) extension of a DH primary network by about 20 km; (b) construction of 58 group substations and 17 BLS; (c) conversion of two coal-fired boilers (2x64 MW) to natural gas (2x70 MW) for peak load supply and backup capacity; (d) construction of a pressure isolation station; and (e) installation of heat meters and a Supervisory Control and Data Acquisition (SCADA) system. The implementing entity is the Zhangjiakou Dongyuan Heating Company, a state-owned enterprise and subsidiary of the Qiaodong Urban Construction and Investment Company. Dongyuan owns the 4x64 MW coal-fired HOB plant, which will be partially converted to gas.

21. **Subproject 1.3. Pingshan (County) District Heating and Energy Efficiency Subproject (estimated cost US$22.13 million; US$11.81 million IBRD financing).** The subproject is located in the urban area of Pingshan County, about 30 km west of Shijiazhuang, the capital of Hebei Province. It will rehabilitate DH facilities that serve the existing DH area of about 4.5 million m^2 and expand DH to an additional 3 million m^2 of new buildings. The main investments will comprise (a) extension of the DH primary network by about 6 km; (b) renovation of some 4 km of the primary network; (c) installation of 27 group substations and nine BLS, as well as rehabilitation/expansion of 5 group substations to 8 group substations; (d) installation of heat meters for 1.9 million m^2 of the residential heating area and about 0.27 million m^2 of public buildings (for example, schools and government offices); (e) automatic control systems for 46 existing substations; (f) rehabilitation of two water treatment stations; and (g) installation of a SCADA and central monitoring and control system for the DH system. The implementing entity is the Pingshan County Urban and Township Heating Co. Ltd., a state-owned enterprise under the Pingshan County Heating Supply Office.

22. **Subproject 1.4. Xingtai Industrial Waste Heat District Heating Subproject (estimated cost US$100.08 million; US$29.88 million IBRD financing).** The subproject is located in the northwest urban area of Xingtai Municipality in southern Hebei Province. It is one of the most polluted cities in the province. It will construct DH facilities to serve about 8 million m^2, including approximately 2.3 million m^2 of existing and about 5.7 million m^2 of new buildings. The subproject will use industrial waste heat from nearby industrial (coking) facilities. The project investments will be split in two phases. Phase I is under implementation, funded from counterpart funds, and comprises construction of a waste heat water network of about 12 km within the coking plant area, approximately 24 km of the primary DH network outside the plant, a primary station, and 27 group substations to provide DH to an existing heating area. Phase II (2016–2019) will include construction of additional 5 km of the network within the plant, 28 km of the primary DH network outside the plant, 103 group substations, 14 BLS, and

installation of a SCADA system. The implementing entity is the RISUN Anneng Heating Company Ltd, a new JV company, established for this project.

Component 2: Institutional Capacity Building and Project Management Support (estimated cost US$2.5 million; indicative US$2.5 million IBRD financing).

23. Component 2 will finance technical assistance, training, workshops, and study tours for the Hebei Project Management Office (HPMO) and the four heating companies, including (a) project management support to the HPMO and the four heating companies; (b) capacity-building support to the heating companies in DH management, operations and maintenance (O&M), and Bank project implementation procedures; (c) training, workshops, and study tours to exchange and learn good practices in the DH sector; and (d) technical assistance activities tailored to the needs of project's companies. All these activities will be provided by a management consulting company that will procured under this component.

B. Project Financing

24. The lending instrument is Investment Project Financing. The loan will be a United States dollar denominated, variable spread loan with a maturity of 19 years including a five-year grace period, at the Bank's standard interest rate for LIBOR-based U.S. dollar loans, with a front-end fee of 0.25 percent. The bulk of counterpart funds will be sourced from connection fees, complemented by commercial loans, equity, government subsidies. Details on the financing sources for each subproject are presented in annex 5, paragraph 9.

Project Cost and Financing

	Cost (US$, millions)	IBRD Financing (US$, millions)	% IBRD Financing	Cost (CNY, millions)
Component 1: District Heating Subprojects	**217.06**	**89.67**	**41.3**	**1334.90**
1.1 Chengde Subproject	30.57	18.09	59.2	187.98
1.2 Zhangjiakou Subproject	64.28	29.89	46.5	395.31
1.3 Pingshan Subproject	22.13	11.81	53.4	136.12
1.4 Xingtai Subproject	100.08	29.88	29.9	615.49
Component 2: Institutional Capacity Building and Project Management Support	**2.5**	**2.5**	**100.0**	**15.38**
Total Baseline Costs	**219.56**	**92.17**	**42.0**	**1350.28**
Physical Contingencies	17.57	–	–	108.05
Total Project Costs	**237.13**	**92.17**	**38.9**	**1458.32**
Interest and Commitment Charge	9.01	7.58	84.1	55.41
Front-end Fee	0.25	0.25	100.0	1.54
Initial Working Capital Requirement	1.94	–	–	11.94
Total Financing Requirement	**248.33**	**100.00**	**40.3**	**1527.21**

Note: US$1 = CNY 6.15.

C. Lessons Learned and Reflected in the Project Design

25. The project design, as noted above, incorporates international best practices in DH and takes into account lessons learned from Bank DH and other lending operations in China, as well as Bank-supported DH projects in the Europe and Central Asia region:

- **Sector investments should seek to limit environmentally harmful resource use as much as possible and clean up what cannot be avoided.** The Green Urbanization chapter in the joint Bank-China State Council Development Research Center study, Urban China: Toward Efficient, Inclusive and Sustainable Development (2014), calls for minimizing the direct use of coal in Chinese cities to combat air pollution. Reducing energy demand as much as possible, using local clean energy sources when feasible or importing them, and applying strict emissions standards when polluting resource use cannot be avoided is the study's recommended approach. Investments in this project support alternatives to coal-fired HOBs, energy efficiency improvements in DH, and demand management through metering. The use of waste energy from CHPs and industry is promoted. Emissions from heating sources are to be monitored to ensure compliance with Hebei's emissions standards.
- **Large countries often adopt a decentralized approach for managing municipal infrastructure, including DH.** A study financed by an energy sector management assistance program, Enhancing the Institutional Model for District Heating Regulation (World Bank 2012), concluded that monitoring the progress of sector development in over 300 cities across 15 provinces where provision of heating services is required by a central ministry is impractical and may be a reason for the slow pace of reform. However, provincial governments usually have understaffed heating offices and leave sector development issues to municipalities or lower levels of government. During preparation, the HPMO agreed to enhance its technical capacity by hiring an experienced consulting firm to help review feasibility studies and other project preparatory documents. In addition, the project aims to share experiences among project cities and other cities through periodic workshops managed by the HPMO.
- **In projects with multiple subprojects, a central Project Management Office is critical for project success.** As suggested by international experience, operations with a number of subprojects implemented in different locations benefit from a strong central Project Management Office. This institutional arrangement also makes the Bank's implementation support more efficient and helps subprojects benefit from each other's experiences and lessons learned.
- **Institutional capacity building for public utilities helps enhance their operational and financial performance and the ability to sustain project investments and results.** Public utilities in Bank client countries, especially utilities that are managed at the municipal level in medium-size cities, such as for heating and water supply and sanitation, often face shortages of skilled staff and often lag behind industry best practice. Deficiencies in expertise and experience at the utility level contribute to suboptimal service delivery and cannot be offset by investments in physical infrastructure alone. As such, the project comprises a technical assistance component to enhance the capacity of project-implementing heating companies on management and operation.

- **CBB and public outreach are important for improving the performance of utilities and customer satisfaction.** Historically, billing for DH in many countries, including China and former Soviet Union countries, was based on norms, such as a fixed payment per square meter. That method of billing, however, does not provide incentives for consumers to conserve energy and it deprives utilities of data on actual consumption, which is important for efficient management of DH assets. The project will support the scale-up of CBB and related public communications with a view to improving the transparency and efficiency of heating services in the four subprojects.
- **Project experience gained by participating cities and heating companies is valuable and worth disseminating to other cities.** The four subprojects will generate practical experience in DH applications for medium-size and small county towns. As suggested by international experience, sharing lessons among peers is an effective way to disseminate best practices and promote sector modernization. The project intends to serve as a knowledge-sharing platform for project cities to learn from each other through periodic meetings and to share their experiences with other cities in Hebei through project workshops. Some participating cities are more advanced than others. Chengde, for example, is one of the first pilot cities for heat metering and billing in China. The municipal heating company has already integrated its billing and accounting functions and has piloted BLS, which it will now scale up through the project. In China, such practical and local experience has proven to yield positive demonstration effects.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

26. The Bank loan to the People's Republic of China will be on-lent to the Hebei Provincial Government, which will in turn on-lend funds to the Chengde, Zhangjiakou, and Xingtai municipal finance bureaus. As Pingshan County is managed by the province, the Bank loan will be directly on-lent to the county government. The proceeds of the Bank loan will be on-lent to the four project-implementing companies from the municipal (Chengde and Xingtai), county (Pingshan), and district (Zhangjiakou) finance bureaus.

27. A Project Leading Group (PLG), chaired by an executive deputy governor of Hebei Province and composed of senior government officials from various departments, has been established to provide high-level guidance to the project and to coordinate policy and institutional issues when needed. In addition, all project cities/counties have established leading groups to provide support and ensure smooth project implementation.

28. The HPMO has been established under the Hebei Foreign Debt Management Center (Hebei Provincial Finance Bureau) and is responsible for overall project management, coordination, reporting of consolidated project results to the Bank, as well as implementation of procurement and Component 2. A project management consultant, hired under Component 2, will support the HPMO on all key project functions.

29. The project-implementing heating companies in Chengde, Zhangjiakou, and Pingshan have been operating for years and have experience with the construction and operation of heating networks. The heating company in Xingtai was established in 2014. It has nearly been fully

staffed and benefits from experience and knowledge in DH from a private parent company that provides DH in other cities, including the capital of Hebei Province, Shijiazhuang. In each company, a Project Implementation Unit (PIU) has been established, often under the chief engineer, with full-time staff coming from various departments (engineering, operations, procurement, and finance). The four companies will implement the physical investments under Component 1 and own, operate, and maintain the project assets after their construction.

B. Results Monitoring and Evaluation

30. Annex 1 lists the PDO-level results indicators for the project, as well as the intermediate results indicators for each component. The four project-implementing companies will be responsible for the implementation of monitoring plans and obtaining operational data from the heat sources (CHP and coal-/gas-fired boilers) on heat production, fuel (coal/gas) consumption, heat supplied, fuel chemical composition/analysis, emissions data, and flue gas treatment facilities in use. Subproject-level indicators are elaborated in the Project Implementation Plan, prepared by HPMO and the project-implementing heating companies, and will periodically be reported by the companies to HPMO and the Bank. These indicators cover the following areas: implementation progress, citizen engagement, and financial performance of the project-implementing heating companies.

31. The project-implementing companies will prepare and submit periodic monitoring reports to the HPMO, including inputs to the semiannual project progress reports and annual reports, to monitor the achievement of the PDO and intermediate results indicators. They will also report annually on their work plans and financial viability plans. The HPMO will check the inputs from the project-implementing companies for quality and consistency, ensure that corrective actions are taken as necessary, and consolidate and submit them to the Bank.

C. Sustainability

32. The Hebei Provincial Government has continually expressed its commitment to implement the Hebei Air Pollution Control and Prevention Plan. Among the more than fifty measures in the plan, the province has demonstrated a firm stance on enforcing the ban on the construction of new coal-fired HOBs, the time-bound elimination of small coal-fired HOBs, and promoting the optimization of the energy mix including the use of CHP plants for DH supply. The policy environment, therefore, is likely to support the project's investments during the implementation period.

33. At the subproject level, assessments of demand and technical designs have been carried out to determine to optimal size of investments. To ensure the long-term sustainability of project objectives, technical and financial analyses were carried out to ensure that resources and capacity are in place to design, construct, operate, and maintain project investments. The project will put the four heating systems on a more sustainable path by addressing major energy efficiency and environmental penalties associated with the use of stand-alone coal-fired boilers and take advantage of economies of scale through the increased coverage of DH/CHP systems in Chengde, Zhangjiakou, and Pingshan, and industrial waste heat in Xingtai. The project will expand metering and introduce a SCADA system that will collect data to help build more robust heat-load estimates, optimize heating supply operations, help prioritize O&M budgets, and

provide referential heat-load data for future DH system planning and design. The project also includes technical assistance to improve the capacity of the four companies to operate their networks. It will support the gradual transition of the participating heating companies to CBB (except for Chengde, where it has already been implemented for new residential heating areas exceeding 3 million m^2). This important institutional change will provide incentives for further cost reduction and energy efficiency, as well as promote heating price and billing reform. Finally, the project will showcase the use of about 150 BLS—the largest deployment to date in China—that are technically capable of achieving higher efficiencies than conventional network designs using group substations and can improve the cost effectiveness of DH systems.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

34. The overall implementation risk is assessed as Substantial based on the following assessment of key risks. The lack of technical and institutional capacity to implement the project and sustain results is a substantial risk in the project due to a lack of sector experience (HPMO) or Bank project experience (subproject-implementing companies and their local governments). In addition, the pressure to construct DH systems quickly can lead to a deterioration of quality or even dropping out of the project. The HPMO has hired sector specialists to assist in guiding feasibility studies and designs prepared by subproject sponsors and their consultants. Except for Chengde, the other three companies have limited exposure to foreign loan utilization projects and lack familiarity with Bank safeguards and fiduciary requirements. To address these risks, fiduciary training has been provided and more will be offered during project implementation. Manuals on procurement and financial management (FM), as well as safeguards assessments and plans, have been prepared. In the case of environmental and social safeguards, external monitoring teams will be mobilized by each city to supervise the implementation of the Environmental Management Plan (EMP) and the reemployment plans for the workers affected by the boiler closure program. In addition, the HPMO will hire a safeguards specialist under Component 2 to monitor the safeguards aspects of the project for the HPMO. The specialist will provide training to the PIUs on an as needed basis.

35. Risks of changes in sector policies and in technical design are assessed as Moderate. The proposed investments use mature technologies and relatively straightforward technical designs. Nonetheless, technical challenges exist, especially for optimizing peak load and base load heating supply in Zhangjiakou and utilizing industrial waste heat to provide heating in Xingtai. The risk associated with the operation of new gas-fired boilers in Zhangjiakou, which lacks experience in doing so, is moderate provided that operational training is included in and provided under the boiler supplier's contract. In addition, there is some uncertainty with respect to heating demand. Each of the subprojects include new heat demand from real estate developments that may face delays or partial occupancy and subsequently can negatively affect planned new revenue collections. The risk is mitigated by the following actions: (a) the scope of planned new heat demand from new construction in the project was reduced during preparation, based on in-depth assessment of actual plans by developers and (b) it is a standard practice for real estate developers to pay the heating bills of unsold apartments, at least in the first year of operation.

36. Stakeholder risk is assessed as Substantial. While there are factors favorable to the project, there are risks of increased project complexity. Government stakeholders have a strong mandate to implement the Hebei Air Pollution Control and Prevention Plan. Therefore, as noted earlier, municipal leadership may wish to accelerate implementation of subprojects and thus drop out of the Bank project should alternative financing sources be available. The main business of the companies involved is DH. Financial assessments identified weaknesses due to the tendencies of smaller towns to keep tariffs low, especially for residential consumers. Consumers are generally supportive of the extension of DH, which is considered superior in service quality and environmental performance to distributed coal-fired systems or individual heating options.

37. The risk associated with the timely availability of counterpart funding is assessed as Substantial. Though not fiscal outlays, connection fees are planned as the main source of local counterpart financing (ranging from 60 percent to 100 percent of total local counterpart financing for each company). A slowdown in real estate development may result in shortfalls in connection fees. The risk is partially mitigated by matching investments with new connection orders, but there are parts of the network that must be built to make capacity available upon demand, so a mismatch in funding is possible. Given this concern, the collection of connection fees will be closely monitored during project implementation.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analyses

Economic Analysis

38. The project supports rehabilitation and expansion of DH systems in the project cities. Rehabilitation will result in more efficient operation of the systems. Expansion will connect existing and new buildings to DH systems that have better performance with respect to efficiency and lower emissions as compared to alternative heating options—stand-alone coal-fired HOBs, which are considered the 'business as usual' (BAU) scenario.

39. A cost-benefit analysis was conducted to estimate the economic internal rate of return (EIRR) of the project compared to the without-project alternative/BAU. The economic costs include the total investment costs of both alternatives. The economic benefits were estimated by taking into account the following: (a) fuel efficiency improvements stemming from connecting existing and new heating areas to more efficient and cleaner heating sources—CHPs (in Chengde, Zhangjiakou, and Pingshan) and industrial waste heat (in Xingtai); (b) reduced heat losses resulting from improved DH networks and substations[6] and installed BLS; (c) operation, maintenance, and repair cost savings for both alternatives; and (d) environmental benefits of reductions in particulates, SO_2, NOx, and CO_2 emissions through avoided local and global emissions as a result of the project.

40. The project's consolidated EIRR is estimated at 29.3 percent, while the subprojects' EIRRs range from 26.5 percent for Zhangjiakou to 35.4 percent for Chengde. The sensitivity analysis was conducted for three scenarios: (a) a 20 percent increase in investment costs; (b) a 20

[6] Estimates took into account experience from similar projects in China and in Europe.

percent decrease in total economic benefits; and (c) no carbon price. The results of the sensitivity analysis, presented in detail for each of the three cases for each of the participating cities in annex 5, suggest that under all of the above scenarios, each subproject remains economically viable.

Financial Analysis

41. The financial analysis of the project has been carried out at the project level and the heating company level.

42. ***Project-level analysis.*** The financial viability of the individual subprojects has been assessed on the basis of the resulting financial internal rate of return (FIRR). The analysis has been carried out based on the difference between the 'with project' and 'without project' scenarios. The cost streams include capital costs and the incremental O&M expenses. The benefits include the incremental heat sales revenues, including connection fees, resulting from the project investments. The results for the base case are summarized in table 1.

