

Document of
The World Bank

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Report No: 42393-CN

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US\$191 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

LIAONING THIRD MEDIUM CITIES INFRASTRUCTURE PROJECT

April 21, 2008

Transport, Energy and Mining Sector Unit
Sustainable Development Department
East Asia and Pacific Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective October 15, 2007)

RMB7.5 = 1US\$

Currency Unit = RMB
RMB 7.5 = US\$1

FISCAL YEAR

July 1 – June 30

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank	GEF	Global Environment Facility
APL	Adaptable Program Loan	GJ	Gigajoule (10 ⁹ joules)
ASTAE	Asia Sustainable and Alternative Energy Program	GQHC	Gongchangling District Qinglong Heating Co.
		GTZ	German Technical Assistance Corporation
BHZC	Benxi Hengze Heating Development Company	HoB	Heat-only Boiler
BSGHC	Benxi Steel (Group) Heating Company, Ltd.	HRBEE	Heat Reform and Building Energy Efficiency
		HUCIC	Haicheng Urban Construction Investment Co.
CBE	Cash break-even	HYHC	Haicheng Hengye Heating Supply Company Ltd.
CHP	Combined Heat and Power		
CLG	City Leading Group		
CNAO	China National Audit Office	IBRD	International Bank for Reconstruction and Development
CO ₂	Carbon dioxide	ICB	International Competitive Bidding
CPIC	China Power Investment Company	IDC	Interest during construction
CQ	Selection Based on Consultant Qualifications	<i>i.e.</i>	that is
CY	Current Year	IFI	international financial institution
DA	Designated Account		
DH	District Heating	kg	Kilogram
DSCR	Debt Service Credit Ratio	km	Kilometer
		kWh	Kilo-Watt hour
EA	Environmental Assessment		
ECA	Europe and Central Asia Region	LDRC	Liaoning Provincial Development and Reform Commission
EDZ	Economic Development Zone	LEPB	Liaoning Provincial Environmental Protection Bureau
EIA	Environmental Impact Assessment	LIBOR	London inter-bank offered rate
EIRR	Economic Internal Rate of Return	LMC1	Liaoning Medium Cities Infrastructure Project (Urban Transport)
EMP	Environmental Management Plan	LMC2	Second Liaoning Medium Cities Infrastructure Project (Urban Environment)
ESMAP	Energy Sector Management Assistance Programme	LMC3	Liaoning Third Medium Cities Infrastructure Project (Urban Energy)
FGD	Flue Gas Desulfurization	LPCD	Liaoning Provincial Construction Department
FFEM	Fonds Français de L'Environnement Mondial	LPCG	Liaoning Provincial Coordinating Group
FFUPO	Foreign Funds Utilization Project Office	LPDF	Liaoning Provincial Department of Finance
FIRR	Financial Internal Rate of Return	LPG	Liquefied Petroleum Gas
FM	Financial Management		
FMS	Financial Management Specialist		
FTPPC	Fushun Thermal Power Plant Company		

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ltr	Liter	RFP	Resettlement Framework Policy
m ²	Square meter	RMB	Renmimbi (Yuan)
m ³	Cubic meter	RRR	Resettlement retroactive review
MBD	Chinese Model Bidding Document	SA	Social Assessment
MFB	Municipal Finance Bureau	SBD	Standard Bidding Document
MOC	Ministry of Construction	SCADA	supervisory control and data acquisition
MOF	Ministry of Finance	SEPA	State Environmental Protection Administration
MPMO	municipal project management office	SLA	Subsidiary loan agreement
MW _e	Megawatt-electric	SO ₂	Sulfur Dioxide
MW _{th}	Mega-watt thermal (10 ⁶ watts)	SOE	State-owned enterprise
NCB	National Competitive Bidding	TCE	Tons of Standard Coal Equivalent
NDRC	National Development and Reform Commission	TSP	Total suspended particulates
NPV	Net Present Value	UCIC	Urban Construction and Investment Company
O&M	Operation and Maintenance	UNDP	United Nations Development Programme
OP/BP	Operational Policy/Bank Procedure	VAT	Value-added Tax
PAD	Project Appraisal Document	YETDZ	Yangjiazhangzi Economic & Technical Development Zone
PAP	Project-affected Person	YDHC	YETDZ District Mudu Heating Company (Yangjiazhangzi)
PCN	Project Concept Note	YEDZHC	Yingkou Economic Development Zone Huayuan Heating Company Ltd.
PFM	Public Financial Management	YHC	Yingkou Heating Company
PIU	Project Implementation Unit	YGC	Yingkou Gas Company
PMO	Project Management Office	Y	Yuan
QBS	Quality Based Consultant Selection		
QCBS	Quality and Cost Based Consultant Selection		
RAP	Resettlement Action Plan		

ENERGY UNIT CONVERSION

$$1 \text{ TCE} = 7.0 \text{ GCal} = 29.31 \text{ GJ} = 8.314 \text{ MWh}$$

$$1 \text{ GCal} = 1.15 \text{ MWh} = 4.186 \text{ GJ}$$

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CHINA
Liaoning Third Medium Cities Infrastructure Project

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IBRD 36022

CHINA
LIAONING THIRD MEDIUM CITIES INFRASTRUCTURE PROJECT
PROJECT APPRAISAL DOCUMENT
EAST ASIA AND PACIFIC
EASTE

<p>Date: April 21, 2008 Country Director: David R. Dollar Sector Manager/Director: Junhui Wu</p> <p>Project ID: P099224</p> <p>Lending Instrument: Specific Investment Loan</p>	<p>Team Leader: Gailius J. Draugelis Sectors: District heating and energy efficiency services (97%); Oil and gas (3%) Themes: Climate change (P) Environmental screening category: Partial Assessment B</p>		
Project Financing Data			
<input checked="" type="checkbox"/> Loan <input type="checkbox"/> Credit <input type="checkbox"/> Grant <input type="checkbox"/> Guarantee <input type="checkbox"/> Other:			
<p>For Loans/Credits/Others: Total Project Cost (US\$m): 375.85 Total Bank financing (US\$m.): 191.00 Proposed terms: Loan would be payable in 30 years including five years' grace period and level principal repayments, at six-month LIBOR for US Dollars plus the variable spread for Variable-Rate Single Currency Loans.</p>			
Financing Plan (US\$m)			
Source	Local	Foreign	Total
Borrower	184.85	0.00	184.85
International Bank for Reconstruction and Development	158.40	32.60	191.00
Total:	343.25	32.60	375.85
<p>Borrower: Government of China; Liaoning Province (China)</p> <p>Responsible Agency: LDRC Foreign Fund Utilization Project Office 13 Shisiwei Rd. Heping District, Shenyang Liaoning Province 110003 China Tel: (86-24) 23223724 Fax: (86-24) 23851576 td56789@163.com</p>			

Estimated disbursements (Bank FY/US\$m)								
FY	2008	2009	2010	2011	2012	2013	2014	
Annual	0.00	30.00	40.00	49.00	34.00	24.00	14.00	
Cumulative	0.00	30.00	70.00	119.00	153.00	177.00	191.00	
Project implementation period: Start: <i>September 15, 2008</i> End: <i>June 28, 2013</i>								
Expected effectiveness date: <i>August 1, 2008</i> Expected closing date: <i>December 31, 2013</i>								
Does the project depart from the CAS in content or other significant respects? Ref. PAD A.3							<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Does the project require any exceptions from Bank policies? Ref. PAD D.7							<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Have these been approved by Bank management?							<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Is approval for any policy exception sought from the Board?							<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Does the project include any critical risks rated "substantial" or "high"? Ref. PAD C.5							<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Does the project meet the Regional criteria for readiness for implementation? Ref. PAD D.7							<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Project development objective Ref. PAD B.2, Technical Annex 3								
The project development objective is to improve the energy and environmental efficiency of heating and gas services in selected areas of participating cities in Liaoning Province.								
Project description [one-sentence summary of each component] Ref. PAD B.3, Technical Annex 4								
The project will support: (A) a centralized heating infrastructure development including construction and rehabilitation of centralized heating systems; (B) an urban gas infrastructure development to rehabilitate gas transmission facilities, rehabilitate and expand gas storage tanks, and rehabilitate and expand gas distribution facilities; and (C) an institutional development providing technical assistance and training for (i) project management, bid document preparation, design review and construction supervision to heating and gas utilities, and (ii) operation and maintenance training to heating utilities; and (iii) review of safety procedures in Yingkou Gas company.								
Which safeguard policies are triggered, if any? Ref. PAD D.6, Technical Annex 10								
The project is classified as a Category B project under OP4.01, Environmental Assessment. It also triggers OP4.12, Involuntary Resettlement.								
Significant, non-standard conditions, if any, for: Ref. PAD C.6								
Board presentation: None								
Loan/credit effectiveness: None								
Covenants applicable to project implementation:								
<ul style="list-style-type: none"> • A Project Coordination Group shall be established at the provincial level, chaired by a Vice Governor of Liaoning • The Foreign Funds Utilization Project Office is to be responsible for day-to-day implementation; • Project Management Offices established by Benxi, Yingkou, Liaoyang and Fushun municipalities will be responsible for day-to-day management of implementation within their respective jurisdictions. 								

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and sector issues

1. **Supporting the Northeast through a period of economic transition.** While China has become an international symbol of economic growth and poverty alleviation in the last three decades, the medium-sized cities in Liaoning Province have benefited only to a limited extent from this prosperity. Before the initiation of market oriented reforms of the late 1970s, Liaoning was one of the country's major industrial centers, focusing on heavy industry and mining. The province became China's most urbanized province with 53 percent of the residents living in urban areas. Much of the urban population settled in a number of medium cities with economies anchored around a small number of state-owned industrial and mining enterprises. Such enterprises have had mixed success in the transition to a market economy, and have generally found themselves under severe financial pressure. This weakened the economic base of the cities, an impact that has been further exacerbated with the decline in key extractive industries such as coal, oil, and iron ore. As a result, at a time when many of the cities in China's coastal region (as well as the two large cities of Shenyang and Dalian in Liaoning) have been investing heavily in infrastructure, the medium cities of Liaoning have suffered from systemic under-investment, and deferred infrastructure maintenance, despite continued urban growth, that has resulted in an accelerated deterioration of the asset base for urban services.

Sector Issues

2. **Energy conservation is a national priority.** Energy conservation is a high priority for China's Government, which has set a target of reducing 20 percent of energy consumption per unit of GDP by the year 2010 in its 11th Five-Year Plan. Important drivers for the Government's energy conservation initiatives are the dominance of coal in China's fuel mix, accounting for 69% of total primary energy consumption, and the environmental impacts of this ever-increasing coal consumption on public health, urban livability and on global warming. Due to its major cost advantage, and shortages of alternatives, coal is expected to remain the dominant fuel for heating systems for the foreseeable future. Heating services nationwide used about 200 million tons of raw coal in 2002, representing 10% of total energy use, 15% of total coal use and over 50% of building energy use in China per annum. This is equivalent to emissions of 4 million tons of sulfur dioxide and 400 million tons of carbon dioxide per year. The 11th Five-Year Plan includes 10 key projects to achieve its energy conservation objectives covering a comprehensive list of measures. The measures include building energy efficiency and the replacement of distributed small coal-fired boilers for heating with central heating supply.

3. **Demand for urban heating services is increasing.** China's unprecedented urbanization and construction boom are driving growth in demand for heating services in China's northern provinces. The urban residential building stock in northern China is expected to grow from 4 billion m² to 10 billion m² in 2024. Yet, the current building stock consumes between 50 and 100 percent more energy for heating compared to buildings in comparable climates in northern Europe and North America due to antiquated equipment, a lack of incentives to use energy for heating efficiently, poor enforcement of building codes and a lack of consumer controls for heating.

4. Demand for cleaner, modern heating services continues to increase in Liaoning with its long, cold winters and average January temperatures ranging from -17°C to -5°C . Liaoning's building stock has grown an annual average of 12% between 2000–2004 and is expected to grow by 10 percent (residential) and 7 percent (commercial) for the next five years. According to national statistics, Liaoning is the second largest centralized heating supply producer in China. Liaoning produced in 2005 about 225 petajoules, or 16% of total hot water central heating energy nationwide. In 2003 centralized heating covered 297 million m^2 , representing about fifty percent of total urban heating area, and grew to a reported 476 million m^2 , or about 70 percent of total heated area by 2005. Coal-fired heat-only boilers and combined-heat and power (CHP) plants provide the majority of the services.

5. **Moving toward cleaner urban heating services.** In the early stages of urbanization, cities invested in small, coal fired boilers to provide space heating to new urban areas. Over time, larger boilers replaced small boilers. The remaining small boilers, usually located in smaller and medium cities in Liaoning, are now located in dense urban centers after urban expansion. Much of it is in urgent need of modernization. Most systems, and nearly all small boiler systems, rely on Soviet-era technology except that only heat, and not domestic hot water, is provided. The small coal fired boilers are a source of major winter air pollution. The small boilers operate at a reported 40-60% efficiency (compared to about 75-85% efficiency of large boilers), and use little, if any, TSP or sulfur removal equipment. The impact on human health and city aesthetics with coal dust and slag in residential centers, and smoke stacks emitting black smoke over apartment buildings is severely negative. Liaoning Province will undertake a major move forward in this project by implementing dust removal and flue gas desulfurization (FGD) systems for new boiler plants, exceeding current national standards and local practices, and thus contribute to a national goal of reduction in sulfur dioxide emissions in the 11th Five Year Plan.

6. **Moving toward central heating supply sector reform.** As in the rest of northern China, urban space heating in Liaoning is characterized by energy waste and represents one of the last vestiges of the old-style welfare system in China. The unreformed heating sector presents no incentives for consumers to respond to market-based energy costs because heat, unlike water or electricity, is billed on a flat floor area basis and still many state-owned enterprises (SOEs) pay for a share of the heating bill. Reform of urban heating system design, pricing, metering and bill payment systems has been gradually emerging on the national agenda over the past four years. In July 2003, the central government issued instructions to move ahead with implementing heat system reform in pilot cities of China's 16 northern provinces and autonomous regions, including Liaoning Province. The goals of heat reform are to commodify heating by addressing key sector issues: (i) discontinuing employer payment of heating bill and making households responsible for payment of the heating bill; (ii) introducing heat metering and billing based on consumption, promoting consumer control of heating and building energy efficiency; (iii) developing safe, clean and demand-responsive heat supply systems; (iv) reforming heat pricing; and (v) accelerating reform of heating enterprises, consolidating many small enterprises in cities, introducing competition, and fostering and standardizing the heat market. Far stricter enforcement of the Government's building energy efficiency standards for all new residential buildings is also an important part of the effort. Implementation has been slow and limited mainly to larger cities, and thus far only Tianjin, a provincial-level city, has implemented a large scale consumption-based billing pilot. In December 2005, the Government

issued a follow-on circular underscoring the need for progress in heat reform, but leaving flexibility to apply reforms based on local circumstances.

7. As in the rest of northern China, the pace of reform in Liaoning has been gradual, but there are some signs of moving forward. Liaoning Province issued in July 2007 guidelines mandating heat metering systems in new real estate developments proposed after August 2007 and set a schedule for installation of metering systems in existing buildings. Municipalities, including Liaoning Third Medium Cities Infrastructure Project (LMC3) cities, are promoting consolidation of enterprises through the use of larger centralized heating systems, discontinuing use of small boiler houses.

8. **Municipalities and centralized heating operators have little experience with sector innovations demanded by central heating reforms.** Un-metered space heating has had major impacts on the design approaches, technology choice and operation of heating systems and business models. Since space heating is considered a vital service for cold climate regions and changes involve major organizational and institutional challenges at local levels where capacities especially in medium and small cities are weak, implementation of reform has been slow. Until recently, building codes did not mandate consumer control devices and in general thermal integrity standards were low or weakly enforced. Older heating systems were designed to guarantee heating at the furthest part of the network, varying water temperatures at the heating plant – thus heating levels were too high or too low, forcing customers to open windows and literally heat the outside air. These system designs do not respond efficiently with end-use devices, a key pre-requisite for consumers to adjust to desired consumption. Modern, demand-driven systems which vary water temperature and water flow are able to efficiently match heating supply and demand, reducing required piping dimensions and pumping costs. Demand driven approaches are gradually being accepted in China, but companies and municipalities lack operating experience to understand the benefits and gain confidence in new approaches.

9. The social impacts of reforms are being carefully considered and, in addition to technical and operational issues, are setting the pace for introduction of consumption-based billing. As part of the legacy of the welfare state, employers used to pay a large share of heating expenses normally directly to heating enterprises. The development of transparent subsidy schemes, which would in turn place responsibility for paying the full heating bill to the consumer, are still under development in many cities of Liaoning. Respondents to a consumer survey in Yingkou, Benxi, Fushun, Gongchangling and Haicheng (LMC3 cities) indicated that heating costs represent a significant share of total income, particularly for poorer residents. Unsubsidized costs of heating bills for respondents ranged between 23 and 4 percent of total income, and amount to 10 and 2 percent after current subsidies. Other energy costs amounted to an additional 24 and 5 percent of total income. Thus far, Shenyang, Anshan, Tieling and Dalian, four large Liaoning cities, have implemented new schemes which reimburse part of the heating bill to consumers after households pay the heating bill.

10. **Urban Gas Supply.** In Liaoning, gas supply networks first were constructed in the 1920's-1930's and then have gradually expanded over the years. The networks and storage facilities generally have not been well-maintained, are corroded and leaking. There are growing safety concerns. About half of the different types of gas used in the province are for household

use (e.g. cooking, production of domestic hot water). Southern Liaoning uses associated natural gas from the Liaohe Oil Field. In the province about 26% of gas users use natural gas. The other main markets are liquefied petroleum gas (LPG) (42%) and coal gas (31%). Liaoning has large potential coal mine methane / coal bed methane resources. However, these are largely undeveloped due to perceived risks associated with poor financial performance of coal mines. Yingkou Gas Company is the distributor of gas in Yingkou City, a growing city and Liaoning's second largest seaport after Dalian. The gas infrastructure is in a poor state of repair and has been plagued with gas leakages and ruptures. The company has, therefore, sought Bank support for its rehabilitation and upgrading to ensure safe and efficient supply of natural gas to the consumers.

2. Rationale for Bank involvement

11. The Bank is well positioned to provide assistance to Liaoning Province on urban energy issues. The Bank's lending experience for the heating sector in China is successful but limited, and this is the first major Bank loan to China focusing principally on urban heating. The Bank has supported the Ministry of Construction over the past six years in its efforts to study, develop and implement consumption based billing and to increase efficiency of heating use in buildings in China. A cornerstone of this effort is the \$18 million Global Environment Facility (GEF) Heat Reform and Building Energy Efficiency Project, which has allowed the Bank and Ministry of Construction (MOC) to gain experience with challenges to implementing consumption based billing and building energy efficiency improvements in Tianjin and other cities of northern Chinese provinces. In addition, the Bank has been involved in the urban heating sector in Central and Eastern Europe and the former Soviet Union where conversion to modern heating systems started over a decade ago. The Bank has also worked with the Chinese Government on gas sector reforms, institutional development of the operating agencies, and rehabilitation and capacity expansion of gas fields and gas supply infrastructure. Its last gas project was completed successfully in Sichuan province.

3. Higher level objectives to which the project contributes

12. The project is consistent with the 2006-2010 Country Partnership Strategy (discussed by the Executive Directors on May 23, 2006) which seeks among other themes to engage China on managing resource scarcity and environmental challenges, through *inter alia* reducing air pollution, and optimizing energy use. The project is the third of a suite of three Liaoning Medium Cities Infrastructure projects (FY06-FY08) totaling about US\$586 million in IBRD lending which aim to support the revitalization of medium cities in Liaoning Province through priority investments in urban roads (LMC-1), water, wastewater, solid waste (LMC-2), and central heating and gas supply (LMC-3) across 13 municipalities. LMC-3 covers 2 municipalities also participating in LMC-1 (Benxi, Fushun) and 4 municipalities also participating in LMC-2 (Yingkou, Yingkou EDZ, Fushun, Haicheng).

B. PROJECT DESCRIPTION

1. Lending instrument

13. The lending instrument is a Specific Investment Loan. The loan will be a single currency, variable spread loan with a maturity of 30 years including five years' grace period, at the Bank's standard interest rate for LIBOR-based US dollars, with a Front-end fee of 0.25 percent.

2. Project development objective and key indicators

14. The project development objective is to improve the energy efficiency and environmental performance of heating and gas services in selected areas of participating cities in Liaoning Province.

15. The key project performance indicators will be based on sub-project specific indicators, focusing on operational efficiencies actually achieved in subprojects. Annex 3 provides the detailed results monitoring framework:

- Total Suspended Particulates (TSP) and sodium dioxide (SO₂) emissions per m² connected floor area per boiler plant
- Fuel and electricity consumption per m² connected floor area
- Make-up water per m² connected floor area
- Reduction of gas losses to an agreed target.

3. Project components

16. The total estimated project costs are US\$376 million equivalent, of which US\$338 million are investment costs, US\$37 million include land acquisition, interest during construction (IDC) and other investment-related costs, and US\$1.22 million are institutional development costs. The proposed IBRD loan is US\$191 million, 51% of total estimated project costs. Annex 5 provides more details on estimated costs and indicative financing. The LMC3 project covers 6 municipalities and 9 cities as follows:

Proposed Estimated Project Costs by City		
	US\$ Million	RMB Million
Benxi	117.5	881.2
1. Benxi General Heating Ph II	66.1	496.0
2. Benxi Nanfen Heating	14.2	106.5
3. Benxi Steel Heat Recovery	37.2	278.7
Fushun	31.1	233.0
4. Fushun Power Plant Heat Recovery	31.1	233.0
Gongchangling	26.1	195.9
5. Gongchangling Heating	26.1	195.9
Anshan	23.6	177.2
6. Haicheng Heating	23.6	177.2

Proposed Estimated Project Costs by City		
	US\$ Million	RMB Million
Huludao	17.6	132.2
7. Huludao YJZZ Heating	17.6	132.2
Yingkou	158.7	1190.3
8. Yingkou EDZ Heating	55.7	417.5
9. Yingkou Dashiqiao Heating	30.9	232.0
10. Yingkou North	61.1	457.9
11. Yingkou Gas	11.0	82.8
Institutional Development	1.2	9.2
Total Project Costs	375.9	2818.9

17. The following provides a description of each component with estimated project costs and indicative financing amounts:

18. **Component 1: Centralized Heating Infrastructure (US\$364 million equivalent; IBRD US\$185.7 million).** This component covers 10 subprojects in six cities and includes the construction and rehabilitation of centralized heating systems. The component will replace use of 317 small, polluting boiler plants with a capacity totaling 2,693 MW_{th} capacity with the use of (a) 8 new boiler plants in Benxi, Benxi Nanfen, Haicheng, Gongchangling, Huludao and Yingkou Dashiqiao, and (b) recovery of waste heat from power generation and steel production in Fushun, Yingkou EDZ, Yingkou city and Benxi with the capacity of 1,611 MW_{th} in total to cover both existing and new demand through the year 2013. The subprojects will construct (a) 8 large boiler plants amounting to a total capacity of 1,126 MW_{th}; (b) 305 km of primary and about 188 km of secondary pipelines; and (c) 202 new and 156 rehabilitated group substations. Most subprojects of Component 1 will have a system for computerized acquisition of data and plant maintenance and operation equipment. A summary table of the investments is presented in Annex 4.

19. The component will contribute to implementation of heating reform by implementing in new heat-only boiler (HOB) and CHP supplied systems: (i) demand driven ready systems across the heating chain; (ii) establishing a metering regime across the heating chain (at boiler plants and substations); and (iii) piloting technical approaches in network design through use of about 150 building level substations and in metering through use of building level meters. For all heating subprojects the component will also (i) work with new, existing, restructured and merged companies in line with central and provincial government initiatives to consolidate the fragmented heating supply sector and strengthen utility management; and (ii) reduce energy waste by replacing small distributed HOB systems with more efficient centralized heating systems. The combination of these features will greatly enhance the ability of the participating utilities to implement downstream reforms, including consumption based billing.

20. **Component 2: Urban Gas Infrastructure (US\$11 million equivalent; IBRD US\$4.1 million).** This component comprises (a) rehabilitation of gas transmission facilities; (b) rehabilitation and capacity expansion of gas storage equipment involving rehabilitation of the existing 20,000 and 50,000 m³ capacity storage tanks and provision of a new 50,000 m³ storage

tank; and (c) rehabilitation and capacity expansion of gas distribution network including the upgrading of facilities for pressure/flow control, corrosion control, supervisory control and data acquisition (SCADA), and emergency response arrangements. The scope and investment for (b) have been defined following the integrity and safety assessment of the existing 20,000 and 50,000 m³ storage tanks by a certified entity, which concluded that the tanks could be used safely after the recommended rehabilitation works. The scope for (a) and (c) will be firmed up after the completion of the ongoing feasibility and system integrity studies.

21. Component 3: Institutional Development (US\$1.22 million equivalent; IBRD US\$1.22 million). The component includes: (a) project management, bid documents preparation, and design review and advisory consultancy services for the FFUPO and heating and gas utilities, including follow-up on training in operation and maintenance (O&M) and pilot project assessments for the heating utilities; and (b) a study of safety and security measures of Yingkou Gas Company.

4. Lessons learned and reflected in the project design

22. The proposed project design takes lessons learned from several Bank / GEF projects in Europe and Central Asia (ECA)¹ and energy efficiency and gas projects in China (see Annex 2).

- Operators require experience with demand driven heating systems, which sets a foundation for downstream reform. Enabling consumers to control the quantity and quality of heat and to pay according to their consumption needs to be addressed from the beginning of heat reform, but presents a major operations challenge to standard Chinese heating supply designs. Increasingly Chinese systems operate in demand driven mode on the primary side of the network between the heating source and the group substation. This project lays the foundation for introducing consumer control devices that are needed to complete the full shift to demand driven operation by enabling variable flow operation in both the primary and secondary side (pipelines supplying the buildings from the heat exchanger with district heating hot water).
- Integrating modern design concepts in district heating requires a step-by-step approach to build knowledge among designers and heating supply companies and piloting technical approaches provides high value added in China. The Bank team used Energy Sector Management Assistance Programme (ESMAP) financing to provide intensive reviews of feasibility study approaches prepared by local design institutes. This helped to facilitate dialogue and understanding of new concepts and approaches. The LMC-3 project includes metering of the entire network at the heat source, at each substation, and on a pilot basis at each building in another 9 group substation areas. The project design also includes 9 pilots to demonstrate energy savings and heating quality benefits of building level substations, a technical

¹ Belarus (*Social Sector Energy Efficiency Project*, 2001), Bulgaria (*District Heating Project*, IBRD 2003), Latvia (*Jelgava District Heating Project*, 2000) Lithuania (*Energy Efficiency/Housing Pilot Project* 1996 and *Vilnius District Heating Project* GEF 2003), Poland (*Podhale Geothermal District Heating and Environment Project*, GEF/IBRD 2000, *Krakov Energy Efficiency Project*, 2001, also, district heating projects in Gdansk, Gdynia, Katowice, Krakow and Warsaw), Romania (*Energy Efficiency Project*, 2002), Russia (*Municipal Heating*, 2000) and Serbia and Montenegro (*Serbia Energy Efficiency Project, negotiations*, early 2004), Ukraine (*Kiev District Heating Improvement*, 1998)

innovation used widely in European systems. Monitoring of metering data will provide critical inputs to designing new meter-based tariffs. Actual heat load data will also provide critical inputs to future heating design standards and to measuring energy efficiency benefits of demand-driven operation.

- Difficulties with implementation in other district heating projects have often come from implementation capacity of the borrowers. The project design includes technical assistance in construction supervision and institutional development targeted at district heating companies.
- Pre-investment studies of the condition of gas infrastructure and its operation are necessary to determine the scope of its rehabilitation and capacity expansion to ensure safe and efficient gas supply. Also, depending on the findings of the studies, expert assistance in the implementation of recommended action should be provided.

5. Alternatives considered and reasons for rejection

23. **Program Options.** A number of alternatives were reviewed with Liaoning Province and the central Government [Ministry of Finance (MOF) and National Development and Reform Commission (NDRC)] to determine the optimal packaging for the urban infrastructure investments proposed in the Liaoning Medium Cities Infrastructure Program. The Adaptable Program Loan] (APL) approach (with three stages) was discarded because of the difficulty in defining appropriate triggers to move to the second and third projects in the context of multi-sector and multi-city projects. The design of three multi-city projects, each handling multiple sectors, was not considered feasible because of the long lead time required for preparing a comprehensive first project with an appropriate set of investments and corresponding sectoral reforms in multiple sectors. It was thus agreed with the central Government to pursue three separate sectoral projects. LMC3 is the third of these three projects.