Table 1. Project-level Financial Viability Indicators (Base Case)

Subproject	Weighted Average Cost of Capital (WACC) (%)		FIRR (%)
	Corporate level	Project level	
Chengde	6.6	2.4	12.1
Pingshan	7.1	2.6	14.2
Xingtai	5.6	2.7	11.7
Zhangjiakou	6.5	2.2	17.5
Total project	**6.2**	**2.5**	**13.2**

43. The resulting FIRRs are compared with the estimated corporate-level and project-level WACC for each company. For the base case, the FIRRs substantially exceed the respective WACCs, thereby indicating the financial viability of the individual subprojects.

44. Sensitivity analysis has also been carried out for the FIRRs to assess the impact on the FIRRs from adverse changes in the key underlying variables: (a) capital costs, (b) incremental O&M expenses, and (c) annual growth in the heating area served. As can be seen from annex 5, the FIRRs are reasonably robust to adverse changes in the key variables and remain over the corresponding project-level WACC levels for most cases.

45. ***Entity-level analysis.*** Detailed historical data and financial projections are presented for each company in annex 5. The analysis proves that the principal financial indicators for the four companies are projected to remain at satisfactory levels during the implementation period. The projections indicate that operating subsidies will not be required for three project-implementing heating companies after 2016 (Chengde, Pingshan, and Xingtai). The Zhangjiakou project-implementing heating company will need operating subsidies of about CNY 35 million per year starting from 2017 to cover the cost of natural gas for peak-load boilers. The Zhangjiakou Municipality has guaranteed provision of the subsidies.

46. ***Project financing.*** The project will be financed by counterpart funds of about US$148.33 million equivalent (about 60 percent of the project cost) and an IBRD loan of US$100 million (about 40 percent of the project cost). All required counterpart funds for the Chengde and

Pingshan subprojects will come from connection fees paid by real estate developers for connecting new buildings to DH. The Zhangjiakou and Xingtai subprojects, in addition to connection fees, will use loans from domestic banks to co-finance their respective subprojects; they have obtained a Commitment Letter from local banks. In support of early subproject implementation, the Zhangjiakou subproject has received government subsidies, while the Xingtai heating company has received equity contributions from its parent company. Details on the financing sources for each subproject are presented in annex 5, paragraph 9.

B. Technical

47. Detailed feasibility studies prepared for the four DH subprojects define the technical solutions, pipeline routes, and locations for the heat exchange stations, as well as investment costs for all subcomponents and expected benefits. All proposed technical designs are based on well-tested solutions and mature technologies.

48. Pre-insulated pipes will be used for rehabilitation and construction of the DH network in the project cities. The primary network feed water will have softening and de-aeration facilities to prevent corrosion of the network. Secondary network water will also be treated.

49. Heating substations, new and renovated, will include heat exchangers to separate the heat distribution networks from the heat transmission networks. The four heating companies have agreed to limit the capacity of each heat exchanger loop to serve less than 50,000 m^2 of buildings to ensure their efficient operation. Substations will operate with variable flow and local automation systems to optimize operations and regulate the water temperatures to buildings in accordance with weather conditions. The project will also showcase the use of about 150 BLS.

50. All substations will be connected to a company-wide monitoring and dispatch system (SCADA) that allows operators to remotely change parameters at each substation. The dispatch center will monitor and dispatch heat supply from the base-load plants and the peak-load boiler plants to optimize operation of the hydraulic regime and to maximize the reliability of heat supply to customers.

51. Heat metering systems have been designed at different heat supply levels. Heat meters are installed at heat sources (base-load and peak-load boiler plants) and will be installed in all heating substations financed by the project. All new residential buildings are required to have heat meters and therefore are not included in the project. Several subprojects, however, have agreed to increase the coverage of metering in public buildings and to pilot meters in residential buildings, including at the staircase and apartment levels.

52. Three of the four companies are well-established organizations with qualified staff in place to construct and operate the subproject assets. The RISUN Anneng Heating Company Ltd., which is the implementing entity for the Xingtai subproject, was established in 2014, but has already appointed its management and operational staff to implement the ongoing phase I of the Xingtai subproject. One of the two founding companies of the RISUN Heating Company is experienced in DH and seconded management staff and systems to this newly established company to transfer knowledge and experience and, thus, ensure smooth implementation of the subproject.

C. Financial Management

53. Each project-implementing heating company will be responsible for FM of their respective subproject, including project accounting and financial reporting. The HPMO will consolidate the project financial statements and submit them to the Bank.

54. The Bank loan proceeds, including overseeing the designated account (DA), will be managed by the Hebei Provincial Finance Bureau (HPFB), which has experience with Bank disbursement and FM-related requirements.

55. Retroactive financing will be available for eligible activities under Components 1 and 2. The eligibility criteria for retroactive financing are described in annex 3, paragraph 28.

56. The Bank's assessment of the FM arrangements for the project has identified the principal risk to be the lack of experience of the four companies in implementing Bank-financed projects. To reduce this risk, the following risk management measures have been agreed: (a) preparation and issuance of a Financial Management Manual (FMM) acceptable to the Bank to standardize the project's FM procedures; (b) HPFB, which has experience with Bank-financed operations, will arrange training workshops in addition to the FM training provided by the Bank; and (c) qualified consultants to enhance FM guidance and supervision for HPMO and the PIUs will be hired on an as needed basis.

57. The residual project FM risk after mitigation is assessed as Moderate. The FMM has been prepared and has been agreed with the Bank. The implementation of the other risk mitigation activities mentioned above should ensure that the project's FM arrangements are satisfactory to the Bank as required under OP/BP 10.00.

D. Procurement

58. The HPMO, with the assistance of a procurement consultant, will be responsible for the management of all procurement activities under the project; contracts will be signed and implemented by the four PIUs. The key project procurement issues and risks identified by the procurement capacity assessment are (a) the PIUs and their designated procurement staff have no procurement experience in Bank-financed projects (although HPMO has implemented Bank-financed projects in the past); and (b) the HPMO and PIUs may unintentionally follow domestic procurement practices, which may lead to delays or noncompliance with the Bank's Procurement/Consultant Guidelines. A detailed action plan for procurement capacity strengthening and risk mitigation has been developed and agreed upon with the HPMO and PIUs. During project preparation, the Bank provided training on the Bank's procurement policy and procedures to key staff of the HPMO and PIUs. Tailored procurement training will also be provided to the procurement and project management staff during implementation. With the implementation of the proposed actions to strengthen procurement capacity, the HPMO and PIUs are expected to have adequate capacity to carry out procurement activities for the project.

59. All procurement activities under the project will be guided by the Project Procurement Manual which has been prepared and agreed with the Bank. A detailed draft procurement plan for the entire project has been prepared and agreed with the Bank. The main project packages such as for pipelines, substations, and automated management systems will be procured under

supply and installation contracts. During project implementation, the procurement plan will be updated annually, or as required, to reflect actual project implementation needs. The procurement plan will be available at the HPMO and PIUs, and the Bank will arrange the publication of the plan on its external website. Further details on procurement arrangements are provided in annex 3.

E. Social (including Safeguards)

60. ***Involuntary Resettlement (OP 4.12).*** The project includes the construction of DH systems in four cities in Hebei Province. The heating sources are existing CHPs, industrial waste heat, and peak-load boilers (coal-fired in Chengde, and coal- and gas-fired in Zhangjiakou). The land area (35,227 m²) for the primary heating stations (gas-fired boilers in Zhangjiakou) has been acquired recently. For heating transmission, 164 km of primary and secondary heating pipelines and 243 group heat substations will be constructed. Land acquisition is limited since all heat exchange stations will be built within existing housing estates and all pipeline construction will mainly require temporary land occupation along urban roads of about 664,000 m². OP 4.12 was triggered during the early phase of project preparation when more components with potential land acquisition were still part of the project and alignments of heating pipelines had not been determined. An abbreviated resettlement action plan (ARAP) was prepared by each subproject to address potential land acquisition impacts. The ARAPs include compensation policies and due diligence review of related facilities, such as heating sources, primary heating stations, and related road construction. The components with potential land acquisition were dropped and alignments of pipeline construction were selected to avoid any potential occupation of farmland. However, OP 4.12 is still triggered for land acquisition that has recently taken place in connection with the Xingtai and Pingshan subprojects. The due diligence review, included in the ARAPs, found that land acquisition was carried out in compliance with national legislation and was consistent with OP 4.12.

61. In addition, the ARAPs include measures to mitigate social impacts covered by OP 4.01 in relation to loss of employment and affordability. Due to the closure of 125 small boilers, a total of 359 seasonal boiler workers will lose their employment. For such impacts, based on consultation with affected people, detailed reemployment plans have been prepared. Among the 359 affected workers, 249 will be retained by heating companies or property management companies. The remaining 110 workers are planning to move to other areas, such as construction sites, the service sector, or return home to the countryside. Free skill training will be provided for both those who want to work in heating companies or those who will move to other sectors. Institutional arrangements were made to monitor the implementation of the reemployment plans to ensure that the income and livelihood of affected workers will be restored during project implementation. On the issue of affordability, all four cities have adopted measures to assist low income households for both the annual heating charge and the cost of improving the secondary heat network.

62. Public consultations were conducted during the ARAP preparation. Information about project impacts, rehabilitation measures, and grievance procedures were provided to affected people through the disclosure of the ARAP in project areas. Group discussions with affected people were also conducted to collect their views and preferences regarding potential impacts and mitigation measures. Their views and preferences were taken into account during the ARAP

preparation. Implementation of the ARAP and its monitoring were also agreed. The ARAP reports were disclosed on the websites of the HPMO on August 27, 2015 and at the Bank's InfoShop on September 21, 2015; the updated ARAP reports were disclosed at the InfoShop on October 27, 2015.

63. ***Indigenous peoples (OP 4.10).*** Based on the social assessment conducted during the project preparation, the proposed project will not trigger the Bank's OP 4.10 on Indigenous Peoples. Consultations with local government agencies and affected people were conducted for all subprojects and it was concluded that there are no ethnic minority communities, as defined by the Bank, in the project-affected areas.

64. ***Gender impacts.*** The gender impacts were analyzed based on the social assessment conducted during the project preparation. The assessment concluded that women will share at least the same benefits as men from improved heating quality and reduced cost under the project. According to the social analysis, 49.1 percent of members from households that will be served by the project are female. Children will benefit more from improved health conditions since they are more vulnerable to the cold indoor temperature and poor air quality associated with small boiler heating. Other general findings in the assessment were (a) the difference of the education levels between men and women is not significant in the project area, but women's incomes are markedly lower than men's; (b) women have almost the same influence as men in deciding family affairs, apart from investment decisions; (c) women are still the major bearers of housework; and (d) women have a positive attitude on public affairs, but their participation is still less active than men's.

65. ***Other social impacts.*** According to the social assessment, considerable social benefits will be brought by the project, which include enhancing heating quality and reducing real heating costs for residents in the serviced areas and improving air quality in project cities. At the same time, the project will also have limited short-term impacts on local communities, such as inconvenience during pipeline construction, income loss for a small number of boiler workers, and potential financial burden for low-income households due to payment of a connection charge and the cost of internal pipeline installation. The key recommendations to mitigate these impacts include conducting sufficient consultation with affected people—particularly women—during project implementation, providing adequate and timely support to affected boiler workers, and providing a subsidy or waiver of the connection fee for low-income households. All these recommendations have been accepted by the project-implementing agencies and have been built into the project design.

66. ***Citizen engagement.*** In addition to the citizen engagement during preparation through various methods noted above (and through consultations on environmental safeguards), the project will include a core citizen engagement indicator to track during implementation the share of beneficiaries who agree that the investments meet their heating needs (using standard survey methods).

F. Environment (including Safeguards)

67. The project is classified as Category A as per OP 4.01, given the scale of the works, the potential linked activities, the displacement of workers and social issues, and potential safety

risks during the operation phase. Environmental Assessment (EA) reports were prepared in accordance with the national requirements and the Bank's OP 4.01. The reports include the EA Executive Summary, Environmental Impact Assessment (EIA), and the EMP.

68. The project will replace existing small coal-fired boilers with more energy-efficient and cleaner DH systems. As a result, it is expected that the project will improve the efficiency of heat supply and contribute to avoiding air pollution in Hebei Province.

69. The environmental impact during construction is mainly related to small-scale construction of transmission pipelines and substations, temporary disturbance to traffic and local communities along the sites for pipeline construction and near the substations, debris disposal, and the nuisance of dust and noise. The environmental impact during operation is expected to be mainly from noise associated with group substations and BLS, and air pollutant emissions and noise from peak-load boilers. This impact is localized, limited, and can be managed with accepted measures of good environmental codes of practice (ECOP) and site-specific mitigation measures for potential adverse impacts during construction and operation. To enhance the environmental benefits of the project, the project has included mitigation measures in the project design, construction phase, and operational phase. The environmental and social impacts are thoroughly addressed by the EIA report. Preventive and mitigation measures have been developed in the EMP. The project-related adverse environmental and social impacts can be adequately avoided, minimized, and mitigated through good management practices and mitigation measures, as developed in the EIA and EMP.

70. Two rounds of public consultations, including expert consultations, questionnaires, public meetings, and interviews were conducted with different stakeholders during EA preparation according to the requirements of both the Chinese legislation and the Bank's OP 4.01. The project information has been disclosed to the public through public consultations. The affected communities were informed about the EA reports and options to access them. The EIA and EMP reports were disclosed on the websites of the HPMO on August 24, 2015, and at the Bank's InfoShop on September 15, 2015; the updated reports were disclosed at the InfoShop on October 27, 2015. Furthermore, the project-implementing heating companies set up a grievance registration mechanism related to project activities. The companies will report annually on the number of registered and addressed grievances.

71. The project activities that will be financed from counterpart funds will need to comply with Bank environmental and social safeguards, including the activities that are commenced prior to the signing of the Loan and Project Agreement. The requirement to comply with Bank safeguards also applies to linked activities. Such activities include the production of heat (all four subprojects will receive heat from external heat generation sources), construction of a gas pipeline in Zhangjiakou (to supply gas to CHP units that will be converted from coal to gas under the project), and rehabilitation of secondary heating networks and/or in-building heating infrastructure that can be implemented by building management companies.

G. Other Safeguards Policies Triggered

72. ***Safety of Dams OP/BP 4.37.*** The proposed project will finance neither the construction nor the rehabilitation of any dam. However, the Xingtai RISUN Group, which will supply

industrial waste heat under the Xingtai subproject, is using cooling water from the Yangwuowan Reservoir upstream of the RISUN Group. Therefore, OP 4.37 is triggered.

73. The Yangwuowan Reservoir, with a design storage of 7.95 million m^3, is located about 25 km northwest of Xingtai City, downstream of the Baima River of the Ziya River system. The reservoir comprises a 14.5 m high homogeneous earth-fill dam of length of 240 m; a saddle dam of length of 500 m; an open spillway; and a sluice tunnel through the dam. The dam and its appurtenances were built in 1958. The most recent rehabilitation/remedial works were completed in September 2009, following the recommendations of a dam safety assessment conducted by the Hebei Water Resources Department in April 2004 and verified by the Dam Safety Center of the Ministry of Water Resources (MWR) on April 28, 2005. The Yangwuowan Dam safety inspection was carried out in October 2010 and found to be satisfactory.

74. The reservoir is managed by competent staff under the Xingtai Yemengou Irrigation District Management Division of the Xingtai Water Affairs Bureau. An operations manual and emergency preparedness plan have been prepared. The EMP includes an annual review of the O&M of the dam and its appurtenances by a dam safety expert satisfactory to the Bank. The review will be included in the external environment monitoring report.

H. World Bank Grievance Redress

75. Communities and individuals who believe that they are adversely affected by a Bank-supported project may submit complaints through existing project-level grievance redress mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project-affected communities and individuals may submit their complaint to the Bank's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of the Bank's non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the Bank's attention and Bank management has been given an opportunity to respond. For information on how to submit complaints to the Bank's corporate GRS, please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank's Inspection Panel, please visit www.inspectionpanel.org.

ANNEX 1: RESULTS FRAMEWORK AND MONITORING

CHINA: Hebei Clean Heating Project

Project Development Objective (PDO): The project development objective (PDO) is to improve the efficiency and environmental performance of heating systems in selected areas within participating municipalities/counties of Hebei Province.

Project Development Objective Indicators	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection
				YR1 (6/2017)	YR2 (6/2018)	YR3 (6/2019)	YR4 (6/2020)	YR5 (6/2021)			
Indicator One:[7] Projected lifetime energy savings	☒	MWh	0	355,287	1,065,860	2,131,720	3,552,867	4,974,014	Annual	See note[8] below	PIUs and HPMO
Indicator Two: Number of people that gained access to more energy-efficient cooking and/or heating facilities	☒	Number of people	0	446,356	555,803	637,899	682,781	714,896	Annual	See note[9] below	PIUs and HPMO
Indicator Three: Direct project beneficiaries[10], of which females	☒	Percentage of females	0	49	49	49	49	49	Annual	See note[9] below	PIUs and HPMO
Indicator Four: Project-level aggregated avoided CO_2 emissions	☐	Tons	0	123,045	369,135	738,271	1,230,452	1,722,632	Annual	See note[7] below	PIUs and HPMO
Indicator Five: Project-level aggregated avoided TSP emissions	☐	Tons	0	803	2,409	4,818	8,031	11,243	Annual	See note[7] below	PIUs and HPMO

Note: Annual reduction values per million square meters connected upon completion are reported as follows:

Energy savings (MWh per million m^2)	36,703
Avoided CO_2 emissions (tons per million m^2)	12,711
Avoided TSP emissions (tons per million m^2)	83

[7] Cumulative, but each annual target's contribution was averaged over the 20 years of the project's economic life. All the above PDO indicators are calculated by comparing coal/gas consumption and emissions of the without-project alternative to the with-project alternative.
[8] Calculated according to CDM methodology AM0058 based on actual data records if available and as applicable.
[9] Reflects the number of people, who will gain access to more energy-efficient DH as a result of the project
[10] The number of direct project beneficiaries is equal to indicator 2.