C. IMPLEMENTATION

1. Partnership arrangements (if applicable)

24. The Bank has led an international program to provide timely assistance for the implementation of the Government's heat reform and building energy efficiency agendas. The Asia Sustainable and Alternative Energy Program (ASTAE) financed a China Heating Supply Design Workshop in Huludao, Liaoning Province, in July 2005, which introduced basic concepts behind costs and benefits of upgrading central heating systems from production driven (constant flow) to demand driven (variable flow) mode to potential project cities. ESMAP provided pre-investment knowledge building through reviews of feasibility studies from the beginning of preparation in 2006 and a technical workshop on building level substations in February 2007. A cornerstone of the Bank's Program is an ongoing Heat Reform and Building Energy Efficiency (HRBEE) Project, financed by an \$18 million grant from the GEF and implemented by the MOC. The HRBEE Project provides technical assistance and limited investment support to cities which are committed to implementing consumption based billing and enforcing stricter building energy efficiency standards. The GEF supports investment

projects that demonstrate the combined effects of heating system innovation, building energy efficiency, consumer controls and consumption based billing. The LMC3 cities could be eligible for HRBEE support should they demonstrate a commitment to accelerating the implementation of heating reforms and meeting HRBEE project criteria.

2. Institutional and implementation arrangements

25. As for the other LMC projects, a Liaoning Provincial Coordinating Group (LPCG), chaired by a Vice Governor of Liaoning, will provide high-level guidance to the LMC3, and coordinate on policy and institutional issues related to the project. The Liaoning Foreign Fund Utilization Project Office (FFUPO), established under the Liaoning Provincial Development and Reform Commission (LDRC) will provide overall project management. The Liaoning Province Department of Finance (LPDF) is responsible for integrated management of the Project, including providing guidance to the FFUPO and the project cities, and managing the project designated account (DA). The LDRC is responsible for providing overall infrastructure planning management in Liaoning, and developing policies that will promote economic reform and development.

26. The LMC3 subprojects will be implemented (with one exception in Dashiqiao) and operated by heating and gas utilities. The LMC3 cities have introduced various institutional arrangements to consolidate the sector. The implementation arrangements will involve nine heating and one gas company (Yingkou Gas Company, a SOE): four new heating companies (Gongchangling: private company, Haicheng: new subsidiary of the Urban Construction and Investment Company; Huludao Yangjiazhangzi, and Yingkou EDZ: new municipal SOEs); a restructured company (Benxi Phase II: a private company); two subsidiaries of large SOEs (Benxi Steel and Nanfen subprojects: state owned iron and steel parent company subsidiary; Fushun: state owned thermal power company subsidiary); and one existing municipal SOE (Yingkou General Heating Company). Yingkou Dashiqiao municipality will implement its subproject through the Dashiqiao Urban Construction and Investment Company (DUCIC), which will pass on operation of project assets to private operator under a lease agreement. Detailed project responsibilities and implementation arrangements are given in Annex 6.

27. **Construction Supervision.** The project includes two layers of construction supervision: general project supervision across all cities, and local supervision for individual cities. General project supervision will be provided by a consulting firm selected on the basis of international competition. Local supervision will be carried out by local consultants who will perform periodic on-site supervision and provide construction supervision reports.

28. **Fund Flow.** The Bank loan to the People's Republic of China will be on-lent to Liaoning Province, which will in turn on-lend funds to the participating municipalities. The participating municipalities will on-lend the funds to the participating companies. The DA will be established and managed by LPDF.

29. **Disbursement.** The borrowing entities will submit the withdrawal applications and related supporting documents for civil works and equipment to the Municipal Financial Bureaus (MFB) for checking, who will forward the above documents to LPDF. LPDF will send a copy to

FFUPO. LPDF will release funds from the project DA to the contractors or to the MFBs, to enable them to make payments to the contractors. Consultants will submit withdrawal applications and related supporting documents to FFUPO, who will review and confirm with municipal PMO, if applicable, and municipal financial bureau, then forward the above documents to LPDF for checking and payment to the consultant.

3. Monitoring and evaluation of outcomes/results

30. Annex 3 lists the main outcome indicators for the project, as well as the principle results indicators for each component. FFUPO and the Project Implementation Units (PIUs) will prepare semi-annual reports reviewing project progress and take corrective action as necessary. Each utility will also provide annual reports on their compliance with performance indicators and covenants. Each company will also be required to develop and report on their business development plans.

4. Sustainability

31. The project assets are expected to be constructed to high quality standards. Detail designs and construction implementation will be closely supervised and reinforced through provision of third party review. The proposed Project will move participating LMC3 centralized heating and gas sectors toward sustainability by (a) addressing major energy efficiency and environmental penalties associated with use of small, distributed coal fired boilers in city centers, improving cost effectiveness of supply and taking advantage of economies of scale through increased coverage of centralized heating, and reducing growth in winter air pollution driven by new demand; and (b) supporting priority investments that will strengthen the integrity of the gas supply infrastructure and safety of its operation.

32. Long term sustainability will depend on effective operation and maintenance (O&M) of heating subproject assets. A fundamental issue remains on the use of normative heat load estimates from the older system design standards to drive investment and O&M cost estimates. The LMC3 will introduce SCADA systems which will collect metered data that, if properly used, could start to build more robust heat load estimates, optimize heating supply operation, and help to prioritize O&M budgets. It will also provide, through the pilot projects, real energy consumption data, which is an important input to developing meter-based tariffs. Although improved efficiency can help lower costs, the reluctance of municipalities to adjust tariffs to offset rising input costs in the past has led to the need for restructuring of balance sheets, as seen in some LMC3 cities. If input costs increases cannot be properly passed on to consumers, this may impact upon long term sustainability of the sector. A Central Government guideline supports adjustments to heating tariffs if coal prices rise more than 10 percent, but this has been unevenly implemented across northern China so far. The LMC3 includes financial covenants and operating performance indicators which will maintain focus on these issues and, more importantly, retain an open dialogue during supervision on greater cost effective operation, commercialization and downstream heating reform issues.

33. For gas, a key factor for long term sustainability is the assurance of supply for gas. A five year gas supply contract signed on December 2006 between Liaohe Oil Field and Yingkou

Gas Company for gas delivery during 2007-2011, though falling short of international practices, is considered a major achievement compared with prevailing Chinese contractual arrangements in the energy sector.

5. Critical risks and possible controversial aspects

34. The overall project risk rating is considered moderate. There are no major controversial aspects associated with the project.

Potential Risks to Project Objectives	Proposed Mitigation Measures	Risk Rating with Mitigation Measures
Slower implementation due to major coordination effort needed among 11 subprojects	<ul style="list-style-type: none"> ➤ Well defined procurement and implementation plans. ➤ Design, Review and Advisory Services consultant will strengthen technical design, construction supervision quality and project management ➤ Provision of technical assistance to support project management ➤ Strong Bank supervision 	S
Reluctance of municipalities to adjust tariffs to meet input costs	<ul style="list-style-type: none"> ➤ Annual reviews of financial performance of companies during supervision 	S
Shortage of Counterpart Funding	<ul style="list-style-type: none"> ➤ Require city governments to demonstrate annual budgeting and availability of counterpart funds. 	M

Note: High Risk-H, Substantial Risk-S, Modest Risk-M, Low or Negligible Risk-N

6. Loan/credit conditions and covenants

35. There are no project-specific effectiveness conditions. In addition to standard covenants on project management, environmental management and resettlement, the following project specific covenants are included in the legal agreement:

- Disbursement Conditions:
 - *Utility Subsidiary Loan Agreements:* For all subprojects, the municipal government must enter into a subsidiary loan agreement (SLA) acceptable to the Bank with the respective utility company (including Yingkou Dashiqiao UCIC)
 - *Update to the feasibility study submitted by Yingkou Gas Company, satisfactory to the Bank.* The Yingkou Gas subproject feasibility study needs to be updated to reflect the findings of an ongoing evaluation of the integrity and safety of the system. It is planned to maintain the current subproject scope but adjust it, if necessary, after the update is completed.

- *Long term heating supply contracts shall be executed by Yingkou Heating Company, Yingkou EDZ Huayuan Heating Company Ltd., Benxi Steel (Group) Heating Development Company, Ltd. and the Fushun Thermal Power Plant Company (FTPPC).*
- *Staffing plan for Benxi Hengze Heating Development Company, Ltd. shall provide the Bank a staffing plan for operation and maintenance of the project assets.*
- **General Covenants:**
 - *Financial Covenants (applicable to all companies except Yingkou Dashiqiao UCIC): Debt Service Coverage Ratio (DSCR): companies cannot incur additional debt unless the debt service coverage ratio is above 1.3; Cash breakeven (CBE): Each company (except Dashiqiao) shall for each Fiscal Year, starting with the Fiscal Year 2009, undertake to produce total collected revenues equivalent to not less than the sum of its total operating expenses and the amount by which debt service requirements exceeds the provision for depreciation; Profit-break even, starting from year 2012: Each company to generate each year total revenues not less than its total expenses for the year; Accounting and Auditing: Each company to maintain accounts adequate to reflect, in accordance with sound accounting practices, its operations and financial condition and its financial statements be audited;*
 - *Financial Covenants applicable to Yingkou Dashiqiao UCIC: DSCR as above.*
 - *Dashiqiao Urban Construction and Investment Company shall execute a lease agreement for operation and maintenance of subproject assets.*
 - *Municipalities will take all necessary measures to enable the project company to meet its financial requirements under the SLA, including without limitation, adjustments to levels of heat and gas tariffs.*
- **Implementation Covenants:**
 - *A Project Coordination Group shall be established at the provincial level, chaired by a Vice Governor of Liaoning*
 - *The Foreign Funds Utilization Project Office is to be responsible for day-to-day implementation;*
 - *Project Management Offices established by Benxi, Yingkou, Liaoyang and Fushun municipalities will be responsible for day-to-day management of implementation within their respective jurisdictions.*

D. APPRAISAL SUMMARY

1. Economic and financial analyses

Economic Analysis

36. **Heating Subprojects.** An economic analysis was conducted for each investment subproject. The analyses find that the sub-projects represent the least cost technically feasible

alternative to supplying space heating in selected areas, and that they are economically viable, taking into account local environmental benefits.

37. Least Cost Analysis. To optimize the technical design of all heating supply subprojects, a lifecycle cost comparison of different heating supply options was conducted. The total heating supply area of the LMC3 subprojects comprises existing area (52% of total area), which is currently served by existing small heating-only-boilers (HoBs), and new construction (48% of total area). The following options were compared:

- Option 1: to purchase heat from CHP (if available) to meet both existing and new area;
- Option 2: to purchase heat from CHP (if available) to meet demand from the new area only and maintain small boilers to supply the existing area;
- Option 3: to build large HoBs to meet both existing and new area; and
- Option 4: to build large HoBs to meet demand from the new area only and maintain small boilers to supply the existing area.

38. The comparison of net present values (NPVs) of each option shows that when CHP is available, the heat purchased from CHP to meet both existing and new expansion area will be the least cost option; when CHP is not available, the use of large HoBs to meet both existing and new demand will be the least cost option. These findings are reflected in project design.

39. Cost Benefit Analysis. A cost-benefit analysis was conducted to estimate the economic internal rate of return (EIRR) of each investment subproject. The economic costs include total investment costs of heating plants, substations and pipelines, fuel or heat purchase costs, and other O&M costs. The major benefits considered in the analysis are (i) cost saving due to improved heating supply efficiency for existing area due to discontinued use of the inefficient small boilers, (ii) additional heating supply services for new demand, which is quantified using consumers' tariff as a proxy of willingness-to-pay, and (iii) local environmental benefits due to improved environmental performance. The EIRR of each subproject was estimated after the costs and benefits were identified.

40. Based on conservative assumptions for heat demand growth, the analyses showed that the EIRRs of each heating subproject range 13 - 36 percent.

41. **Gas Subproject.** A cost-benefit analysis was also conducted for the Yingkou gas subproject. Cost included the capital cost, gas purchase cost, and other O&M cost. Benefits included (i) cost saving to serve the existing consumers due to losses reduction after the rehabilitation, and (ii) incremental gas supply to new consumers, which is quantified as the avoided fuel cost (electricity and LPG). The derived EIRR is 18.2 percent.

Financial Analysis

42. Two separate financial analyses were carried out: (i) at the project level, to estimate the financial internal rate of return (FIRR) for the investments made under each subproject; and (ii) at the entity level, to assess their financial structure, efficiency and viability. The analyses included projections of the tariff levels that would be required for the entities to meet their

financial obligations in regards to ensuring efficient operations, contributing the local counterpart financing required for the subprojects, and providing for debt service. Analyses were also carried out on the impact of the obligations and contingencies arising from the subprojects on the debt levels of each participating municipality.

43. **Project Level Financial Analysis.** The financial analyses of each investment subproject are based on the feasibility study reports approved by Liaoning Provincial Government and the project entities' historical financial accounts, and their latest financial projections. The FIRR for each investment subproject were calculated based on comparison between the project financial cost and financial income. Estimates of the FIRR for each investment subproject range from 6 –23 percent.

- For heating subprojects, the project financial cost includes the capital cost, fuel/heat purchase cost, and other O&M costs. The project income includes (i) cost saving of existing heating area if it was supplied by the project entities, (ii) heating sales income for expanded area which was quantified using the forecast consumer heating tariff over the analytical period, (iii) connection fees, and (iv) carbon credits. A carbon financing workshop was held for interested companies during appraisal.
- For Yingkou gas subproject, the project financial cost include the capital cost, gas purchase cost, and other O&M cost; the project financial income includes (i) cost saving to serve the existing gas consumers, and (ii) incremental gas sales to new consumers.

44. **Financial Sustainability.** Historically, the financial performance of the district heating (DH) companies has been affected by (i) reluctance of their owner municipalities, on social considerations, to allow timely increases in tariffs in line with increasing costs of coal and other inputs; (ii) difficulties in collecting bills fully from customers; and (iii) inability to achieve significant reductions in operating and maintenance expenses given old and inefficient facilities and equipment and lacking funds to replace them. Municipalities have increasingly realized that the situation is not sustainable unless addressed. Thus, the municipalities participating under the project have taken different measures towards strengthening their DH companies to improve their performance. These include: (i) in one case, restructuring of the existing company and setting up of new company, with clean balance sheets free of legacy debt, accumulated losses and non-performing assets, to take over and operate the assets on commercial principles; (ii) in one company, the municipality has introduced a concession-type agreement; (iii) in four cases, the municipalities have established completely new DH companies, of which three are wholly owned by the municipalities and the other one is a private company; and (iv) in one case, the company remains in its original form. The two remaining DH companies are a SOE and a subsidiary of an SOE which has provided assurances of its support for the subsidiaries to implement the project successfully. In addition, the project includes a municipal gas transmission and distribution company.

45. While the municipalities continue to be sensitive to the social considerations of tariff increases, taking into account that district heating is one among several utility services that impact on household budgets, they are now more open to making periodic increases to help the utilities to achieve and maintain efficient operations. Regulations being introduced at the

national level would also permit indexing of tariff increases to increases in coal costs. Collection performance has improved significantly with progressive changes in apartment-level connections which have increasingly enabled the companies to turn off supply to delinquent customers.

46. Financial projections, based on conservative assumptions, indicate that all the participating companies should be able to (i) meet their financial obligations during the construction and operations phases of the project, including debt service, and, in addition, (ii) achieve and maintain profitable operations each year, not later than 2012 (the end of the implementation period). Most companies are projected to achieve profitable operations by 2010, and the remaining companies by 2012. Needed tariff increases are projected to be modest and mostly towards the latter part of the implementation period, provided that (i) the companies continue with their efforts to improve collection performance; and (ii) the local counterpart funds for the project, including in some cases equity contributions from the municipalities and contracting of loans from local banks, are provided in a timely manner and in the required amounts. Covenants are included under the Loan Agreement (para. 35 above) to reinforce these requirements.

2. Technical

47. All investment components and feasibility studies have been prepared by Liaoning-based design institutes. The Bank mobilized a multi-donor ESMAP trust fund activity that funded through the reviews of the feasibility studies the transfer of knowledge on evaluation of investment options in central heating. This also served as a platform to discuss introduction of modern design concepts. Project designs are technically sound, represent the most appropriate cost-effective alternative, and are based on sound engineering practice.

48. The project will improve the performance and sustainability of heating and gas infrastructure. In the heating side, in particular, 547 small and heavily polluting boilers in 317 plants will be replaced with centralized heating systems, and the customers, the existing ones as well as those to come in the next few years, will be connected by means of underground pipelines and substations to either the existing waste heat sources or to the new large boiler plants both equipped with high chimneys and appropriate flue gas cleaning facilities.

49. All substations will comprise heat metering, temperature controller and frequency controlled heating circulation pumps. In addition, the group substations (heat exchangers serving several buildings) will comprise water softener and side flow filter, whereas measured tapping of primary network water will be used as make-up water of the secondary side of most of the building level substations. The technologies employed in group substations are known in China. In nine cases, pilot projects will be organized to have one group substation replaced by a number of building level substations. Some estimates indicate the life-cycle costs of the building level substations are lower, but the data and experience does not currently exist to make a final determination. The pilot projects will help to collect experience of the expected benefits associated with bringing substations closer to the consumer: (i) improved hydraulic balance in the network necessary to provide sufficient heating within each building; and (ii) the degree of additional energy savings from reduced pumping and fuel costs. Annex 4 provides more detail.

50. Pre-insulated steel pipes, using polyurethane foam insulation and polyethylene jacket pipes will be used for all network investments and will be constructed mainly underground. These pipe technologies are impervious to external corrosion and with appropriate internal water quality, to internal corrosion. Together with water quality control equipment, the expected lifetime range of the pre-insulated pipelines can reach 30–50 years from the lifetime of 10–20 years with the current pipelines.

51. The boiler plants will comprise chain-grate boilers or fluidized bed boilers depending on the quality of coal. The boilers will be equipped with wet flue gas scrubbers that are expected to reduce SO₂ and fly ash emissions more than 80% and 99.7%, respectively. More advanced flue gas cleaning systems would be not cost effective given the size of the boilers. The CHP plants of Fushun and Yingkou are already or are expected to be equipped with electric precipitators that collect 99.7% of the fly ash from the flue gases. The chimneys of the new boiler and CHP plants are typically 100 meters tall or even higher compared to the low chimneys of the small boiler plants ranging from 10 to 30 meters only, and with poor flue gas cleaning with simple cyclones for TSP removal.

52. The rehabilitation planning of existing gas storage tanks is based on the integrity and safety assessment conducted by the Liaoning Academy of Safety Sciences, an entity certified by the National Safety and Security Bureau. The scope and planning of rehabilitation and capacity expansion of gas transmission and distribution infrastructure will be determined by the feasibility and safety studies to be undertaken, on already agreed terms of reference, by competent Chinese entities with the highest level certification from appropriate national and local government agencies, demonstrated experience in similar studies, including at least three similar studies in China. Also, based on the findings of the studies, expert assistance in the implementation of recommended actions would be provided by a competent organization in China having certification and experience as mentioned above.

3. Fiduciary

53. **Financial Management.** The adequacy of the project financial management system was assessed based on guidelines issued by the Financial Management Sector Board on November 3, 2005. The assessment concluded that the project meets minimum Bank financial management requirements as stipulated in OP/BP 10.02. The project will have in place an adequate project financial management system that can provide, with reasonable assurance, accurate and timely information on the status of the project in the reporting format agreed with the Bank (see Annex 7).

54. **Procurement.** The procurement capacity assessment concluded that the procurement risk is moderate. There will be a need to further enhance the procurement capacity of FFUPO and the PIUs, through training, advisory support from the Bank office in Beijing and guidance from supervision missions. The main risk is that most PIUs do not have experience with World Bank projects. The loan will finance consulting service contracts for technical design review and project management support including procurement management. With counterpart funds, FFUPO will employ an experienced procurement agent for the project. All procurement will be

conducted at the provincial level. These measures can mitigate the identified risks. For further details on procurement (see Annex 8).

4. Social

55. **Social Benefits:** The Bank carried out a consumer survey on the impacts of early heating reforms in Liaoning Province as part of an ASTAE funded research activity. The survey validated that households were more satisfied with well functioning central heating systems than with small boilers in terms of heating reliability, quality and environmental performance. Most households confirmed they received some form of heating subsidies (mainly from employers), but levels varied across cities, reporting out-of-pocket payments of between 30% (Benxi) and above 90% (Haicheng and Yingkou) of the total heating bill. Out of pocket heating payments constitute between 10.0% of total income for the poorest quintile and 2.4% for the richest, while total unsubsidized heating bills are estimated to be between 23% and 4% of total income, respectively. Thus, the project should have a positive long term benefit by improving the cost effectiveness of heating systems in the project areas in particular for poorer households, who shoulder a significant heating bill every winter.

56. **Involuntary Resettlement and Land Acquisition.** Resettlement Action Plans (RAPs) were prepared for the different components in accordance with local laws and regulations and the World Bank OP 4.12 on Involuntary Resettlement. Efforts have been made to minimize the resettlement impacts during project planning and design. The resettlement impacts have been significantly reduced in some subprojects through comparison of alternative designs. Among eleven subprojects, only five involve resettlement and the impacts are limited. The project will affect 956 persons from 308 households by permanent land acquisition, temporary land use and housing demolishing. Haicheng, Benxi Nanfen District, Yingkou Dashiqiao, Benxi Central Heating and Yangjiazhangzi subprojects will involve land acquisition for boiler plants. The RAPs describe in detail the impacts, affected populations, consultation process, rehabilitation measures, budget and implementation and monitoring arrangements. The individual RAPs were prepared in Chinese by the respective design institutes, assisted by the respective project management offices (PMOs), house demolition offices, land resources bureaus, affected villages and communities and potential displaced persons. The other subprojects will construct boiler plants on acquired state-owned and unused land based on their current design. To address any resettlement impacts caused by project design changes during implementation, a resettlement policy framework is in place.

57. A social assessment was carried out to investigate the impact of the Liaoning Provincial Government's official policy of gradually closing down boilers in the subproject areas. In the boiler closure program about 5,574 workers will be affected, of which 67% are a seasonal workforce. The findings of the social assessment were shared with each municipal government. The municipal governments are developing policies which plan to: (a) give affected workers preferential treatment for employment in companies managing central heating systems or in other municipal enterprises; (b) make available opportunities for vocational training; (c) provide reasonable compensation for these worn out, polluting assets.

58. Social screening was carried out in order to identify if there are any ethnic minority community to be affected by the project. The screening process was carried out by reviewing the census data at provincial level and municipal level, interviewing with the official from Ethnic Minority Bureaus at provincial and municipal levels. A total of 200,700 scattered, minority individuals were identified in the subproject areas, accounting for 6.8 percent of the subproject area population of 2.9 million. The assessment did not substantively identify characteristics defined in paragraph 4 of OP 4.10 that would trigger the Bank's Policy on Indigenous People.

5. Environment

59. In accordance with World Bank's OP 4.01 Environmental Assessment (EA) policy, the project was assigned "Category B" reflecting the limited extent and duration of any adverse environmental impacts associated with the construction and operation phases in each of the eleven sub-projects. Chinese language Environmental Management Plans (EMPs) were prepared and disclosed in-country on September 19, 2007. Chinese EA requirements varied by sub-project. A full Environmental Impact Assessment (EIA) report was required for 6 subprojects and an EIA Report in Table Form was required for 5 subprojects. According to Chinese regulations, the nature of EA documentation is determined based on the scale of the investment and potential environmental impacts identified through screening. Chinese language EIA Reports and EIA Reports in Table Form were reviewed by Bank Beijing staff to assure consistency in terms of the technical specifications, environmental issues and mitigating measures with the Chinese language EMPs, and the English language EA Comprehensive Summary and translated EMPs. Furthermore, in order to meet World Bank overall disclosure requirements, an English language EA Comprehensive Summary was prepared and a draft submitted to the InfoShop on September 19, 2007. Major findings of the EIA reports and key points on EMPs are presented in Annex 10.

60. **Environmental Benefits:** The project will contribute to the overall reduction in atmospheric emissions of coal combustion products from the residential heating system, namely dust and SO₂, per square meter of connected floor area by replacing small inefficient heat-only boilers with larger more highly efficient boilers utilizing more effective control systems for removal of these pollutants from the flue gases. In order to meet the national air quality requirement and emission standards, emission control technology proposed for the new boilers is to install the bag-filter house for dust collection and the FGD system for SO₂ reduction where chain grate boilers are used. Expected efficiency is 99.7% for TSP and 90% for SO₂. In the Benxi Phase II Caitun case, the fluidized bed boilers will be installed due to the low quality of coal, with an expected efficiency of 99.7% for TSP and 80% for SO₂. According to the EIA reports, total 317 scattered small boilers will be closed down under all project cities and closing down small boilers under all project cities would contribute to an estimated annual reduction of 8934.98 tons sulfur dioxide and 11659.09 tons TSP. It is expected that after project, the incidence of respiratory diseases in all project cities in heating season should be reduced.

61. **Key Impacts and Mitigation Measures during Construction and Operations:** The main environmental issues associated with construction of boilers, heat exchange stations (group substations), hot water and gas pipelines are dust, noise, disposal of solid waste (primarily packing materials), interruption of traffic and chance find items of cultural significance.

Mitigation and monitoring measures are addressed in the EMPs. During operation, the main environmental issues associated with the boilers are emissions of dust and SO₂, wastewater (domestic and industrial), dust associated with transport and storage of coal, ash, limestone, and spent sorbent, and management of solid waste products produced (ash and spent sorbent from FGD operations). New Chinese regulations require new boiler installations to include continuous emission monitoring for dust and SO₂ and this is included in the project. For both hot water and gas pipelines and heat exchange stations, the main issues are domestic wastewater and domestic waste produced by operating personnel. Additionally, noise from pumps is an issue during the operation of heat exchange stations. Detailed mitigation measures have been proposed in the EMPs which are summarized in Annex 10.

62. **Public Consultations and Information Disclosure:** For all sub-projects at least one public consultation was conducted, as required by World Bank EA policy. However, public consultation for sub-projects requiring a full EIA Report has been conducted twice, exceeding World Bank EA requirements for Category B projects. Chinese language versions of the EMPs were disclosed publicly prior to appraisal. A table summarizing the Chinese EA documentation requirements, public consultation and disclosure characteristics for each of the subprojects is presented in Annex 10.

63. For each sub-project the institutional capacity for implementing the EMP was evaluated. Training needs were identified for the implementing agencies and contractors. These, as well as the costs, have been included both the EMPs and in the EA Comprehensive Summary. All environmental documentation is available in the project file.

6. Safeguard Policies

Safeguard Policies Triggered by the Project	Yes	No
<u>Environmental Assessment (OP/BP 4.01)</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Natural Habitats (<u>OP/BP 4.04</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pest Management (<u>OP 4.09</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Physical Cultural Resources (<u>OP/BP 4.11</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Involuntary Resettlement (<u>OP/BP 4.12</u>)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Indigenous Peoples (<u>OP/BP 4.10</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Forests (<u>OP/BP 4.36</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Safety of Dams (<u>OP/BP 4.37</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects in Disputed Areas (<u>OP/BP 7.60</u>)*	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects on International Waterways (<u>OP/BP 7.50</u>)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

7. Policy Exceptions and Readiness

64. Bank experience over the years has established the general practice of requesting the Borrower to provide the Bank also with the entire RAP and EA reports in English. As an exception to this general practice, in April 2007 Bank senior management endorsed “Guidelines for the use of English Translation of Summaries of Environmental Assessment Reports and

* By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas

Resettlement Action Plans in China Projects” which allows the creation of English language comprehensive summaries of RAPs and EA reports for projects that meet certain criteria. The Regional Safeguards Secretariat has confirmed that the proposed project meets the criteria. Accordingly, English language comprehensive summaries of the RAPs and EA reports covering all relevant parts of the Chinese-language EA reports and RAPs were prepared. Chinese-speaking Bank safeguard specialists have reviewed both the English language comprehensive summaries of the RAPs and EA reports and have confirmed the consistency between the English and Chinese documentation, and compliance of the full set of safeguards documents with Bank policy. The Chinese language full-length safeguard documentation has been approved and adopted by the Project Implementing Agencies.

65. The Safeguard Policy on Resettlement, OP 4.12 and the Safeguard Policy on Environmental Assessment, OP 4.01, require the Borrower to prepare RAPs and EA reports in a form, manner, and language that are understandable to the displaced persons and local NGOs, which in this case would be Chinese. The Chinese language RAPs and EA reports for the subprojects have been reviewed by the Bank, meet the requirements of OP 4.12 on involuntary resettlement and OP 4.01 on environmental assessment, and have been publicly disclosed. An English language comprehensive summary of the RAPs and an English language comprehensive summary of the EA reports have also been prepared, reviewed and disclosed through the Bank's InfoShop.

Annex 1: Country and Sector or Program Background
CHINA: Liaoning Third Medium Cities Infrastructure Project

1. **General Economic Context:** The economy of Northeastern China is largely dependent on its oil and mineral reserves and the associated heavy industry developed through state investments in the 1950's. During the recent transition to a market economy, many of Liaoning's SOEs have struggled, resulting in high levels of urban unemployment from SOE layoffs and closures, and urban fiscal pressures due to the SOE subsidy burden and welfare payments. Recognizing the potential of the region and the challenges it faces, the central government, led by the State Council in conjunction with provincial governments, launched an ambitious program in 2003 to revitalize Northeast China. The program includes initiatives to stimulate economic development including partially restructuring SOEs, supporting "pillar" industries and providing social support for displaced workers. It also includes an ambitious program for infrastructure investments including those needed to deliver urban services.