INTERMEDIATE RESULTS											
Component 1: District Heating Subprojects. All indicators are cumulative from the beginning of the project and aggregate the four subprojects.											
Intermediate Results Indicators	**Core**	**Unit of Measure**	**Baseline**	**Cumulative Target Values**					**Frequency**	**Data Source/ Methodology**	**Responsibility for Data Collection**
				YR1 (6/2017)	**YR2 (6/2018)**	**YR3 (6/2019)**	**YR4 (6/2020)**	**YR5 (6/2021)**			
Intermediate Result Indicator One: Area connected to DH	☐	Million m^2	0	7.07	12.73	15.89	18.52	18.52	Annual	Project progress reports[11]	PIUs and HPMO
Intermediate Result Indicator Two: Length of pipelines installed	☐	km	0.0	81.5	120.3	154.6	164.4	164.4	Semiannual	Project progress reports	PIUs and HPMO
Intermediate Result Indicator Three: Number of substations constructed or rehabilitated (non-BLS)	☐	Number	0	97	167	202	243	243	Semiannual	Project progress reports	PIUs and HPMO
Intermediate Result Indicator Four: Number of BLS installed	☐	Number	0	34	70	154	154	154	Semiannual	Project progress reports	PIUs and HPMO
Intermediate Result Indicator Five: Beneficiaries who feel project investments reflected their needs	☒	Percent	0	50	60	75	80	85	Annual	Project progress reports, annual surveys (tbd)	PIUs and HPMO
Intermediate Result Indicator Six: Grievances registered related to delivery of project benefits that are actually addressed	☒	Percent	n.a.	70	80	90	100	100	Annual	Project progress reports, annual surveys (tbd)	PIUs and HPMO

Note: n.a. = not applicable; tbd = to be decided.

[11] Recorded at start of the project and whenever newly installed pipelines or equipment start operation.

Component 2: Technical Assistance and Project Management Support. All indicators are cumulative from the beginning of the project.											
Intermediate Results Indicators	**Core**	**Unit of Measure**	**Baseline**	**Cumulative Target Values**					**Frequency**	**Data Source/ Methodology**	**Responsibility for Data Collection**
				YR1 (6/2017)	**YR2 (6/2018)**	**YR3 (6/2019)**	**YR4 (6/2020)**	**YR5 (6/2021)**			
Intermediate Result Indicator Seven: Project management capacity enhanced through PMS services	☐	PMS services provided	PMS terms of reference available	PMS contract signed	PMS services provided	PMS services provided	PMS services provided	PMS contract completed	Annual	Project progress reports	HPMO
Intermediate Result Indicator Eight: Number of study tours implemented	☐	Number	0	0	1	2	3	3	Annual	Project progress reports	HPMO
Intermediate Result Indicator Nine: Number of workshops and training sessions	☐	Number	0	1	2	3	4	5	Annual	Project progress reports	HPMO

Note: PMS = Project Management Support

ANNEX 2: DETAILED PROJECT DESCRIPTION

CHINA: Hebei Clean Heating Project

1. The project consists of an investment component, District Heating Subprojects, and a technical assistant component, Institutional Capacity Building and Project Management Support. The total estimated project costs are CNY 1.527 billion (US$248.33 million equivalent). The project is supported by an IBRD loan of US$100 million that accounts for about 40 percent of the total estimated project cost.

Component 1: District Heating Subprojects (estimated cost US$217.06 million equivalent; US$89.67 million IBRD financing)

Subproject 1.1. Chengde District Heating and Energy Efficiency Subproject (estimated cost US$30.57 million; US$18.09 million IBRD financing)

2. ***Introduction.*** The subproject is located in the Shuangqiao (old town) District of Chengde, a city in northeast Hebei Province. Chengde is a prefecture level city located northwest of Beijing and home of the Qing Dynasty's summer palace—a United Nations Educational, Scientific and Cultural Organization world heritage site. The population of the entire urban area was 400,000 in 2013 and the city expects to grow to 800,000 by 2020. The subproject will rehabilitate DH facilities that serve the existing DH area of approximately 12.3 million m^2 and expand DH to an additional 2.5 million m^2. The latter will include replacement of six small coal-fired boilers that serve about 87,000 m^2 of existing buildings and about 2.4 million m^2 of new buildings

3. ***Generation.*** The project's DH system is supplied by two interconnected heat sources with a total heating capacity of 634 MW: a coal-fired 2x330 MW CHP (Luanhe) plant for base-load heating with 518 MW heating capacity and a 2x58 MW coal-fired peak-load boiler. Based on feasibility study analyses, the subproject area can be supplied with current heating sources. With the project implementation, six existing small polluting coal-fired boiler plants (covering 87,000 m^2 of heating area) will no longer be used.

4. ***Transmission and distribution.*** The proposed subproject will invest in new primary pipelines of 4.76 km and rehabilitation of 2.74 km of corroded primary pipelines with 15 years of operation and significant water leakages. It will also replace 56.79 km (channel length) of corroded secondary network pipelines. All pipelines will be directly buried, preinsulated pipes. The water in the primary and secondary networks will be treated.

5. ***Substations.*** In 2013, Chengde implemented a pilot BLS project supported by the Global Environment Facility/Bank's Heat Reform and Building Energy Efficiency Project. BLS have several advantages over group substations for energy efficiency and better management. This subproject will scale up BLS deployment in the city, investing in 114 BLS and 20 group substations. All of them will use variable flow control operation and will be automatically controlled based on outdoor temperature (automatic temperature control) and heat load.

6. ***Heat metering.*** Chengde is one of the first pilot cities for heat metering and billing in China. Chengde has promoted individual household heat metering and billing to encourage

energy conservation. A two-part heat tariff is applied (30 percent fixed and 70 percent variable). All new residential buildings constructed in Chengde since 2005 are implementing CBB. All new buildings to be connected to DH systems are already metered and heat metering for existing buildings is under implementation. This subproject will finance meters in new substations constructed as part of the project.

7. ***Control systems.*** A SCADA system exists. New substations will be connected to this existing SCADA system.

8. ***Implementing entity.*** The proposed sub-borrower is the Chengde Heating Group Company Ltd., a state-owned enterprise and the only major DH company in Chengde (see annex 3).

Building Level Substations[12]

BLS are part of a network design that is technically capable of achieving higher efficiencies than conventional network designs using group substations and will also improve cost effectiveness of DH systems. Basically, a BLS eliminates the underground secondary pipelines, where heat losses are the highest and substantial maintenance needs occur. From the government perspective, BLS enhance energy efficiency and reduce maintenance needs. From the heating company's perspective, it can save between 5 to 12 percent on energy costs and provide better service to customers (improved comfort and faster reaction time). DH companies can also save on costs: installation costs (since BLS are prefabricated) and water savings (companies do not need to flush water every year in the secondary network). BLS also give them flexibility to expand.

18 BLS were installed in Chengde in 10 buildings covering 180,000 m^2 under the Global Environment Facility's Heat Reform and Building Energy Efficiency Project managed by the Bank between 2005 and 2013.

Subproject 1.2. Zhangjiakou District Heating Subproject (estimated cost US$64.28 million; US$29.89 million IBRD financing)

9. ***Introduction.*** The subproject is located in Qiaodong District, one of the four urban districts of Zhangjiakou Municipality, a prefecture-level city located in northwest Hebei Province. The population of the entire urban area was 890,000 in 2010. The subproject will rehabilitate DH facilities that serve the existing DH area of approximately 3.5 million m^2 and expand DH to an additional 5 million m^2. The latter will include connection to DH of about 2.6 million m^2 of existing buildings that are currently served by 99 small coal-fired boilers and approximately 2.4 million m^2 of new buildings.

10. ***Generation.*** The project's heating area is currently supplied by one large 4x64 MW coal-fired HOB plant (3.49 million m^2 heating area) and 99 small dispersed heating boilers (2.59 million m^2). The subproject will replace use of these heating sources located in the city center with a DH network supplied by the Datang Zhangjiakou coal-fired CHP plant located 15 km away from the project area and convert two of the four coal-fired boilers (2x64 MW) to natural

gas (2x70 MW) as peak load and backup capacity. The Datang plant was previously a thermal power plant and has completed converting 2x300 MW units into CHP (capable of supplying 24 million m^2) and plans to convert its remaining 6x300 MW units in the future to supply other urban areas. The bulk heat from the Datang CHP plant will be supplied through a transmission company, Shenghua Heating Company, under a bulk heat supply contract between Shenghua and Dongyuan (see the section below on 'Contractual arrangements'). For the 2015 and 2016 heating seasons, the heating supply sources will be the Datang Zhangjiakou CHP (with 2x279 MW of heating capacity), and the Dongyuan Heating Company's 4x64 MW coal-fired peak-load boiler plant. After the 2016 heating season, the Dongyuan Heating Company's peak-load boiler plant will be partially converted to gas. From 2017, the heating supply sources will be the Datang Zhangjiakou CHP and the Dongyuan Heating Company's gas-fired peak-load boiler plant. Gas-fired peak-load boilers will be introduced for the first time in Zhangjiakou. A training program on gas-fired boiler operation—included in the boiler supplier's contract—will be delivered to the Dongyuan Heating Company for safety considerations.

11. ***Transmission and distribution.*** The subproject's heat load is 492.4 MW and the heat production capacity of the system is 500 MW, including 360 MW from the CHP and 140 MW from Dongyuan's peak-load boilers (to be converted from coal to gas). The system is designed with a 1.6 MPa pressure and temperatures of 130/70^{o}C, which are typical design parameters. Preinsulated pipes will be used in the subproject. Because of high ground level difference from CHP to consumers, a pressure isolation station (including the dispatching center for the company) is needed to prevent system damage from a possible water hammer. The water in the primary and secondary networks will be treated.

12. ***Substations.*** Dongyuan already has 43 group substations with automation, control systems, and data communication through SCADA. For the buildings to be connected, the DH system will need 58 new substations (group substations) each with a heat exchanger loop of about 50,000 m^2 of buildings, with a few exceptions due to technical barriers. All new buildings will be equipped with full automation, control, and communication with SCADA. In the project's area, 17 BLS will be piloted. All substations will operate with variable flow and heat supply according to outdoor temperature (automatic temperature control).

13. ***Control systems.*** The SCADA system will be expanded and will reach the pressure isolation station (including the 4x64 MW HOB plant). In addition to communication with all new built substations and existing substations, DH heat load prediction, hydraulic simulation, and operation optimization functions will be developed in the SCADA system. The automation and control in the pressure isolation station and the primary station at the CHP will be designed, installed, and connected to the SCADA system.

14. ***Implementing entity.*** The proposed sub-borrower is the Zhangjiakou Dongyuan Heating Company, a state-owned enterprise and subsidiary of the Qiaodong Urban Construction and Investment Company (see annex 3). Dongyuan owns the large 4x64 MW coal-fired HOB plant, which will be partially converted to gas. All project assets will be owned by the Dongyuan Heating Company.

15. ***Contractual arrangements.*** Draft commercial contracts have been reviewed by the Bank and have been found satisfactory. These include (a) gas supply to the 2x70 MW gas-fired peak-

load boilers owned and operated by the Dongyuan Heating Company and (b) long-term bulk heat supply contract from the CHP to the project's network—the Dongyuan Heating Company must purchase bulk heating from the Shenghua Heating Company which owns and operates the transmission pipeline between the CHP and the heating area. The contracts were signed in September 2015.

Subproject 1.3. Pingshan (County) District Heating and Energy Efficiency Subproject (estimated cost US$22.13 million; US$11.81 million IBRD financing)

16. ***Introduction.*** The subproject is located in the urban area of Pingshan County, about 30 km west of Shijiazhuang, the capital of Hebei Province. Shijiazhuang is one of the more polluted cities in Hebei Province. Pingshan County's urban population is growing (from 131,000 in 2014 to an estimated 200,000 in 2020). The subproject will rehabilitate DH facilities that serve the existing DH area of approximately 4.5 million m^2 and expand DH to an additional about 3 million m^2 of new buildings.

17. ***Generation.*** The heating supply is provided by the Xibaipo Thermal Power Plant (4x330 MW and 2x600 MW, owned by Hebei Jiantou, which has converted 2x330 MW units to CHP.

18. ***Transmission and distribution.*** The project includes the construction of 6.28 km of new pipelines (diameter between DN250 to DN500) and replacement of 3.19 km of existing corroded pipelines by new pipes (diameter between DN400 and DN700). Variable flow operation with automatic temperature control will be implemented in the primary network. Deaeration and water softening will be part of the subproject; the heating company will upgrade its existing water treatment facilities.

19. ***Substations.*** Pingshan has 81 group substations, of which 35 substations have automatic control systems and data communications with SCADA and use variable flow operation with automatic adjustment based on the outdoor temperature (automatic temperature adjustment). Five existing substations will be rehabilitated into eight modern substations with variable flow operation and automatic control system. Modernization of 46 existing substations with constant flow operation will be carried out by installing variable speed drives and automation facilities to realize full automatic operation. The subproject will also build 36 new substations including 9 BLS. The Pingshan Heating Company has accepted to limit the capacity of each heat exchanger loop to serve less than 50,000 m^2 of buildings to improve their efficient operation and investment.

20. ***Heat metering.*** Pingshan has realized heat metering for 900,000 m^2 of existing buildings with heat meters installed at the staircase level. An area of about 1.9 million m^2 of existing buildings has been modified with individual horizontal piping to adopt heat metering under the project. Heat meters and balancing valves purchased for those buildings are included in the Bank loan. All new buildings will have heat metering systems installed in compliance with Hebei regulations. A two-part heat tariff is applied in Pingshan (30 percent fixed and 70 percent variable). In addition to heat metering in residential buildings, Pingshan has agreed to connect all public buildings to its DH metering system.

21. ***Control systems.*** A SCADA system is operational in Pingshan. The newly built consumer substations and all modernized substations will be connected to the SCADA system. The function of the SCADA system will be extended—but not limited—to load prediction, hydraulic simulation, operation data, and trend curves to strengthen the heating company's management.

22. ***Implementing entity.*** The proposed sub-borrower is the Pingshan County Urban and Township Heating Co. Ltd., a state-owned enterprise under the Pingshan County Heating Supply Office.

Subproject 1.4. Xingtai Industrial Waste Heat District Heating Subproject (estimated cost US$100.08 million; US$29.88 million IBRD financing)

23. ***Introduction.*** The subproject is located in the northwest urban area of Xingtai Municipality, in southern Hebei Province. Xingtai, one of the most polluted counties in the province, is a heavy industry center (with significant iron, steel, and chemical industries). The population of the urban area was 868,500 at the end of 2013. It is expected to reach 1 million by 2020—a two percent annual increase. It will construct DH facilities to serve about 8 million m^2, including approximately 2.3 million m^2 of existing and about 5.7 million m^2 of new buildings. The subproject will use industrial waste heat from nearby industrial (coking) facilities. The project investments will be split in two phases. Phase I is under implementation and comprises construction of a waste heat water network of about 12 km within the coking plant area, approximately 24 km of the primary DH network outside the plant, a primary station, and 27 group substations to provide DH to an existing heating area. Phase II (2016–2019) will include construction of an additional 5 km of the network within the plant, 28 km of the primary DH network outside the plant, additional capacity at the primary station, 103 group substations, 14 BLS, and installation of a SCADA system.

24. ***Generation.*** The heat sources will be supplied by China RISUN Coal Chemicals Group[13] with a heating capacity of 317 MW. The 40 natural gas boilers heating 1.4 million m^2 of existing buildings will be kept as peak-load backup capacity. Xingtai Municipality would like to replace the gas boilers due to affordability and heating security concerns.

25. ***Transmission and distribution.*** The subproject utilizes steam driven absorption heat pumps to recover energy from cooling towers heat (water at 30–35^oC) and increase the water temperature for DH to 90^oC. The project includes the construction of a 17.15 km long pipeline to transmit cooling water from the four sources to the primary station and a primary network of 52.09 km. Feed-in water deaeration systems in the two feed-in water stations already exist.

26. ***Substations.*** To supply heat to households, 144 new substations will be built: 130 group substations (about 50,000 m^2 per heating exchanger loop) and 14 BLS. All substations will be designed with automatic control systems, data communication with a SCADA installed primary station, and with variable flow control operation based on the outdoor temperature.

[13] Based on its website, RISUN is the world's largest independent coke and coking chemicals producer (with regard to coke production volume).

27. ***Heat metering.*** A significant share of the heating area in the project will be billed according to the meter. At least 5.7 million m^2 (new heating demand) will implement the heat metering reform and consumers will be billed according to consumption.

28. ***Control systems.*** SCADA will be established with functions of data communication with all substations, data recording, remote control and settings, load prediction, hydraulic simulation, operation data, and trend curves to strengthen the heating company's management.

29. ***Implementing entity.*** The proposed sub-borrower is the RISUN Anneng Heating Company Ltd., a new JV company, established for this project (see details on the company in annex 3).

Component 2: Institutional Capacity Building and Project Management Support (estimated cost US$2.5 million; US$2.5 million IBRD financing)

30. The component will invest US$2.5 million of IBRD loan funds for technical assistance, training, workshops, and study tours for the HPMO and the four heating companies, including (a) project management support; (b) capacity-building support in DH management, O&M, and Bank project implementation procedures; (c) training, workshops, and study tours to exchange and learn about good practices in the DH sector; and (d) technical assistance activities to fit the needs of project's companies.

ANNEX 3: IMPLEMENTATION ARRANGEMENTS

CHINA: Hebei Clean Heating Project

Project Institutional and Implementation Arrangements

1. ***Loan Agreement.*** The World Bank Loan Agreement will be signed between the Bank and the People's Republic of China through its Ministry of Finance (MOF). The ministry will on-lend the loan proceeds to the Hebei Provincial Government represented by the HPFB. HPFB will further on-lend the funds to the Chengde, Zhangjiakou, and Xingtai municipal finance bureaus which will then on-lend to administered county and district finance bureaus. As Pingshan County is directly subordinate to the province, the Bank loan will be on-lent to the county government through HPFB. The loan proceeds will ultimately be on-lent to the four project-implementing heating companies from the municipal, county, or district finance bureaus.

2. ***Subsidiary Loan Agreement.*** A Subsidiary Loan Agreement (SLA) will be signed between each municipal (Chengde, Zhangjiakou, Xingtai) and county (Pingshan) government and the local project's heating company. The main provisions of the SLA will be articulated in an annex to the Project Agreement. The SLA will include project implementation obligations for the four companies as well as the terms and conditions of the on-lending. Signing of the SLAwith the local project's heating company, satisfactory to the Bank, will be a condition of disbursement for the loan proceeds allocated to each subproject under Component 1. In addition, the signing of all SLAs, satisfactory to the Bank, will be a condition of disbursement for the loan proceeds allocated to Component 2.