2. The medium-sized cities in Liaoning are especially vulnerable during this transition period. Many of the cities are reliant on large, inefficient SOEs focusing on single industries, and in general growth in these cities has been lower than the major cities in the province. Urban infrastructure funding for the medium-sized cities of Liaoning, on a per-capita basis, is generally half that of Shenyang and Dalian and the accumulated under-investment and lack of maintenance of urban infrastructure has resulted in a serious deterioration of the asset base and a neglect of basic urban services.

3. This project will support urban heating and gas rehabilitation, construction and service delivery and is part of trio of urban infrastructure projects planned for medium-sized cities in Liaoning Province. The other projects focus on transport (LMC-1) and urban water, wastewater and solid waste (LMC-2) infrastructure. Liaoning covers a total area of 145,900 km² and has a total population of about 42 million. The urban populations of the participating municipalities of LMC-3 are provided in the table below.

City Name	Administrative Level	Urban Population
Fushun	City	1,415,000
Benxi	City	1,047,000
Yingkou	City	701,000
Haicheng	County-Level City under Anshan Municipality	320,000
Yingkou EDZ	Special Urban Area under Yingkou Municipality	335,000
Yingkou Dashiqiao	County-Level City under Yingkou Municipality	266,360
Liaoyang Gongchangling	County-Level City under Liaoyang Municipality	65,300
Huludao Yangjiazhangzi	Special Urban Area under Huludao Municipality	53,500
	Total	4,203,160

4. **Increasing Demand for Heating Services.** China is experiencing the greatest wave of urbanization in history. The urban population has increased from 300 million in 1990, to around 600 million in 2005, and is expected to grow to as much as 900 million by 2020. Driven by urbanization and a construction boom, the urban residential building stock in northern China is expected to grow from 4 billion m² to 10 billion m² in 2024. Liaoning follows this trend. Liaoning's building stock has grown an annual average of 12 percent between 2000–2004 and is expected to grow about 10 percent (residential) and 7 percent (commercial) annually for the next five years. Liaoning is rapidly expanding its centralized heating network to meet demand. In 2003 centralized heating covered 297 million m², representing about fifty percent of total urban heating area, and grew to a reported 476 million m², or about 70 percent of total area. A reported 255 petajoules of heat energy (through supply of district heating hot water) were supplied through 14,000 km of pipelines in 2005, and has in the past five years comprised about 15 - 16 percent of total heating energy supplied in China. It is estimated that about three-fourths of the centralized heating was supplied by large heat-only boiler (HOB) houses and about a fourth by Combined Heat and Power (CHP) Plants and industrial waste heat in 2003. The rest of the market is supplied by relatively small, scattered polluting boiler houses.

5. **The supply and use of space heating for about 250 million urban citizens in China's northern, cold climate provinces is a local priority, and a national concern.** Heating services nationally used about 200 million tons of raw coal in 2002, representing 10% of total energy use, 15% of total coal use and over 50% of building energy use in China per annum. This is equivalent to emissions of 4 million tons of SO₂ and 400 million tons of CO₂ per year. Due to its major cost advantage, and shortages of alternatives, coal is expected to remain the dominant fuel for heating systems for the foreseeable future. Natural gas use is becoming more common in some areas, but is used mainly for cooking and unlikely to gain a large market share due to its relatively high cost. The current building stock consumes between 50 percent and 100 percent more energy for heating compared to buildings in comparable climates in northern Europe and North America. This is largely due to inefficient production and distribution of heating and the absence of incentives for consumers to save energy. The national government has set an ambitious goal of reducing national energy consumption by 20 percent and efforts in improved heating supply and consumption will help to contribute to this objective.

6. As in most of Chinese cities, in the early stages of urbanization, cities invested in small, coal fired boilers to provide space heating to new urban areas. Over time, larger boilers replaced small boilers – but many still remain. The small boilers operate at a reported 40-60% efficiency (compared to about 75-85% efficiency of large boilers), and use simple, if any, dust or sulfur removal equipment. The impact on human health and city aesthetics with coal dust and slag in residential centers, and smoke stacks emitting black smoke over apartment buildings is highly negative. A recent investment climate study conducted by the Bank found that “livability” concerns had become a significant factor undermining the investment climate in Liaoning's medium cities. These cities and their residents would benefit from investments that support removal of small boilers and upgrading of heating systems to meet existing and new demand. The national government has also set a goal of reducing sulfur dioxide emissions and this project is supporting this objective with the introduction of improved flue-gas desulfurization systems.

7. **Central Heating Supply Sector Reform.** Urban central heating is one of the last vestiges of the welfare state in China. It is not surprising that it is one of the last – reform is technically and institutionally complex, and socially sensitive. In the past state-owned enterprises and government agencies paid the heating bill as a non-wage benefit. Now, a reported 65% of China’s cities have transferred the responsibility to the household, but not without additions to wages to offset new heating expenses and other targeted subsidies. This creation of the invisible subsidy to a visible subsidy, “anbu bian minbu”, raises issues not only with current SOE employees but also pensioners, employees of bankrupt SOEs, low income persons, and government workers. Following individual responsibility of the heating bill is a series of heating sector reforms in billing, pricing, enterprise reform that remain to be implemented.

8. Despite the challenges, urban central heating is transitioning from a welfare-based system to a market-driven one. Reform of urban heating system design, pricing, metering and bill payment systems has been emerging on the national agenda over the past four years. In July 2003, the central government issued instructions to move ahead with implementing heat system reform in pilot cities of China’s 16 northern provinces and autonomous regions, including Liaoning Province. The goals of heat reform are to commodify heating by addressing key sector issues: (1) discontinuing employer payment of heating bill and making households responsible for payment of the heating bill; (2) introducing heat metering and billing based on consumption, promoting consumer control of heating and building energy efficiency; (3) developing safe, clean and demand-responsive heat supply systems; (4) reforming heat pricing; and (5) accelerating reform of heating enterprises, consolidating many small enterprises in cities, introducing competition, and fostering and standardizing the heat market. Far stricter enforcement of the Government’s building energy efficiency standards for all new residential buildings is also an important part of the effort. In December 2005, the government issued a follow-on circular underscoring the need for progress in heat reform, including a call for full implementation of anbu to minbu within two years, but giving local authorities to apply this guidance according to local conditions.

9. **Central Heating Supply Sector Reform in Liaoning Province.** Reforms in Liaoning Province are moving as gradually as they are in the rest of northern China. Consumers in Liaoning are not metered and tariffs are based on a flat per square meter basis, but recent initiatives suggest that Liaoning is picking up the pace of reform. Shenyang, the Provincial Capital, has transferred payment responsibility to consumers and adopted measures to provide heating subsidies to low income households. It has embarked also on the replacement of small heat only boilers with centralized heating systems due to severe winter air pollution concerns. According to Provincial estimates, building internal piping has been retrofitted to vertical piping with an apartment level shut off valve and space for a meter in the staircase in nearly sixty percent of the residential building stock in cities across the Province. Although the quality of the piping retrofit and cost has raised concerns about its disruptiveness to households and its cost-effectiveness, the measure is popular in the local heating industry because it allows for cutting off individual apartments for non- payment, and eventually installation of individual apartment level meters. In addition to Shenyang, Dalian, Tieling and Anshan have implemented anbu bei mingbu. Liaoning’s 10 other major cities have progressed with policy formulation but have not yet implemented them. Liaoning Province issued in July 2007 guidelines mandating heat

metering systems in new real estate developments proposed after August 2007 and set a schedule for installation of metering systems in existing buildings. Municipalities, including LMC3 cities, are promoting consolidation through the discontinuation of small boilers, substituting them with centralized heating supply systems.

10. Space heating services are provided by up to several hundred heating companies in larger cities. The size and capacity of these companies ranges from a one-boiler shop serving a few buildings to a large, central heating company serving millions of square meters. While there is some private sector participation and investment from national state-owned enterprises, currently, most heating SOEs are municipally managed because heating is considered a vital service in cold climate provinces. The quality of financial information varies from company to company because the application of uniform accounting principles is not evenly applied.

11. Based on available information, heating companies have been able to cover operating expenses from revenues, but there have been times when operating subsidies or restructuring have taken place. This was the case in the mid 1990s when economic difficulties hit SOEs that consequently led to poor collection rates for heating companies. A second period started recently in 2003 with a jump in coal prices from an average of RMB 210 / ton in Shenyang to RMB 390 / ton in 2006, without a commensurate rise in heating tariffs. Several municipalities had been providing operating subsidies and are now restructuring and consolidating existing small companies, six of which will be involved in LMC3. Nevertheless, social impacts of heating expenses are a serious concern expressed by all municipalities. Respondents to a Bank consumer survey in Yingkou, Benxi, Fushun, Gongchangling and Haicheng (LMC3 cities) indicated that heating costs represent a significant share of total income, particularly for poorer residents. Unsubsidized costs of heating bills for respondents ranged between 23 and 4 percent of total income, and amount to 10 and 2 percent after current subsidies. Other energy costs amounted to an additional 24 and 5 percent of total income.

12. Heating operators have little experience with sector innovations demanded by reforms. There is little experience with the sector and business innovations needed for implementing reforms, as there has been no experience with incentives for consumers to respond to market based energy costs. Most systems, and nearly all small boiler systems that are pervasive in Liaoning's smaller cities, rely on Soviet-era technology except that only heat, and not domestic hot water, is provided. The performance of these old-style systems depends on the ability of heating operators to distribute sufficient heat by changing water temperature at the heating source while maintaining a constant flow of water in the network. Maintaining a hydraulic balance in the network to meet demand is a constant challenge, especially the longer the network and the greater the number of buildings. Heating levels are often too high or uncomfortably too low, causing people to open and close their windows to maintain comfort. Thus, the old style systems carry major efficiency penalties. Importantly, they are not compatible with consumer control devices, which is a key prerequisite for enabling customers to control their heating and adjust to desired consumption. Modern, demand driven systems which vary water temperature and water flow are able to efficiently match heating supply and demand. By varying water flow, they reduce pumping costs. They also change required pipeline sizes by reducing the required flow of water needed to meet demand, thus reducing investment costs. Conversion to demand-

driven operation in heating transmission is starting to gain acceptance in China, but experience with full demand driven operation remains limited.

13. **Urban Gas Supply.** In Liaoning, gas supply networks first were constructed in the 1920's–1930's. The networks and storage facilities have not been well-maintained, are corroded, leaking and there is a growing source of safety concerns. About half of the different types of gas used in the province are for household use (e.g. cooking, production of domestic hot water). Southern Liaoning uses associated natural gas from the Panjin Oil Field. In the province about 26% of gas users use natural gas. The other main markets are LPG (42%) and coal gas (31%). Liaoning has large potential in coal mine methane / coal bed methane resources. However, it is largely undeveloped due to perceived risks associated with poor financial performance of coal mines.

14. Yingkou Gas Company supplies around 27,000 cubic meters of natural gas per day to about 72,000 households and 350 commercial/ industrial consumers in the urban areas of Yingkou City. All of its gas supplies are received from Liaohe field. Its gas supply infrastructure includes: a 45 kilometer long gas transmission pipeline of 8 inch diameter from Liaohe field to Yingkou City, two gas storage tanks of 50,000 cubic meters and 20,000 cubic meters capacity in the vicinity of Yingkou city, and gas distribution network of various diameters of cast iron and steel pipelines with a cumulative length of about 200 kilometers. This infrastructure is 20-30 years old. It is in a poor state of repair and has been plagued with gas leakages and ruptures. The company has, therefore, sought Bank support for its rehabilitation and upgrading to ensure safe and efficient supply of natural gas to its customers.

15. Although Yingkou Gas Company has been receiving all of its supplies from Liaohe Oil Field for the last 30 years, a formal contract for gas supply was signed December 26, 2006 covering the period 2007–11. The contract is not backed up with any certification and dedication of reserves to assure that adequate quantities would be for the duration of the contract, also it does not include any commitment about the gas specification during the contract period, and the contractual period is short compared to international practice. Still it is a major achievement compared with prevailing Chinese contractual arrangements in the energy sector. The contracted quantities are small compared to the total production of the field and the current production to reserves ratio of the field is 50 years. The government of Liaoning Province is working on securing additional supplies through import of LNG for which a terminal is being planned in Dalian in the vicinity of Shenyang, from where the supply is to be piped to Yingkou Gas Company. Additional supplies from Russia are also being explored by the provincial government.

Annex 2: Major Related Projects Financed by the Bank and/or other Agencies
CHINA: Liaoning Third Medium Cities Infrastructure Project

Sector Issue	Project	Latest Supervision (PSR) Rating (Bank-financed projects only)	
		Implementation Progress	Development Objective
Water Supply in Shenyang, Fuxin, and Yingkou; Urban Transport in Shenyang.	Liaoning Urban Infrastructure Project (Cr. 2219) 1991-1997	Closed	S
Wastewater in Anshan, Benxi, and Dalian; Water supply in Jinzhou; Solid Waste in Dalian; Air Quality in Benxi.	Liaoning Environment Project (CPL-37810) 1995-2001	Closed	S
Wastewater in Yingkou, Panjin, and Jinzhou.	Liao River Basin Project (Ln. 4617) 2002-Ongoing	S	S
Urban Transport in Shenyang, Fushun, and Anshan	Liaoning Urban Transport Project (Ln. 4453) 2000-2006	Closed	S
Urban Transport in Panjin, Jinzhou, Fushun, Benxi, and Liaoyang.	Liaoning Medium Cities Infrastructure Project 1 (Ln. 4831) 2006-Ongoing	S	S
Water in Anshan, Haicheng, Yingkou, Wastewater in Panjin, Yingkou, Gaizhou, Solid waste in Fushun, Yingkou EDZ	Liaoning Medium Cities Infrastructure Project II (Ln. 4864) 2007-Ongoing	S	S
Bank-Financed Projects in China			
Building energy efficiency, heating supply, heat pricing	GEF Heat Reform and Building Energy Efficiency (TF054687-CHA)	S	S
Urban environment, air and water pollution, waste management.	Second Beijing Urban Environment (Ln. 4561)	S	S
Weihai and Yantai district heating components	Shandong Environment Project Ln. 4237	Closed	S
Water supply, wastewater pollution control; and water resource management.	Shandong Environment Project II (Ln. 4852)	S	S

Other International Organizations	Targeted Sector Issues
UNDP	Building energy efficiency
FFEM	Building energy efficiency
GTZ	Building energy efficiency
ADB	Liaoning Urban Environment Project: coal bed methane and central heating

Annex 3: Results Framework and Monitoring
CHINA: Liaoning Third Medium Cities Infrastructure Project

Results Framework

PDO	Project Outcome Indicators	Use of Project Outcome Information
Improve the energy efficiency and environmental performance of heating and gas services in selected areas of participating cities in Liaoning Province.	<ul style="list-style-type: none"> • Reduced TSP and SO₂ emissions per m² connected floor area per boiler plant.* • Reduced fuel and electricity consumption per m² connected floor area* • Reduced make-up water per m² connected floor area* • Reduced gas loss after completion of distribution system rehabilitation. 	Recommend adjustments to heating company management to improve operational efficiency.
Intermediate Results	Results Indicators for Each Component	Use of Results Monitoring
Component 1: Central Heating Infrastructure. Replace small, inefficient, scattered boilers with centralized heating systems	<u>Per subproject, % of planned:</u> <ul style="list-style-type: none"> • m² connected to centralized heating • kilometers of pipelines installed • number of substations installed • number of heat meters installed • capacity of boilers installed • number and capacity of boilers replaced with centralized heating 	Monitor and adjust physical progress of centralized heating supply infrastructure subprojects
Component 2: Urban Gas Infrastructure. Improved reliability of gas supply	<ul style="list-style-type: none"> • % of rehab of existing storage tanks and installation of new tank • % of planned kilometers of transmission pipelines replaced • % of planned kilometers of distribution network replaced • % of planned control stations and valves rehabilitated / replaced • provision of SCADA and upgrading of emergency response arrangements 	Monitor and adjust physical progress of gas supply subproject
Component 3: Institutional Development. Improve management of heating and gas utilities in Liaoning	<ul style="list-style-type: none"> • number of business development plans developed • number of training plans developed 	Provide guidance on organizational development and O&M practices; provide advice on network optimization options.

*Project weighted average.

Arrangements for results monitoring

The monitoring of project outcomes is an integral part of the project and its objectives. Subject to confirmation at appraisal, performance indicators chosen are based on data from heat and water meters, which will be installed as part of subproject inputs, and stack emissions measurements, which will be collected as part of technical assistance inputs. The data collected will also form a basis for inputs to future analysis needed to move to meter-based billing and tariffs. Data collection and reporting will be the responsibility of the heating companies. They are not normally used to collecting this information, but this capacity constraint will be addressed with technical assistance.

Arrangements for Results Monitoring

Project Outcome Indicators	Baseline / Target Values	Data Collection and Reporting		
		Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
<ul style="list-style-type: none"> TSP and SO₂ emissions per m² connected floor area per boiler plant.* Fuel and electricity consumption per m² connected floor area* Make-up water per m² connected floor area* Gas loss under % in five years commencing from completion of distribution system rehabilitation. 	See subproject performance indicator table below	Annual	Meter readings Project reports	Heating Companies Gas Company
Intermediate Results Indicators				
Component 1: Central Heating Infrastructure				
Per subproject				
• % of planned m ² connected to centralized heating	See subproject results indicators below	Semi-Annual	Meter readings Billing information	Heating Companies
• % of planned kilometers of pipelines installed				
• % of planned number of substations installed				
• % of planned number of heat meters installed				
• % of planned capacity of boilers installed				
• % of planned number and capacity of boilers replaced with centralized heating				
Component 2: Urban Gas Infrastructure				
• Gas storage tanks rehabilitated	See subproject results indicators below	Semi annual	Supervision reports	Gas Company
• km of gas pipelines rehabilitated				
• km of gas pipelines constructed				
Component 3: Institutional Development				
• number of man days of training	135	Annual	Supervision Reports	FFUPO

SUBPROJECT INDICATORS AND PROJECT PERFORMANCE INDICATORS	Unit	Benxi III	Benxi Nanfen	Benxi Steel	Fushun	Gongchan g-ang	Haicheng	Huhudao	Yingkou Dashiqiao	Yingkou EDZ	Northern Yingkou	Project weighted average
		2009-2013	2009-2013	2009-2010	2009-2013	2008-2012	2009-2011	2009-2010	2008-2012	2008-2012	2010-2013	
Start - End of connection to central heating system	CY	2009-2013	2009-2013	2009-2010	2009-2013	2008-2012	2009-2011	2009-2010	2008-2012	2008-2012	2010-2013	2008 - 2013
Base												
Fuel consumption per connected floor area	kWh/m ²	221.4	279.2	117.4	221.0	218.7	190.7	215.2	248.0	187.0	183.7	199.5
Electricity used for DH/connected floor area	kWh/m ²	4.9	5.4	3.6	1.2	4.3	4.8	6.2	3.9	4.0	6.9	4.4
Make-up water used /connected floor area	ltr/m ²	41.0	118.8	132.9	193.3	159.3	145.4	157.7	100.7	55.0	144.1	115.4
TSP emissions /connected floor area	kg/m ²	0.685	1.043	0.015	0.750	0.693	0.319	0.591	0.782	0.306	0.382	0.494
SO ₂ emissions /connected floor area	kg/m ²	0.246	0.737	0.032	0.367	0.522	0.265	0.271	0.629	0.234	0.150	0.285
Project												
Fuel consumption per connected floor area	kWh/m ²	148.6	155.4	14.4	176.5	145.1	145.4	144.8	156.1	148.1	143.0	138.9
Electricity used for DH/connected floor area	kWh/m ²	4.1	4.0	4.9	1.2	3.6	3.3	3.1	3.5	1.2	2.3	2.7
Make-up water used /connected floor area	ltr/m ²	34.2	99.0	234.0	148.7	96.6	96.9	84.2	89.4	43.3	96.6	96.7
TSP emissions /connected floor area	kg/m ²	0.008	0.006	0.004	0.064	0.006	0.004	0.004	0.005	0.023	0.023	0.020
SO ₂ emissions /connected floor area	kg/m ²	0.054	0.042	0.010	0.073	0.040	0.032	0.022	0.042	0.043	0.023	0.040

Urban Gas Supply Reduced gas loss after distribution system rehabilitation within two years after commissioning.	Base %	14.1
	Project %	2.8

RESULTS INDICATORS

		2008	2009	2010	2011	2012	2013
Benxi City Central Heating Supply Phase II							
Results Indicators							
1	Floor area connected/ planned *100%	%	50%	80%	90%	95%	100%
2	Length of pipelines installed / planned * 100%	%	60%	100%	-	-	-
3	Number of substations installed/ planned * 100%	%	30%	90%	100%	-	-
4	Number of heat meters installed / planned *100%	%	100%-	-	-	-	-
5	New boiler capacity installed/ planned *100%	%	33%	100%	-	-	-
6	Number of boilers replaced /planned * 100%	%	30%	80%	100%	-	-
Benxi Nanfen Central Heating Supply							
Results Indicators							
1	Floor area connected/ planned *100%	%	-	80%	86%	91%	100%
2	Length of pipelines installed / planned * 100%	%	-	100%	-	-	-
3	Number of substations installed/ planned * 100%	%	-	100%	-	-	-
4	Number of heat meters installed / planned *100%	%	-	100%	-	-	-
5	New boiler capacity installed/ planned *100%	%	-	100%	-	-	-
6	Number of boilers replaced /planned * 100%	%	-	100%	-	-	-
Benxi Steel Central Heating Supply							
Results Indicators							
1	Floor area connected/ planned *100%	%	-	81%	100%	100%	100%
2	Length of pipelines installed / planned * 100%	%	-	100%	-	-	-
3	Number of substations installed/ planned * 100%	%	-	100%	-	-	-
4	Number of heat meters installed / planned *100%	%	-	100%	-	-	-
5	New boiler capacity installed/ planned *100%	%	-	-	-	-	-
6	Number of boilers replaced /planned * 100%	%	-	100%	-	-	-
Fushun Power Plant Heating Network Expansion							
Results Indicators							
1	Floor area connected/ planned *100%	%	-	18%	69%	81%	100%
2	Length of pipelines installed / planned * 100%	%	-	41%	72%	100%	-
3	Number of substations installed/ planned * 100%	%	-	23%	75%	88%	100%
4	Number of heat meters installed / planned *100%	%	-	20%	43%	66%	89%
5	New boiler capacity installed/ planned *100%	%	-	-	-	-	-
6	Number of boilers replaced /planned * 100%	%	-	-	30%	55%	80%

Gongchangling		2008	2009	2010	2011	2012	2013
Results Indicators							
1	Floor area connected/ planned *100%	75%	81%	87%	93%	100%	100%
2	Length of pipelines installed/ planned * 100%	100%	-	-	-	-	-
3	Number of substations installed/ planned * 100%	100%	-	-	-	-	-
4	Number of heat meters installed/ planned *100%	100%	-	-	-	-	-
5	New boiler capacity installed/ planned *100%	100%	-	-	-	-	-
6	Number of boilers replaced /planned * 100%	20%	50%	100%	-	-	-
Haicheng Central Heating Supply							
Results Indicators							
1	Floor area connected/ planned *100%	-	87%	94%	100%	100%	100%
2	Length of pipelines installed / planned * 100%	-	100%	-	-	-	-
3	Number of substations installed/ planned * 100%	-	100%	-	-	-	-
4	Number of heat meters installed / planned *100%	-	100%	-	-	-	-
5	New boiler capacity installed/ planned *100%	-	100%	-	-	-	-
6	Number of boilers replaced /planned * 100%	-	100%	-	-	-	-
Huludao YJZZ							
Results Indicators							
1	Floor area connected/ planned *100%	-	93%	100%	100%	100%	100%
2	Length of pipelines installed / planned * 100%	-	100%	-	-	-	-
3	Number of substations installed/ planned * 100%	-	100%	-	-	-	-
4	Number of heat meters installed / planned *100%	-	100%	-	-	-	-
5	New boiler capacity installed/ planned *100%	-	100%	-	-	-	-
6	Number of boilers replaced /planned * 100%	-	100%	-	-	-	-
Yingkou Dashiqiao							
Results Indicators							
1	Floor area connected/ planned *100%	86%	89%	93%	96%	100%	100%
2	Length of pipelines installed / planned * 100%	100%	-	-	-	-	-
3	Number of substations installed/ planned * 100%	100%	-	-	-	-	-
4	Number of heat meters installed / planned *100%	100%	-	-	-	-	-
5	New boiler capacity installed/ planned *100%	100%	-	-	-	-	-
6	Number of boilers replaced /planned * 100%	-	100%	-	-	-	-

Yingkou EDZ Central Heating Supply						
Results Indicators	2008	2009	2010	2011	2012	2013
1 Floor area connected/ planned *100%	68%	76%	84%	92%	100%	100%
2 Length of pipelines installed / planned * 100%	72%	100%	-	-	-	-
3 Number of substations installed/ planned * 100%	38%	100%	-	-	-	-
4 Number of heat meters installed / planned *100%	50%	100%	-	-	-	-
5 New boiler capacity installed/ planned *100%	-	-	-	-	-	-
6 Number of boilers replaced /planned * 100%	8%	48%	88%	100%	-	--
North Yingkou Central Heating Supply						
Results Indicators	2008	2009	2010	2011	2012	2013
1 Floor area connected/ planned *100%	-	-	60%	80%	90%	100%
2 Length of pipelines installed / planned * 100%	-	30%	90%	100%	-	-
3 Number of substations installed/ planned * 100%	-	-	90%	100%	-	-
4 Number of heat meters installed / planned *100%	-	-	100%	-	-	-
5 New boiler capacity installed/ planned *100%	-	-	-	-	-	-
6 Number of boilers replaced /planned * 100%	-	-	80%	100%	-	-
Yingkou Gas						
Results Indicators	2008	2009	2010	2011	2012	2013
1 Length of network rehabilitated / planned * 100%	85%	100%	-	-	-	-
2 Number of storage tanks rehabilitated	# 0	2	-	-	-	-
3 Number of storage tanks new built	# 0	1	-	-	-	-
4 Number of safety auxiliary installed / planned *100%	% -	100%	-	-	-	-

Annex 4: Detailed Project Description

CHINA: Liaoning Third Medium Cities Infrastructure Project

1. The project development objective is to improve the energy and environmental efficiency of heating services in selected areas of participating cities in Liaoning Province, thus contributing to the revitalization of Liaoning Province. The project will achieve this objective by (a) constructing and rehabilitating centralized heating systems to supply existing heating areas currently supplied by small, inefficient and polluting hot water boilers and new heating areas; (b) provide targeted technical assistance and training to strengthen heating company management; and (c) project and procurement management support. The cities were selected by Liaoning Province based on a demand-driven process and assessment of the willingness and ability to meet Bank and Provincial appraisal criteria.

2. *Summary of Innovations.* The project is well timed with recent government initiatives in heating reform. With the exception of Benxi Steel Central Heating Supply subproject, the technical design is arranged to be compatible with heating reform as much as possible. However, northern China lacks experience with certain technical innovations that will be important in the future district heating systems and / or there are major institutional barriers that prevent their large-scale implementation. The project takes the following approach to introducing these innovations:

- *Innovation #1: Demand driven-enabled operation in the primary and secondary network is required.* With the implementation of consumption based billing, apartment owners will wish to control their heating inside their apartments for comfort and to save money. Heating supply systems in China have traditionally been production driven by supplying heating at a constant flow rate under an assumed indoor temperature and adjust the temperature of the water at the boiler plant based on outside air temperature. This causes under- and over-heating in the apartments and wastes energy. A consumer survey carried out by the Bank indicated that more than half of the respondents in Yingkou, Gongchangling, Benxi and Fushun reported that temperatures fell below 16°C and many used supplemental heating, such as electrical blankets to cope with the cold. Demand-driven operation allows the heating system to respond to requirements of each consumer more efficiently, thus saving energy and pumping costs. China's heating systems are currently converting to demand-driven mode in the primary network, but not all do, and few do so in the secondary network. Full demand driven operation in the secondary network will be achieved when control valves (i.e. thermostats) are installed in apartments, which is a mandatory requirement for all new buildings.
- *Innovation #2: Building level substations will be piloted in subprojects.* With improved living standards and the transfer of responsibility to pay the heating bill to the apartment owner, consumers will demand high quality service. Another reason for over and under heating are the use of group substations that supply too many buildings that have different heating demand – it is hard to keep the proper hydraulic balance in the network. Building level substations in modern systems dominate, but not in China, mainly due to (a) higher housing densities and lack of domestic hot water services reduce secondary network lengths; (b) conventional design assumptions particularly on energy savings prevail due to a lack of experience with building level substations; (c) secondary network construction is the

responsibility of the developer, thus installing building level substations requires changes in the division of labor between heating companies and developers, a difficult institutional barrier. The use of building level substations on a pilot basis in heating subprojects of all project cities (replacing one area otherwise supplied with group substations) is expected to demonstrate benefits associated with linking substations to fewer buildings, i.e. (a) improved hydraulic balance in the network which improves responsiveness and quality of heating within each building; (b) improved energy savings from reduced pumping costs; and (c) extended lifetime of the small-size pipelines that are part of an extended primary network, replacing the need for larger secondary network pipelines.