Table 3.1. Sub-loan Amount per City

Project City	IBRD Sub-loan Amount (US$, millions)
Chengde	20.00
Zhangjiakou	33.50
Xingtai	33.50
Pingshan	13.00
Total	**100.00**

3. ***Project Agreement.*** The Project Agreement will be signed between Hebei Province and the Bank. The HPMO—established under the HPFB's Foreign Debt Management Center—is directly responsible for project management to ensure that the four municipal and county governments and the project-implementing heating companies implement the project according to the Loan and Project Agreements.

4. ***Project Leading Groups.*** To provide high-level support and ensure smooth project implementation, a PLG has been established by Hebei Province. The PLG is chaired by an executive deputy governor of the province and composed of senior government officials from various departments. The PLG will provide overall executive leadership to the HPMO and the four project-implementing companies for project preparation and implementation. In addition, all project cities/counties have established municipal/district PLGs.

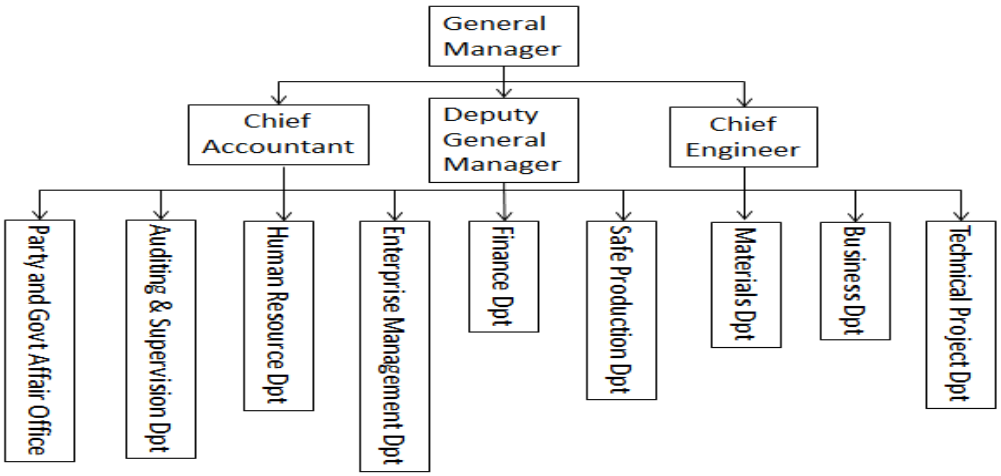
5. ***Project management and oversight.*** The HPMO is responsible for overall project management and coordination. It will be the primary body responsible for ensuring that the obligations of Hebei Province under the Project Agreement are executed. These include (a) overall project management and oversight of obligations undertaken by the four municipal and county governments and the project-implementing heating companies under the SLAs, including procurement, FM, and safeguards policies; (b) guidance and quality control of the work and reports produced by the project-implementing companies; (c) reporting to the Bank on physical implementation, project performance indicators, procurement, FM (including consolidated financial reports), and safeguards work; and (d) communicating with the Bank on project issues. The HPMO employs 13 people; it is experienced with Asian Development Bank projects.

6. ***Implementation of project components.*** The HPMO will implement Component 2—Institutional Capacity Building and Project Management Support—in coordination with the four cities and it will be responsible for the management of all procurement activities under the project, with the assistance of a procurement agent. Component 1—District Heating Subprojects—will be implemented by the four DH companies. Each company has established a PIU. The PIUs' responsibilities include (a) overall subproject implementation, that is, procurement coordination (preparation of bidding documents and contract signing), contract management (with the HPMO), social and environmental safeguards, loan (special account) disbursement requests to the municipal/county finance bureau, and fiduciary compliance; (b) coordination inside the company and with the HPMO; and (c) monitoring and reporting to the HPMO on physical implementation, project performance indicators, procurement, FM, and safeguards work. The HPMO will hire a procurement agent with experience in procurement under Bank-financed projects to assist the HPMO and the four project-implementing companies with procurement activities. The four companies will own, operate, and maintain the project assets after their construction.

Project-implementing Companies

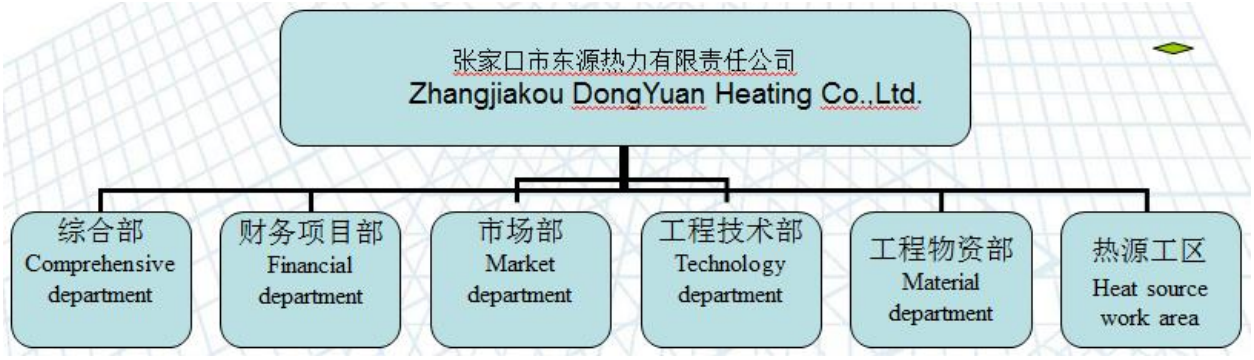
7. ***Chengde Heating Group Company.*** The Chengde Heating Group Company was originally established in 1987 and was reorganized in 2000. It is a state-owned company controlled by the Chengde Municipal Finance Bureau, which holds 85 percent of the company shares. It is the largest DH company in Chengde, providing heat to the northern and southern districts and to the old city area. Another company, the Chengde Shuangluan District Xingye Heating Group Company provides heat to the western district. The Chengde Heating Group Company employs 548 core staff, of which 160 hold senior technical designations. In the subproject area—the old city area—it currently operates two coal-fired boiler plants with a total capacity of 2x58 MW, 165 substations, and more than 240 km of primary network pipelines and supplies heat to an area of about 12.25 million m^2 of residential and commercial buildings. Its organizational chart is provided in figure 3.1.

Figure 3.1. Organizational Chart of Chengde Heating Group Company



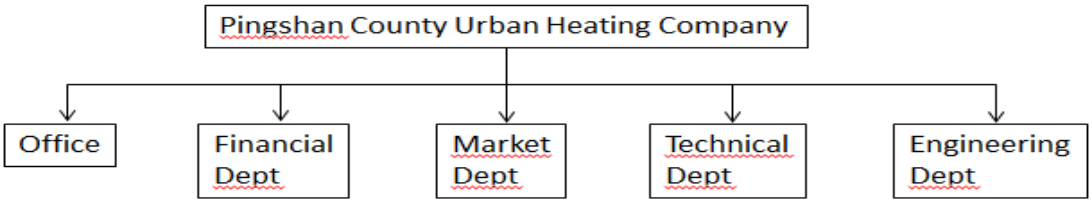
8. ***Zhangjiakou Dongyuan Heating Company.*** The Zhangjiakou Dongyuan Heating Company was established in January 2009. It is a state-owned company owned by the Zhangjiakou municipal government. It is one of the largest DH companies in Zhangjiakou, providing heat to the Qiaodong District. The Zhangjiakou Dongyuan Heating Company employs 83 staff, including 23 technicians and senior cadres. In the subproject area—the Qiaodong District area—it currently operates one coal-fired boiler plant with a total capacity of 4x64 MW and 43 substations and supplies heat to an area of about 3.48 million m^2 of residential and commercial buildings. Its organizational chart is provided in figure 3.2.

Figure 3.2. Organizational Chart of Zhangjiakou Dongyuan Heating Company



9. ***Pingshan County Urban Heating Company.*** The Pingshan County Urban Heating Company is a state-owned enterprise under the Pingshan Municipal Construction Bureau. It is the only entity providing DH services in Pingshan County. The Pingshan County Urban Heating Company employs 101 staff, including 50 percent with university degrees and 10 percent technicians and cadres. It currently operates 95 km of pipelines (primary and secondary network) and 70 substations and supplies about 4 million m^2 of residential and commercial area. Its organizational chart is shown in figure 3.3.

Figure 3.3. Organizational Chart of Pingshan County Urban Heating Company

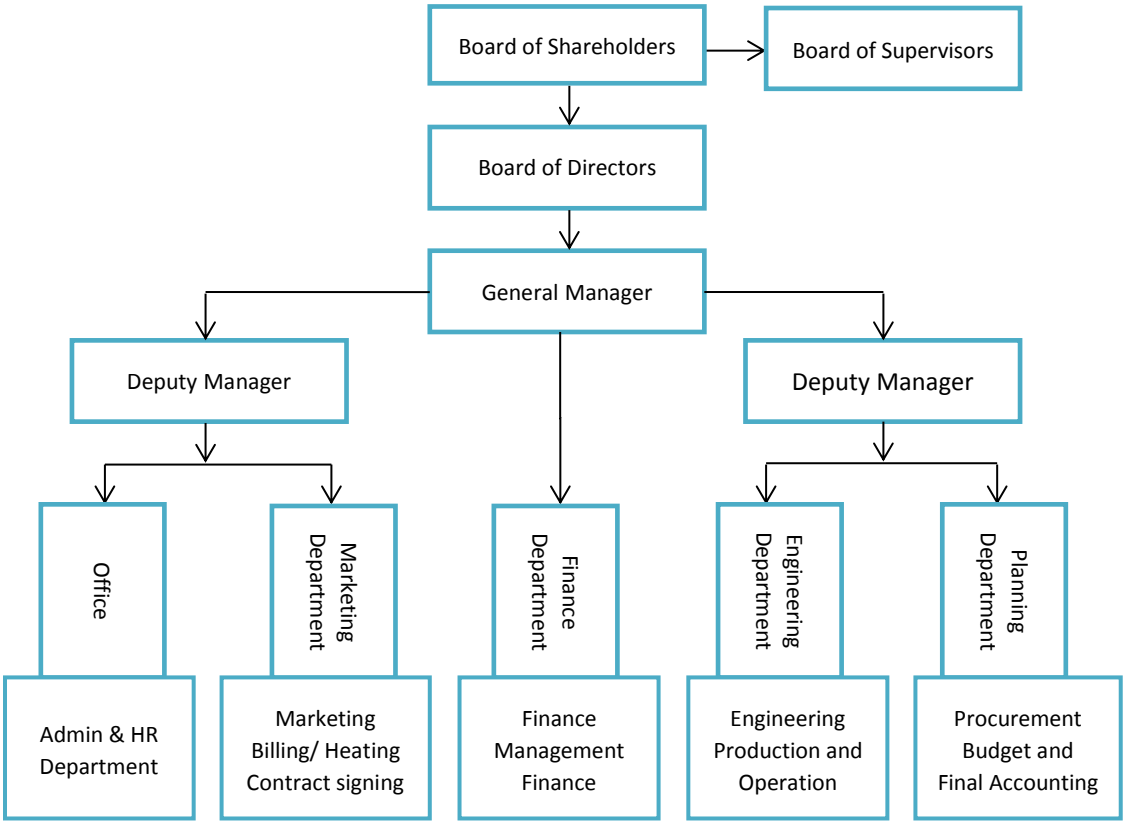


10. ***RISUN Anneng Heating Company.*** The RISUN Anneng Heating Company is a privately owned JV. The shareholding of the JV is as follows:

- 50 percent by Shijiazhuang Anneng Co. Ltd., which is a private company with experience in DH. This shareholder will provide the know-how necessary to build and operate the DH network.
- 50 percent is owned by China RISUN Xuyang Coking Company Ltd., which is a private company. Xuyang itself is 45 percent owned by the China National Coal Group (Zhongmei) Corporation, a central-state-owned enterprise, 45 percent owned by the privately held Xuyang Group and 10 percent owned by Delong Holdings Ltd., also a private company.

11. The company's organization chart is provided in figure 3.4.

Figure 3.4. Organization Chart of RISUN Anneng Heating Company



12. The RISUN Anneng Heating Company has appointed its management and operational staff to implement the ongoing phase I of the Xingtai subproject. The Shijiazhuang Anneng Co. Ltd. seconded management staff and systems to equip the subproject-implementing heating company with knowledge and experience on DH construction and operation and enable the smooth implementation of the subproject. To further develop the company's capacity to operate DH assets, training and tailored capacity-building activities will be provided to the company during implementation under Component 2.

Financial Management, Disbursements, and Procurement

Financial Management and Disbursements

13. The Bank's assessment of the project FM arrangements identified the principal FM risk to be the lack of experience of the HPMO and the four companies' financial staff in managing Bank-financed projects.

14. The following risk management measures were agreed to address the above risk: (a) preparation and issuance of an FMM acceptable to the Bank to standardize the project's FM procedures; (b) organization of extensive workshops and experience sharing by HPFB, which has experience with Bank-financed operations, in addition to extensive FM training from the Bank; and (c) outsourcing qualified consultants to strengthen FM guidance and supervision for HPMO and the PIUs on an 'as needed basis'. The FMM has been prepared and has been agreed with the Bank.

15. Overall, the residual project FM risk after mitigation is assessed as Moderate.

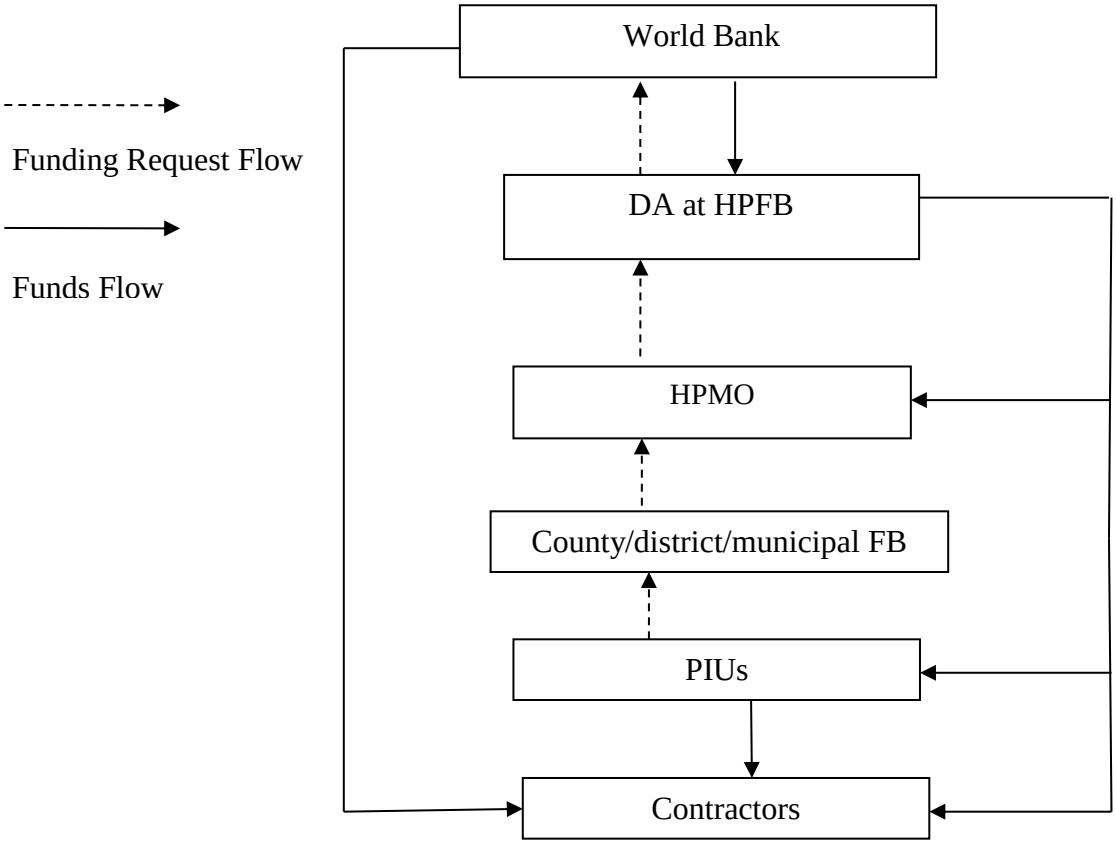
16. The project will be implemented in Hebei Province. The HPMO established under the Foreign Debt Management Center which has experience with the Bank and Asian Development Bank operations will be responsible for overall project management and coordination.

17. The HPMO will implement Component 2. Project activities for direct investments will be implemented by the four heating companies in Chengde, Zhangjiakou, Pingshan, and Xingtai. Each company will be responsible for day-to-day project FM work including project accounting and financial reporting. Both HPMO and the project companies' staff have the required qualifications to perform the project's FM activities. However since they are new to Bank operations, they will receive training from the Bank and the HPFB.

18. ***Budgeting.*** All the counterpart funds will be mobilized by each project company mainly from connection fees and will be complemented by commercial bank loans and equity contributions. Each project company will prepare an annual project implementation plan, including funding resources and budget, for the HPMO's review and documentation. Budget variance analysis will be conducted semiannually by PIUs to inform management of significant variations from the plan that may need corrective actions.

19. ***Funds flow.*** A DA will be opened and maintained at the HPFB. Supporting documents required for Bank disbursements will be prepared and submitted by the PIUs to the municipal/county/district finance bureaus' review before going to the HPMO and then to the

HPFB for further review and disbursement from the DA. The HPFB will, from the DA, reimburse the funds to the PIUs for the Bank-financed portion paid by the PIUs or disburse the funds to contractors directly for payment of eligible expenditures. The withdrawal applications will finally be submitted by the HPFB to the Bank for further processing.



20. ***Accounting and financial reporting.*** The administration, accounting, and reporting of the project will be set up in accordance with Circular #13, 'Accounting Regulations for World Bank Financed Projects', issued in January 2000 by the MOF. The standard set of project financial statements has been agreed between the Bank and the MOF. The HPMO will consolidate the project financial statements and submit them to the Bank. The consolidated unaudited semiannual project interim financial reports will be prepared and furnished to the Bank by the HPMO no later than 60 days following each semester (the due dates will be August 30 and February 28), in form and substance satisfactory to the Bank.

21. ***Computerized accounting systems.*** Yongyou and Jindie have been adopted by the PIUs and a separate project accounting profile will be set up in the existing system according to the requirements of Circular #13. The detailed chart of accounts and project profile will be established before the start of the project.

22. The project's FM-related roles and responsibilities have been clearly defined. The task team will monitor the accounting process, including the adequacy of the FM system and staff training, especially during the initial stage to ensure that complete and accurate financial information is provided in a timely manner.

23. ***Internal controls.*** Accounting policy, procedures, and regulations for Bank projects were issued by the MOF and the FMM aligns FM and disbursement requirements among various implementing agencies. In addition, HPMO will provide guidance and supervision to the four companies covering: (i) compliance of Circular #13 for project accounting and financial reporting; (ii) examination of use of the Bank loan and eligibility of project expenditures as well as efficiency of withdrawal procedures and funds flow, (iii) contract management, and (iv) budget preparation and variation analysis. The supervision results will be documented in a report and filed.

24. ***Audit.*** The Hebei Provincial Audit Office (HPAO) has been identified as the auditor for the project. An annual audit report will be issued by the HPAO and will be due to the Bank within six months after the end of each calendar year. The HPAO has extensive experience with auditing Bank-financed operations. According to the World Bank Policy on Access to Information, the audit report for all investment lending operations for which the invitation to negotiate was issued on or after July 1, 2010, needs to be made publicly available in a timely fashion and in a manner acceptable to the Bank. The audit report will be made publicly available on the website of the provincial auditor. Following the Bank's formal receipt of the audited financial statements from the borrower, the Bank will also make them available to the public in accordance with the World Bank Policy on Access to Information.

Disbursements

25. Four disbursement methods are available for the project: advance, reimbursement, direct payment, and special commitment. Supporting documents required for Bank disbursement under different disbursement methods will be documented in the Disbursement Letter issued by the Bank.

26. A segregated DA in U.S. dollars will be opened at a commercial bank acceptable to the Bank and will be managed by the HPFB. The ceiling of the DA will be determined and documented in the Disbursement Letter.

27. The Bank loan will be disbursed against eligible expenditures (taxes inclusive) as shown in table 3.2.

Table 3.2. Loan Allocation by Category

Category	Amount of the Loan Allocated (US$)	Percentage of Expenditures to be Financed (Inclusive of Taxes)
(1) Goods, works, and non-consulting services for:		100
Chengde	18,089,000	
Zhangjiakou	29,889,000	
Pingshan	11,810,000	
Xingtai	29,882,000	
(2) Consultants' services and Training and Workshop for Component 2	2,500,000	100
(3) Commitment charge and interest on the loan accrued on or before the last payment date immediately preceding the closing date	7,580,000	n.a.
(4) Interest rate cap or interest rate collar premium*	0	n.a.
(5) Front-end Fee	250,000	n.a.
TOTAL AMOUNT	**100,000,000**	

Note: * will be discussed at negotiations

28. ***Retroactive financing*.** The Zhangjiakou and Xingtai subprojects commenced project works in 2015. The other two subprojects plan to begin project construction activities once the coming heating season is over—that is, by the end of March 2016. The HPMO intends to hire a management consulting company, under Component 2, by the end of March 2016. The subprojects and the HPMO can apply for retroactive financing for all the activities under Components 1 and 2 subject to the following eligibility criteria: (a) the activities are procured based on the Bank's procurement rules and are subject to prior review; (b) the payments take place on or after December 1, 2015; (c) the aggregated amount of expenditures should not exceed US$ 20 million.

29. ***Supervision plan.*** The supervision approach for this project is based on its FM risk rating, which will be evaluated on a regular basis by the FM specialist in line with the Financial Management Sector Board's (FMSB) FM Manual and in consultation with the task team leader. The initial FM supervision will focus on (a) setup of project accounts and (b) compliance of project accounting and financial reporting with Circular #13.

Procurement

30. ***Capacity assessment.*** The procurement capacity assessment identified that the HPMO's procurement staff has experience with Bank-financed and other international donor-funded projects, including the Bank-financed Hebei Urban Environment Project (2000–2005), the Asian Development Bank financed Hebei Wastewater Management Project (2001–2006), and the Hebei Small Cities and Towns Development Demonstration Sector Project (ongoing), and is familiar with the Bank's procurement procedures. Newly appointed procurement staff in the four PIUs, however, lack experience with Bank-financed projects. Procurement under the project will be carried out by the HPMO. The procurement capacity and risk assessment identified the possibility of noncompliance and delays in processing procurement as key procurement risks. The main reasons for the risks are the PIUs' and their staff's lack of experience in procurement

under Bank-financed projects and the differences between Bank procurement policies and procedures and domestic procurement regulations and procedures. To address these risks, a capacity-strengthening and risks mitigation action plan was agreed with the HPMO which includes the following measures: (a) procurement training provided by the Bank team during project preparation and implementation; (b) preparation and implementation of a procurement and contract management training plan by the HPMO to train all procurement staff; (c) preparation and issuance of a procurement manual by the HPMO to standardize project procurement procedures and provide guidance to project staff; and (d) recruitment of a procurement agent with experience in Bank procurement procedures by the HPMO to assist with procurement planning and implementation. The overall procurement risk is rated Moderate.

(a) *Applicable guidelines***.** Procurement for the proposed project will be carried out in accordance with the Bank's "Guidelines: Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011, revised July 2014; and "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011, revised July 2014; and the provisions stipulated in the legal agreements. National competitive bidding will be carried out in accordance with the Law on Tendering and Bidding of China promulgated by Order of the President of China on August 30, 1999, subject to the modifications stipulated in the legal agreements to ensure broad consistency with the Bank's Procurement and Consultant Guidelines.

(b) *Procurement of goods, works, and non-consulting services*. Procurement will be done using the Bank's standard bidding documents for all international competitive bidding contracts and national model bidding documents, agreed with or satisfactory to the Bank for all national competitive bidding.

(c) *Selection of consultants.* The Bank's standard request for proposal will be used for all competitive selection of firms. Universities and research institutes may be included in shortlists as a source of consultants, provided they possess the relevant qualifications and they are not in a conflict of interest situation. In such cases, Quality-Based Selection or Selection Based on Consultants' Qualifications (for small assignments) will be used, if the shortlist also includes consulting firms.

(d) *Training, workshops, and study tours.* Detailed programs for training, including study tours and workshops, will be developed by the HPMO during project implementation and will be included in the annual work plan for Bank review. Expenditures incurred in accordance with the approved programs will be used as the basis for reimbursement.

(e) *Procurement plan.* The procurement plan for the entire scope of the project, acceptable to the Bank, has been prepared by the HPMO. The plan will be available at the HPMO website and the Bank shall arrange for its publication on the Bank's external website after loan negotiations. The procurement plan will be updated annually in agreement with the Bank or as required to reflect project implementation needs.

(f) *Prior review thresholds.* The thresholds for procurement methods and Bank prior review are indicated in table 3.3.

Table 3.3. Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value (US$)	Procurement Method	Prior Review Threshold (US$)
Goods and non-consulting services	≥10,000,000	ICB	All
	<10,000,000	NCB	First contract irrespective of value and all contracts ≥3,000,000
	<500,000	Shopping	n.a.
	n.a.	DC	All contracts ≥200,000
Works/supply and installation of plant and equipment	≥40,000,000	ICB	All
	<40,000,000	NCB	First contract irrespective of value and all contracts value ≥15,000,000
	<500,000	Shopping	n.a.
	n.a.	DC	All contracts ≥200,000
Consultants	≥300,000	QCBS/QBS	First contract for each selection method and all contracts ≥1,000,000
	< 300,000	CQS	
	n.a.	SSS	All contracts ≥100,000 for firms and ≥50,000 for individual consultants
	n.a.	IC	Only in exceptional cases, for example, long-term technical assistance

Note: ICB = International Competitive Bidding; NCB = National Competitive Bidding; DC = Direct Contracting; QCBS = Quality- and Cost-Based Selection; QBS = Quality-Based Selection; CQS = Selection Based on the Consultants' Qualifications; SSS = Single Source Selection; IC = Individual Consultant

(g) *Frequency of procurement supervision.* In addition to the prior review supervision carried out from Bank offices, procurement post reviews will be carried out every 12 months by the Bank and/or by external auditors in accordance with terms, conditions, and reporting procedures acceptable to the Bank. The initial procurement post review sampling ratio will be 1 out of 15 contracts.

(h) *Advance contracting and retroactive financing.* Contracts expected to be procured before signing of the Loan Agreement are included in the procurement plan. Retroactive financing will be allowed under the project for eligible expenditures. Withdrawals for eligible expenditures up to an aggregate amount of US$ 20 million may be made for payments made on or after December 1, 2015. The activities for which retroactive financing is being sought are subject to prior review.

Environmental and Social (including safeguards)

A. Environmental Safeguards

31. The project is classified as Category A as per OP 4.01 given the scale of the works, the potential linked activities (heating sources), the displacement of workers and social issues, and potential operating safety risks during the operation phase.

32. The heating sources of the project are local power plants (CHP), industrial enterprises, and peak-load boilers (coal-fired in Chengde and coal- and gas-fired in Zhangjiakou). All these power plants are main local industrial pollution sources. In Xingtai, both heat sources – Hebei China Coal RISUN Coking Co. Ltd. (which is the main heat source) and Xingtai RISUN Chemical Industry Co. Ltd. (which is the standby heat source) – are chemical industrial enterprises. The potential impact of hazardous materials associated with the heat source renovation of the Xingtai subproject has been determined during the design stage of this project. In accordance with the 'Interim Provisions on Supervision and Administration of Major Hazard Sources of Hazardous Chemicals' and 'Hebei Province Methods for Classification of Major Hazardous Sources', the storage area, phase III coking production area, and gas pipelines of Hebei RISUN Coking Co. Ltd. are classified as Class 3 and Class 4 major hazardous sources, respectively, and the gas-fired boilers of Xingtai RISUN Chemical Indutstry Co. Ltd. are classified as a Class 3 major hazard source.

33. Due to the scope of the construction of the pipelines network, the construction of pipelines will have potential impacts on municipal public facilities, railways, and highways. Pipeline construction may interrupt existing underground pipelines and cables. In addition, pipeline crossing construction may also produce impacts on normal operations of railways and highways and, when serious, may impact traffic safety. Pingshan and Xingtai will involve the crossing of the existing railway which is technically complicated and needs professional design, monitoring, and construction. Before the commencement of construction, the underground pipelines and cables will be identified together with the associated management departments and the construction plan will be prepared by the contractors and submitted to the supervisor for approval. For the crossing of the existing railway and highway in Pingshan and Xingtai, the construction plan will be prepared by the contractor for review and approval of the management of the railway and highway.

34. The potential operating safety risks during the operation phase is another concern of the project. The environmental risks during the operation phase include natural gas and boiler explosion. The occupational safety risk is a major concern for the heating sources that will provide heating to the proposed project. The safety risks identified are: workers may be injured by the exposure to steam from recovery of surplus heat or co-generation and the workers may be injured by exposure to electric devices that may cause electric shock in co-generation.

35. The project EA reports were prepared in accordance with relevant national laws, regulations, and technical guidelines, and standards applicable to the project, as well as the World Bank Safeguard Policies. The reports include the EA Executive Summary, EIA, and EMP. The EA Report has been prepared, incorporating the Bank's comments and found to be satisfactory.

36. ***Main environmental impacts and mitigation measures.*** The EA identified and assessed the project benefits and impacts on the natural and social environment and concluded the project will bring significant net positive environmental benefits by providing more energy efficient and cleaner heating in the project areas of the four participating cities. It is expected that the project will help reduce air pollution in Hebei Province.

37. The environmental impact during construction is mainly related to small-scale construction of transmission pipelines and substations, for example, temporary disturbance to traffic and local communities along the sites for pipeline construction and near the sites for substations, soil disposal, nuisance of dust, and noise. The environmental impacts during operation mainly include noise from the substations and BLS, air pollutants emission and noise of the peak-load boilers, and safety issues. The adverse impacts are localized, limited, and can be readily managed with accepted measures of good ECOP and site-specific mitigation measures for potential adverse impacts during construction and operation. To enhance the environmental benefits of the project, the project has integrated mitigation measures in the project design, construction phase, and operational phase. These environmental and social impacts are thoroughly addressed by the EIA report, and preventive and mitigation measures have been developed in the EMP. Bank review has concluded that the project's adverse environmental and social impacts can be adequately avoided, minimized, and mitigated with good management practice and mitigation measures, as developed in the EIA/EMP.

38. ***Sensitive sites.*** Sensitive sites have been identified within the project's areas of influence—hospitals, residential areas, schools, public utility facilities, provincial highways, and railways—that are subject to potential impacts during the construction and operation stages.

39. ***Cumulative impacts.*** The cumulative impact assessment has been conducted in the EIA by following the Good Practice Handbook - Cumulative Impact Assessment of IFC. Through consultation with the stakeholders, air pollutant emission load reduction (SO2, NOx, and PM), displacement of small boiler workers, and affordability of heating tariff for poor households were selected as the valued ecosystem components (valued environmental and social components). It is expected that the reduction of NOx (1692.6 tons per year), SO2 (78.76 tons per year) and PM (25.68 tons per year) will be achieved once the project is completed.

40. Implementation of this project will increase DH coverage in the project area to replace small coal-fired boilers and other non-centralized heating facilities and will improve heating service quality. Improved ambient air quality will decrease the incidence of respiratory diseases and improve the quality of life of the residents. Project implementation is expected to increase employment opportunities and income of local residents. However, DH to be achieved by this project will require payment from local residents for the heating service and connection charges. Increased expenditure for the heating service will have insignificant impact on a majority of the households, but may be a burden for poor households. In addition, closure of existing small coal boilers will cause unemployment and loss of incomes to a small number of workers and new job opportunities are demanded. Occupational training will be provided for workers facing unemployment and reemployment arrangements have been considered and will be carried out during the project implementation phase. The implementing agencies and government have taken into consideration the affordability of poor families (low-income group) for connection to DH

services. The local government has committed to providing heating subsidy so as to alleviate the financial burden of the low-income groups.

41. To enhance the project's environmental benefits, mitigation measures have been integrated into the project design, construction phase, and operational phase. The environmental and social impacts are thoroughly examined in the EIA report and preventive and mitigation measures have been developed in EMPs.

42. ***Project feasibility study and design.*** During the design phase, the EA teams worked closely with project planners/owners and the feasibility study teams to compare and evaluate alternatives. The EA identified, evaluated, and compared various options for heating sources selection, pipeline alignment selection, and heating exchange station selection and optimal alternatives were selected based on the avoidance of (or least adverse) social and environmental impacts, as well as other engineering technology and financial considerations for least cost solutions. A 'without project' scenario was also considered as an alternative. Adequate engineering measures have been designed to mitigate the expected impacts, including noise reduction equipment and so on. As a result, the pipeline alignment and the locations of the heating exchange stations were optimized so as to reduce land acquisition, decrease construction risks, minimize resettlement, avoid environmental sensitive sites, and reduce costs. Further optimization will be implemented while preparing detailed designs.

43. ***Construction phase.*** To address the potential adverse impacts such as dust, wastewater, solid waste, noise, and social impacts during the construction phase, preventive and mitigation measures have been developed in the EMP to adequately avoid, minimize, and mitigate these adverse environmental and social impacts. These impacts will be avoided, minimized, or mitigated by— including but not limited to—the following measures: public consultation throughout the construction period to address public concerns and improve construction activities; proper management of solid waste; careful scheduling of construction activities; restricting night-time construction; measures for dust and wastewater pollutant control; use of low noise equipment and facilities; traffic management; and so on. In addition, a small boilers dismantlement management plan was developed as a part of the EMP to cope with the identification, dismantlement operation, storage, transportation, and disposal of the waste.

44. ***Operational phase.*** To address potential impacts during the operational phase, a number of mitigation measures were adopted. They include but are not limited to: use of low noise equipment, installation of noise barriers, installation of low noise silencers and vibration-reduction facilities, collection and treatment of wastewater and solid waste, environmental, health and safety (EHS) measures, regular monitoring of waste gas, wastewater, and noise of heating sources, and so on.

45. The due diligence review for the heating sources of the four subprojects have been conducted in the EIA, including for the Power Luanhe Power Plant (main heat source) and north-east countryside heat source plant (peak-load heat source) in Chengde, Xibaipo Power Plant in Pingshan, Hebei China Coal RISUN Coking Co. Ltd. (main heat source) and Xingtai RISUN Chemical Industry Co. Ltd. (standby heat source) in Xingtai, and Datang Power Plant (main heat source) and Xingtai Xuyang Chemical Co. Ltd. (standby heat source) in Zhangjiakou. The assessment of environmental risks, environmental management capacity, pollution treatment

technologies, environmental performance, and so on, followed international standards and provided a thorough assessment of potential issues and their mitigation at each plant. The environmental performance of the heating sources was found to be in compliance with the respective environmental standards. In addition, prevention and monitoring methods for the possible risks have been developed in the Xingtai subproject. The heat source companies will follow the requirements and implement monitoring measures. The due diligence review also showed that the industrial enterprises have established a system for occupational health and safety management in accordance with relevant laws and regulations, that is, the safety operation law. The performance of such a system is satisfactory.

46. ***Risk analysis and management.*** Environmental risks during the construction and operational phase have been adequately identified in the EIA. The environmental risks during the construction phase include the use of natural gas, pipeline construction safety, and acetylene explosion. The environmental risks during the operational phase include natural gas and boiler explosion. The risks prevention and mitigation measures in the design, construction, and operation phases have been prepared, respectively, as part of the EIA/EMP to cope with these potential risks which include institutional arrangements, mitigation measures and management systems, emergency planning and response, training plans, and monitoring plans.

47. ***Environmental Management Plan (EMP).*** A stand-alone EMP has been developed which details the policies, applicable environmental standards, environmental management organizations and responsibilities, sufficient mitigation measures, a capacity training plan, an environmental monitoring program, and budget estimates of EMP implementation. EMP measures were developed in consistency with World Bank Group's EHS Guidelines. EMP measures will be incorporated in bidding documents and contracts to ensure effective implementation.

48. Environmental management responsibility will be built into the relevant divisions of the overall project management structure (including heating companies' PIUs and HPMO), with dedicated management staff to ensure effective EMP implementation. A training plan will be implemented before and during construction for project management staff, technical staff, and contractors.