- *Innovation #3: Metering of the system up to the building will be piloted in subprojects.* With the introduction of consumption based billing and rising expectations from consumers, heating companies will need to become more commercially oriented and financially self sustaining. To do so requires precise knowledge of production efficiency, network losses and actual heating sales per building. The metered data will also be important objective information to calculate consumption-based heating tariffs. The metering will be implemented in heating subprojects in all project cities.
- *Innovation #4: Use of World Bank Procurement in District Heating.* Participating municipalities have not had experience with Bank procurement procedures, which have in other sectors proven to improve economy, efficiency and transparency in procurement.

Summary Table of Pilots with Building Level Substations and Heat Metering

Subproject	a) Building substation with metering			b) Building level metering			
	Location	Heating area m2	Number of buildings	Location	Number of buildings m2	Number of meters	
Fushun	East of City Hall	80,000	20	East of City Hall	80,000	20	60
Benxi Nanfen	GS 7, Xuanmuchang	90,000	17	GS 6 nearby railroad	90,000	28	83
Benxi General II	Ruixin Residential Area, Xihu	33,456	4	Ruixin Residential Area, Xihu	38,114	9	30
Haicheng	GS 21, Jiahe Sunshine Garden	70,000	12	GS 23, Jiahe Sunshine Garden P	80,000	14	76
Huludao	GS 4	131,000	46	GS 3	38,000	7	7
Yingkou Dashiqiao	Compound East of Vocational	87,000	12	GS 32, Luydao quarter phase II	65,000	12	59
Yingkou EDZ	Qiantang Yayuan Compound	136,368	11	Qiaoguang Real Estate	110,000	11	39
Yingkou North	South Qinghua Str., East Gu	30,000	n.a.	Shuxinyuan Residential Area	30,000	n.a.	n.a.
Gongchangling	GS 1	97,000	28	GS 16	127,100	13	44
Total		754,824	150		658,214	114	398

3. **Component 1: Centralized Heating Infrastructure (US\$364 million; IBRD US\$185.7 million).** This component covers six cities and includes the construction of new and rehabilitated centralized heating systems. The subprojects in this component will replace 547 individual, small boilers in 317 boiler plants with a total capacity of 2,693 MW_{th} with central heating systems supplied by: (a) 8 new boiler plants in Benxi, Haicheng, Huludao, Gongchangling, and Yingkou Dashiqiao with a total capacity of 1,126 MW_{th} and (b) recovery of waste heat (total capacity of 1,611 MW_{th}) from power generation and steel production in Fushun, Yingkou and Benxi. Overall, this component will substantially improve heating services for 2.2 million out of the 4.2 million people living in the project cities.

4. *Technical Summary:* The subprojects will use boiler, substation and network technologies which are well recognized in China, but are not always comprehensively implemented. The boiler plants will use chain grate boilers, except in Benxi Caitun, where

fluidized bed boilers will be installed due to the low quality of coal. The boilers will be equipped with heat meters, energy efficient fans and blowers, ancillary equipment, and process control systems. Wet FGD systems and dry bag houses with an expected SO₂ and TSP emissions removal rate of 90% and 99.7%, respectively, will be installed where chain grate boilers are used. Bag houses and limestone input will be installed with fluidized bed boilers with about 80% and 99.7% removal rates for SO₂ and TSP respectively. The 358 group substations (heat exchangers serving several buildings) and all building level substations will include heat meters, temperature controls, frequency controlled circulation pumps. Due to a lack of alternative group substation sites other than small boiler plant locations in some cases, large group substations are needed. These large group substations, i.e. serving 0.3 million m², will be divided into 2-4 smaller functional substation units, following secondary network layouts, but will be located in the substation building.

5. Water will be treated at the boiler plant and the group substations. Boiler plants will have filtering, degasification and softening of make-up water. Substations will treat with softening and side-flow filtering, except the latter in Fushun with fine mechanical filtering located in the inlet of the heat exchangers. Building level substations installed in new buildings will use a bypass from the primary network to the secondary network for make-up water. The 305 km of primary and 188 km of secondary network will be installed below ground and will use pre-insulated steel pipes, using polyurethane foam insulation and polyethylene jacket pipes. Together with water quality control equipment, the expected lifetime range of the pre-insulated pipelines can be expected to be 30–50 years from the reported current lifetime of 10-20 years, provided that water quality is maintained to avoid internal corrosion.

6. The subproject descriptions are provided below:

Benxi City

7. **Benxi City Central Heating Supply (Phase II) Subproject.** Benxi City includes about 86 boiler plants with 202 boilers of various capacities totaling 2,565 MW_{th}. The Benxi Hengze Heating Development Company, Ltd. will implement the subproject. It is currently in the final process of acquiring part of the assets and staff of the Benxi General Heating Company, the major heating operator in the city. It operates in the project area 50 boiler plants with 91 boilers totaling 294 MW_{th}, out of which 30% are more than 30 years old. The efficiency of the boilers is about 40-50% and are highly polluting. The heat load in the proposed project area is expected to grow 90 percent by 2011. The subproject area includes: (i) the Caitun district located across the river from Benxi city center; (ii) the Wolong district located 10 km from the city center and; (iii) Xihu district.

8. The subproject will include construction of: (a) 2 x 58 MW_{th} hot water, fluidized bed boilers in Caitun boiler house, to supply heat for 2.9 million m²; (b) 2 x 29 MW_{th} chain grate boilers in Wolong boiler house to supply heat for 1.20 million m²; (c) 3 x 58 MW_{th} chain grate boilers in Xihu, to supply 3.1 million m²; (d) 17 km of new primary network; (e) 45 group substations and 4 building substations; (f) meters. The new system will replace 31 boiler houses with total 52 small boilers.

9. **Benxi Steel Central Heating Supply Subproject.** The project area, located in the south of Benxi receives heating supplied by the Benxi Steel (Group) Heating Development Company,

Ltd. (BSGHC), which will implement the project. BSHC receives heating from three sources within the Benxi Bengang Steel Plant: (i) waste heat from a captive CHP Plant with a capacity of 83 MW_{th}; (ii) waste heat recovered from a coke-oven plant with a capacity of 64 MW_{th}; and (iii) waste heat recovered from slag flushing of blast furnaces with a capacity of 110 MW_{th}. The area near the steel plant is expected to have an increased heat demand and existing heating supply capacity could not satisfy the expected demand. In addition, due to improper maintenance, the existing network is corroded and water losses were high, amounting to about 4-8% of circulating water flow. The low temperature circulation water is not as aggressive as high temperature water used in boiler-reliant heating systems and thus the existing networks have operated for over 26 years. The substantial amount of waste heat energy available at the steel mill is considered the least cost solution, compared to individual heat only boilers and heat pumps.

10. The proposed project will expand and rehabilitate 66 km of network and pumping stations and install collectors for circulation water to meet existing and future demand in Benxi city, avoiding construction of coal fired boiler plants. The three sources will supply one network serving 5.0 million m², including 3.5 million m² of new demand. The supply temperature of each source will be 60°C (or 65°C for slag flushing) and return 45°C, a small temperature difference which requires very large diameter pipelines for heating. The waste heat energy of all three sources would otherwise not be used. The low temperature waste heat will connect the buildings directly and is the only exception to the demand driven requirement due to technical reasons. In spring 2008, however, the company will implement a SCADA system, not financed by the Bank, to monitor room temperatures of 100 apartments and the network pressures of about 40 locations as a means to monitor and control the heating service quality.

11. **Benxi Nanfen Central Heating Supply Subproject.** Nanfen system is located 25 km southeast of Benxi city center. The subproject area is supplied by 9 small polluting boiler plants (27 boilers and 146 MW_{th}) that are operated by 4 companies. The subproject area includes 0.5 million m² of existing heating area, representing 30 percent of the total heating area of Nanfen. Boiler efficiency ranges between 40-50% and they operate with no effective flue gas cleaning, contributing to poor air quality in winter. The municipality has decided to consolidate the four companies currently operating the boiler plants and pass on the service area to Benxi Steel (Group) Heating Development Company, Ltd. (BSGHC).

12. The subproject will construct (a) 3 x 29 MW_{th} chain grate boilers with flue gas cleaning in one plant, (b) 19 km of primary network; (c) 11 group substations and 17 pilot building level substations; (d) heat meters; (e) ancillary and control equipment. The subproject will replace 7 of 9 boiler plants (22 boilers amounting to 98 MW_{th}), fully integrating the previously discrete boilers and networks. The subproject will supply 1.3 million m² of heating area, of which 0.8 million m² is new demand.

Fushun City

13. **Fushun Power Plant Heating Network Expansion Subproject.** The project area is located in the Gaoshan Road, Changchun Road, Dongcheng (Fuxihe) and Chengdong districts located in central Fushun city. Together they represent 7.1 million m² of heating area, or 16% of total heating area of Fushun city. Currently, the existing area is supplied by the Xindong HoB plant, the existing Fushun Power Plant CHP, and 82 boiler houses. A new CHP plant (3rd phase

of Fushun Power plant) will be commissioned by October 2008 with $2 \times 300 \text{ MW}_e$ and is expected to supply 10 million m^2 heating area, equal to 627 MW_{th} . The heating networks in the project area will be interconnected to the CHP plant, but Xindong HOB and 15 boiler plants of the Dongcheng Heating Company will remain for peak load.

14. The subproject includes (a) installation of 63 heating substations and 20 pilot building level substations (b) extension of 30 km of primary network (including hot water and steam network) and (c) heat meters; (d) auxiliary and control (SCADA) equipment. Altogether, 66 boiler plants operating 139 boilers will be replaced by the subproject central heating supply system.

Haicheng (Anshan Municipality)

15. **Haicheng – Central Heating Supply Subproject.** The project area located in the Tiedong District, North Heating Area of Hebei residential section is supplied by 14 small polluting boiler plants (19 boilers and 98 MW_{th}). The project area represents 1.9 million m^2 out of 8.0 million m^2 , or 24% of the current heating area in Haicheng. Boiler efficiency ranges from 40-50% and operate with no effective flue gas cleaning, contributing to poor winter air quality in this residential area. In addition, the water losses in secondary networks range between 4–8% of the total water flow. The Haicheng Hengye Heating Supply Company Ltd. (HHHC), a newly formed subsidiary of the Haicheng Urban Construction and Investment Company will implement the subproject.

16. The subproject will construct: (a) one new boiler house with $3 \times 58 \text{ MW}$ chain grate boilers with flue gas cleaning, (b) 20 km new primary network, (c) 26 new group substations and 12 pilot building level substations; (d) heat meters; (e) auxiliary and control (SCADA) equipment. The project would heat 3.2 million m^2 , of which 1.3 million m^2 is new demand to be realized by 2011. The central heating system will replace the 14 small HoB plants.

Yangjiazhangzi Special District (Huludao Municipality)

17. **Huludao Yangjiazhangzi Central Heating Supply Subproject.** The project is located at Yangjiazhangzi Economic & Technical Development Zone (YETDZ) in Huludao City, in an area 32 km northwest Huludao City. YETDZ District Mudu Heating Company (YDHC) will implement the subproject.

18. There are 4 small boiler houses with 9 boilers with operation efficiencies in the range of 45% to 65% and the total capacity is 54 MW_{th} , which will be replaced by the subproject. These boilers contribute to winter air pollution due to low efficiencies and poor emissions control. Moreover, the room temperatures are reported to be as low as 13°C .

19. In the project area, the heat load is expected to rise from the recent (2006) 0.5 million to 1.7 million m^2 by year 2010. In order to meet the heating load requirements, the project will (a) new construction of $3 \times 29 \text{ MW}_{th}$ boiler plant, (b) build 13 group substations and 46 pilot building level substations; (iii) construct 13 km of primary and 52 km of secondary network, and (c) to install ancillary and control (SCADA) system

Gongchangling (Liaoyang Municipality)

20. **Gongchangling Central Heating Supply Subproject.** Gongchangling's economy is heavily dependent on manufacturing of intermediate goods for iron and steel products. It aspires to differentiate its economy through tourism – making use of its natural hot water spas. Thus, clean air is vital for this city's economic plan. The subproject area covers 1.8 million m² of existing heating area representing 91% of the city's total heating area and an additional 1.3 million m² of new heating load. The city has 31 small polluting boiler plants with 58 boilers running at 40–50% efficiency amounting to about 264 MW_{th} (377 t/h), provide very poor quality heating, and flue gas cleaning is poor. There is reported to be a chimney every 500 meters in the city. The municipality has decided to restructure the two key heating companies and replace boilers with centralized heating supply. The Gongchangling District Qinglong Heating Company Ltd., a newly established, private company, will implement the project and operate the assets.

21. The subproject will construct; (a) 3 x 58 MW_{th} chain grate boiler plants with flue gas cleaning; (b) build 16 group substations and 28 pilot building level substations; (c) build 38 km of primary heating network; (d) install two booster pump stations.; (e) heat meters The subproject will replace 22 boiler plants in the subproject area.

Yingkou Municipality

22. **Yingkou Dashiqiao Central Heating Supply Subproject.** Dashiqiao is located 20 km on the coast south from Yingkou city and operates 101 boiler plants with 120 boilers totaling 457 MW_{th}. In the subproject area, there are 72 boiler plants with 84 small boilers with a total capacity is 407 MW_{th} supplying 3.5 million m², representing 80% of the total heating area of the city. Boilers operate with efficiencies 40–50% with poor flue gas cleaning. Dashiqiao is filling-in quickly as a result of rapid economic development stemming from one of the world's largest magnesium deposits. The municipality has decided to professionalize heating management and consolidate a fragmented heating operation (17 heating supply companies) by contracting out its entire heating area to the Hongyang Heating Company, a private company. The Dashiqiao Urban Construction and Investment Company will borrow and implement the subproject. After construction, it will hand over operation and maintenance to Hongyang Heating Company a private lessee.

23. In order to meet heating demand which is expected to reach 4.46 million m² by 2012, the subproject will construct: (a) a boiler plant, one 4 x 64 MW_{th} in the city (b) 35 km of primary network; (c) 31 group substations and 12 pilot building level substations; (d) heat meters; (e) ancillary and control equipment (SCADA). Total 64 boiler plants and 76 small boilers will be replaced by the centralized heating system.

24. **Yingkou Economic Development Zone (EDZ) Central Heating Supply Subproject.** Yingkou EDZ Huayuan Heating Company Ltd. operates 164 boilers at varying capacities totaling 681 MW_{th}, supplying 9.8 million m². In the subproject area, 87 boiler plants operate with 144 small and 2 large boilers at efficiencies between 40-50% and supply 5.4 million m² (674 MW_{th}), representing 56% of the total heating supply area of the city. The systems are characterized by weak flue gas cleaning, high water losses (2–4% of circulation water) and poor condition of the existing secondary networks.

25. The subproject will construct the central heating system in the north part of Wanghai Road, west of the Shenyang-Dalian Expressway, and south of the Huanghe Road comprising: (a) 85 km primary and about 70 km secondary network; (b) 66 group substations and 11 pilot building level substations; (c) a booster pump station; (d) heat meters; (e) ancillary and control (SCADA) systems. The heating system will supply 10.4 million m², of which 5.0 million m² will be new demand by 2012. The heating supply will be purchased from the Huaneng Yingkou CHP plant.

26. **Northern Yingkou Central Heating Subproject.** Yingkou Heating Company (YHC) has 5 district heating boiler buildings, 12 sets of 14 MW ~ 72 MW_{th} hot water boilers, 1 power plant with the installed capacity of 3 × 75 ton/h circulating fluidized-bed boilers and 2×12 MW_e generator sets. A new CHP plant will be commissioned in October 2010 and thus these boilers will be replaced by a CHP-supplied district heating system. The heating area serviced by YHC is 7.2 million m², which is expected to increase to 9.6 million m² by year 2013.

27. The project will (a) construct 49 km of primary network, (b) retrofitting 60 group substations with new heat exchangers, pumps, water softening, side flow filters, temperature control and remote monitoring; (c) install 23 group substations and pilot building level substations; (d) heat metering; (e) install ancillary and control (SCADA) equipment.

28. **Component 2: Urban Gas Infrastructure (US\$11 million; IBRD US\$4.1 million).** This component comprises (a) rehabilitation of gas transmission facilities; b) rehabilitation and capacity expansion of gas storage equipment involving rehabilitation of the existing 20,000 and 50,000 m³ capacity storage tanks and provision of a new 50,000 m³ storage tank; and c) rehabilitation and capacity expansion of gas distribution network including the upgrading of facilities for pressure/flow control, corrosion control, SCADA, and emergency response arrangements. The scope and investment for b) has been defined following the integrity and safety assessment of the existing 20,000 and 50,000 m³ storage tanks conducted by an entity certified by the National Safety and Security Bureau, which concluded that the tanks could be used safely after the recommended rehabilitation works. The scope and needed investments for a) and c) would be firmed up after the completion of the ongoing feasibility and safety studies.

29. **Component 3: Institutional Development (US\$1.22 million; IBRD US\$1.22).** There are two major institutional development activities packages:

Package A (A1, A2 and A3): Project Management and Bid Document Preparation, Design Review and Advisory Assistance: (\$1.2 million IBRD Financed). The purpose of this activity is to support implementation of project investments through: (a) design review advisory for the preparation of technical bid documents and review of designs by design institutes; (b) development and implementation of a project and construction management, supervision (in coordination with local construction supervisors), monitoring and reporting system; (c) quality assurance, health and safety support for establishing monitoring and reporting procedures to ensure the project works meet contractual obligations; (d) environmental and RAP monitoring; (e) operation and maintenance training, including preventative maintenance; and (f) monitoring and assessment of pilot projects. Packages A1 and A2 address institutional development for the heating component while Package A3 covers project management, bid document preparation, design review and advisory assistance for the urban gas component.

Package B: Review of Safety and Security Measures of the Yingkou Gas Company:
(\$0.02 equivalent; IBRD \$0.02 million): The purpose of this package is to perform a thorough review of the safety and security measures of the Yingkou Gas Company to develop a plan to gradually adapt and upgrade its safety policies, procedures and knowledge to meet the requirements of its fast expanding system.

Annex 5: Project Costs

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	Project Costs*		World Bank financing		% of total
	US\$m	RMBm	US\$m	RMBm	
Bank Financed	283.64	2,127.32	191.00	1,432.50	67%
1. Works	182.80	1,370.97	90.15	676.14	49%
Benxi II	25.45	190.91	9.98	74.87	39%
Benxi Nanfen	5.25	39.35	2.06	15.43	39%
Benxi Steel	24.04	180.27	14.20	106.53	59%
Fushun	18.68	140.10	11.21	84.05	60%
Gongchangling	10.41	78.08	3.57	26.80	34%
Haicheng	9.50	71.26	4.35	32.66	46%
Huludao	8.31	62.31	3.32	24.93	40%
Yingkou Dashiqiao	10.34	77.56	4.11	30.83	40%
Yingkou EDZ	30.10	225.78	15.02	112.63	50%
Yingkou North	35.62	267.11	21.33	160.00	60%
Yingkou Gas	5.10	38.24	0.99	7.42	19%
2. Goods and Equipment	99.15	743.63	99.15	743.63	100%
Benxi II	23.92	179.40	23.92	179.40	100%
Benxi Nanfen	5.33	39.98	5.33	39.98	100%
Benxi Steel	3.10	23.25	3.10	23.25	100%
Fushun	4.48	33.60	4.48	33.60	100%
Gongchangling	10.29	77.18	10.29	77.18	100%
Haicheng	9.32	69.90	9.32	69.90	100%
Huludao	5.72	42.90	5.72	42.90	100%
Yingkou Dashiqiao	13.61	102.08	13.61	102.08	100%
Yingkou EDZ	12.42	93.15	12.42	93.15	100%
Yingkou North	7.88	59.10	7.88	59.10	100%
Yingkou Gas	3.08	23.10	3.08	23.10	100%
3. Institutional Development	1.22	9.15	1.22	9.15	100%
4. Front end fee	0.48	3.58	0.48	3.58	100%
Non Bank Financed	92.21	691.60	0.00	0.00	0%
5. Contingencies	55.35	415.12	0.00	0.00	0%
Physical	30.61	229.57	0.00	0.00	0%
Price	24.74	185.55	0.00	0.00	0%
5. Land Acquisition & Resettlement	2.90	21.71	0.00	0.00	0%
6. Other costs (design, engineering etc.)	21.26	159.42	0.00	0.00	0%
7. Interest During Construction	12.71	95.34	0.00	0.00	0%
8. Working Capital	0.00		0.00	0.00	0%
Total Project Costs	375.86	2,818.92	191.00	1,432.50	50.8%

Note: Physical contingencies are calculated based on estimates in feasibility study reports per Chinese industry practice. Price contingencies cover factors of inflation and estimated exchange rate changes between the US dollar and Chinese RMB.

Taxes are estimated as \$9.32 million out of the total project investment cost US\$281.95 million.

Annex 6: Implementation Arrangements

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1. Liaoning Provincial Government has established a coordinating group to give policy direction for the preparation and implementation of LMC 3 which is led by an Executive Vice Governor. Members include senior representatives from LDRC, LPDF, Liaoning Province Construction Department (LPCD), Liaoning Price Bureau, Liaoning Land Resource Bureau, Liaoning Audit Office and the Liaoning Provincial Environmental Protection Bureau (LEPB). The Provincial Government has designated Liaoning Foreign Funds Utilization Project Office (FFUPO) under the LDRC as the provincial agency responsible for managing LMC3 implementation. (A separate project management office under the LPCD manages LMC1 and LMC2). FFUPO serves as the equivalent of a provincial Project Management Office (PMO) and has experience in coordinating project preparation and implementation of international financial institution (IFI)-financed projects, including (i) the ADB's Urban Environment Project (ongoing); and (ii) a previous World Bank agriculture project.
2. FFUPO's responsibilities include: (a) overall project coordination, management and monitoring; (b) annual budget preparation; (c) project-wide quality assurance; (d) progress reporting (on physical implementation, safeguards implementation and financial management), to the Liaoning Provincial Government and the Bank, including cost management, project impact and environmental improvement assessment; (e) interagency coordination and procurement support; and (f) implementation of across-municipal activities such as technical assistance and training. All cities, with the exception of Yingkou Dashiqiao, will onlend proceeds of the Bank loan to heating companies who will be responsible for project implementation and coordination with city departments. The heating companies will also own and operate the subproject assets. Dashiqiao UCIC will borrow and implement its subproject and then transfer responsibility for operation to a private company under a leasing contract. These agencies will receive functional guidance from, and report to the FFUPO. The skill mix of FFUPO, the city PMOs and the heating and gas company implementing units would be adjusted as necessary to reflect the needs of the various phases of project preparation and implementation.
3. Following Provincial procedures, the FFUPO, with assistance from the LPDF, will hire a procurement agency to assist FFUPO and the PIUs with the procurement and consultant selection process. Goods and civil works contracts will be signed by each borrowing entity for each subproject. FFUPO will hire technical assistance consultants including an internationally experienced consultant to assist in construction supervision.

Heating Implementing Agencies:

4. *Benxi Steel Central Heating Supply and Benxi Nanfen Central Heating Supply Subprojects* will be implemented by the Benxi Steel (Group) Heating Development Company, Ltd. (BSGHC) which is a well established company. Subsidiary loan agreements will be signed between the city and the BSHC. A PMO has been established by Benxi Municipality for oversight and coordination.
5. *Benxi City Central Heating Supply – Phase II Subproject* will be implemented by the Benxi Hengze Heating Development Company, Ltd. (BHZC), a private company that is in the

process of taking over assets and most staff of the Benxi General Heating Company, which is a well established heating company in Benxi city. Due to financial difficulties in 2005, the municipality decided to restructure the company and invite private sector to participate in ownership and management. The process is ongoing but the Bank has been advised the process will be completed early 2008. The municipality has confirmed technical and accounting staff capable of implementing the project will remain. Subsidiary loan agreements will be signed between the city and BHZC.

6. *Fushun Power Plant Heating Network Expansion Subproject* will be implemented by the Fushun Thermal Power Plant Company (FTPPC), a subsidiary of China Power Investment Company (CPIC), one of the main power companies of China. Fushun Thermal Power Plant Company was established at the end of February 2007. Its major responsibilities are operation and management of existing heating supply assets owned by Fushun Power Company. Currently the heating branch has three departments. They are production, marketing and administration departments. It does not have independent financial and human resources departments. The head company, Fushun Power Company, is taking care of these two functions. A subsidiary loan agreement will be signed between Fushun City and the FTPC. A PMO has been established by Fushun Municipality for oversight and coordination.

7. *Gongchangling Central Heating Supply Subproject* will be implemented by a new company, the Gongchangling District Qinglong Heating Company Ltd. (GQHC) and will own and operate the assets. The company is private. The company is in the process of merging the assets of four existing heating companies, but the completion of the merger is likely to take some time. The key staff, general manager, technical manager and accountant have been appointed. A subsidiary loan agreement will be signed between the Gongchangling district municipality and the GQHC. A PMO has been established by Liaoyang Municipality for oversight and coordination.

8. *Haicheng Central Heating Supply Subproject* will be implemented by the Haicheng Hengye Heating Supply Company Ltd. (HHHC), a newly formed subsidiary of the Haicheng Urban Construction Investment Company (HUCIC), a municipal SOE. The general manager, technical manager and accountant have been appointed. The HUCIC will support project implementation during construction.

9. *Huludao Yangjiazhangzi Central Heating Supply Subproject* will be implemented by the Huludao Yangjiazhangzi Economic & Technical Development Zone District Mudu Heating Company (YDHC), a newly formed municipal SOE. YDHC is supervised by the municipality's Construction Bureau, which is responsible for the heating sector. The subsidiary loan agreement will be signed by the Huludao municipality and the YDHC.

10. *Yingkou EDZ Central Heating Supply Subproject* will be implemented by the Yingkou EDZ Huayuan Heating Company Ltd. (YEDZHC), a new company owned by the EDZ municipal government. The company was registered in the spring of 2007 and key staff have been appointed. A subsidiary loan agreement will be signed between the city and the respective heating company.

11. *North Yingkou Central Heating Subproject* will be implemented by the existing Yingkou Heating Company (YHC), a municipal SOE. The company has established a team of experts in

their areas of competence to handle the project. A steering committee chaired by the Vice Mayor of Yingkou and municipal PMO have been established. A subsidiary loan agreement will be signed between the city and the YHC.

12. *Yingkou Dashiqiao Central Heating Subproject* will be implemented by the Yingkou Urban Construction and Investment Company, a municipal SOE. YDCH is supervised by the municipality and is a traditional urban construction development company responsible for construction of major urban infrastructure in the city. The subsidiary loan agreement will be signed by the Dashiqiao municipality and the UCIC. A private operator will operate the project assets through a lease agreement.

Urban Gas Infrastructure Component Implementing Agency

13. *Yingkou Gas Subproject* will be implemented by the Yingkou Gas Company (YGC), municipal SOE established in the 1986 subordinated to the Yingkou Public and Real Estate Bureau. The staff of the company will provide the needed expertise in utility management, project management, technical and financial management. A subsidiary loan agreement will be signed between the Yingkou city and YGC.

Institutional Development Component Implementing Agencies

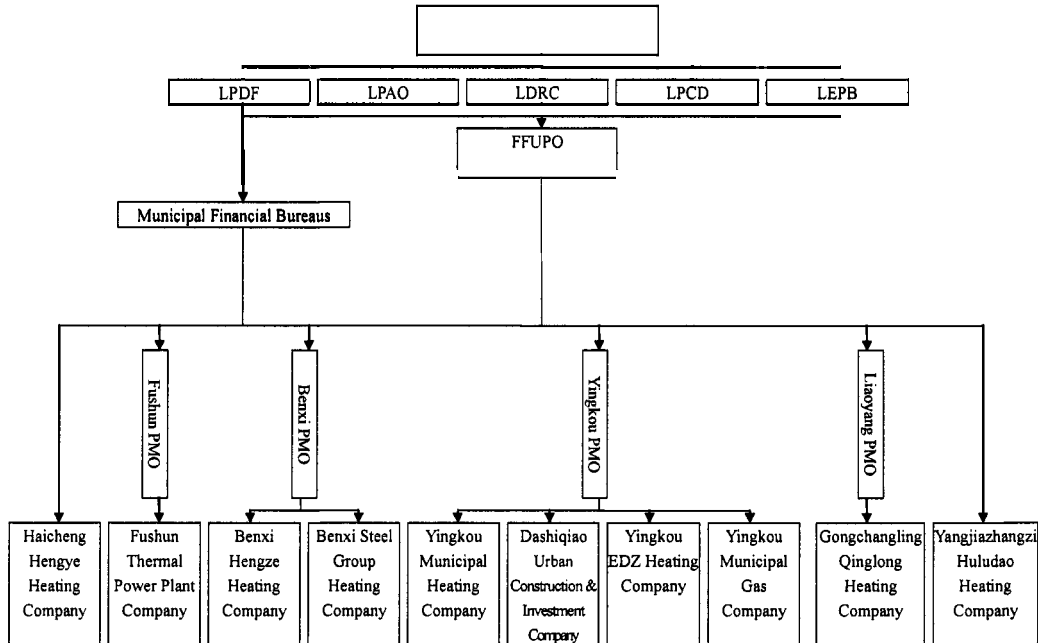
14. All technical assistance packages will be implemented by the FFUPO.

15. The table below summarizes the institutional arrangements for investments:

SUBPROJECTS	MUNICIPAL PARTY TO THE SLA	PROJECT OWNER & BORROWER	IMPLEMENTING AGENCY	MANAGEMENT, O&M
<u>Component 1</u>				
Benxi Steel Central Heating Supply	Benxi municipality	Benxi Steel (Group) Heating Development Company Ltd.	BSGHC	BSHC
Benxi Nanfen Central Heating Supply	Benxi municipality	Benxi Steel (Group) Heating Development Company Ltd.	BSGHC	BSHC
Benxi City Central Heating Phase II	Benxi municipality	Benxi Hengze Heating Development Company, Ltd.	BHZC	BHZC
Fushun Power Plant Heating Network Expansion	Fushun municipality	Fushun Thermal Power Plant Company	FTPPC	FTPPC
Gongchangling Central Heating	Gongchangling district municipality	Gongchangling District Qinglong Heating Company, Ltd.	GQHC	GQHC
Haicheng Central Heating Supply	Haicheng district municipality	Haicheng Hengye Heating Supply Company Ltd.	HYHC	HYHC

SUBPROJECTS	PARTY TO THE SLA	PROJECT OWNER & BORROWER	IMPLEMENTING AGENCY	MANAGEMENT, O&M
Huludao Yangjiazhangzi Central Heating Supply	Huludao	Huludao Yangjiazhangzi Economic & Technical Development Zone District Mudu Heating Company (YDHC)	YDHC	YDHC
Yingkou Dashiqiao Central Heating Supply	Dashiqiao district municipality	Dashiqiao Urban Construction and Investment Company (DUCIC).	YDUCIC	Private operator under lease contract
Yingkou EDZ Central Heating Supply	Yingkou EDZ municipality	Yingkou EDZ Huayuan Heating Company Ltd.	YHHC	YHHC
North Yingkou Central Heating Supply	Yingkou municipality	Yingkou Heating Company	YHC	YHC
Component 2				
Yingkou Gas Subproject	Yingkou municipality	Yingkou Gas Company	YGC	YGC

Figure 1. LMC3 Implementation Arrangements



Annex 7: Financial Management and Disbursement Arrangements
CHINA: Liaoning Third Medium Cities Infrastructure Project

Introduction

1. The Financial Management Specialist (FMS) has conducted an assessment of the adequacy of the project financial management system of the Liaoning Third Medium Cities Infrastructure Project (LMC 3). The assessment, based on guidelines issued by the Financial Management Sector Board on November 3, 2005, has concluded that the project meets the minimum Bank financial management requirements, as stipulated in BP/OP 10.02. In the FMS' opinion, the project will maintain adequate financial management arrangement acceptable to the Bank and, as part of the overall arrangements that the borrower has in place for implementing the operation, provide reasonable assurance that the proceeds of the loan will be used for the purposes for which the loan is granted. Financial management risk is the risk that World Bank loan proceeds will not be used for the purposes intended and is a combination of country, sector and project specific risk factors. Taking into account the risk mitigation measures proposed under the project, the FM risk rating proposed for this project during the appraisal stage is modest.

2. Funding sources for the project include Bank loan and counterpart funds. The Bank loan proceeds will flow from the Bank into a project designated account (DA) to be set up at and managed by Liaoning Provincial Department of Finance (LPDF), to various municipal/county finance bureaus, to Project Implementing Units (PIUs), and finally to contractors or suppliers. The LPDF may also make direct payments from the DA to contractors or suppliers. The Bank loan agreement will be signed between the Bank and the People's Republic of China through its Ministry of Finance (MOF), and on-lending agreements for the Bank loan will be signed between MOF and LPDF, then between LPDF and related municipal finance bureaus in project cities and finally between each municipal finance bureau and the PIUs.

3. No outstanding audits or audit issues exist with any of the implementing entities involved in the proposed project. However, the task team will continue to be attentive to financial management matters during project supervisions.

Audit Arrangements

4. The Bank requires that project financial statements be audited in accordance with standards acceptable to the Bank. In line with other Bank financed projects in China, the project will be audited in accordance with International Auditing Standards and the Government Auditing Standards of the People's Republic of China. Liaoning Provincial Audit Office (LPAO) has been identified as auditors for the project. Annual audit reports will be issued by above audit office and subject to reviews by the China National Audit Office (CNAO). The Bank currently accepts audit reports issued by CNAO or provincial/regional audit bureaus/offices for which CNAO is ultimately responsible.

5. The annual audit report of project financial statements will be due to the Bank within 6 months after the end of each calendar year. This requirement is stipulated in the loan agreement. The responsible agency and timing are summarized as follows:

Audit Report	Submitted by	Due date
Consolidated project financial statements	FFUPO	June 30 of each calendar year

Disbursement Arrangements

6. The Bank loan will be disbursing using traditional transaction-based disbursement techniques. Four disbursement methods: reimbursement, advance, direct payment and special commitment are all available for the project. Supporting documents required for Bank disbursements under different disbursement methods will be documented in the Disbursement Letter issued by the Bank.

7. Applications for reimbursement and reporting for uses of advances will be supported by:

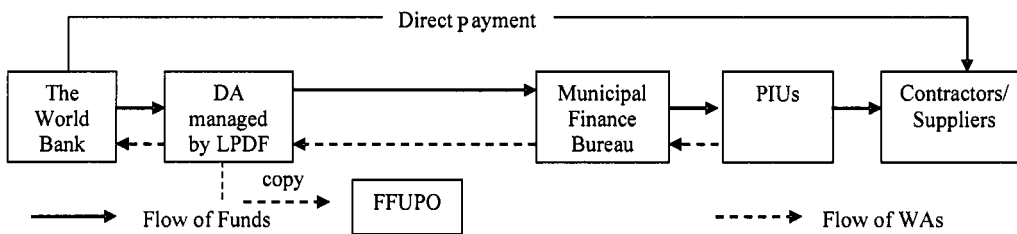
(a) The list of payments against the contracts, and records evidencing eligible expenditures, e.g., copies of receipts, supplier invoices, for the contracts subject to the Bank prior review indicated in the table below:

Expenditure Category	Contracts Equivalent or More than US\$ Equivalent
Civil Works	5,000,000
Goods	500,000
Firm Consultant	200,000

(b) Statement of Expenditures (SOEs) for any other expenditures.

8. One segregated designated account (DA) denominated in US dollar will be established at a commercial bank acceptable to the Bank and managed by LPDF. The ceiling of DA for the Bank loan will be US\$10 million as specified in the Disbursement Letter issued by the Bank.

9. LPDF will be directly responsible for the management, maintenance and reconciliation of the DA activities of the project. Supporting documents required for Bank disbursements will be prepared and submitted by respective PIUs to the LPDF for further disbursement processing. The flow of funds and withdrawal applications for the loan proceed is as follows:



10. Counterpart funds will be contributions from local government appropriations and commercial bank loans.

11. The Bank loan would be disbursed against eligible expenditures as in the following table:

<u>Category</u>	<u>Amount of the Loan Allocated (expressed in Dollars)</u>	<u>Percentage of Expenditures to be financed (inclusive of Taxes)</u>
(1) Part A (1) (Benxi City Central Heating Supply Phase II)		
(a) Civil Works	9,983,192	39%
(b) Goods, including installation	23,920,000	100%
(2) Part A (2) (Benxi Steel Central Heating Supply)		
(a) Civil works	14,203,618	59%
(b) Goods, including installation	3,100,000	100%
(3) Part A (3) (Benxi Nanfen Central Heating Supply)		
(a) Civil works	2,057,504	39%
(b) Goods, including installation	5,330,000	100%
(4) Part A (4) (Fushun Power Plant Heating Network Expansion)		
(a) Civil works	11,207,291	60%
(b) Goods, including installation	4,480,000	100%
(5) Part A (5) (Gongchangling Central Heating Supply)		
(a) Civil works	3,572,727	34%
(b) Goods, including installation	10,290,000	100%
(6) Part A (6) (Haicheng Central Heating Supply)		
(a) Civil works	4,354,321	46%
(b) Goods, including installation	9,320,000	100%
(7) Part A (7) (Huludao Yangjiazhangzi Central Heating Supply)		
(a) Civil works	3,323,496	40%
(b) Goods, including installation	5,720,000	100%
(8) Part A (8) (Yingkou Dashiqiao Central Heating Supply)		
(a) Civil works	4,110,095	40%
(b) Goods, including installation	13,610,000	100%
(9) Part A (9) (Yingkou EDZ Central Heating Supply)		
(a) Civil works	15,017,886	50%
(b) Goods, including	12,420,000	100%

Category	Amount of the Loan Allocated (expressed in Dollars)	Percentage of Expenditures to be financed (inclusive of Taxes)
installation		
(10) Part A (10) (Northern Yingkou Central Heating Supply)		
(a) Civil works	21,332,870	60%
(b) Goods, including installation	7,880,000	100%
(11) Part B (Yingkou Urban Gas Supply)		
(a) Civil works	989,500	40%
(b) Goods, including installation	3,080,000	100%
(12) Consultants services, training, workshops, and study tours under Part C of the Project	1,220,000	100%
(13) Front-end Fee	477,500	Amount payable pursuant to Section 2.03 of this Agreement in accordance with Section 2.07(b) of the General Conditions
TOTAL AMOUNT	<u>191,000,000</u>	

12. Retroactive financing amounting to US\$21,317,000 will be provided for Category (1)(a) and (1)(b); (5)(a) and (5)(b); Category (8)(a) and (8)(b); Categories (9)(a) and (9)(b); and Category 12 to be implemented before the signing date of loan agreement and after October 15, 2007, which will be procured in conformity with the Bank procurement procedures.

Financial Management and Reporting Arrangements

Risk Assessment and Mitigation

13. The following risks with corresponding mitigating measures have been identified during the assessment:

Risk	Risk Rating	Incorporated Risk Mitigating Measures	Conditions of Negotiations, Board or Effectiveness
Inherent Risk			
• Country level	Modest	Legal and institutional framework is acceptable and current PFM systems are functioning reasonably well. See the following mitigating measures utilized in the project.	
• Entity Level	Modest	Foreign Funds Utilization Office (FFUPO) under Liaoning Provincial Development and	

Risk	Risk Rating	Incorporated Risk Mitigating Measures	Conditions of Negotiations, Board or Effectiveness
		<p>Reform Commission (LDRC) has been designated as the provincial agency to be responsible for managing the project and it has some prior experience with the Bank-financed rural project. LPFB is very experienced with Bank financed project and their involvement will mitigate some risks. The Bank will work with the FFUPO to further strengthen their FM knowledge and capacity to supervise the project's financial management</p>	
<ul style="list-style-type: none"> • Project Level 	Modest	<p>Most staffs at the FFUPO and PIUs are new to Bank financed projects. To furnish them with enough knowledge and information in managing the project, a training session should be provided to the project financial staff during project launch workshop by the Bank.</p> <p>A Financial Management Manual including detail financial management and disbursement procedures has been prepared to standardize all PIUs' financial management work and to detail roles of responsibilities of PIUs, FFUPO and finance bureaus.</p> <p>Furthermore, LPFB will review and manage the project funds to ensure appropriate usage.</p>	
Control Risk			
<ul style="list-style-type: none"> • Budgeting 	Modest	<p>The FMS will work with each PIU to improve their budgeting, execution and monitoring.</p>	
<ul style="list-style-type: none"> • Accounting 	Low	<p>Accounting policies and procedures for the Bank loan are already in place. Checking by the task team at the initial implementation stage to ensure the accounting system has been correctly set up. This should be followed up by regular supervision missions.</p>	
<ul style="list-style-type: none"> • Internal Control 	Modest	<p>There are some existing internal controls at PIUs although not specifically focused to the project activities. A financial management manual will be prepared and issued to all PIUs to uniformly align their financial management arrangement, disbursement requirements and internal control procedures surrounding the project. Also, all disbursement documents will be reviewed by LPFB to ensure compliance.</p>	

Risk	Risk Rating	Incorporated Risk Mitigating Measures	Conditions of Negotiations, Board or Effectiveness
• Funds Flow	Modest	The flow of withdrawal applications and loan proceeds will go through several finance bureau levels, which will affect project implementation efficiency. The task team will ensure that mechanisms will be in place to ascertain Bank loan and counterpart funds will be released to the ultimate beneficiaries on a timely basis and avoid bottleneck in disbursements. Procedures on withdrawal applications and funds flow should be clearly documented in financial management manual.	
• Financial Reporting	Modest	The format and contents of financial statements have been stipulated by MOF and all the PIUs will use them for project financial reporting. The project financial management manual will also establish such financial reporting requirements consistent with MOF's regulations and guidance. The FFUPO will be responsible for the consolidated project financial statements.	
• Auditing	Low	The external auditor, Liaoning Provincial Audit Office, has extensive experience with previous Bank projects.	

Therefore, the overall FM risk-rating of this project at the appraisal stage is modest. The FMS will monitor the project FM risk during project implementation.

14. **Strengths.** LPFB has experience with World Bank financed projects and they are currently handling the LMC1 and Liao River Basin projects etc. LPFB is very familiar with the management of designated account and withdrawal applications procedures for Bank financed projects.

15. **Weaknesses and Action Plan.** Since most of the PIUs do not have experience in Bank-financed projects, well designed training courses on project disbursement and financial management should be conducted during the launch workshop and after project begins implementation. In addition, existing financial internal controls at PIUs are not specifically related to the project activities. Thus, a financial management manual has been prepared to uniformly align the project financial management policies at all PIUs.

Implementing Agencies

16. The Liaoning Provincial Coordinating Group (LPCG), chaired by an Executive Vice Governor, has been established to provide high-level guidance and coordination on policy and institutional issues among different agencies. The members of LPCG include senior

representatives from the Provincial Development and Reform Commission, LPFB, the Provincial Construction Commission, the Provincial Price Bureau, the Provincial Land Resource Bureau, the Provincial Audit Office, and the Provincial Environment Protection Bureau (LPEB).

17. Under the guidance of the LPDF, FFUPO has been designated as the provincial agency to be responsible for managing the project. It is responsible for the overall management of the project, providing necessary guidance to and coordinating with PIUs as well as municipal PMOs at municipal level, if any. The FFUPO consists of around 6 full-time staff including one financial staff and one procurement staff.

18. In Fushun, Benxi, Yingkou and Liaoyang cities, the municipal project management offices (MPMO) were established. Each MPMO will be responsible for implementation of its subproject. In each sub-PIU, a project team has been established, which includes 2 or 3 financial staff. The PIUs are responsible for daily project implementation. The accounting, reporting and withdrawal applications of each subproject will be handled by each PIU.

The PIUs' name and their responsible subprojects are listed as follows:

City	County	PIU Name	Subproject Name
Fushun	-	Fushun Thermal Power Plant Company	Fushun Power Plant Heating Network Expansion
Benxi	-	Benxi Hengze Heating Development Company, Ltd.	Benxi City Central Heating Supply – Phase II
	Nanfen	Benxi Steel (Group) Heating Development Company Ltd. (BSGHC)	Benxi Steel Central Heating and Benxi Nanfen Central Heating Supply
Haicheng	-	Haicheng Hengye Heating Supply Company Ltd.	Haicheng Central Heating Supply
Yingkou	-	Yingkou Heating Company	Northern Yingkou Central Heating Supply
	-	Yingkou Gas Company	Yingkou Gas
	Dashiqiao	Dashiqiao Urban Construction and Investment Company	Yingkou Dashiqiao Central Heating Supply
	EDZ	Yingkou EDZ Huayuan Heating Company Ltd.	Yingkou EDZ Central Heating Supply
Liaoyang	Gongchangling	Gongchangling District Qinglong Heating Company Ltd.	Gongchangling Central Heating Supply
Huludao	Yangjiazhangzi	Huludao Yangjiazhangzi Economic & Technical Development Zone District Mudu Heating Company	Huludao Yangjiazhangzi Central Heating Supply

Budgeting

19. Although the cost table has been prepared for the project and the project will prepare its annual implementing plan, the budgeting system within the project is usually not well maintained or monitored. The FMS will work with the related entities to improve their budgeting system during project implementation.

Accounting

20. The administration, accounting and reporting of the project will be set up in accordance with the Circular #13: "Accounting Regulations for World Bank Financed Projects" issued in January 2000 by MOF. The circular provides in-depth instructions of accounting treatment of project activities and covers the following:

- Chart of account
- Detailed accounting instructions for each project account
- Standard set of project financial statements
- Instructions on the preparation of project financial statements

The standard set of project financial statements mentioned above has been agreed between the Bank and MOF and applies to all Bank projects appraised after July 1, 1998 and includes the following:

- Balance sheet of the project
- Statement of sources and uses of fund by project components
- Statement of implementation of loan agreement
- Statement of designated account
- Notes to the financial statements

21. Each PIU will be managing, monitoring and maintaining their respective project accounting records for their respective components. Original supporting documents for project activities will be retained by each PIU. In addition, each PIU will prepare their own financial statements, which will then be reviewed, approved and consolidated by the FFUPO before sending to the Bank for review and comment on a regular basis.

22. Adequate project accounting staff with educational background and work experience commensurate with the work they are expected to perform is one of the factors critical to successful implementation of project financial management. Based on discussions, observation and review of educational background and work experience of the staff identified for financial and accounting positions in the PIUs, the task team note that the financial staff are qualified and appropriate to the work they are expected to assume.

23. To strengthen financial management capacity and achieve consistent quality of accounting work, the task team has suggested that a project financial management manual (the Manual) be prepared. The Manual will provide detailed guidelines on financial management including internal controls, accounting procedures, fund and asset management, withdrawal application procedures, financial reporting and auditing arrangement. The first draft of the

Manual has been prepared by the FFUPO and submitted to the Bank for review. The FMS has reviewed it and provided feedback and the Manual is ready to be finalized and distributed to all the relevant financial staff before project effectiveness.

24. Some PIUs will use computerized financial management information software while others will manually record and maintain their project accounting books. The task team will monitor the accounting process especially during the initial stage to ensure complete and accurate financial information will be provided in a timely manner.

Internal Control and Internal Auditing

25. The related project accounting policy, procedures and regulations were issued by MOF and a financial management manual will be prepared and issued jointly by the FFUPO and LPFB to uniformly align the financial management and disbursement requirements among the different PIUs. The project will follow these documents.

26. There is no formal independent Internal Audit department for the project. However, this will not impact on the project's financial management as the FFUPO and LPFB's monitoring and annual external audits will serve as the mechanism to ensure that financial management controls are functioning appropriately.

Financial Reporting

27. The format and content of the project financial statements represents the standard project financial reporting package agreed to between the Bank and MOF, and have been discussed and agreed to with all parties concerned.

Each PIU will prepare financial statements on its implemented components, which will then be used by the FFUPO for preparing consolidated project financial statements and submitted to the Bank for review and comment on a regular basis. In line with the requirements on project reporting by the Bank, the interim un-audited project financial statements should be submitted no later than two (2) months after the end of each calendar semester as part of Project Report to the Bank on a semi-annual basis.

Financial Covenants

28. Further specific financial covenants applicable to the project are detailed in the PAD.

Supervision Plan

29. The supervision strategy for this project is based on its FM risk rating, which will be evaluated on regular basis by the FMS and in consultation with relevant task team leader.

Annex 8: Procurement Arrangements

CHINA: Liaoning Third Medium Cities Infrastructure Project

A. General

1. Procurement for the proposed project would be carried out in accordance with the World Bank's "Guidelines: Procurement Under IBRD Loans and IDA Credits" dated May 2004, "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004, and the provisions stipulated in the Legal Agreement. The various items under different expenditure categories are described in general below. For each contract to be financed by the Loan, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame are agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.
2. **Procurement of Works:** Works procured under this project would include heating plants, substations, pipeline networks, pump stations, storage tanks, and related structures in heating plants. The procurement will be done using the Bank's Standard Bidding Documents (SBDs) for all ICB and the Chinese Model Bidding Documents (MBDs) for NCB. It is expected that all civil works contracts will be procured through NCB procedure.
3. **Procurement of Goods:** Goods procured under this project would include: supply and installation of plant and equipment of heating plants, substations, heating collecting equipment, and supply of heat meters, vehicles, heating automatic control systems, gas supply monitoring system, power supply equipment, etc. It is expected that ICB, NCB and shopping may be applicable for procurement of goods under this project. The procurement will be done using the Bank's Standard Bidding Documents (SBDs) for all ICB and the Chinese Model Bidding Documents (MBDs) for NCB.
4. **Selection of Consultants:** Consulting services include: Package A—Bid Document Preparation, Design Review and Project Management; Package B—Institutional Strengthening (Review of safety and security measures); and training and study tours. Short lists of consultants for services estimated to cost less than \$300,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

B. Assessment of the agency's capacity to implement procurement

5. Procurement activities will be carried out by the following Implementing Agencies:

PROJECT COMPONENT	IMPLEMENTING AGENCY
Benxi Steel Central Heating	Benxi Steel (Group) Heating Development Company
Benxi Nanfen Central Heating	Benxi Steel (Group) Heating Development Company

PROJECT COMPONENT	IMPLEMENTING AGENCY
Benxi Central Heating (Phase II)	Benxi Hengze Heating Development Company
Fushun Power Plant Heating Network	Fushun Thermal Power Plant Company Ltd.
Liaoyang Gongchangling Central Heating	Gongchangling District Qinglong Heating Company, Ltd.
Haicheng Central Heating	Haicheng Hengye Heating Supply Co. Ltd.
Northern Yingkou Central Heating	Yingkou Municipal Heating Co.
Yingkou Dashiqiao Central Heating	Dashiqiao Urban Construction and Investment Company
Yingkou EDZ Central Heating	Yingkou EDZ Huayuan Heating Co. Ltd.
Yingkou Gas Subproject	Yingkou Gas Company
Huludao Yangjiazhangzi Central Heating	Huludao Yangjiazhangzi Economic & Technical Development Zone District Heating Co. Ltd.
Technical Assistance	Provincial PMO

6. Inside each implementing agency, two specific personnel have been designated for procurement, one for leadership and another for actual procurement activities. At the provincial level, the Director of the Provincial Project Management Office (PPMO) will be coordinating procurement activities, and a department head of the PPMO has been appointed for day-to-day procurement coordination.

7. With the counterpart fund and following the domestic procedures, a qualified international tendering company will be employed as procurement agent for all ICB and NCB procurement before project procurement starts.

8. An assessment of the capacity of the Implementing Agencies to implement procurement actions for the project has been carried out by a procurement specialist of WBOB. The assessment reviewed the organizational structure, staffing and working procedures for implementing the project. Key issues and risks concerning procurement for implementation of the project have been identified and include some of the implementing agencies are new to the World Bank project, and one of the implementation agencies is from private sector. The corrective measures which have been agreed are: (1) the PPMO will employ an experienced tendering company as procurement agent for the project; (2) the procurement will be centralized at provincial level and PPMO will manage the procurement process with the assistance from international consultants; (3) as a part of the project, the loan will finance a consulting service contract to employ international consultants to provide project management services, including procurement management, detailed design review, and contract management throughout the life of the project; (4) the PPMO has prepared a procurement management manual to guide procurement activities of the project implementation agencies; and (5) the PPMO will organize procurement training for all the related staff before and during project launch. Before negotiations, the corrective measures have been addressed as follows: (1) PPMO has assigned an international tendering company to provide the professional service of procurement. (2) Liaoning

has confirmed that the procurement will be centralized at PPMO. (3) The selection of the consultant for project management is under way. (4) The procurement manual has been finalized according to the Bank team's comment and will guide procurement activities of PPMO who is assigned to be responsible for all procurement tasks. (5) Procurement training has been provided during appraisal to the FFUPO and the Project Companies. Additional training is planned during the project launch mission.

9. The overall project risk for procurement is moderate.

C. Procurement Plan

10. With the guidance from PPMO, the implementing agencies, during project preparation, developed a procurement plan for project implementation. This plan has been primarily agreed between the Borrower and the Bank Project Team during project appraisal. It will be finalized before the loan negotiation and will be available in the PPMO, the project's database and in the Bank's external website. The Procurement Plan will be updated in agreement with the Bank Project Team annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

D. Frequency of Procurement Supervision

11. In addition to the prior review supervision to be carried out from Bank offices, the capacity assessment of the Implementing Agency has recommended once every-6-month supervision mission to visit the field to supervise procurement activities for the first 18 months. The prior review thresholds and frequency of procurement supervision (including special procurement supervision for post-review/audits) will be further defined when the procurement plan is updated and reviewed following the first 18 months.

**ATTACHMENT 1
DETAILS OF THE PROCUREMENT ARRANGEMENT**

TABLE A: THRESHOLD FOR PROCUREMENT METHODS AND PRIOR REVIEW*

Expenditure Category	Contract Value Thresholds (US\$)	Procurement Method	Contracts Subject to Prior Review (US\$)
1. Works	Equivalent or above \$20 million	ICB	All
	Less than \$20 million	NCB	Above \$5 millions plus the first contract
2. Goods	Equivalent or above \$500,000	ICB	All
	Less than \$500,000	NCB	None
3. Services	Equivalent or above \$200,000 (Firms)	QCBS	All
	Less than \$200,000	CQS	None

Table B: Contracts Eligible for Retroactive Financing (if any)

City/Project/Proc.Method	Description	Contract No.	Period	Possible Expenditures before date of loan agreement getting effective (US\$ Million)
Yingkou Dashiqiao/Heating/NCB Civil Works	29,900m of pre-insulated pipe DN25- 900 mm for primary network; 43 substations (0.0023-0.3537 million m ² heating area); Pre-insulated pipe DN200- 300 mm 5,033 m.	YKDHC-1	June to November 2008	2.813
	4×64 MW heat source plant and auxiliary building.	YKDHC-2	June to November 2008	2.773
Yingkou Dashiqiao/Heating/Substation Equipment and Installation ICB S+I	43 substations (0.0023-0.3537 million m ² heating area) including 12 building level substations; heat exchangers, pump, water treatment, heat meter, electrical auto control and installation.	YKDHG-1	July to November 2008	1.246
Yingkou Dashiqiao/Heating/Boilers and Auxiliaries ICB S+I	Supply and installation of 4×64 MW boilers and auxiliary equipment, electric and auto control equipment.	YKDHG-2	July to November 2008	3.204
Yingkou EDZ/Heating/NCB Civil Works	Pre-insulated pipe DN 900-1,200 mm (primary network), 19620 m; Pre-insulated pipe DN 200-900 mm (primary network), 41514 m; 15 substations (the	YKEHC-1	June to November 2008	8.477

	service areas are from 8,000 m ² to 296,200 m ²), booster pump station			
Yingkou EDZ/Heating/ Substation Equipment Supply and Installation ICB S+I	19 substations (service areas from 39,000 m ² to 260,000 m ²) and relay pump station.	YKEHG-1	July to November 2008	1.823
Liaoyang Gongchangling/ Heating/NCB Civil Works	Pre- insulated pipe DN200-600 mm 29723 m; 19 substations, 2 relay station (heating area: 97,000-367,000 m ²); Pre-insulated pipe DN250-350 mm 7840 m. 28 building level substations	LYHC-1	June to November 2008	2.45
	3x58 MW heat source plant.	LYHC-2	June to November 2008	1.88
Liaoyang Gongchangling/ Heating/Substations Equipment Supply and Installation ICB S+I	Supply and installation of 19 substations, 2 relay pump stations, 1 intermediary substation, 28 building level substations, water pumps, water treatment and electrical control.	LYHG-1	July to November 2008	1.38
Liaoyang Gongchangling Heating/ Boilers and Auxiliaries ICB S+I	Supply and installation: 3x58 MW hot water boilers, auxiliary equipment, electrical equipment; supply and installation of auto control equipment for 17 substations and 2 relay pump stations.	LYHG-2	July to November 2008	2.189
Benxi Ph II/ Heating/NCB Civil Works	Pre-insulated pipe DN125-700mm 19450m for Caitun and Xihu heating networks; 9.73Km of pipe ditch, well, chamber and anchor bolster; 14 substations;	BXHC-1	July to Oct.2008	2.00
	installation of 1x58 MW CFB in Caitun Heat Source Plant; installation of 1x58 MW chain-grate boiler in Xihu Heat Source Plant; civil works of the main plant and common buildings & facilities in heat source plants	BXHC-2	July .to Oct. 2008	1.40
Benxi Ph II/ Heating/Substations ICB S+I	14 substations, heat exchanger, pump, water treatment, electrical & auto control procurement and installation.	BXHG-1	Aug. to Nov.2008	1.10
Benxi Ph II /Heating/Boilers and Auxiliaries ICB S+I	Procurement and installation: 1x58 MW+1x58 MWCfb auxiliaries, electrical & auto control and common equipment & facilities	BXHG-3	Aug. to Nov.2008	1.20
TA-Service	Design review and project management	Package A1	April 2008	0.187
TOTAL				34.122

Table C Proposed Contract Package Involving International Competition

1. Goods and Works and non consulting services.

(a) List of contract Packages which will be procured following ICB:

Bo.	Contract/ Package	Contract Description	Contract Number	Contract Type	Proc. Method	Prior-or Post-review	Bidding period	Pre-qualification	Period of Implementation
Procurement of Equipment for Substations and Small Heat Meters									
		A-CITY CENTRAL HEATING							
A1		Fushun Heating							
1	Supply & Installation of Chengdong and Gaoshan Substations	36 Stations for Supply & installation	FSHG-1	S+I	ICB	Prior review	Sep.2008 to Jan. 2009	No	May. to Oct.2009
2	Supply & installation of Park and Dongcheng Substations	27 Stations for Supply & installation (incl. 20 building level subs/heat meters)	FSHG-2	S+I	ICB	Prior review	Sep.2008 to Jan. 2009	No	May to Oct.2009
A2		Yingkou Dashiqiao Heating							
3	Substation Equipment and Installation	43 substation(0.0023-0.3537 million m ² heating area) including 12 building level substations; heat exchanger, pump, water treatment, heat meter and installation	YKDHG-1	S+I	ICB	Prior review	Mar. to June 2008	No	July. to Nov. 2008