49. ECOP and site-specific management plans have been developed and incorporated in the EIA and the EMP. An environmental monitoring plan for noise, air, and heating sources has been designed for the construction and operational phases of the project and is incorporated in the EMP. It includes the monitoring locations, monitoring parameters, methods, frequency, and cost estimate. An environmental monitoring report will provide key and timely information, especially on environmental impacts and mitigation measures, to the borrower and the Bank to evaluate the success of environmental management.

50. ***Public consultation and information disclosure.*** In accordance with the requirements of China's EA Law and the Bank, two rounds of public consultation were conducted by the EIA team during EA preparation. The key stakeholders included relevant government agencies such as the traffic police bureau, cultural relic bureau, environmental protection bureau, highway administrative bureau; some public utility institutions such as the water supply company, gas company, and electricity company; and project-affected residents, including poor families,

female-headed families, the disabled, and so on. The first round was conducted from January to April 2015 through meetings, field interviews, and questionnaire surveys among project-affected people, experts, and relevant key stakeholders and focused on environmental screening to define public concerns, to assist identification of key environmental issues and risks, and to draw public response and comments on the initial mitigation measures for the potential adverse impacts identified before EA terms of reference finalization. The main concerns raised by the public are construction-related impacts, safety of gas utilization, affordability impacts, and so on. All these concerns were addressed in the Resettlement Action Plan and EIA/EMP.

51. The second round was conducted from March to May 2015 after the draft EIA report had been prepared. During the consultation, the key findings of the draft EIA report and proposed mitigation measures were explained, as well as the responses to the questions raised from the first round of consultations.

52. The consultation revealed that the public strongly supports the project as it is expected to improve air quality and the level of heating services in the project areas of the four municipalities. As a follow-up to the public consultations, the public's concerns have been carefully considered in the impact assessment and development of mitigation measures. The proposed measures have been found satisfactory by the participants of the consultations.

53. The affected communities have been informed about the EA documents and options to access them. The documents have been disclosed on the websites of the HPMO on August 24, 2015, as well as at the Bank's InfoShop on September 15, 2015; the updated documents were disclosed at the InfoShop on October 27, 2015.

B. Social Safeguards

54. The project has significant social benefits as it supports more energy efficient and hence cleaner heating systems in four cities of Hebei Province. Residents from both existing communities and newly developed housing areas will benefit from improved heating quality and reduced air pollution and heat cost under the project.

55. The project includes construction of DH systems in four cities of Hebei Province. Heat will come from existing thermal generation plants and industrial waste heat. Two primary heating stations will be built on existing land plots with 35,227 m² of land area, including a 33,333 m² land plot in Xingtai which had gone through land acquisition recently. Due diligence review was conducted for all heating sources and two primary heating stations. The construction of the project will require limited land acquisition for the installation of 243 group heat substations and 164 km of heating pipelines including about 100 km of new pipelines. Limited impacts are expected since all heat exchange stations will be built within existing housing estates with no new land acquisition and all pipeline construction will require temporary land occupation along urban roads. OP 4.12 was triggered during the early phase of project preparation when more components with potential land acquisition were still part of the project and alignments of heating pipelines had not been determined. An ARAP was prepared by each subproject to address potential land acquisition impacts. The ARAPs include compensation policies and due diligence review of related facilities, such as heating sources, primary heating stations, and related road construction. In the end, those components with potential land

acquisition were dropped and alignments of pipeline construction were selected to avoid any potential occupation of farmland. However, OP 4.12 is still triggered for land acquisition that has recently taken place in connection with the Xingtai and Pingshan subprojects. The due diligence review included in the ARAPs found that land acquisition was carried out in compliance with national legislation and consistent with OP 4.12 objectives.

56. In addition, the ARAPs include measures to mitigate social impacts covered by OP 4.01 in relation to loss of employment and affordability. Due to the closure of 125 small boiler houses, a total of 359 seasonal boiler workers will lose their employment. For such impacts, based on consultation with affected people, detailed reemployment plans have been prepared. Among 359 affected workers, 249 will be retained by heating companies or property management companies. The remaining 110 workers are planning to move to other areas, such as construction sites (59), service sector (23), and back home in the countryside (28). Free skill training will be provided for those who want to work in heating companies or those who will go to other sectors. An institutional arrangement is made for monitoring the implementation of reemployment plans to ensure that the income and livelihood of the affected workers will be restored during project implementation.

57. On the issue of affordability, all four cities have adopted measures to assist low-income households with both annual heating charges and secondary heat network improvement costs.

58. Public consultations were conducted during ARAP preparation, including socioeconomic surveys and public meetings with project-affected people. Information about project impacts, rehabilitation options, and grievance procedures have been provided to affected people through disclosure of the ARAPs in the project areas. Focus group discussions and key informant interviews have been used to consult with potentially affected people and obtain views and preferences regarding potential social impacts and rehabilitation measures, which have been taken into account during ARAP revisions.

59. The ARAPs were disclosed locally on the website of the local government on: July 10 (Zhangjiakou), July 30 (Xingtai), August 24 (Pingshan), and August 27, 2015 (Chengde). They were disclosed at the Bank's InfoShop on September 21, 2015; the updated ARAPs were disclosed at the InfoShop on October 27, 2015.

60. Implementation of the ARAPs and their monitoring were also agreed. The project-implementing agencies will lead operations under the oversight of the HPMO. An experienced external monitoring agency will be contracted to conduct independent monitoring and evaluation during project implementation.

61. A social assessment has been conducted in project-affected areas based on consultations with local government agencies and affected people. According to the assessment, there are no ethnic minority communities in the project-affected areas. The Bank's Indigenous People Safeguard Policy (OP 4.10) is not triggered for the project.

62. According to the social assessment, considerable social benefits will be brought by the project, which include enhanced heating quality, reduced heating costs for residents in serviced areas, and improved air quality in project cities. For the identified negative project impacts, such

as inconvenience during pipeline construction, income loss for a small number of boiler workers, and the potential financial burden for low-income households due to the payment of a connection charge and the cost of internal pipeline installation, a set of recommendations was proposed. These include conducting consultations with the affected people, providing adequate and timely rehabilitation to affected boiler workers, and providing a subsidy or waiver of the connection charge for low-income households. All these recommendations were accepted by the project-implementing agencies and were built into the project design.

Monitoring and Evaluation

63. Annex 1 lists the PDO-level results indicators for the project, as well as the intermediate results indicators for each component.

64. The four project-implementing heating companies will be responsible for the implementation of monitoring plans, metering data collection, and preparation and submission of periodic monitoring reports to the HPMO, including inputs to the semiannual project progress reports and annual reports on compliance with performance indicators and covenants. They will also report annually on their work plans and financial viability plans. Based on inputs from the project-implementing companies, the HPMO will evaluate interim results and ensure that corrective actions are taken as necessary. The HPMO will also consolidate and submit this information to the Bank with the help of its project management consultant to be procured under Component 2.

65. The four project-implementing companies will collect four data sets needed for computing results indicators:

- *Fuel consumption***:** coal/gas consumption from the heat sources (CHP plants and coal-/gas-fired boilers).
- *Heat supplied:* industrial waste heat (for Xingtai) and from CHP plants, peak-load boiler plants (coal-/gas-fired), and the various substations under CHP production conditions.
- *Power supplied:* by the CHP plants under CHP production conditions.
- *Pollutant emission:* of CO_2 and TSP from the CHP plants under CHP production conditions and emission of the peak-load boiler plants.

ANNEX 4: IMPLEMENTATION SUPPORT PLAN

CHINA: Hebei Clean Heating Project

Strategy and Approach for Implementation Support

1. The strategy for implementation support has been developed based on the nature and risk profile of the proposed project. It aims to make implementation support to the client more flexible and efficient and will focus on the implementation of risk mitigation measures defined in the Systematic Operations Risk-rating Tool: stakeholder risks and institutional capacity for implementation and sustainability, rated as Substantial; and project-specific risks, which are rated Moderate.

2. ***Stakeholder risks.*** Bank missions will confirm that the EMP and plans for boiler closure and traffic management are carried out by the responsible stakeholders. Third party monitoring reports will enhance supervision. Bank missions will also review the financial performance of the four heating companies to monitor the performance of new commercial agreements put in place to purchase and sell heating. The environment specialist and the social safeguards specialist will ensure that the EMP and Resettlement Action Plan are followed consistently through reviews of monitoring reports and regular dialogue with the HPMO, project's municipalities and counties, the four heating companies, and site visits.

3. ***Implementing agency risks.*** Bank missions will confirm that the HPMO and the four project-implementing companies are staffed with qualified specialists and that appropriate training is provided to them, including refresher training when required. This will be particularly important in the case of the newly established Xingtai-based RISUN Anneng Heating Company. Bank FM and procurement specialists will also provide necessary training to relevant project staff. They will review project reports as part of their supervision function, maintain contact with project staff, and conduct site visits to perform their implementation support function.

4. Technical specialists will confirm that the four companies maintain adequate staff in place for project management and system operations. They will also review the work of the consultants supporting the HPMO and the companies with the technical assistance component. Together with the task team leader, the technical specialists will monitor performance through the project results indicators. The reviews of the results indicators will be the focus of dialogue on sustainability issues.

5. ***Use of country office based staff.*** To ensure that the mitigation measures for the risks are being implemented efficiently and effectively, the task team will include a substantial number of Beijing-based staff, including the environmental safeguards, social safeguards, FM, and procurement specialists. The task team leader will maintain regular contact with key officials of the HPMO and the four companies to exchange views on strategic issues of project implementation and address any critical issues, for example, potential or actual noncompliance with important project covenants. Staffing and resources will be reviewed from time to time as is standard Bank practice.

Implementation Support Plan

6. The tables below indicate the focus areas, skill needs to provide implementation support, and the required resources.

Time	Focus	Resource Estimate (in Staff Weeks)		Partner Role
First 12 months	Team leadership	Task team leader	4	n.a.
	Client interaction and on-the-ground project coordination on technical aspects. Technical supervision of (a) bidding documents; and (b) the development and implementation of the technical assistance component.	Country office based DH engineer	4	
	Support to the team with the preparation of project documents and missions	Operations officer	4	
	Procurement: (a) review of bidding documents and (b) delivery of training	Procurement specialist	3	
	FM training and supervision	FM specialist	1	
	Environmental supervision	Environmental specialist	2	
	Social supervision	Social specialist	2	
	Review of the financial status of the four DH companies	Financial analyst	2	
12–48 months	Team leadership	Task team leader	3	n.a.
	Review of project construction and implementation of the technical assistance component.	Country office based DH engineer	3	
		Procurement specialist	3	
	Support to the team with the preparation of project documents and missions	Operations officer	3	
	FM, disbursement, and reporting	FM specialist	1	
	Environment and social monitoring and reporting	Environmental specialist	2	
		Social specialist	2	
	Review of the financial status of the four DH companies	Financial analyst	2	

Skills Needed	Number of Staff Weeks	Number of Trips (per Fiscal Year)	Comments
Task team leader.	4 during the first year, then 3 annually in the following years.	Two	International staff (Washington based or country office based)
DH engineer	4 during the first year, then 3 per year in the following years.	Two	Country office based
Operations officer	4 during the first year, then 3 per year in the following years.	Two	International staff (Washington based)
Procurement specialist	3 per year	Fields trips as required	Country office based
FM specialist	1 per year	Fields trips as required	Country office based
Environmental specialist	2 per year	Fields trips as required	Country office based
Social specialist	2 per year	Fields trips as required	Country office based
Financial analyst	2 per year	One	International staff (Washington based)

ANNEX 5: ECONOMIC AND FINANCIAL ANALYSES

CHINA: Hebei Clean Heating Project

A. Economic Analysis

1. This annex provides details on the economic and financial appraisal of the project and the analysis of the current as well as the projected financial performance of the four heating companies.

2. ***Key assumptions.*** The economic appraisal of the project relies on the key assumptions listed in table 5.1.

Table 5.1. Key Assumptions of Economic Appraisal

Item	Value	Notes
Coal price in Chengde (CNY per ton)	573	Current prices in Hebei Province
Coal price in Zhangjiakou (CNY per ton)	470	
Gas price in Zhangjiakou (CNY per m^3)	3.22	Includes government subsidy of CNY 2.27 per m^3
Heat price in Xingtai (65°C for circulating water) (CNY per GJ)	5	–
Steam price in Xingtai (CNY per GJ)	90	–
Electricity price (CNY per kWh)	0.68	All cities
Lower heating value of coal (kJ per kg)	21,000	–
Lower heating value of standard coal (kJ per kg)	29,300	–
Boiler efficiency of existing small coal-fired boilers in Zhangjiakou (%)	65	–
Boiler efficiency of existing large coal-fired boilers in Zhangjiakou (%)	80	–
Boiler efficiency of existing gas-fired boilers in Xingtai (%)	85	–
Theoretical efficiency of new large coal-fired boilers (%)	80	Based on experimental measurements in Hebei Province
CHP heating efficiency (%)	90	–
Transmission heat loss improvements (%)	2.3	Consultants' and Bank team's joint estimates
Distribution heat loss improvements (%)	3.4	
Energy efficiency gains through SCADA (%)	1	
O&M of new investments (% of investments)	3	Bank team's estimates
O&M and repair existing heating systems (% of investments)	5	
Value of SO_2 emission reduction (CNY per ton)	1,301	Based on Benefit Transfer Method of New York Externality Model (Rowe and others 1994) also used in Liaoning and Urumqi PADs
Value of dust emission reduction (CNY per ton)	5,609	
Value of NOx emission reduction (CNY per ton)	5,478	
Value of water savings (CNY per ton)	6.5	Average for Chengde, Zhangjiakou, and Pingshan
Value of water savings in Xingtai (CNY per	2	Supplied by RISUN

Item	Value	Notes
ton)		
Value of CO_2 emission reduction (US$)	30	Bank guidelines[14]: starts at US$30 per ton in 2015 and increases to US$80 per ton in real terms by 2050
New boiler and network investment cost per MW capacity (CNY per MW)	840,000	Bank team's estimates
Value Added Tax rate (%)	13	–
Assessment period (years)	20	–
Discount rate (%)	10	–

3. The project supports rehabilitation and expansion of DH systems in the project cities. Rehabilitation will result in more efficient operation of the systems. Expansion will connect existing and new buildings to DH systems that have better performance with respect to efficiency and emission of greenhouse gases and pollutants as compared to alternative heating options—standalone coal-fired HOBs, which are considered as BAU scenario.

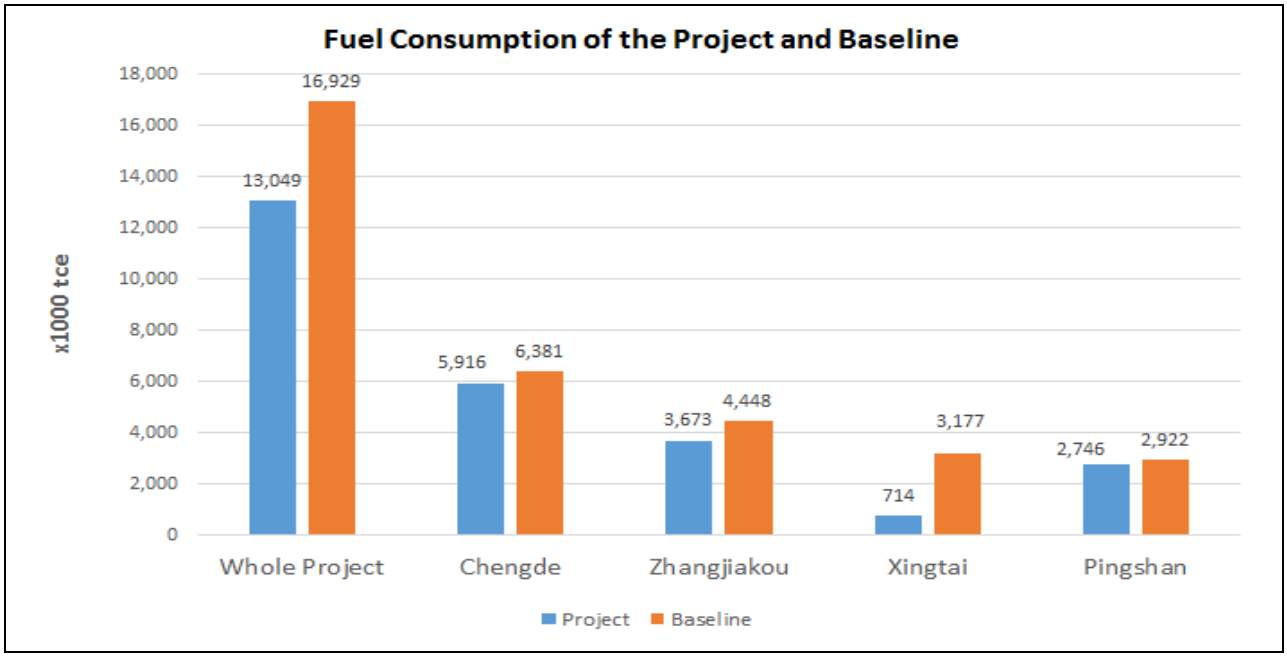
4. The cost-benefit analysis estimates the EIRR of the project compared to the without-project/BAU alternative. The economic costs include the total investment costs of both alternatives, exclusive of taxes and subsidies.

5. The major benefits were estimated by taking into account the following: (a) actual and projected fuel efficiency improvements generated by connecting existing and new building areas to more efficient and cleaner heating sources: CHPs (in Chengde, Zhangjiakou, and Pingshan) and industrial waste heat (in Xingtai); (b) reduced heat losses generated by improving existing networks and substations[15] and installing BLS—this benefit takes into account the reduced heat and water losses because of modernization and automation of the substations; (c) operation, maintenance, and repair cost savings for both alternatives; and (d) environmental benefits of reduced dust, SO_2 and CO_2, and NOx emissions through avoided local and global emissions as a result of the project. The assumptions for the baseline emissions include the use of current boilers for the existing buildings and new boilers with emission reduction equipment for the new (planned) heating areas.

6. The project's consolidated EIRR is estimated at 29.3 percent, while subproject EIRR ranges from 26.5 percent for Zhangjiakou to 35.4 percent for Chengde. Without carbon benefits, the consolidated EIRR is reduced to 11.3 percent.

[14] Two cases are presented in the sensitivity analysis: with and without a carbon price.
[15] Estimates took into account experience from similar projects in China and in Europe.

Figure 5. 1. Comparison of Fuel Consumption With and Without the Project



Source: World Bank estimates

7. ***Sensitivity analysis.*** The sensitivity analysis for the economic appraisal was conducted for three scenarios: (a) 20 percent increase in investment costs; (b) 20 percent decrease in total economic benefits; and (c) no carbon price. The results of the sensitivity analysis suggest that under all of the above scenarios, the project remains economically viable. The impact of defined variation in the above parameters is presented in table 5.2.

Table 5.2. Sensitivity Analysis for Economic Appraisal

	Base Case (%)	+20% Investment Cost (%)	-20% Economic Benefits (%)	Without a Carbon Price (%)
Whole Project	**29.3**	**23.4**	**22.3**	**11.3**
Chengde	35.4	24.0	22.4	16.7
Zhangjiakou	26.5	21.3	20.2	10.7
Xingtai	29.6	24.8	23.8	10.0
Pingshan	27.2	22.4	21.5	11.4

B. Financial Analysis

8. The financial analysis for the project has been carried out at the project level and at the entity level. The main features are discussed below. Detailed analyses are retained in project files.

Project-Level Analysis

9. ***Project financing.*** The project will be financed by counterpart funds of about US$148.33 million equivalent (about 60 percent of the project cost) and an IBRD loan of US$100 million

(about 40 percent of the project cost). All required counterpart funds for the Chengde and Pingshan subprojects will come from connection fees paid by real estate developers for connecting new buildings to the DH system. The Zhangjiakou and Xingtai subrpojects, in addition to connection fees, will use loans from domestic banks to co-finance their respective subprojects; they have obtained a Commitment Letter from local banks. In support of early subproject implementation, the Zhangjiakou subproject has received government subsidies, while the Xingtai heating company has received equity contributions from its parent company. Details on the financing sources for each subproject are presented in table 5.3.

Table 5.3. Project Financing Plan

Subproject		World Bank	Domestic Bank	Connection Fees	Equity Contributions	Government Subsidy	Total
Chengde	CNY, thousands	219,560	–	96,560	–	–	219,560
	%	56	–	44	–	–	100
Zhangjia-kou	CNY, thousands	206,025	80,000*	141,456	–	29,000	456,480
	%	45	18	31	–	6	100
Pingshan	CNY, thousands	79,950	–	74,932	–	–	154,882
	%	52	–	48	–	–	100
Xingtai	CNY, thousands	206,025	200,000**	190,263	100,000	–	696,288
	%	30	29	27	14	–	100
Total Project	CNY, thousands	**615,000**	**280,000**	**503,210**	**100,000**	**29,000**	**1,527,210**
	%	**40**	**18**	**33**	**7**	**2**	**100**

Note: * A Letter of Commitment for CNY 80 million has been obtained from the China Minsheng Banking Corp. Ltd. ** A Letter of Commitment for CNY 200 million has been obtained from the Agricultural Bank of China.

10. ***Base case estimates.*** The financial analysis at the project level measures the financial impact of the project on an incremental basis, that is, the difference between the 'with project' and 'without project' cases. The costs include the investment costs and the incremental O&M expenses. The benefits include the incremental revenues from heat sales, including connection fees. The financial viability indicators estimated are the FIRR and the financial net present value (FNPV). The FIRR for each subproject is compared with the estimated corporate-level and project-level WACC for the company carrying out the subproject. The WACC for each company is estimated on the basis of the cost of borrowed funds (currently assumed at 2 percent for the Bank loan and 6 percent for local bank loans) and the expected minimum return on equity (currently estimated at 8 percent based on a risk-free rate of 6 percent and a risk premium of 2 percent). The current estimates for each subproject are as given in table 5.4.

Table 5.4. Project-level Financial Viability Indicators

Subproject	WACC (%)		FIRR (%)	FNPV (CNY, millions)
	Corporate Level	Project Level		
Chengde	6.6	2.4	12.1	39.6
Pingshan	7.1	2.6	14.2	37.1
Xingtai	5.6	2.7	11.5	152.3
Zhangjiakou	6.5	2.2	17.5	162.0
Total project	**6.2**	**2.5**	**13.2**	**391.0**

11. ***Sensitivity analysis***. As seen from table 5.4, the base case FIRRs for all the subprojects are higher than the respective corporate-level and project-level WACCs. Key variables impacting the subproject FIRRs are (a) the capital costs of the investments, (b) the incremental O&M expenses, (c) delays in implementation, and (d) lower rates of increase of the heating areas served. The impact on the subproject FIRRs from unfavorable variations in the underlying variables are shown in table 5.5.

Table 5.5. Sensitivity Analysis on FIRRs

Subproject	Base Case (%)	+20% Capital Costs (%)	+10% O&M Costs (%)	Implementation Delayed by One Year (%)	Heating Area Lower by 10% (%)	Heating Area Lower by 20% (%)
Chengde	12.1	7.7	7.9	10.1	5.8	<0
Pingshan	14.2	8.7	7.8	9.8	4.7	<0
Xingtai	11.5	8.2	9.7	9.8	7.5	3.1
Zhangjiakou	17.5	10.9	8.8	12.0	5.3	<0

12. As seen from table 5.5, the FIRRs are sensitive to adverse changes in all the key variables. However, with the exception of a 20 percent shortfall in the heating area served, all FIRRs remain above the respective project-level WACC levels.

Entity-level Financial Analysis

13. Background information on each company is provided in annex 3. This section focuses on the financial performance aspects. Details of historical and projected financial indicators for each company are retained in project files.

14. ***Historical financial performance.*** The historical indicators are based on the audited financial statements of the companies for the years 2012 to 2013 and the unaudited statements for 2014. A summary of the principal financial performance ratios is summarized for each company in its respective section. The definitions used are the following:

- Collection ratio = Collected revenues / Billed revenues
- Operating ratio = Operating expenses (including depreciation) / Operating revenues
- Working ratio = Cash operating expenses (excluding depreciation) / Collected revenues
- Cost recovery ratio = Operating revenues / (Operating expenses + Depreciation or debt service whichever is greater)
- Debt service coverage = (Net income after tax + Depreciation + Interest) / (Interest + Principal repayment)
- Current ratio = Current assets / Current liabilities
- Debt to assets ratio = (Medium-term debt + Long-term debt) / Total assets

15. ***Projected financial performance***. The projections are based on conservative assumptions (given in the tables) in regard to the main underlying variables impacting the projected financial performance. For each company, the main assumptions are in relation to the following:

- Investment costs
- Implementation schedule
- Growth of annual connected area
- Growth of annual heating area
- Annual collection of connection fees
- Annual heat purchase price
- Annual fuel purchase price
- Annual heat sales tariffs

16. For each company, the main features of the historical and projected financial performance are discussed below.

Chengde Heating Group Company

17. ***Historical financial performance (2012 to 2014).*** Main financial performance ratios are given in table 5.6.

Table 5.6. Financial Performance of Chengde Heating Group Company

Indicator	Unit	2012	2013	2014
Operating revenues	CNY, millions	461.6	474.3	366.7
Net income after tax	CNY, millions	20.9	53.1	20.2
Net income/revenues	%	4.5	11.1	5.5
Collection ratio	%	95	95	95
Working ratio	%	88	85	87
Cost recovery ratio	Ratio	1.0	1.1	1.0
Current ratio (unadjusted)	Ratio	0.6	0.6	0.5
Current ratio (adjusted)	Ratio	1.5	1.4	1.3
Debt to assets ratio (unadjusted)	%	78	78	77
Debt to assets ratio (adjusted)	Ratio	45	46	41
Debt service coverage	Ratio	1.4	2.3	1.7

18. The Chengde Heating Group Company made a net profit in each of the years 2011 to 2013. The current ratio was lower than 1.0 because the company includes the unamortized part of the collected connection fees as deferred income and includes it under current liabilities as required by applicable Chinese accounting standards. If the unamortized connection fees were excluded from the current liabilities, the current ratio will be over 1.2 in each of the years. The CHC has outstanding medium- and long-term loans from local banks in the amount of about CNY 170 million.

19. ***Investment program and financing.*** Chengde Heating Group Company's investment program and financing sources under the project are shown in table 5.7.

Table 5.7. Investment and Financing Sources (Chengde Heating Group Company)

	Unit	2016	2017	2018	2019	2020	Total	% Share
Investment cost	CNY, millions	57.9	71.2	85.6	2.5	2.4	219.6	
Financed from:								
World Bank loan proceeds	CNY, millions	30.1	39.9	48.2	2.4	2.4	123.0	56
Connection fees	CNY, millions	27.8	31.3	37.4	0.1		96.6	44
Total financing	CNY, millions	57.9	71.2	85.6	2.5	2.4	219.6	100

20. ***Projected financial performance (2015 to 2020).*** The main financial indicators for the years 2015 to 2020 are summarized in table 5.8.

Table 5.8. Projected Financial Indicators for Chengde Heating Group Company

Indicator	Unit	2015	2016	2017	2018	2020
Operating revenues	CNY, millions	541.9	556.4	580.0	615.6	627.6
Net income after tax	CNY, millions	46.9	57.3	61.7	63.9	58.4
Net income/revenues	%	8.6	10.3	10.6	10.4	9.3
Collection ratio	%	95	95	95	95	95
Working ratio	%	79	77	78	78	82
Cost recovery rate	Ratio	1.2	1.2	1.2	1.2	1.1
Current ratio (unadjusted)	Ratio	0.6	0.7	0.8	0.9	1.2
Current ratio (adjusted)	Ratio	1.5	1.6	1.8	2.1	2.2
Debt to assets ratio (unadjusted)	%	73	70	68	67	59
Debt to assets ratio (adjusted)	%	37	36	36	36	37
Debt service coverage	Ratio	2.3	2.8	3.0	7.3	7.0

21. As seen from table 5.8, the main financial indicators are projected to remain at satisfactory levels over the project implementation period.

Zhangjiakou Dongyuan Heating Company

22. ***Historical financial performance (2012 to 2014).*** The main financial performance ratios are given in table 5.9.

Table 5.9. Financial Performance of Zhangjiakou Dongyuan Heating Company

Indicator	Unit	2012	2013	2014
Operating revenues	CNY, millions	47.0	56.6	79.0
Net income after tax	CNY, millions	-0.8	0.1	0.1
Net income/revenues	%	-1.7	0.2	0.1
Collection ratio	%	95	95	95
Working ratio	%	134	111	99
Cost recovery ratio	Ratio	0.7	0.5	0.8
Current ratio	Ratio	1.9	1.5	0.5
Debt to assets ratio (unadjusted)	%	81	84	61
Debt to assets ratio (adjusted)	%	81	76	49
Debt service coverage	Ratio	0.3	0.1	0.4

23. The Zhangjiakou Dongyuan Heating Company was just about breaking even on a net profit basis in 2013 and 2014. Its debt to assets ratio was high because it is carrying on its books a loan in the amount of about CNY 200 million on behalf of its parent company Zhangjiakou Dongshan Development and Investment Company. The debt has been fully repaid by the end of September 2015.

24. ***Investment program and financing.*** Zhangjiakou Dongyuan Heating Company's investment program and financing sources under the project are shown in table 5.10.

Table 5.10. Investment and Financing Sources (Zhangjiakou Dongyuan Heating Company)

	Unit	2015	2016	2017	2018	2019	2020	Total	% share
Investment cost	CNY, millions	39.0	252.6	130.8	26.1	4.0	4.0	456.5	
Financed from:									
World Bank loan	CNY, millions	–	115.4	78.7	3.9	4.0	4.0	206.0	45
Connection fees	CNY, millions	10.0	87.2	22.1	22.2	–	–	141.5	31
Local bank loan	CNY, millions	–	50.0	30.0	–	–	–	80.0	18
Government subsidy	CNY, millions	29.0	–	–	–	–	–	29.0	6
Total financing	CNY, millions	39.0	252.6	130.8	26.1	4.0	4.0	456.5	100

25. ***Projected financial performance (2015 to 2020).*** The main financial indicators for the years 2015 to 2020 are summarized in table 5.11.

Table 5.11. Projected Financial Indicators for Zhangjiakou Dongyuan Heating Company

Indicator	Unit	2015	2016	2017	2018	2020
Heat sales revenues	CNY, millions	67.7	196.9	197.6	200.0	200.6
Connection fees (amortized)	CNY, millions	3.8	22.0	24.5	24.5	24.5
Other operating revenues	CNY, millions	–	136.3	18.4	–	–
Operating subsidies	CNY, millions	–	–	34.8	34.8	34.8
Total revenues	CNY, millions	71.4	355.2	275.3	259.2	259.8
Net income after tax	CNY, millions	5.5	80.0	58.2	44.9	40.5
Net income/revenues	%	7.7	22.5	21.1	17.3	15.6
Collection ratio	%	95	95	95	95	95
Working ratio	%	90	76	75	78	79
Cost recovery ratio	Ratio	1.1	1.4	1.4	1.3	1.3
Current ratio	Ratio	0.4	1.2	1.4	1.4	1.6
Debt to assets ratio (unadjusted)	%	54	73	70	65	58
Debt to assets ratio (adjusted)	Ratio	44	52	50	48	45
Debt service coverage	Ratio	–	5.5	4.5	3.9	4.3

26. As seen from table 5.11, the main financial indicators are projected to remain at satisfactory levels over the project implementation period.

Pingshan County Urban Heating Company

27. ***Historical financial performance (2012 to 2014).*** The main financial performance ratios are given in table 5.12.

Table 5.12. Financial Performance of Pingshan County Urban Heating Company

Indicator	Unit	2012	2013	2014
Operating revenues	CNY, millions	31.0	35.4	40.4
Operating subsidies	CNY, millions	93.2	49.2	32.0
Total revenues	CNY, millions	124.3	84.6	72.4
Net income after tax	CNY, millions	38.2	0.4	0.0
Net income/revenues	%	30.7	0.5	0.0
Collection ratio	%	95	95	95
Working ratio	%	73	105	105
Cost recovery ratio	Ratio	1.5	1.0	1.0
Current ratio (unadjusted)	Ratio	1.0	0.7	0.7
Debt to assets ratio (unadjusted)	%	30	39	39
Debt to assets ratio (adjusted)	%	30	33	33

28. The Pingshan County Urban Heating Company would have made substantial losses each year without operating subsidies provided by the municipal government. Over the three-year period, operating subsidies amounted to CNY 174 million as compared to the company's heat sales revenues of CNY 106 million. The current ratio was lower than 1.0 because Pingshan County Urban Heating Company includes the unamortized part of the collected connection fees as deferred income and includes it under current liabilities as required by the Chinese accounting standards.

29. ***Investment program and financing.*** Pingshan County Urban Heating Company's investment program and financing sources under the project are shown in table 5.13.

Table 5.13. Investment and Financing Sources (Pingshan County Urban Heating Company)

	Unit	2016	2017	2018	2019	2020	Total	% share
Investment cost	CNY, millions	59.5	36.9	33.7	23.3	1.6	154.9	
Financed from:								
World Bank loan proceeds	CNY, millions	15.7	24.6	31.9	6.1	1.6	79.9	52
Connection fees	CNY, millions	43.8	12.3	1.8	17.1	–	75.0	48
Total financing	CNY, millions	59.5	36.9	33.7	23.3	1.6	154.9	100

30. ***Projected financial performance (2015 to 2020).*** The main financial indicators for the years 2015 to 2020 are summarized in table 5.14.

Table 5. 14. Projected Financial Indicators for Pingshan County Urban Heating Company

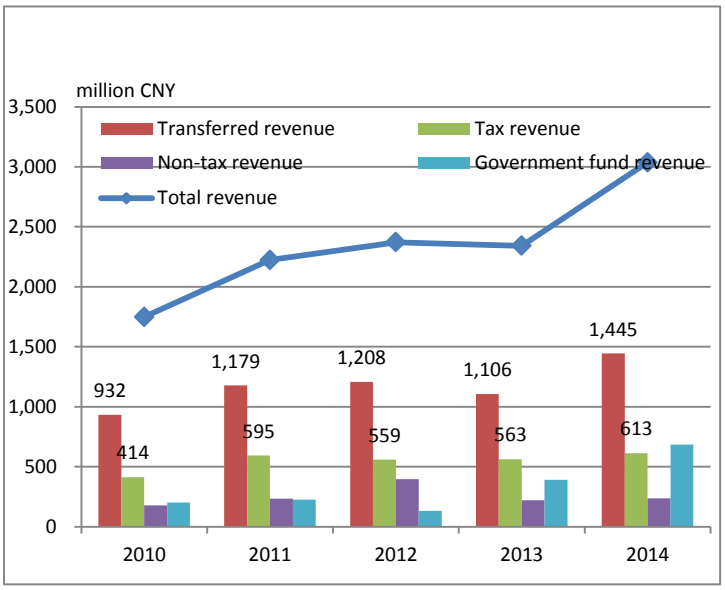
Indicator	Unit	2015	2016	2017	2018	2020
Operating revenues	CNY, millions	73.7	90.3	105.3	116.6	128.9
Operating subsidies	CNY, millions	1.5	0.0	0.0	0.0	0.0
Total revenues	CNY, millions	75.2	90.3	105.3	116.6	128.9
Net income after tax	CNY, millions	0.0	3.1	7.1	11.0	10.6
Net income/revenues	%	0.0	3.4	6.7	9.4	8.2
Collection ratio	%	95	95	95	95	95
Working ratio	%	92	89	85	82	81
Cost recovery ratio	Ratio	1.0	1.1	1.1	1.1	1.1
Current ratio	Ratio	0.8	1.0	1.2	1.5	2.1
Debt to assets ratio (unadjusted)	%	38	49	54	57	55
Debt to assets ratio (adjusted)	%	26	26	30	35	33
Debt service coverage	Ratio	2.4	2.6	2.9	6.4	5.3

31. Starting 2015, the municipal government approved an increase in Pingshan County Urban Heating Company's heat sales tariffs to CNY 19 per m^2 for residential customers and CNY 30 per m^2 for non-residential customers. The heat purchase price was reduced from CNY 43.5 per GJ to CNY 33.0 per GJ. With these changes, the company is projecting that it will not require annual operating subsidies starting from 2016 (after an operating subsidy of CNY 1.5 million in 2015). The company's main financial indicators are projected to remain at satisfactory levels over the project implementation period.