A3	Yingkou EDZ Heating												
4	Substation; Booster pump station; pilot area of building heat meter	47 substations (service areas from 8,000 m ² to 296,200 m ²), heat exchangers, pumps, water treatment equipment, dirt separator, heat meter, electrical instrument, automatic control equipment and installation.	YKEHG-2	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No	Apr. to Oct. 2009				
5	Substations;	19 substations and 11 building level substations (service areas from 39,000 m ² to 260,000 m ²), heat exchangers, pumps, water treatment equipment, dirt separator, heat meter, electrical instrument, automatic control equipment and installation.	YKEHG-1	S+I	ICB	Prior review	Mar. to June 2008	No	July. to Oct. 2008				
A4	Haicheng Heating												
6	Substation	Supply and installation: 26 substations and 12 building level substations (25,000-368,000 m ² heating area) heat exchangers, pumps, water treatment devices, electric and auto-control equipment, etc.	HCHG-1	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No	May. to Oct. 2009				
A5	Liaoyang Gongchangling Heating												
7	Gongchangling District Substation	Supply and installation: (heating area 224,100-602,000 m ²), 19 substations, 2 relay pump stations, 1 intermediary substation, 28 building level substations, heat exchangers, pumps, water treatment devices, etc.	LYHG-1	S+I	ICB	Prior review	Mar. to June 2008	No	July. to Oct. 2008				
A6	Yangjizhangzi Mining Area Heating												
8	Substations	Supply and installation: 13 substations, 46 building level substations, heat exchanger, pumps and water treatment device, (38000 – 227000m ²) Supply and installation:	YZZHG-1	S+I	ICB	Prior review	Sep. 2008 to Mar. 2009	No	May to Oct. 2009				

A7	Yingkou City Central Heating Expansion												
9	Substation	83 substations (20 -235 thousand m ² service area), and one relay pump station, heat exchanger, water pumps, water treatment, one relay pumping station	YKHG-1	S+I	ICB	Prior review	Aug. 2009 to Jan. 2010	No		Apr. to Oct. 2010			
A8	Benxi City Central Heating Phase II												
10	Substations	14 substations, heat exchangers , pumps, water treatment, and installation	BXHG-1	S+I	ICB	Prior review	Mar. to July 2008	No		Aug. to Nov. 2008			
11	Substations	31 substations, and 4 building level substations, heat exchangers , pumps, water treatment, and installation	BXHG-2	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No		May to Oct. 2009			
A9	Benxi Nanfen Heating												
12	Substation	11 substations(the service areas of them are from 60,000 to 163,000 m ²), and 17 building level substations, heat exchangers, pumps, water treatment equipment, electrical instrument and installation	BXNHG-1	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No		May to Oct. 2009			
B1	B. Gas Distribution Improvements												
1	Data Collection and Monitoring System	Gas intelligent data collection and monitoring system (SCADA)	YKGG-1	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No		May to Oct. 2009			
2	The thorough repair and construction of the storage	a. 20000 and 50000m ³ storage tanks, b. 50000m ³ storage tank newly built	YKGG-2	S+I	ICB	Prior review	Sep. 2008 to Jan. 2009	No		May to Oct. 2009			

Procurement of Boilers and Related Equipment									
A.CITY CENTRAL HEATING									
Yingkou Dashiqiao Heating									
A1	Central Heat Source Plant	4×64 MW boilers, auxiliary equipment & installation electric and auto-control equipment	YKDHG-2	S+I	ICB	Prior review	Mar. to July. 2008	No	Aug. to Nov. 2008
A2	Heat Source Plant	Haicheng Heating Supply and installation: 3×58 MW boilers, auxiliary equipment, electric and auto-control equipment, etc	HCHG-2	S+I	ICB	Prior review	Sep. 2008 to Feb. 2009	No	May to Oct. 2009
A3	Gongchangling District Heat Source Plant	Liaoyang Gongchangling Heating Supply and installation: 3×58 MW hot water boilers, auxiliary equipment, electrical and auto-control equipment, etc.	LYHG-2	S+I	ICB	Prior review	Mar. to July. 2008	No	Aug. to Nov. 2008
A4	Heat Source Plant	Yangjiazhangzi Mining Area Heating 3×29 MW hot water boilers, auxiliary equipment, electrical equipment for boilers, auto control system for the network.	YZZHG-2	S+I	ICB	Prior review	Sep. 2008 to Feb. 2009	No	May to Oct. 2009
A5	Heat Source Plant	Yingkou City Central Heating Expansion Supply & Installation of electrical and auto-control Equipment for 1×58 MW and 4×29 MW (Two heating plants) Auto control system for the network.	YKHG-2	S+I	ICB	Prior review	Sep. 2008 to Feb. 2009	No	May to Oct. 2009

2. **Consulting Services.**

(a) List of consulting assignments with short-list of international firms.

1	2	3	4	5
Ref. No.	Description of Assignment	Selection Method	Review by Bank (Prior / Post)	Expected Proposals Submission Date
A-1	Design review of first-year contracts	CQS	Prior	January 2008
A-2	Design review and project management	QCBS	Prior	May 2008
A-3	Design review and project management	CQS	Prior	May 2008
B	Review of safety and security measures	CQS	Prior	May 2009

(b) Consultancy services estimated to cost above US\$200,000 per contract and single source selection of consultants (firms) for assignments will be subject to prior review by the Bank.

(c) **Short lists composed entirely of national consultants:** Short lists of consultants for services estimated to cost less than US \$300,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines

Annex 9: Economic and Financial Analysis
CHINA: Liaoning Third Medium Cities Infrastructure Project

A. ECONOMIC ANALYSIS AND PROJECT LEVEL FINANCIAL ANALYSIS

Economic Analyses of Each Investment Subproject

1. **Heating Subprojects.** The economic analysis was conducted for each investment subproject to examine its economic rationality, which comprises of least cost analyses and cost benefit analyses. The least cost analyses were carried out to select the optimal technical options by comparison of different heating supply options. The cost benefit analyses were carried out further to estimate the economic internal rates of return (EIRRs) of each investment subproject.

2. **Least Cost Analysis.** The supply area or demand of each heating subproject comprises existing area (52% of total area), which is currently supplied by existing small HoBs, and new expansion area (48% of total area) to be developed in the cities. To optimize the technical design of all heating supply subprojects, the least cost analyses were conducted based on the life-cycle cost comparison of different heating supply options:

- Option 1: to purchase heat from CHP (if available) to meet both existing and new expansion area. The small boilers will be replaced;
- Option 2: to purchase heat from CHP (if available) to meet new expansion area only. The small boilers will be kept to meet the existing area;
- Option 3: to build large HoBs to meet both existing and new expansion area. The small boilers will be replaced;
- Option 4: to build large HoBs to meet new expansion area only. The small boilers will be kept to meet the existing area.

Table A9.1 Summary of Least Cost Analysis

Subproject	Heating Area ('000 m ²)			Options considered	Least cost option
	Existing	Expansion	Total		
1. Benxi II	2880	4254	7134	3, 4	3
2. Benxi Steel	1470	3510	4980	-	-
3. Benxi Nanfen	533	780	1313	3, 4	3
4. Fushun	2670	4400	7070	1,2,3,4	1
5. Haicheng	1897	1300	3197	3, 4	3
6. Gongchangling	1853	1284	3137	3, 4	3
7. Huludao YJZZ	465	1250	1715	3, 4	3
8. Yingkou North	7611	1986	9597	1,2,3,4	1
9. Yingkou Dashiqiao	2982	1475	4457	3, 4	3
10. Yingkou EDZ	5424	5000	10424	1,2,3,4	1
Total	27785	25239	53024		

The comparison of NPVs of life-cycle cost of each option shows that when CHP is available, the heat purchase from CHP to meet both existing and new expansion area will be the least cost

option; when CHP is not available, the large HoBs to meet both existing and new expansion area will be the least cost option. The conclusion is fully complied with the project design, which proves its economic justification.

3. Cost Benefit Analysis. Cost-benefit analyses were conducted further to estimate the EIRR of each investment subproject. The methodology, assumptions and results of the cost-benefit analyses were summarized as below.

4. *Economic Costs.* The economic costs of each investment subproject include (a) total investment costs of heating plants, substations and pipelines, and (b) operations costs including fuel cost, heat purchase cost, electricity and water consumption, salary and maintenance cost etc. All the costs exclude taxes, duties and financing charges. The conversion factor is considered as 1.0 when estimating the economic costs from financial costs because the distortions in the exchange and wage rates in the overall costs are not significant enough to justify the use of shadow prices. The land cost is valued as its opportunity cost using market price or the yield production.

5. *Economic Benefits.* Three major benefits considered for the analyses are (i) cost saving due to improved heating supply efficiency for existing area because of the replacement of inefficient small boilers, which is quantified as the reduction of fuel consumption and other related saving on electricity, water, labor, maintenance cost etc., (ii) additional heating supply service for new expansion area, which is quantified using consumers' tariff as a proxy of willingness to pay, and (iii) local environmental benefits due to pollutants emission reduction.

6. Local pollution emission reduction benefits are estimated based on the externality cost of particulate and SO₂ which were calculated using the Benefit Transfer Method, based on the New York Externality Model (Rowe and others 1994). Global pollution reductions benefits are estimated based on recent carbon trade market price. The derived externality cost used in the analysis are: 5609 Y/ton for TSP, 1301 Y/ton for SO₂, 1413 Y/ton for NO_x and 94 Y/ton for CO₂. Table A9.2 summarizes the main assumptions of cost benefit analysis for heating subprojects.

7. *Economic Internal Rate of Return.* Estimates of the EIRRs for each heating subproject are shown in Table A9.3. Based on conservative assumptions for heat demand growth, the analyses showed that the EIRRs of each heating subproject ranged 13.3–36.2 percent, which shows the economic viability of these heating subprojects. The results show that all heating subprojects are economically justified; all EIRRs are higher than the assumed discount rate of 12 percent. Sensitivity analysis was conducted using the following variables: (a) cost overrun of 10 percent; (b) heating supply area reduction of 10 percent; (c) delay of implementation by one year; and (d) exclusion of environmental benefits. Benxi Nanfen, Haicheng, Gongchangling, and Huludao Yangjiazhangzi (YJZZ) (four boiler subprojects) are sensitive to implementation delays and environmental benefits. Under all other conditions, the subproject EIRRs remained above the 12 percent discount rate, an indicator of the robustness of the project economic returns.

TABLE A9.2. MAIN ASSUMPTIONS OF COST-BENEFIT ANALYSIS FOR HEATING SUBPROJECTS

Subproject	Project description	Investment Cost *	Boiler Efficiency	Fuel price **	Coal Quality	Heating Tariff ***
		Million Y	%	Y/ton, Y/GJ	Kcal/kg, %	Y/m ²
1. Benxi II	2 new boiler plant (3x58MW _{th} , 2x29MW) and 1 expansion (2x58 MW _{th} CFB), heating networks	474.1	81% for Chain grate, 88% for CFB	Low quality Coal: 340 Other coal: 380	LHV: 4827 S%: 0.89% Ash%: 28.9%	R:24 P:24
2. Benxi Steel	Waste heat collection system and heating network	247.1	-	-	-	R:23 P:23
3. Benxi Nanfen	1 new boiler plant (3x29 MW _{th}), heating network	97.8	81%	Coal: 384	LHV: 4539 S%: 0.89% Ash%: 29.0%	R:24 P:24
4. Fushun	Heating network to deliver heat/steam from CHP to consumers	207.7	-	Coal: 380 Heat: 25.5	LHV: 4500 S%: 0.9% Ash%: 30.0%	R:24 P:24
5. Haicheng	1 new boiler plant (3x58 MW _{th}), heating network	163.3	83%	Coal: 380	LHV:4982 S%: 0.8% Ash%: 21.7%	R:22 P:27
6. Gongchangling	1 new boiler plant (3x58 MW _{th}), heating network	195.3	83%	Coal: 380	LHV: 4457 S%: 0.9% Ash%: 30.9%	R:22 P:24
7. Huludao YJZZ	1 new boiler plant (3x29 MW _{th}), heating network	126.6	81%	Coal: 420	LHV: 5420 S%: 0.6% Ash%: 26.5%	R:22.5 P:30
8. Yingkou North	Heating network to deliver heat from CHP to consumers	391.4	-	Coal: 380 Heat: 28	LHV: 4500 S%: 0.4% Ash%: 27.0%	R:22 P:25
9. Yingkou Dashiqiao	1 new boiler plant (4x64 MW _{th}), heating network	215.3	83%	Coal: 380	LHV: 4567 S%: 0.9% Ash%: 25.1%	R:22 P:25
10. Yingkou EDZ	Heating network to deliver heat from CHP to consumers	375.1	-	Coal: 400 Heat: 28	LHV:4800 S%:0.9% Ash%:30.0%	R:22 P:25

Note: * Price contingency and financing charges (IDC, front-end fee etc.) are excluded in the investment cost.

** 13% VAT included.

*** R refers residential; P refers to tariff of non-residential (public), 2007 price

TABLE A9.2 MAIN ASSUMPTIONS OF COST BENEFIT ANALYSIS FOR HEATING SUBPROJECTS (CONT.)

Subproject	Commissioning Year	Heating Supply Area By Year ('000 m ²)									
		2008	2009	2010	2011	2013	2013	2013	2013	2013	2013
1. Benxi II	2008	3567	5707	6421	6777	7134	7134	7134	7134	7134	7134
2. Benxi Steel	2009	-	4050	4980	4980	4980	4980	4980	4980	4980	4980
3. Benxi Nanfen	2009	-	1050	1128	1189	1250	1250	1250	1250	1250	1313
4. Fushun	2008	1286	4887	5707	6428	7075	7075	7075	7075	7075	7075
5. Haicheng	2009	-	2797	2997	3197	3197	3197	3197	3197	3197	3197
6. Gongchangling	2009	-	2537	2727	2927	3137	3137	3137	3137	3137	3137
7. Huludao YJZZ	2008	1073	1590	1717	1715	1715	1715	1715	1715	1715	1715
8. Yingkou North	2010	-	-	5758	7677	8637	8637	8637	8637	8637	9596
9. Yingkou Dashiqiao	2008	3822	3981	4140	4298	4457	4457	4457	4457	4457	4457
10. Yingkou EDZ	2008	7095	7927	8760	9592	10424	10424	10424	10424	10424	10424

Note: * Fushun subproject will also supply steam at an amount of 80 ton/h.

8. **Gas Subproject.** The cost benefit analysis was also conducted for Yingkou Gas subproject. The economic cost includes the capital cost, gas purchase cost and other O&M cost. The economic benefits include (i) cost saving due to losses reduction after the pipeline system rehabilitation, and (ii) incremental gas supply to consumer, which is quantified as the avoided fuel cost (electricity and LPG).

9. The main assumptions for the cost benefit analysis of Yingkou gas subproject are summarized as below:

	2009	2010	2011	2012	2013	2014	2015
Gas sales ('000 m ³)	11845	12995	14147	15299	16451	17603	18755

Commissioning year	2009
Line losses rate – before rehabilitation	14.1%
– after rehabilitation	2.8%
Investment cost (base cost + physical cont.)	74.7 million Y
Gas purchase price (VAT included)	1.19 Y/m ³
Gas sales price - Residential use	2.50 Y/m ³
- commercial/enterprise	4.40 Y/m ³
Electricity price	0.50 Y/kWh
LPG price	12.5 Y/m ³

10. The derived EIRR is 18.2 percent, confirming the economic viability of this gas subproject. The sensitivity analysis was conducted using the following variables: (i) cost overrun of 10%, (ii) benefits reduction of 10%, and (iii) implementation delay by one year. A robust conclusion can be drawn on the project's economic rate of return higher than 12 percent.

Table A9.3 Economic Rate of Return for Each Investment Subproject

Subproject	EIRR	Sensitivity Analysis			
		Without Env. Benefit	Capital Cost +10%	Heating Supply Area -10%	Implementation Delay by 1 year
	Base Case				
1. Benxi II	19.3%	9.6%	16.8%	16.5%	11.9%
2. Benxi Steel	24.0%	23.2%	21.6%	21.4%	17.3%
3. Benxi Nanfen	19.8%	5.8%	17.5%	17.3%	12.6%
4. Fushun	36.2%	19.2%	32.5%	32.2%	17.1%
5. Haicheng	15.1%	10.6%	13.6%	13.4%	10.1%
6. Gongchangling	16.4%	6.9%	14.6%	14.4%	10.8%
7. Huludao YJZZ	13.3%	5.7%	11.6%	11.4%	8.6%
8. Yingkou North	20.4%	13.8%	18.1%	17.9%	12.0%
9. Yingkou Dashiqiao	29.9%	12.1%	26.3%	25.9%	16.5%
10. Yingkou EDZ	26.3%	17.2%	22.8%	22.5%	13.2%
11. Yingkou Gas	18.2%	-	16.8%	13.2%	12.0%

Note: * For Yingkou Gas subproject, the quantified environmental benefits were not calculated as the replaced fuel by natural gas will be electricity and LPG.

Project Level Financial Analysis of Each Investment Subproject

11. The financial analyses of each investment subproject are based on the feasibility study reports approved by Liaoning Provincial Government and the project entities' historical financial accounts, as well as their latest financial projections. All the subprojects will be financed by equity investments from the shareholders, IBRD loan and/or local loans. The terms and conditions of the IBRD loans and local loans used in these analyses were those applicable in late 2007. All the major assumptions are consistent with the current Chinese financial and taxation regulations as well as common practices in the project areas.

12. Project level FIRR was prepared for each subproject—reflecting total financial revenues and capital and O&M costs under the assumption of a 20 year project life.

- For heating subprojects, the project financial cost includes the capital cost, fuel/heat purchase cost, and other O&M cost; the project income includes (i) cost saving of existing heating area if it was supplied by the project entities; (ii) heating sales income for expanded area which was quantified using forecast consumer heating tariff over the analytical period; (iii) connection fees for new expansion area; and (iv) potential carbon financing credits. A workshop on carbon financing preparation was held with interested subproject sponsors during project appraisal.
- For Yingkou gas subproject, the project financial cost include the capital cost, gas purchase cost, other O&M cost; the project financial income includes (i) cost saving to serve the existing gas consumers, and (ii) incremental gas sales to new consumers.

13. The main assumptions of the project level financial analysis are summarized as below:

Heat/gas demand	See assumptions in economic analysis part
Heat tariff/gas price	See assumptions in economic analysis part
Term of IBRD loan	Interest rate: 5.2% - assumed 17 years (4 years' grace period included) Front-end Fee: 0.25% Commitment fee: 0%
Term of Local loan	Interest rate: 7.83% 5 years
Taxes – Income tax	25% (effective 2008)
-- VAT	13% for heat/steam and coal, 17% for electricity etc.
Depreciation period	20 years for boilers/substation, 30 years for pipelines

*Note: * The revised loan term of maximum maturity limits up to 30 years (average maturity of up to 18 years) was approved by the Bank Executive Board on February 12, 2008. This term will provide more benefits to the project owner in comparison with the assumed terms in the project analysis.*

14. *Financial Internal Rate of Return.* Estimates of the FIRR for each investment subproject are shown in Table A9.4 given below.

TABLE A9.4
FINANCIAL RATE OF RETURN FOR EACH INVESTMENT SUBPROJECT

Subproject	FIRR (%)
1. Benxi II *	10.3%
2. Benxi Steel	23.2%
3. Benxi Nanfen *	7.2%
4. Fushun	7.9%
5. Haicheng *	8.7%
6. Gongchangling *	6.2%
7. Huludao YJZZ *	6.2%
8. Yingkou North	8.3%
9. Yingkou Dashiqiao *	10.0%
10. Yingkou EDZ *	14.2%
11. Yingkou Gas	11.4%

* Potential carbon finance transactions

B. FINANCIAL VIABILITY OF THE BORROWERS

1. With an exception in Dashiqiao municipality, the final borrowers under the project will be the district heating (DH) companies that will implement the projects and be responsible for operations. A review has been carried out of the current financial status of the proposed borrowers, including their capacity to provide counterpart funding. Financial projections have been prepared to assess the borrowers' capacity to meet their financial obligations and performance targets during the subproject implementation and operations periods. For each company, a brief summary, with key financial indicators, is given in Section B4 below. Detailed projections are kept in project files. The projections, based on conservative assumptions, indicate that, subject to compliance with key financial covenants, the companies will be able to (i) over the implementation period (2008 to 2012), generate sufficient cash flow to meet their financial obligations in regards to operations, subproject financing, and debt service; and, in addition, (ii) by 2012, the end of the implementation period, attain and maintain thereafter, a net profit each year.

B1. Financial Covenants

2. For each company (excepting the Dashiqiao Urban Construction and Investment Company - YDUCIC), the proposed financial covenants are:

- (i) For each year starting with 2009, generate sufficient cash from operations to cover cash operating expenses, counterpart financing requirements, and debt service;
- (ii) For each year, starting with the year 2012, realize total revenues not less than total expenses;
- (iii) Not incur new debt unless a reasonable forecast of revenues and expenses indicates that the company will be able to maintain a DSCR of at least 1.3; and

3. For the YDUCIC, the proposed covenants are:

- (i) Not incur new debt unless a reasonable forecast of revenues and expenses indicates that the company will be able to maintain a debt service coverage ratio of at least 1.3; and
- (ii) YDUCIC will execute a leasing agreement which specifies payment timing in regard to depreciation, debt service and profit-sharing;

B2. General Background

4. Out of the ten companies under the project, nine are district heating (DH) companies, and one is a gas transmission and distribution company. Tariff policy for district heating reflects the concern of the municipalities to keep tariffs at levels that are affordable to the population keeping in mind that district heating is just one of several utility services that households have to pay for out of their monthly incomes. This is particularly so given that the lower income households are especially vulnerable as

schemes for directed subsidies are not yet effectively in place. The authorities have therefore been sensitive to making increases in heating tariffs, preferring to make step-wise increases in tariffs at periodic intervals rather than annual adjustments. Historically, tariffs were based at levels that would enable the utilities to cover their cash expenses. Major investments were funded out of municipal budgets. Over the years, the cash flow of the utilities was adversely affected by increases in coal prices, particularly, over the past five years, and difficulties in enforcing collections from delinquent customers. Realizing that the situation was not sustainable, municipalities have taken steps to strengthen the DH companies: (i) in one of the nine DH companies, the existing company has been restructured, and a new company has been set up, with clean balance sheets free of legacy debt, accumulated losses and non-performing assets, to take over and operate the assets on a commercial basis; (ii) in one case, the municipality has entered into a concession-type arrangement; (iii) in four cases, the companies are newly established wholly owned by the municipalities, of which three are wholly owned by the municipalities and the other one is a private company; and (iv) one large DH company, wholly owned by the municipality, continues in its existing form. The two remaining DH companies are an SOE and a subsidiary of an SOE which has given assurances of its support for the subsidiary to implement the project successfully.

B3. Approach and Main Assumptions

5. Given the desire of the authorities to keep, on social considerations, heating tariffs at levels that would be affordable to the population, and to lower income households in particular, the overall approach under the projections has been to ensure that (i) the companies will have sufficient cash flow each year, from tariff and non-tariff sources, to meet their financial obligations in regards to operations and maintenance, subproject financing, and debt service, and, in addition, and (ii) by the end of project implementation (2012), require all companies to achieve, and maintain thereafter, a net profit each year. Eight of the ten companies are projected to achieve and maintain profitable operations starting 2010, and the remaining two, by 2012. This is in line with the approach of the Government, at both the national and provincial levels, to achieve progressive cost recovery in the infrastructure sectors.

6. Connection fees from developers will be a major source of revenue for the companies. Self-financing in regards to subproject financing will come mainly from connection fees. Where connection fees are not used, equity contributions from the municipality and/or local loans would provide the required local counterpart financing. In one case (Gongchangling), there will be a substantial equity contribution from a private investor.

7. The main assumptions in the projections are:

- All operating costs and revenues are given in nominal terms. Costs were escalated at the projected rates of local inflation. Consistent with the approach to limit the extent and timing of tariff increases to those necessary to achieve the required cash generation (taking into account that, during the implementation

period, local counterpart funds will also be available to the companies from other sources, e.g. connection fees, government equity contributions, and local loans), tariffs were adjusted to a level necessary for meeting the annual cash requirements, taking into account other sources of revenues available.

- Capital and operating costs and financing plans were taken from the feasibility studies prepared for the subprojects.
- The annually collected connection fees enter into the annual cash flow statements. For purposes of revenue recognition in the income statements, the annually collected amounts are amortized over a period of 10 years.
- Collection ratios (annual collections/annual billings) have been improving in recent years; the companies have confirmed that a collection rate of at least 95% is attainable.
- The IBRD loan will finance the capital costs of civil works (disbursement percentages ranging from 31–60%), equipment (100%), and consulting services (100%). Interest during construction (IDC) will be financed from local counterpart funds.
- Repayment terms for the IBRD loan were assumed to be a maturity of 17 years with a grace period of four years, at the Bank's variable interest rate. Repayment terms for local bank loans were assumed to be 10 years including two years of grace at an average interest rate of 6.8%.
- Depreciation rates for equipment were based on allowable rates for income tax calculation.
- Working capital assumptions were: (i) accounts receivable adjusted in line with annual collections; (ii) inventories equivalent to one month of material expenses; and (iii) accounts payable were assumed to progressively decline over time to the equivalent of two months of operating expenses.

B4. Company Financial Projections

8. **Benxi Hengze Heating Development Company, Ltd.**: The municipality decided in 2006 to restructure the existing Benxi Municipal Heating Company. A new private/public joint venture, the Benxi Hengze Heating Development Company, Ltd., has been established to take over the fixed assets and customer base of the old company. The municipality has taken over the old debts and receivables of the erstwhile company. The projections show that, with modest increases in tariffs in 2011 and 2012, the company would be able to realize the necessary cash flow, taking into account that the company will also be collecting substantial amounts of connection fees. The company is also projected to make a net profit after tax each year during the period 2008 to 2015.

9. The project financing plan anticipates a total financing requirement of RMB 496 million of which RMB 256.4 million will be covered by the IBRD loan and the balance of RMB 239.6 million by self-financing from connection fees.

Benxi Hengze Heating Development Company, Ltd. – Key Financial Indicators

Indicator	Unit	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²	7.4	9.6	11.2	11.8	12.1	12.3	12.3	12.3
Ratios:									
Operating ratio (operating expenses/operating revenues)	ratio	0.91	0.85	0.83	0.83	0.82	0.83	0.85	0.87
Debt service coverage	ratio	1.1	1.5	1.8	2.6	2.2	2.0	2.0	1.9

10. Benxi Steel (Group) Heating Development Company Ltd. (BSGHC):

BSGHC is a subsidiary of the Bengang Steel Group and services heating areas in Benxi City, Waitoushan District, and Nanfen District. Under the subproject, heating areas will be expanded in Benxi City and in Nanfen District. The company's current ratio is low due mainly to a large payment to the parent company which is a matter of dispute between BSGHC and the parent company. BSGHC together with its parent company will provide assurances prior to negotiations that the disputed payable will not be allowed to affect BSGHC's ability to meet its financial obligations under the subproject. In one year, 2009, BSGHC has a large capital expenditure as a result of which its annual net cash flow for that year would be negative, but it would have sufficient cash balances on hand from previous years to be able to meet its local counterpart financing needs. The projections show that, with modest increases in 2013 and 2015, BSGHC would be able to (i) meet its cash flow requirements under the subproject, and (ii) achieve and maintain profitable operations by the end of the project implementation period (2012). Starting 2010, BSGHC is projected to consistently make a net profit after tax each year.

11. The project financing plan anticipates a total financing requirement of RMB 277.1 million, of which RMB 130.9 million will be covered by the IBRD loan, RMB 43.9 million from a local bank loan, and the balance of RMB 102.4 million by self-financing from connection fees.

Benxi Steel (Group) Heating Development Company Ltd. – Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²	9.0	9.8	10.9	11.5	11.6	11.6	11.7	11.7	11.7
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio	1.10	0.96	1.00	0.93	0.96	0.96	0.94	0.96	0.95
Debt service coverage	ratio	36.3	37.3	10.1	7.8	3.6	1.8	2.2	1.7	2.0

12. Fushun Thermal Power Plant Company (FTPPC): FTPPC currently generates and sells electricity, and it also sells district heating to Fushun City Heat Networks, a

separate company. FTPPC is a subsidiary of the China Power Investment Company (CPIC). Under the subproject, FTPPC will construct new pipeline to transmit heat from a new thermal power plant under construction and will supply the heat to an expanded heating area. FTPPC's current ratio is currently low since, in 2004 and 2005, it had to resort to substantial short-term borrowing from local banks to meet increases in operating costs due to higher coal prices while it was not allowed to correspondingly increase power tariffs. As a result, it accumulated substantial short term debt (RMB 700 million). FTPPC has provided a plan to gradually reduce the short term debt. FTPPC does not wish to convert the short term debt into a long term debt since interest rates on short term debt are currently lower than on long term debt. However, instead of rolling it over each year, it has started to reduce this debt in installments each year, starting with 2007. Although this results in the company's annual net cash flow becoming negative in some years, the company is able to draw on its accumulated cash balances for the payments. To help FTPPC further strengthen its liquidity, the parent company has agreed to provide a fresh injection of RMB 100 million as additional equity in 2009 which would help FTPPC to start gradually improving its current ratio to reach a level of at least 1.0 by 2014. The financial projections show that no increases in tariffs would be required during the implementation period. The projections indicate that FTPPC would maintain profitable operations through the period 2008 to 2015.