32. ***Municipal financial analysis.*** Pingshan County Urban Heating Company's financial sustainability has depended so far on operating subsidies from the Pingshan County budget. Therefore, an assessment of Pingshan County's financial performance was conducted to determine the level of risk associated with dependence on continued operating subsidies. Based on information provided, the municipality has relatively stable fiscal capacity due to a relatively

low debt to GDP ratio and low scale of investment. Some revenue instability is expected due to changes in its economic structure—while the services industry (tertiary industry) grew over 11 percent annually in the period of analysis (reflecting the government's greater emphasis on growing services sectors), secondary industry representing two-thirds of its GDP experienced negative growth, reflecting an exiting of the cement industry from the city and downward trends in steel, as experienced throughout the country.

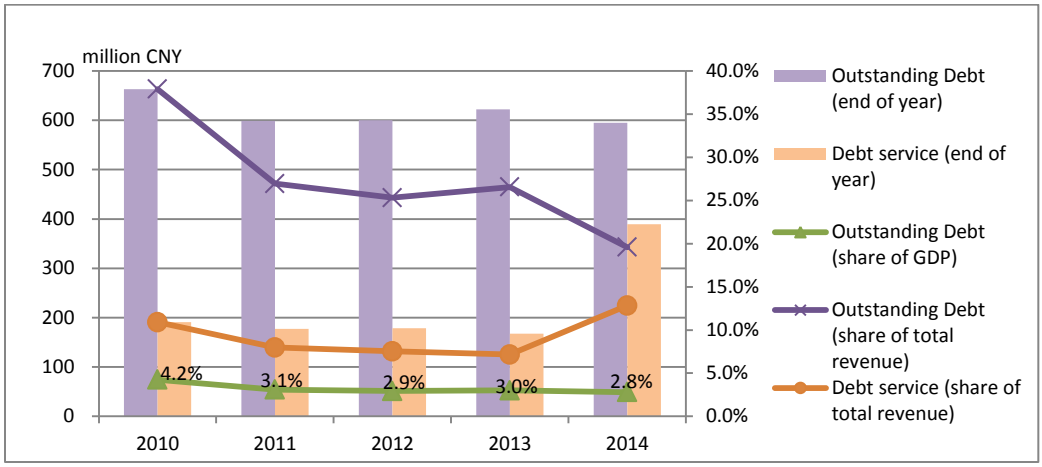
Figure 5.2. Government Revenue of Pingshan



Source: Pingshan's County Finance Bureau

33. In line with many cities in China, Pingshan's economic structure is changing, and as a result, it is facing a tighter fiscal environment. A large share of government expenditure is for education and agriculture. The government expects some temporary increases in these expenditures due to changes in policies. Other drivers for unexpectedly rapid expenditure growth are not apparent. The government's fixed investment ratio has held between 0.65 and 1.85 percent of local GDP in the period of analysis, which is very small and not expected to radically increase over the coming years. Also, Pingshan's stock of debt is low, amounting to only 3.2 percent of GDP, a share that has been decreasing over the period of analysis. With strengthened local government debt monitoring and controls being put in place by the central government the debt to GDP ratio should not increase in the absence of unexpected jumps in investment. Pingshan is starting to optimize its debt structure, which is expected to improve as it gains more experience under the new operating procedures for local debt management. The structure of its debt is also relatively favorable. Pingshan issued CNY 351.9 million of new debt in 2014 to repay maturing debt totaling CNY 379.1 million and finance expenditures. Debt service payments will rise relative to 2014 in 2016 (CNY 175 million) and 2017 (CNY 125 million).

Figure 5.3. Government Debt of Pingshan



Source: Pingshan's County Finance Bureau

34. Overall, tax revenues have shown an increasing trend during 2010–2014. Value Added Tax and business tax are the main sources of tax revenue (55.9 percent). These have decreased slightly in 2013 and 2014 due to a stagnant secondary industry (due to structural reforms) and Value Added Tax reform.

35. Subsidies to heating companies are included in the Urban and Rural Community Affairs Expenditure and they accounted for only about 2 percent of total government expenditure. While the fiscal situation has been tight in 2014, transfers from higher levels of government were increased and revenue was arranged to ensure needed expenditure on urban and rural community affairs.

RISUN Anneng Heating Company

36. ***Historical financial performance (2012 to 2014).*** RISUN Anneng Heating Company started its operations in 2014. Currently, there are no historical financial statements available.

37. ***Investment program and financing.*** RISUN Anneng Heating Company's investment program and financing sources under the project are shown in table 5.15.

Table 5.15. Investment and Financing Sources (RISUN Anneng Heating Company)

	Unit	2015	2016	2017	2018	2019	2020	Total	% share
Investment cost	CNY, millions	359.0	159.3	43.6	58.0	72.2	4.2	696.3	
Financed from:									
World Bank loan	CNY, millions	–	136.0	30.0	31.8	4.1	4.1	206.0	30
Connection fees	CNY, millions	59.0	23.3	13.6	26.2	68.1	0.1	190.3	27
Local bank loan	CNY, millions	200.0	–	–	–	–	–	200.0	29
Owners'equity funds	CNY, millions	100.0	–	–	–	–	–	100.0	14
Total financing	CNY, millions	359.0	159.3	43.6	58.0	72.2	4.2	696.3	100

38. ***Projected financial performance (2015 to 2020).*** The main financial indicators for the years 2015 to 2020 are summarized in table 5.16.

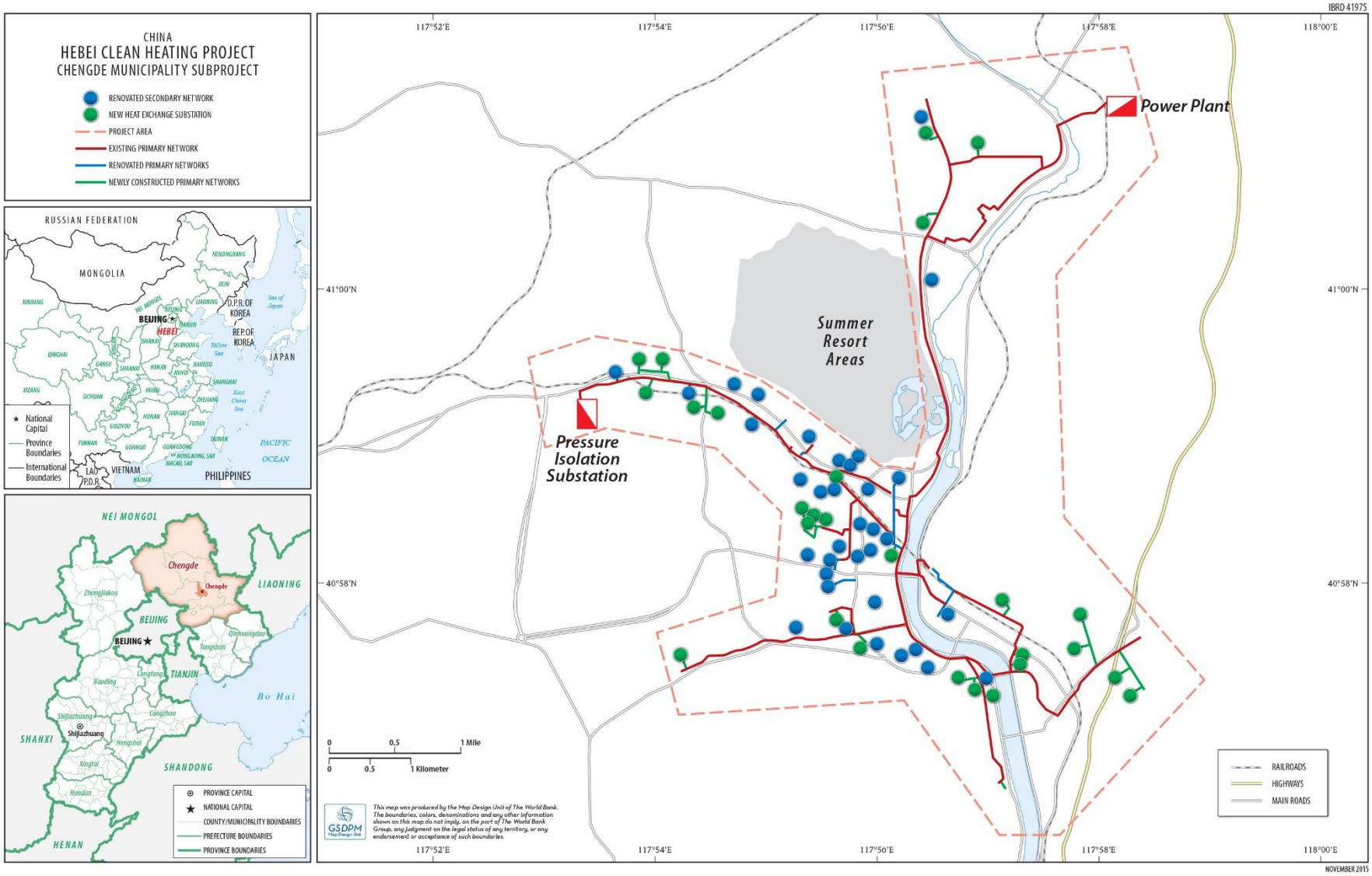
Table 5.16. Projected Financial Indicators for RISUN Anneng Heating Company

Indicator	Unit	2015	2016	2017	2018	2020
Operating revenues	CNY, millions	19.7	36.7	57.9	84.5	124.7
Connection fees (amortized)	CNY, millions	5.4	11.9	19.1	27.1	35.5
Total revenues	CNY, millions	25.0	48.7	77.0	111.6	160.2
Net income after tax	CNY, millions	11.2	-9.3	-3.6	15.1	38.7
Net income/revenues	%	44.8	-19.0	-4.7	13.5	24.2
Collection ratio	%	95	95	95	95	95
Working ratio	%	43	61	59	51	46
Cost recovery ratio	Ratio	2.5	1.1	0.8	1.1	1.4
Current ratio	Ratio	6.5	1.2	1.6	2.2	1.6
Debt to assets ratio	%	70	82	83	83	72
Debt service coverage	Ratio	1.7	1.6	0.6	1.0	1.7

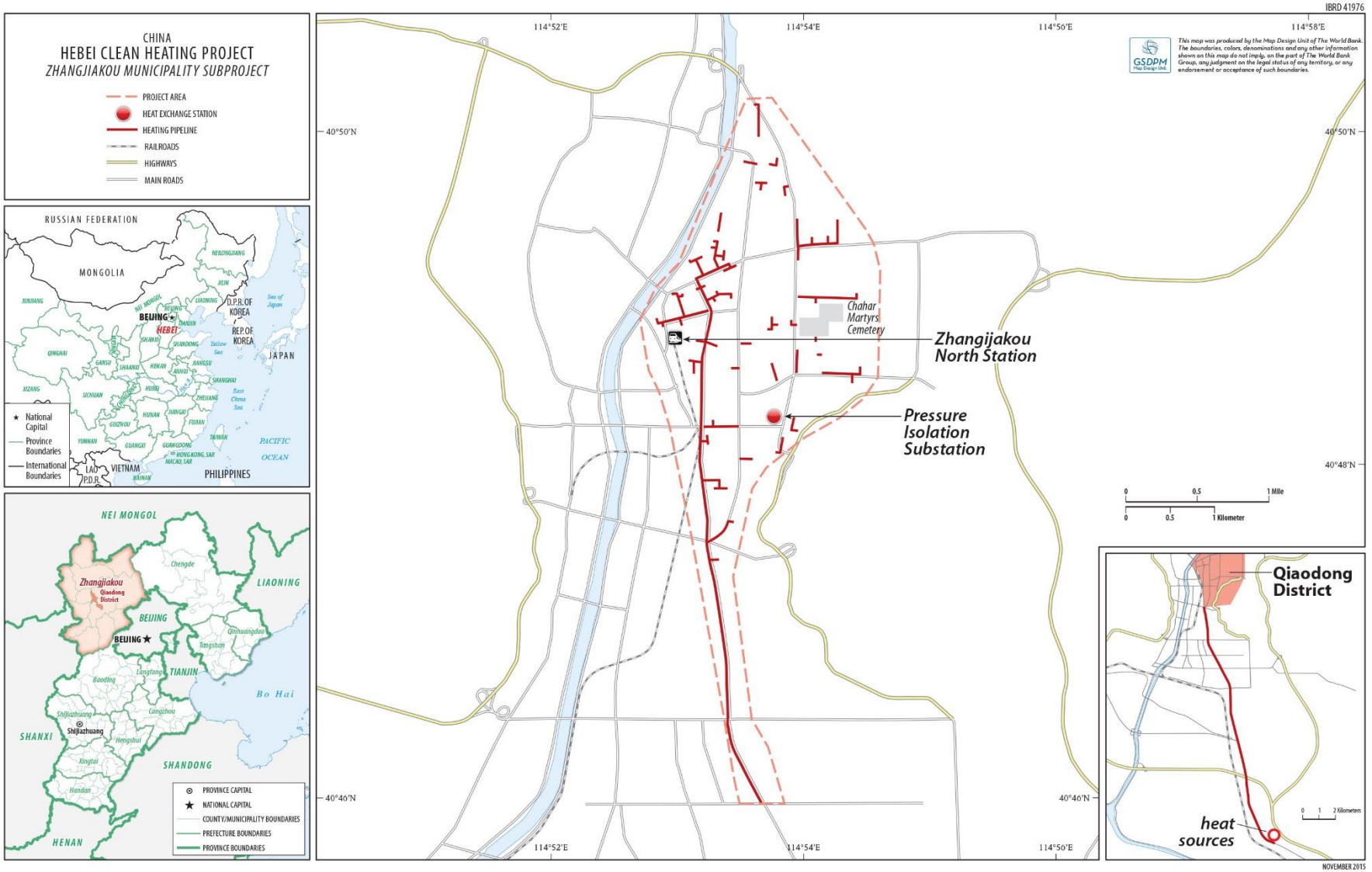
39. Table 5.16 indicates that the main financial indicators are projected to remain at satisfactory levels over the project implementation period.

ANNEX 6: MAPS OF SUBPROJECTS IN HEBEI PROVINCE

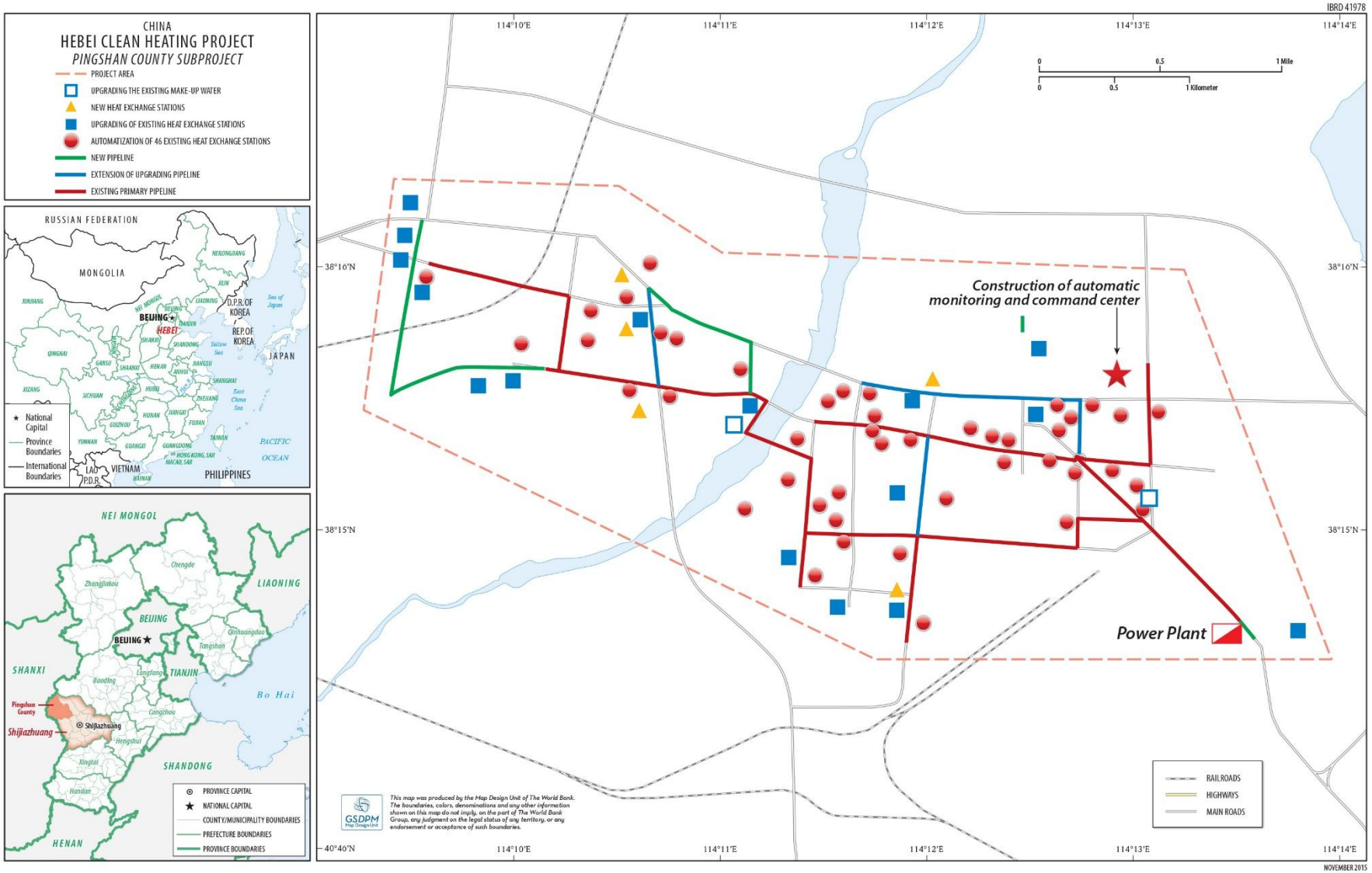
Chengde Subproject



Zhangjiakou Subproject



Pingshan Subproject



Xingtai Subproject