13. The project financing plan anticipates a total financing requirement of RMB 233 million, of which RMB 118 million will be covered by the IBRD loan, RMB 40 million from a local bank loan, and the balance of RMB 75 million by self-financing.

Fushun Thermal Power Plant Company – Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²		0.5	2.7	5.2	6.0	6.7	7.1	7.1	7.1
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio	0.89	0.87	0.85	0.87	0.89	0.90	0.90	0.91	0.93
Debt service coverage	ratio	1.1	1.2	0.9	1.3	1.3	1.4	1.5	1.4	1.3

14. **Gongchangling District Qinglong Heating Company Ltd. (GQHC):** The Gongchangling District Qinglong Heating Company Ltd. will be the borrower, will implement the subproject, and thereafter operate the subproject assets. It is a new company owned by a private investor. The projections show that, given the availability of financing through connection fees, no tariff increases will be necessary during the implementation period (2008-2012). However, tariff increases would be necessary starting 2013 with the start of amortization of the Bank subloan. Starting 2010, GQHC is projected to maintain profitable operations through 2015.

15. The project financing plan anticipates a total financing requirement of RMB204.3 million, of which RMB 104.4 million will be covered by the IBRD loan, and the balance

of RMB 100 million by self-financing from connection fees and equity contribution by the private investor.

Gongchangling District Qinglong Heating Company Ltd. – Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²	0.7	2.1	2.4	2.6	2.8	3.0	3.1	3.1	3.1
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio	2.44	0.93	1.00	0.90	0.97	0.96	0.84	0.84	0.82
Debt service coverage	ratio		14.5	2.4	3.5	3.6	1.8	1.3	1.3	1.4

16. **Haicheng Hengye Heating Supply Company Ltd. (HHHC):** The subproject in Haicheng will be implemented in the existing service area of the Aofeng Heating Company which is a subsidiary of the Haicheng Urban Construction and Investment Company. Haicheng has established a new municipally-owned company (HHHC) to own and operate the subproject assets. The financial projections for HHHC show that, given the availability of financing through connection fees, no increases in tariffs will be required during the subproject implementation period (2008-2012). A modest tariff increase would be required around 2013. The projections indicate that, starting 2011, HHHC will maintain profitable operations each year.

17. The project financing plan anticipates a total financing requirement of RMB 174.2 million, of which RMB 95.9 million will be covered by the IBRD loan and the balance of RMB 78.3 million by an equity grant from the government.

Haicheng Hengye Heating Supply Company Ltd. – Key Financial Indicators

Indicator	Unit	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²		1.12	2.88	3.08	3.20	3.20	3.20	3.20
Ratios:									
Operating ratio (operating expenses/operating revenues)	ratio		1.03	0.91	0.89	0.89	0.90	0.87	0.89
Debt service coverage	ratio		0.7	2.8	3.1	1.6	1.6	1.8	1.7

18. **Huludao Yangjiazhangzi Economic & Technical Development Zone District Mudu Heating Company (YHHC):** YHHC is a newly registered state-owned company. The financial projections show that tariff increases will be required towards the end of the implementation period. Starting 2011, YHHC is projected to make a modest profit each year.

19. The project financing plan anticipates a total financing requirement of RMB 132.2 million, of which RMB 68 million will be covered by the IBRD loan and the balance of RMB 64.2 million by an equity contribution from the government.

Huludao Yangjiazhangzi Economic & Technical Development Zone District Mudu Heating Company– Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²		0.4	1.3	1.6	1.7	1.7	1.7	1.7	1.7
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio		0.79	0.91	1.00	0.90	0.92	0.88	0.89	0.92
Debt service coverage	ratio		0.9	1.6	1.9	2.9	1.3	1.7	1.6	1.5

20. **Yingkou EDZ Huayuan Heating Company Ltd. (YEDZHC)**: YEDZHC is newly established wholly-owned municipal heating company. Given the availability of financing from government equity contributions and connection fees, the company’s cash flow during the implementation period is projected to be adequate for it to meet the cash requirements during the construction period. Modest tariff increases are projected to be required around the end of the implementation period. The company is projected to maintain profitable operations through the period 2008 to 2015.

21. The project financing plan anticipates a total financing requirement of RMB 417.5 million, of which RMB 206.6 million will be covered by the IBRD loan, RMB 74.4 million from a local bank loan, RMB 40 million from a government equity contribution, and RMB 96.6 million by self-financing from connection fees

Yingkou EDZ Huayuan Heating Company Ltd. – Key Financial Indicators

Indicator	Unit	2008	2009	2010	2011	202	2013	2014	2015
Total heat sales area	million m ²	2.8	7.4	8.3	9.1	9.9	10.4	10.4	10.4
Ratios:									
Operating ratio (operating expenses/operating revenues)	ratio	0.75	0.75	0.82	0.86	0.82	0.82	0.84	0.85
Debt service coverage	ratio	3.0	2.9	1.9	2.1	1.5	2.0	1.9	1.8

22. **Yingkou Heating Company (YHC)**: YHC is the primary heat supplier to the population of Yingkou City. Benefits under the subproject in terms of expanded heat sales area and realization of operating cost savings will be realized relatively late in the implementation period. The projections indicate that a significant tariff increase (about 15%) would be required in 2009 with subsequent increases in 2013 and 2014 to meet

debt service requirements. Starting 2011, YHC is projected to achieve and maintain profitable operations each year.

23. The project financing plan anticipates a total financing requirement of RMB 458 million, of which RMB 219.9 million will be covered by the IBRD loan, RMB 160.5 million from a local bank loan, and RMB 77.6 million by self-financing from connection fees.

Yingkou Heating Company – Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total heat sales area	million m ²	4.99	5.20	5.41	5.63	6.53	8.06	9.02	9.60	9.60
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio	0.88	0.98	0.98	0.95	0.88	0.87	0.80	0.72	0.74
Debt service coverage	ratio	8.4	5.0	1.8	0.5	2.6	1.4	1.7	1.1	1.1

24. **Dashiqiao Urban Construction and Investment Company (DUCIC):** The subproject will be implemented by the YDUCIC, wholly owned by Dashiqiao municipality. Once the subproject is complete, it would be transferred to a private concessionaire (Hongyang Heating Company - HHC) under a 30-year concession-type agreement. During the construction period, YDUCIC will provide the local counterpart financing for the subproject through a municipal investment subsidy from Dashiqiao and proceeds from the planned sale of assets. During the operations phase, the lessee (HHC) will make payments, by specified dates each year, to the municipality for depreciation, debt service and profit-sharing. YDUCIC will open a special account in a local bank acceptable to the Bank and the LFB into which the payments made by the lessee would be deposited and used for the purposes of the subproject. The municipality will provide assurances as to the timely and sufficient payments of the municipal subsidy during the construction phase.

25. The project financing plan anticipates a total financing requirement of RMB 232 million, of which RMB 133.4 million will be covered by the IBRD loan, RMB 51.1 million from a local bank loan, and RMB 47.5 million from the municipal investment subsidy and planned sale of assets.

**Dashiqiao Urban Construction and Investment Company – Subproject Financing Indicators
(in RMB million)**

	2008	2009	2010	2011	2012	2013	2014	2015
A. Debt service on IBRD-financed subproject								
IBRD loan		3.5	7.7	7.7	7.7	14.9	14.9	14.9
Local loan		1.8	20.0	18.8	17.6			
Total		5.3	27.7	26.5	25.4	14.9	14.9	14.9

26. **Yingkou Gas Company (YGC):** YGC is engaged in gas transmission and distribution. Current levels of gas sales tariffs are not adequate to allow the company to cover its operating expenses. The company therefore receives a subsidy (in the amount of RMB 2.1 million per year) from the municipality. As a part of policy, the municipality currently does not intend to allow increases in gas sales prices. However, it has confirmed that it would continue with the annual subsidy of RMB 2.1 million. The financial projections indicate that, with the annual subsidy, YGC should be able to meet its financial obligations during the subproject construction and implementation periods. Taking into account the annual subsidy, YGC is projected to maintain making a small net after tax profit each year during the projection period (2008 to 2015).

27. The project financing plan anticipates a total financing requirement of RMB 82.8 million, of which RMB 31.2 million will be covered by the IBRD loan and RMB 51.6 million from local counterpart financing.

Yingkou Gas Company – Key Financial Indicators

Indicator	Unit	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total gas sales billed to consumers	million m ³	9.2	10.5	11.8	13.0	14.1	15.3	16.5	17.6	18.8
Ratios:										
Operating ratio (operating expenses/operating revenues)	ratio	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0
Debt service coverage	ratio	8.4	10.2	4.8	3.8	4.7	2.7	2.9	2.9	3.0

C. PROJECT FISCAL IMPACTS – MUNICIPAL BUDGETS

28. The Bank has reviewed the current and projected budget figures for the project municipalities and cities, and the potential budget impact of their firm and potential financial commitments under the proposed LMC3 project. As noted in the previous sections, the commitments of the municipal budgets to financing the capital costs of the project are relatively modest with the exception of Gongchangling and Yingkou EDZ. Firm commitments include the municipalities’ commitments to provide equity capital to the company to assist in project financing. Potential commitments are those which might be incurred if the project companies are unable to generate the full amount of internal funds (e.g. connection fees) proposed in the financing plans.

29. The forecast debt service obligations represent between 4.1 percent and 0.6 percent of the total disposable revenues of the municipalities. This suggests that the debt service obligations that would be carried by municipalities in a worst-case scenario should not represent a significant burden on the annual budget revenues.

Annex 10: Safeguard Policy Issues

CHINA: Liaoning Third Medium Cities Infrastructure Project

Involuntary Resettlement

1. Liaoning Third Medium Cities Project (LMC-3) involves eleven subprojects in 6 cities including Fushun, Anshan, Benxi, Yingkou, Liaoyang and Huludao. Five of them involve land acquisition and resettlement. These five subprojects are Haicheng Central Heating Supply subproject, Benxi Nanfen Central Heating subproject, Yingkou Dashiqiao Central Heating subproject of Yingkou City, Benxi Central Heating (Phase II) subproject and Huludao Yangjiazhangzi Central Heating Supply subproject. Individual RAPs for each of these subprojects were prepared in Chinese by the respective design institutes, assisted by the respective PMO, house demolition offices, land resources bureaus, affected villages and communities, and potential displaced persons. The RAPs were prepared in compliance with OP 4.12 Involuntary Resettlement and describe in detail the impacts, affected populations, consultation process, rehabilitation measures, budget, and implementation and monitoring arrangements. The remaining six subprojects do not involve land acquisition and resettlement impacts based on their current design. Following Bank procedures, an Executive Summary RAP covering all subprojects was prepared in English. To address any resettlement impacts caused by project design changes during implementation, a Resettlement Policy Framework (RPF) is in place. The Summary RAP and RPF and sent to the Bank's InfoShop on September 19, 2007.
2. In the process of project design, the project owners and design institutes assessed possible linkages with ongoing or previous activities and found resettlement linkage issue exists in the subproject of Fushun Power Plant Heat Supply Expansion and Heating Pipeline Network Construction. To address the linkage issue, a resettlement retroactive review (RRR) was prepared and included in Annex two of the Summary RAP. The RRR found that the relevant district government complied with relevant resettlement policies. Notably, the RRR mentions the district government had benefited from experience with previous Bank financed transport project in dealing with resettlement issues.
3. Efforts have been made to minimize the resettlement impacts during project planning and design. The resettlement impacts have been significantly reduced through optimizing the project design and implementation arrangements. These are described in details in Section 1.3 of Summary RAP and each subproject RAP.
4. **Resettlement Impacts:** The resettlement impacts involved in the project is quite limited and scattered in 6 villages of 5 towns (or district). The project will affect 956 persons from 308 households in total by permanent land acquisition, temporary land use and housing demolishing. The detailed resettlement impacts are provided in the following table:

Subprojects	Permanent Land Acquisition		Temporary land use-{}-		Housing demolishing		PAP in total (Persons)
	Collective land (mu)	PAPs (person)	Land (mu)	PAPs (person)	Housing M ²	Hhs	
1 Yangjiazhangzi mining area central heating supply project					5941	149	474
2 Benxi central heating project (the second phase)					1038	18	54
3 Haicheng Central Heating subproject	41.9	8	45	0			8
4 Benxi Nanfen Central Heating subproject	34.46	93	40	0			93
5 Yingkou Dashiqiao Central Heating Supply subproject	90.26	327	44	0			327
Total	166.62	428	129	0	6979	167	956

5. **Policy Principles and Legal Framework:** The RAP was prepared in line with relevant Chinese laws and regulations at both national and local level and World Bank OP 4.12 on Involuntary Resettlement. The following basic principles were adopted for resettlement planning:

- Acquisition of land and other assets, and relocation of people, will be minimized as much as possible.
- All project affected people residing, working, doing business or cultivating land required for the project as of the date of the baseline surveys are entitled to rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels. Lack of legal rights to the assets lost will not bar them from entitlement to such rehabilitation measures.
- The rehabilitation measures due to land acquisition are: (i) agricultural land for land of equal productive capacity; (ii) compensation for land acquisition and resettlement subsidy for the farmers affected by land acquisition; and, (iii) other forms of assistance.
- Replacement of agricultural land will be, as much as is possible, similar to the land that was lost.
- Plans for acquisition of land and other assets and provision of rehabilitation measures will be carried out in consultation with the affected people.
- Financial and physical resources for resettlement and rehabilitation will be made available as and when required.
- Institutional arrangements will ensure effective and timely design, planning, consultation and implementation of the Resettlement Plan.
- Effective and timely supervision, monitoring and evaluation of the implementation will be carried out.

6. **Compensation Standards:** The compensation for land acquisition includes land compensation, resettlement subsidy, and young crop compensation. The land acquisition compensation is calculated based on annual production value according to the Law of

Land Administration. The compensation rates of structures are determined based on their replacement cost. The detailed compensation rates are included in the RAPs.

7. ***Institutional Arrangements:*** A multi-level organization has been established for the implementation of the RAPs. An independent monitor will be selected through bidding process for resettlement implementation. Details of staffing and their responsibilities are provided in the RAPs.

8. ***Public Consultation and Participation:*** The affected residents, business people and district governments participated in the census, inventory and formulation of the livelihood rehabilitation strategy, measures and relocation sites. Their feedback has been incorporated in determining the compensation rates and livelihood rehabilitation measures. The RAP contains a list of major consultation sessions.

9. ***Complaints and Grievances:*** Issues that arise with respect to the resettlement, such as compensation payment and rehabilitation measures, can be handled by following procedures established:

Step 1: Displaced persons can appeal by verbal or paper way to village committee or project demolition implementation institution if they are not satisfied with resettlement plan. For verbal appeal, village committee and demolition institution should record in written form and solve the problems within two weeks;

Step 2: If displaced persons are still not satisfied with the decision of Phase 1, they can appeal to municipal PMOs/ administration institutions after receiving decision notice and the latter should resolve it within two weeks;

Step 3: If displaced persons are still not satisfied with the decision of municipal PMOs/ administration institutions, they can appeal to subproject leading team or local municipal construction commission after receiving decision notice. The latter should handle the case within two weeks;

Step 4: If displaced persons are still not satisfied with the decision of subproject leading team or local municipal construction commission, they can bring a lawsuit to a civil law court in case of objection to any aspect of the resettlement plan after receiving decision notice.

10. ***Monitoring Arrangements:*** Both internal and external monitoring mechanism will be carried out. The project resettlement offices will carry out internal monitoring of resettlement implementation. An independent external monitor will be selected for external monitoring. The contents and time frequency of both internal and external monitoring are described in RAP.

11. ***Resettlement cost and Funding Arrangements:*** Each subproject RAP contains a detailed resettlement cost estimation that covers all the basic costs for resettlement, management, contingencies, surveys, design and monitoring. The basic resettlement cost

includes compensation for land, standing crops and trees and reconstruction of affected infrastructure. The total resettlement budget is estimated at RMB13 million Yuan. Resettlement costs will be covered through counterpart funds. Project owners will allocate the resettlement fund to resettlement implementation agencies, such as local land administration bureaus or housing demolishing agencies at municipal level. The resettlement implementation agencies will disburse to the fund to affected persons or entities.

Indigenous People

12. Demographic information on minority in the project area was collected through social assessment. There are about 200,000 minority people scattered in the project areas, consisting of mainly Man, Korea and Mongolia. But there is no any minority community will be affected by the project (detailed information are provided in Section 2.4 of summary SA). Therefore, the Bank's Policy on Indigenous Peoples OP 4.10 is not triggered.

Social Assessment

13. A social assessment was carried out to investigate the impact of the Liaoning Provincial Government's official policy of gradually closing down boilers in the subproject areas. In the boiler closure program about 5,574 workers will be affected, of which 67% are a seasonal workforce. The findings of the social assessment were shared with each municipal government. The municipal governments are developing policies which plan to: (a) give affected workers preferential treatment for employment in companies managing central heating systems or in other municipal enterprises; (b) make available opportunities for vocational training; and (c) provide reasonable compensation for these worn out, polluting assets.

Gender

14. The social assessment was carried out with a gender-sensitive approach. Women were interviewed and separate women's group was organized for FGD in the process of SA and resettlement planning. Women's concerns were integrated in project design though no significant gender disparities exist in the project.

Environment

Environmental Safeguards

A. Background

This Annex describes environmental impacts and environmental management plans of the LMC3. The discussion is based on the EIA reports and the EMP reports prepared by borrowers based on the national policies as well as Bank's environmental safeguard policies, especially the OP4.01 Environmental Assessment. The EIA documents identify potential environmental benefits and consequences of the project, propose measures to

avoid, mitigate or otherwise compensate negative environmental impacts during construction and operation, and allow incorporation of appropriate measures in the design to mitigate negative impacts to a minimum and acceptable level. The final draft EA Summary was submitted to the Bank on February 25, 2008 and found to be satisfactory. The EA documentation was sent to the Bank's InfoShop in Washington in September 2007. During EA preparation, local people were consulted, and their opinions have been reflected in the project design and environmental mitigation measures as appropriate. The final EA reports have been reviewed and cleared by Liaoning Environmental Protection Bureau (EPB) from Jan to Feb 2008. The copy of EPB approval documents will be kept in the project file.

15. The EIA reports have been prepared on the basis of the country's legal and policy framework for pollution control and environmental protection, master plans and environmental plans of the project cities/counties, as well as applicable World Bank safeguard policies, e.g., OP 4.01 Environmental Assessment. Chinese environmental standards have been used as a basis for subproject design and therefore the primary reference to determine the extent and level of impacts.

16. Technically, the EIA applies methodologies set out in various technical guidelines issued by the State Environmental Protection Administration (SEPA). The scope of the project covered by the EIA is based on project feasibility study reports for each of the project components prepared by Liaoning Urban Planning Design and Research Institute, the Fushun Design Institute, the [gas design institute, and the institute doing the integrity study].

17. The supply and use of space heating for about 250 million urban citizens in China's northern, cold climate provinces is not only a national concern, but a local priority. Much of the existing heating supply infrastructure especially in medium and small cities of Liaoning Province is in urgent need of modernization. In the early stages of urbanization, cities invested in small, coal fired boilers to provide space heating to new urban areas. Over time, larger boilers replaced small boilers – but many still remain. These small boilers are now located in dense urban centers after rapid urban expansion. The small coal fired boilers are a source of major winter air pollution. The small boilers operate at a reported 40-60% efficiency (compared to about 75-85% efficiency of large boilers), and use little, if any, TSP or sulfur removal equipment. The impact on human health and city aesthetics with coal dust and slag in residential centers, and smoke stacks emitting black smoke over apartment buildings is severely negative.

B. Environmental Benefit

18. The proposed project will contribute to the overall reduction in atmospheric emissions of coal combustion products from the residential heating system, namely dust and sulfur dioxide, per square meter of connected floor area by replacing small inefficient heat-only boilers with larger more highly efficient boilers utilizing more effective control systems for removal of these pollutants from the flue gases. According to the EIA reports, total 317 scattered small boilers will be closed down under all project cities and

closing down small boilers would contribute to an annual reduction of 8934.98 tons SO₂ and 11659.09 tons TSP as detailed in the table below. It is expected that after project, the incidence of respiratory diseases in all project cities in heating season should be reduced.

Name of project	Number of small boilers plants to be shut down	Expected Emission Reduction of the small boiler out of service (t/a)	
		SO ₂	TSP
Central heating project of north side of Yong'an road in Haicheng city	14	572.16	433.6
Central heating project at the Gongchangling district, Liaoyang City	22	1120.1	405.5
Central heating project of Dashiqiao District in Yingkou City	64	1879.2	1360.5
Central heating project of Nanfen District, Benxi City	7	549.4	319.6
Central heating project of Yangjiazhangzi District in Huludao City	4	216.32	96.33
Heating network construction of Heating Unit Expansion for Fushun Thermal Power Plant	66	1548.2	5064.2
Central Heating network in Yingkou EDZ	79	1448.3	694.9
Heating network for Central Heating Project in North Part of Yingkou	30	956.8	2343.0
Second phase of central heating project in Benxi City	31	644.5	941.46
Sum total	317	8934.98	11659.09

C. Key Impacts and Mitigation Measures during Construction and Operations

19. The main environmental issues associated with construction of boilers, heat exchange stations (group substations), hot water and gas pipelines are dust, noise, disposal of solid waste (primarily packing materials), interruption of traffic and chance find items of cultural significance. Mitigation and monitoring measures are addressed in the EMPs presenting in the Section E.

20. During operation, the main environmental issues associated with the boilers are emissions of dust and sulfur dioxide, wastewater (domestic and industrial), dust associated with transport and storage of coal, ash, limestone, and spent sorbent, and management of solid waste products produced (ash and spent sorbent from flue gas desulphurization operations). In order to meet the national air quality requirement and emission standards, emission control technology proposed for the new boilers is to install the bag-filter house for dust collection and the FGD system for SO₂ reduction. Expected efficiency is 99.7% for TSP and 90% for SO₂. New Chinese regulations require new boiler installations to include continuous emission monitoring for dust and sulfur dioxide and this is included in the project. For both hot water and gas pipelines and heat exchange stations, the main issues are domestic wastewater and domestic waste produced by operating personnel. Additionally, noise from pumps is an issue during the operation of heat exchange stations. Detailed mitigation measures have been proposed in the EMPs summarized in the Section E.

D. Main Subproject Specific Issues

21. For Yingkou Gas subproject, the more critical aspects are plant personnel and public safety risk and emergency preparedness because of the flammable and explosive nature of high pressure natural gas. An Emergency Preparedness Plan has been prepared and approved by the local safety operation and supervision bureau.

22. The Fushun Power Plan Heating Network Expansion, Yingkou EDZ Central Heating Supply, Yingkou Northern Central Heating Supply and Benxi Steel Central Heating Supply subprojects were considered linked to existing or planned heat generation facilities that are outside the project scope. To satisfy World Bank environmental safeguard requirements, the Bank team performed environmental due diligence and has documented evidence on file that these facilities have valid operating licenses and no outstanding environmental fees, fines or penalties in the last five years.

E. Generic Environmental Mitigation Measures in Construction and Operation and Environmental Monitoring

23. Due to similar nature of the environmental issues and associated mitigation measures, a summary is presented in Table 1.

24. The environmental monitoring plan, as part of each EMP, has been reviewed by the task team, summarized in the Table 2.

Construction period		Operation period			
Environmental issues	Mitigation measure	Responsible unit	Environmental issues	Mitigation problem	Responsible agency
Noise	<ol style="list-style-type: none"> Construction time from 6:00 am-10:00 pm, night construction is forbidden. The noise of construction equipment must satisfy the requirements of <i>Noise Limits for Construction Site</i> (GB12523-90), which shall be incorporated in the bidding documents made by construction companies. Track monitoring. 	Contractor	Atmosphere-TSP, SO ₂	Installation of bag-filter house for dust collection and the FGD system for SO ₂ reduction. Expected efficiency is 99.7% for TSP and 90% for SO ₂ . The stack height is in the range of 100-150m respectively depending on the geo-conditions.	Heating company
Dust	<ol style="list-style-type: none"> Establish watering system to reduce dust. Increase watering times and amount in case of dry and gale weather. Set up closed fence not lower than the height of stack around the storage ground of building material. Each inlet and outlet of construction sites shall be provided with facilities to clean up dirt on wheels so that vehicles will not take dirt out of the sites. Dispersed materials shall be transported with cover. Temporary storehouse for dispersed materials shall be within sites, or cover dispersed materials with dustproof net. Dispersed materials are forbidden to pile in the open air. Remove building waste in time. It is not allowed to incinerate waste on site. Set up fence around the construction sites to reduce the diffusion extent of flying dust. 	Contractor	Noise of heat source plant	In order to lower the noise within Plant area, set up separate houses for blowers with a large noise to prevent noise from diffusing and propagating; take separate foundations or vibration-isolation measures for such equipment as water pumps and blowers etc., which have a larger vibration; inlet and outlet use hose coupler; the overall floor plan layout has taken into account the direction of sound source and weakening of noise.	Heating company
Solid wastes	<ol style="list-style-type: none"> Domestic waste will be timely collected and carried to the landfill identified; building waste will be removed in time and sent to the site determined by local Environmental Sanitation Bureau. 	Contractor	Wastewater	Drainage from soft water production, blower cooling water and boiler sewage use for slag cooler washing down slag-ash humidifying; domestic sewage, after disposed in septic tank, will be discharged into municipal drainage pipeline network along with washing miscellaneous water, and ultimately into sewage plant.	Heating company

Construction period		Operation period			
Environmental issues	Mitigation measure	Responsible unit	Environmental issues	Mitigation problem	Responsible agency
Interruption of traffic	<p>1. The pipeline will be excavated on pedestrian paths by means of enclosed construction without occupying any carriageways.</p> <p>2. The construction across road should be carried out at its quickest, strictly limited to 7 days.</p> <p>3. Bulletin board shall be erected on the construction site, determining the project contents, construction team and the words "Please understand the inconveniences incurred from the construction". In addition, there should be contact person and contact means on the board.</p> <p>4. Build temporary bridge and set up construction baffle to assure pedestrians' safety when constructing nearby school and hospital.</p>	Contractor	Solid waste	Main waste solid is the ash-slag and small amount domestic waste. The ash-slag will be fully utilized comprehensively as the raw material of bricks. And domestic waste will be delivered to municipal landfill determined by each city.	Heating company
Cultural Properties	<p>1. If any cultural properties are found during construction, stop the work and notify relevant administrations.</p> <p>2. It is forbidden to remove any artifacts.</p>	Construction unit	Noise of heat exchange station	<p>1. Select imported water pumps with high quality and low noise, the noise level is not more than 80dB (A) for each.</p> <p>2. Lay the shock-absorption foundation of pump stand stably, and install shock absorber to lessen sound transmission caused by vibration; the inlet and outlet of water pumps is connected with rubber hose. Lay another concrete foundation at the bottom of water pump, and set another shock absorber between the foundation and ground as well as walls so as to eliminate the effect of low-frequency sound of structure on environment.</p> <p>3. It is necessary to set sound insulation enclosure in case that the noise at the residential area around heat exchange station remains to exceed the standard.</p>	City Investment Company

Table 2

Monitoring item	Construction period			Operation period		
	Monitoring factor	Monitoring frequency	Monitoring spot	Monitoring factor	Monitoring frequency	Monitoring spot
Boiler house	Noise	Once a week in the daytime or each time a complain is received	Residential area close to the plant site	Waste gas —soot	Once upon new coal is bought in during heating season	Boiler chimney (above dust collector)
				Waste gas —SO ₂	Once upon new coal is bought in during heating season	Boiler chimney (above dust collector)
	TSP or PM10 at construction site	Once a week in case of dry or gale weather	Construction location	Environmental quality (Soot, SO ₂)	Once a month during heating season	According to the EIA report
Heat exchange station	Noise	Once a week	Population intensive areas closest to Construction location	Noise	Only once during heating season	Residential area close to the plant site
	Noise	Once a week in the daytime or each time a complain is received	Places where pipelines cross road	Noise	Once during heating season or each time a complaint is received	Outside of the walls of exchange station or nearby residential areas
Pipeline network	TSP or PM10 at construction site	Once a week in case of dry or gale weather	Places where pipelines cross road	-	-	-
				-	-	-

F. Public Consultations and Information Disclosure

25. For all sub-projects at least one public consultation was conducted, as required by World Bank EA policy. However, public consultation for sub-projects requiring a full EIA Report has been conducted twice, exceeding World Bank EA requirements for Category B projects. Chinese language versions of the EMPs were disclosed publicly prior to appraisal.

Public Consultations

Sub-projects	Time	Consultation behavior	Consulted Persons	Consulted places	Consulting personnel	Problems and feedback	Policy Requirements
Central Heating Project in the North of Yong'an Road Tiedong, Haicheng City	24/01/2007	Questionnaire	Residents in Haicheng city, Xiai, Sanli, Xiaoluobao, Tianshuigou and so forth	Local residential area	Project owners and environmental assessment staffs	Some residents are concerned about that the construction of heat source plant will impact local air quality. People residing along the pipeline network consider that the construction of pipeline network will affect their travel.	Environmental assessment policy (OP4.01) of World Bank and the requirement of State Environmental Protection Administration of China, and the <i>Regulation for Public Consultation in the Environmental Impact Assessment</i>
	08/04/2007	Hearing	Resident Representatives and local government officials from Haicheng city, Xiai, Sanli, Xiaoluobao, Tianshuigou and so forth	Haicheng Urban Construction Investment Co., Ltd.	Project owners and environmental assessment staff		
Central Heating Project in Gongchangling District of Liaoyang City	20/01/2007	Questionnaire	Residents from community of Ansheng, Youji, Tuanshan, Sujia, Sunjiazhai and so forth	Local residential area	Project owners and environmental assessment staff	Some residents are concerned that the construction of heat source plant will impact local air quality. People residing along the pipeline network consider that the construction of pipeline network will affect their travel. A few of residents show their dissatisfaction with the construction of heat exchange station.	
	14/04/2007	Hearing	Resident Representatives and local government officials from community of Ansheng, Youji, Tuanshan, Sujia and Sunjiazhai	Liaoyang Gongchangling District Qinglong Heating Company Ltd.	Project owners and environmental assessment staff		
Central Heating Project in Dashiqiao District of Yingkou City	22/01/2007	Questionnaire	Residents from the villages of Xinmintun, Tielingcun, Hepingcun, Wangjiacun, Dongjiangcun, Chenjiacun, and Shengshuicun	Local residential area	Project owners and environmental assessment staff	People residing along the pipeline network consider that the construction of pipeline network will affect their travel	
	25/04/2007	Hearing	Resident Representatives and local government officials from the villages of Xinmintun, Tielingcun, Hepingcun, Wangjiacun, Dongjiangcun, Chenjiacun and Shengshuicun	Dashiqiao Development and Reform Commission	Project owners and environmental assessment staff		
Central Heating Project in Nanfen District	15/04/2007	Questionnaire	Residents from Nanshan Residential Area, Xujiabaozi and Shuairwanzi	Local residential area	Project owners and environmental assessment staff	Residents suppose that the heat source plant can replace small boilers to improve air quality, but they are afraid the pipeline construction will affect their travel.	
	07/07/2007	Hearing	Resident Representatives and local government officials from Nanshan Residential Area, Xujiabaozi and Shuairwanzi	Nanfen Heat Power Company	Project owners and environmental assessment staff		

Central Heating Project in Yangjiazhangzi Diggings	18/07/2007	Questionnaire	Residents from villages of Yangjiazhangzi, Xiafuergou, Heiyugou, Xiaomajiagou, Gaoeshanggou, and Changmaocun etc.	Local residential area	Project owners and environmental assessment staff	Some residents are concerned that the construction of heat source plant will impact local air quality. A few of residents show their dissatisfaction with the construction of nearby heat exchange station.
	12/08/2007	Hearing	Resident Representatives and local government officials from villages of Yangjiazhangzi, Xiafuergou, Heiyugou, Xiaomajiagou, Gaoeshanggou, and Changmaocun etc.	Government of Yangjiazhangzi Economic Development Area	Project owners and environmental assessment staff	
Phase Central Heating Project of Benxi City	11/10/2007	Questionnaire	Residents in Caitun, Wolong and Xihu.	Local residential area	Project owners and environmental assessment staff	Some residents are concerned that the construction of heat source plant will impact local air quality. A few of residents show their dissatisfaction with the construction of nearby heat exchange station.
	28/10/2007	Hearing	Residents in Caitun, Wolong and Xihu.	Benxi Heat Supply Corporation	Project owners and environmental assessment staff	
Heating Network Construction of Thermal Unit Expansion Project for Fushun Electric Generation Plant	10/07/2006	Questionnaire	Residential area along the pipeline and that nearby heat exchange station	Local residential area	Project owners and environmental assessment staff	People residing along the pipeline network consider that the construction of pipeline network will affect their travel
	16/04/2007	Questionnaire	Residential area along the pipeline and that nearby heat exchange station	Inside Benxi Iron & Steel Factory	Project owners and environmental assessment staff	
Central Heating Modification Project for Benxi Iron & Steel Heating Development Company	10/04/2007	Questionnaire	Residential area along the pipeline and that nearby heat exchange station	Local residential area	Project owners and environmental assessment staff	Local people expect that the heating network can be laid as fast as possible so that the centralized heating can be realized soon.
	15/07/2007	Questionnaire	Residential area along the pipeline and that nearby heat exchange station	Local residential area	Project owners and environmental assessment staff	
Rehabilitation and Expansion Project for Gas Facilities of Yingkou City	15/03/2007	Questionnaire	Specially protected hospitals, schools, kindergartens, and residential area at both sides of the gas pipeline	Hospital, school, kindergarten, residential area	Project owners and environmental assessment staff	Residents hope the construction unit can make the construction period as short as they can, avoiding the construction risks.

Information Disclosure

Sub-project	Documents title	Publicity site of environmental management plan	Date of Document	Date of Disclosure	Location of Disclosure
Central Heating Project in the North of Yong'an Road Tiedong, Haicheng City	<i>Environmental Management Plan for Central Heating Project in the North of Yong'an Road Tiedong, Haicheng City;</i> <i>Environmental Impact Report of Central Heating Project in the North of Yong'an Road Tiedong, Haicheng City</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Environmental Management Office of Haicheng Urban Construction Investment Co., Ltd	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Central Heating Project in Gongchangling District of Liaoyang City	<i>Environmental Management Plan for Central Heating Project in Gongchangling District of Liaoyang City;</i> <i>Environmental Impact Report of Central Heating Project in Gongchangling District of Liaoyang City</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Environmental Management Office of Gongchangling District Qinglong Heating Company Ltd.	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Central Heating Project in Dashiqiao District of Yingkou City	<i>Environmental Management Plan for Central Heating Project in Dashiqiao District of Yingkou City;</i> <i>Environmental Impact Report of Central Heating Project in Dashiqiao District of Yingkou City</i>	<i>Foreign Capital Project Office of Liaoning Province Development and Reform Commission</i> <i>Liaoning Academy of Environmental Sciences</i> <i>Environmental Management Office of Dashiqiao Urban Construction and Investment Company</i>	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Central Heating Project of Nanfen District	<i>Environmental Management Plan for Central Heating Project of Nanfen District;</i> <i>Environmental Impact Report of Central Heating Project of Nanfen District;</i> <i>Environmental Management Plan for</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Benxi Iron& Steel Heating Development Company	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp

Central Heating Modification Project for Benxi Iron & Steel Heating Development Company	Central Heating Modification Project for Benxi Iron & Steel Heating Development Company <i>Environmental Impact Report of Central Heating Modification Project for Benxi Iron & Steel Heating Development Company</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Water Heating Center of Yangjiazhangzi Economic Development Zone	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Central Heating Project in Yangjiazhangzi Diggings	<i>Environmental Management Plan for Central Heating Project in Yangjiazhangzi Diggings; Environmental Impact Report of Central Heating Project in Yangjiazhangzi Diggings</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Wushun Power Co., Ltd.	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Heating Network Construction of Thermal Unit Expansion Project for Fushun Electric Generation Plant	<i>Environmental Management Plan for Heating Network Construction of Thermal Unit Expansion Project for Fushun Electric Generation Plant; Environmental Impact Report of Heating Network Construction of Thermal Unit Expansion Project for Fushun Electric Generation Plant</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Wushun Power Co., Ltd.	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Central Heating Network Project in Yingkou Economic Development Zone	<i>Environmental Management Plan for Central Heating Network Project in Yingkou Economic Development Zone; Environmental Impact Report of Central Heating Network Project in Yingkou Economic Development Zone</i>	Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Development and Reform Bureau of Yingkou Economic and Technological Zone	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp
Huaneng Central Heating Project in North Part of Yingkou	<i>Environmental Management Plan for Huaneng Central Heating Project in North Part of Yingkou; Environmental Impact Report of Huaneng Central Heating Project in North Part of Yingkou</i>	Liaoning Academy of Environmental Sciences Liaoning Academy of Environmental Sciences Yingkou Heating Company	15/08/2007	18/09/2007	http://www.laes.com.cn/zixun/huanning/gongshi/gongshi.asp

<p>Reconstruction and Expansion Project for Gas Facilities of Yingkou City</p>	<p><i>Environmental Management Plan for Reconstruction and Expansion Project for Gas Facilities of Yingkou City;</i> <i>Environmental Impact Report of Reconstruction and Expansion Project for Gas Facilities of Yingkou City;</i></p>	<p>Foreign Capital Project Office of Liaoning Province Development and Reform Commission Liaoning Academy of Environmental Sciences Yingkou Coal Gas Co., Ltd.</p>	<p>15/08/2007</p>	<p>18/09/2007</p>	<p>http://www.laes.com.cn/zixun/huani/gongshi.asp</p>
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Annex 11: Project Preparation and Supervision
CHINA: Liaoning Third Medium Cities Infrastructure Project

	Planned	Actual
PCN review	03/31/2006	04/05/2006
Initial PID to PIC		04/27/2006
Initial ISDS to PIC		08/14/2006
Appraisal	01/08/2008	01/08/2008
Negotiations	04/15/2008	03/31/2008
Board/RVP approval	05/27/2008	
Planned date of effectiveness	08/01/2008	
Planned date of mid-term review	06/30/2011	
Planned closing date	12/31/2013	

Key institutions responsible for preparation of the project:

- Liaoning Provincial Finance Bureau (LPFB)
- Liaoning Provincial Development and Reform Commission (LDRC)
- LDRC Foreign Funds Utilization Project Office (FFUPO)
- Participating municipal Development and Reform Commissions
- Participating municipal Finance Bureaus
- Participating heating and gas utilities

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Gailius J. Draugelis	Senior Energy Specialist Task Team Leader	EASTE
Ximing Peng	Energy Specialist Deputy Task Team Leader	EASCS
Robert P. Taylor	Lead Energy Specialist	EASTE
Zhentu Liu	Sr. Procurement Specialist	EAPCO
Chongwu Sun	Sr. Environmental Specialist	EASCS
Chaogang Wang	Sr. Social Scientist	EASCS
Haixia Li	Financial Management Specialist	EAPCO
Xujun Liu	Procurement Specialist	EAPCO
Arto Nuorkivi	Consultant, Project Engineer	EASTE
Bernd Kalkum	Consultant, DH Specialist and Institutional	EASTE
Kishore Nadkarni	Consultant, Financial Analyst	ECSSD
Margret Wilson	Consultant, Financial Analyst	ECSSD
Noureddine Berrah	Consultant, Energy Specialist	EASTE
Salahuddin Khwaja	Consultant, Gas Engineer	EASTE
Bernard Baratz	Consultant, Environmental Specialist	EASTE
Cristina Hernandez	Program Assistant	EASTE

Bank funds expended to date on project preparation: (12/20/2007)

1. Bank resources: \$363,466.24
2. Trust funds: \$0
3. Total: \$363,466.24

Estimated Approval and Supervision costs:

1. Remaining BB costs to approval: \$100,000
2. Estimated annual supervision cost: \$70,000

Annex 12: Documents in the Project File
CHINA: Liaoning Third Medium Cities Infrastructure Project

Presentations on heating supply design workshop in Huludao, July 2005

Presentations in substation workshop in Shenyang, February 2007

Summary of quantities per each subproject

Comparison of group and building level substations

Comparison of water treatment between boilers and substations

Subproject Feasibility Studies and Supplemental Reports

Procurement Capacity Assessment (draft)

Financial Management Capacity Assessment (draft)

Detailed Project Economic and Financial Analysis

Annex 13: Statement of Loans and Credits
CHINA: Liaoning Third Medium Cities Infrastructure Project

Project ID	FY	Purpose	Original Amount in US\$ Millions						Difference between expected and actual disbursements	
			IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P093963	2008	CN-Guiyang Transport	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
P087318	2007	CN--GEF-Guangxi Integrated Forestry Dev.	0.00	0.00	0.00	5.25	0.00	4.65	0.18	0.00
P083322	2007	CN-SICHUAN URBAN DEV	180.00	0.00	0.00	0.00	0.00	170.70	28.54	0.00
P081776	2007	CN-GUANGDONG/PRD2	96.00	0.00	0.00	0.00	0.00	96.00	5.67	0.00
P088964	2007	CN-Guangxi Integrated Forestry Dev	100.00	0.00	0.00	0.00	0.00	76.11	-21.39	0.00
P090377	2007	CN-GEF-2nd Shandong Environment	0.00	0.00	0.00	5.00	0.00	4.50	0.00	0.00
P091020	2007	CN-Fujian Highway Sector Investment	320.00	0.00	0.00	0.00	0.00	320.00	43.50	0.00
P092618	2007	CN-LIAONING MED CITIES INFRAS 2	173.00	0.00	0.00	0.00	0.00	173.00	0.00	0.00
P086035	2007	CN-CF-Tianjin Landfill Gas Recovery	0.00	0.00	0.00	0.00	0.00	8.44	0.00	0.00
P075613	2007	CN-Shaanxi Ankang Road Development	300.00	0.00	0.00	0.00	0.00	290.00	7.39	0.00
P086515	2007	CN-3rd National Railway	200.00	0.00	0.00	0.00	0.00	200.00	18.67	0.00
P077752	2007	CN-SHANDONG ENVMT 2	147.00	0.00	0.00	0.00	0.00	131.16	-10.01	0.00
P096285	2007	CN-MSE Finance	100.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00
P095315	2007	CN-W. Region Rural Water & Sanitation	25.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00
P075732	2006	CN-SHANGHAI URBAN APL2	180.00	0.00	0.00	0.00	0.00	144.90	18.23	0.00
P082992	2006	CN-GEF-Termite Control Demonstration	0.00	0.00	0.00	14.36	0.00	14.36	1.47	0.00
P081348	2006	CN-HENAN TOWNS WATER	150.00	0.00	0.00	0.00	0.00	139.63	14.63	0.00
P081255	2006	CN-Changjiang/Pearl River Watershed Reha	100.00	0.00	0.00	0.00	0.00	95.61	17.27	0.00
P070519	2006	CN-Fuzhou Nantai Island Peri-Urban Dev	100.00	0.00	0.00	0.00	0.00	98.25	22.00	0.00
P086629	2006	CN-Heilongjiang Dairy	100.00	0.00	0.00	0.00	0.00	91.76	16.93	0.00
P099992	2006	CN-Liaoning Medium Cities Infrastructure	218.00	0.00	0.00	0.00	0.00	175.65	-17.77	0.00
P096158	2006	CN-Renewable Energy II (CRESP II)	86.33	0.00	0.00	0.00	0.00	71.95	30.50	0.00
P094388	2006	CN-HFC-23 Emissions Reduction	0.00	0.00	0.00	0.00	0.00	1,045.51	0.00	0.00
P093906	2006	CN-3rd Jiangxi Hwy	200.00	0.00	0.00	0.00	0.00	151.92	-8.08	0.00
P090649	2006	CN-CF-Facilitating Afforestation Program	0.00	0.00	0.00	0.00	0.00	2.01	0.00	0.00
P090336	2006	CN-GEF-NINGBO WATER & ENVMT	0.00	0.00	0.00	5.00	0.00	4.39	1.67	0.00
P085333	2006	CN-5th Inland Waterways	100.00	0.00	0.00	0.00	0.00	65.42	25.59	0.00
P085124	2006	CN-Ecnomic Reform Implementation	20.00	0.00	0.00	0.00	0.00	18.44	4.61	0.00
P084742	2006	CN-IAIL III	200.00	0.00	0.00	0.00	0.00	106.86	6.09	0.00
P082993	2006	CN-GEF-PCB Mgmt & Disposal	0.00	0.00	0.00	18.34	0.00	17.57	10.06	0.00
P081346	2005	CN-LIUZHOU ENVIRONMENT MGMT	100.00	0.00	0.00	0.00	0.00	55.04	-5.41	0.00
P081161	2005	CN-CHONGQING SMALL CITIES	180.00	0.00	0.00	0.00	0.00	144.82	40.16	0.00
P086505	2005	CN-NINGBO WATER & ENVMT	130.00	0.00	0.00	0.00	0.00	85.89	-4.61	0.00
P075730	2005	CN-HUNAN URBAN DEV	172.00	0.00	0.00	0.00	0.00	155.62	56.46	0.00
P057933	2005	CN-TAI BASIN URBAN ENVMT	61.00	0.00	0.00	0.00	0.00	29.77	17.16	0.00
P067625	2005	CN-GEF-Renewable Energy Scale-Up Program	0.00	0.00	0.00	40.22	0.00	37.67	-0.35	0.00
P067828	2005	CN-Renewable Energy Scale-up Program	87.00	0.00	0.00	0.00	10.00	2.40	8.90	0.00
P068752	2005	CN-Inner Mongolia Highway & Trade Corrid	100.00	0.00	0.00	0.00	0.00	28.66	-21.76	0.00

P069862	2005	CN - Agricultural Technology Transfer	100.00	0.00	0.00	0.00	0.00	70.38	29.82	0.00
P087291	2005	CN-CF-Jincheng Coal Bed Methane Project	0.00	0.00	0.00	0.00	0.00	49.24	0.00	0.00
P071094	2005	CN - Poor Rural Communities Development	100.00	0.00	0.00	0.00	0.00	72.21	44.01	0.00
P072721	2005	CN-GEF-Heat Reform & Bldg Egy Eff.	0.00	0.00	0.00	18.00	0.00	14.56	8.24	0.00
P075728	2004	CN-GUANGDONG/PRD UR ENVMT	128.00	0.00	0.00	0.00	0.64	74.54	28.78	0.00
P065035	2004	CN-Gansu & Xinjiang Pastoral Development	66.27	0.00	0.00	0.00	0.00	16.93	7.01	0.00
P065463	2004	CN-Jiangxi Integrated Agric. Modern.	100.00	0.00	0.00	0.00	0.00	54.61	32.08	0.00
P066955	2004	CN-ZHEJIANG URBAN ENVMT	133.00	0.00	0.00	0.00	0.00	85.34	40.08	0.00
P084003	2004	CN-GEF GUANGDONG PRD URB ENV	0.00	0.00	0.00	10.00	0.00	9.45	6.66	0.00
P075035	2004	CN - GEF-Hai Basin Integr. Wat. Env.Man.	0.00	0.00	0.00	17.00	0.00	9.92	11.68	0.00
P073002	2004	CN-Basic Education in Western Areas	100.00	0.00	0.00	0.00	0.00	31.32	28.83	0.00
P077137	2004	CN-4th Inland Waterways	91.00	0.00	0.00	0.00	0.46	47.17	26.46	25.96
P069852	2004	CN-Wuhan Urban Transport	200.00	0.00	0.00	0.00	1.00	62.13	60.79	0.00
P081749	2004	CN-Hubei Shiman Highway	200.00	0.00	0.00	0.00	1.00	9.19	-8.14	0.00
P077615	2004	CN-GEF-Gansu & Xinjiang Pastoral Develop	0.00	0.00	0.00	10.50	0.00	5.28	8.66	0.00
P058847	2003	CN-3rd Xinjiang Hwy Project	150.00	0.00	0.00	0.00	0.00	12.25	12.25	0.00
P040599	2003	CN-TIANJIN URB DEV II	150.00	0.00	0.00	0.00	0.00	126.17	83.35	4.08
P067337	2003	CN-2nd GEF Energy Conservation	0.00	0.00	0.00	26.00	0.00	7.17	25.86	0.00
P068058	2003	CN-Yixing Pumped Storage Project	145.00	0.00	0.00	0.00	0.00	46.41	35.85	0.00
P070191	2003	CN-SHANGHAI URB ENVMT APL I	200.00	0.00	0.00	0.00	0.00	81.53	50.85	0.00
P076714	2003	CN-2nd Anhui Hwy	250.00	0.00	0.00	0.00	0.00	20.54	-0.30	0.00
P070459	2002	CN-Inner Mongolia Hwy Project	100.00	0.00	0.00	0.00	0.00	7.84	3.84	0.00
P060029	2002	CN-GEF-Sustain. Forestry Dev	0.00	0.00	0.00	16.00	0.00	4.59	14.58	0.00
P071147	2002	CN-Tuberculosis Control Project	104.00	0.00	0.00	0.00	0.00	41.63	29.49	0.00
P064729	2002	CN-Sustainable Forestry Development	93.90	0.00	0.00	0.00	0.00	12.11	5.81	0.00
P068049	2002	CN-Hubei Hydropower Dev in Poor Areas	105.00	0.00	0.00	0.00	0.00	14.39	8.52	0.00
P047345	2001	CN-HUAI RIVER POLLUTION CONTROL	105.50	0.00	0.00	0.00	0.00	10.36	10.36	-2.08
P051859	2001	CN-LIAO RIVER BASIN	100.00	0.00	0.00	0.00	0.00	12.17	11.97	0.00
P056596	2001	CN-Shijiazhuang Urban Transport	100.00	0.00	0.00	0.00	0.00	30.86	30.86	0.00
P064924	2000	CN-GEF-BEIJING ENVMT II	0.00	0.00	0.00	25.00	0.00	18.95	25.00	12.15
P049436	2000	CN-CHONGQING URBAN ENVMT	200.00	0.00	0.00	0.00	29.50	48.63	78.13	-0.68
P064730	2000	CN-Yangtze Dike Strengthening	210.00	0.00	0.00	0.00	0.00	64.12	64.12	47.78
P045910	2000	CN-HEBEI URBAN ENVIRONMENT	150.00	0.00	0.00	0.00	0.00	27.83	27.83	7.87
P042109	2000	CN-BEIJING ENVIRONMENT II	349.00	0.00	0.00	25.00	26.51	146.62	173.13	10.02
P038121	1999	CN-GEF-Renewable Energy Development	0.00	0.00	0.00	35.00	0.00	2.21	34.77	28.90
P051856	1999	CN-Accounting Reform & Development	27.40	5.60	0.00	0.00	0.00	5.23	5.02	4.74
P042299	1999	CN-Tec Coop Credit IV	10.00	35.00	0.00	0.00	5.84	9.59	12.82	0.00
P036953	1999	CN-Health IX	10.00	50.00	0.00	0.00	0.40	6.71	5.00	5.00
Total:			7,803.40	90.60	0.00	270.67	75.35	5,853.84	1,480.37	143.74

CHINA
STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

FY Approval	Company	Committed				Disbursed			
		IFC				IFC			
		Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2002	ASIMCO	0.00	10.00	0.00	0.00	0.00	10.00	0.00	0.00
2006	ASIMCO	0.00	0.00	4.12	0.00	0.00	0.00	3.61	0.00
2005	BCCB	0.00	59.21	0.00	0.00	0.00	59.03	0.00	0.00
2003	BCIB	0.00	0.00	12.04	0.00	0.00	0.00	0.00	0.00
2006	BUFH	8.14	0.00	0.00	0.00	8.14	0.00	0.00	0.00
2005	Babei	0.00	5.00	0.00	0.00	0.00	5.00	0.00	0.00
	Babei Necktie	11.00	0.00	0.00	6.00	8.94	0.00	0.00	4.88
1999	Bank of Shanghai	0.00	21.76	0.00	0.00	0.00	21.76	0.00	0.00
2000	Bank of Shanghai	0.00	3.84	0.00	0.00	0.00	3.84	0.00	0.00
2002	Bank of Shanghai	0.00	24.67	0.00	0.00	0.00	24.67	0.00	0.00
2005	BioChina	0.00	3.70	0.00	0.00	0.00	3.13	0.00	0.00
2002	CDH China Fund	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00
2005	CDH China II	0.00	17.99	0.00	0.00	0.00	11.38	0.00	0.00
2006	CDH Venture	0.00	20.00	0.00	0.00	0.00	0.51	0.00	0.00
2005	CT Holdings	0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00
2004	CUNA Mutuai	0.00	10.53	0.00	0.00	0.00	0.00	0.00	0.00
2006	Capital Today	0.00	25.00	0.00	0.00	0.00	0.32	0.00	0.00
2005	Changyu Group	0.00	18.07	0.00	0.00	0.00	18.07	0.00	0.00
1998	Chengdu Huarong	3.36	3.20	0.00	3.13	3.36	3.20	0.00	3.13
2004	China Green Ener	20.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00
2004	China Re Life	0.00	0.27	0.00	0.00	0.00	0.27	0.00	0.00
1994	China Walden Mgt	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
2006	Chinasoft	0.00	0.00	15.00	0.00	0.00	0.00	10.00	0.00
2004	Colony China	0.00	15.31	0.00	0.00	0.00	9.29	0.00	0.00
2004	Colony China GP	0.00	0.84	0.00	0.00	0.00	0.49	0.00	0.00
2006	Conch	81.50	40.93	0.00	0.00	81.50	0.00	0.00	0.00
2006	Dagang NewSpring	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	Darong	10.00	0.24	0.00	8.00	6.67	0.24	0.00	5.33
2006	Deqingyuan	0.00	2.85	0.00	0.00	0.00	2.85	0.00	0.00
1994	Dynamic Fund	0.00	2.21	0.00	0.00	0.00	2.01	0.00	0.00
2007	Epure	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	Fenglin	17.64	0.00	6.00	13.47	13.64	0.00	6.00	12.53
2006	Fenglin HJ MDF	0.23	0.00	0.00	3.27	0.00	0.00	0.00	0.00
2005	Five Star	0.00	0.00	7.00	0.00	0.00	0.00	0.00	0.00
2006	GDIH	50.85	0.00	0.00	0.00	50.85	0.00	0.00	0.00
2003	Great Infotech	0.00	1.73	0.00	0.00	0.00	1.03	0.00	0.00
2006	Hangzhou RCB	0.00	10.85	0.00	0.00	0.00	0.00	0.00	0.00
2005	HiSoft Tech	0.00	4.00	0.00	0.00	0.00	3.00	0.00	0.00
2006	HiSoft Tech	0.00	4.34	0.00	0.00	0.00	1.74	0.00	0.00

2004	IB	0.00	52.18	0.00	0.00	0.00	52.18	0.00	0.00
2004	Jiangxi Chenming	40.00	12.90	0.00	18.76	40.00	12.90	0.00	18.76
2006	Launch Tech	0.00	8.35	0.00	0.00	0.00	8.33	0.00	0.00
2001	Maanshan Carbon	5.25	2.00	0.00	0.00	5.25	2.00	0.00	0.00
2005	Maanshan Carbon	11.00	1.00	0.00	0.00	5.00	1.00	0.00	0.00
2005	Minsheng	15.75	0.00	0.00	0.00	7.00	0.00	0.00	0.00
2006	Minsheng & IB	25.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	Minsheng Bank	0.00	23.50	0.00	0.00	0.00	23.50	0.00	0.00
2005	Minsheng Bank	0.00	2.80	0.00	0.00	0.00	2.79	0.00	0.00
2001	NCCB	0.00	8.94	0.00	0.00	0.00	8.82	0.00	0.00
1996	Nanjing Kumho	0.00	3.81	0.00	0.00	0.00	3.81	0.00	0.00
2004	Nanjing Kumho	31.38	2.23	0.00	0.00	31.38	2.23	0.00	0.00
2006	Neophotonics	0.00	0.00	10.00	0.00	0.00	0.00	10.00	0.00
2001	New China Life	0.00	5.83	0.00	0.00	0.00	5.83	0.00	0.00
2005	New Hope	0.00	0.00	45.00	0.00	0.00	0.00	0.00	0.00
1995	Newbridge Inv.	0.00	0.22	0.00	0.00	0.00	0.22	0.00	0.00
2005	North Andre	8.00	6.74	0.00	0.00	0.00	4.25	0.00	0.00
2003	PSAM	0.00	2.01	0.00	0.00	0.00	0.00	0.00	0.00
	RAK China	13.00	0.00	0.00	0.00	13.00	0.00	0.00	0.00
2006	Renaissance Sec	0.00	0.00	20.04	0.00	0.00	0.00	0.00	0.00
2006	Rongde	0.00	35.00	0.00	0.00	0.00	31.38	0.00	0.00
	SAC HK Holding	0.00	1.60	0.00	0.00	0.00	1.00	0.00	0.00
2003	SAIC	12.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00
2006	SBCVC	0.00	20.00	0.00	0.00	0.00	2.00	0.00	0.00
2000	SEAF SSIF	0.00	3.74	0.00	0.00	0.00	3.37	0.00	0.00
	SH Keji IT	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	SHCT	38.18	0.00	0.00	28.64	29.04	0.00	0.00	21.78
2004	SIBFI	0.14	0.07	0.00	0.00	0.00	0.07	0.00	0.00
1998	Shanghai Krupp	19.25	0.00	0.00	36.75	19.25	0.00	0.00	36.75
2006	Shanshui Group	50.00	5.50	2.20	0.00	50.00	5.50	0.00	0.00
1999	Shanxi	12.61	0.00	0.00	0.00	12.61	0.00	0.00	0.00
	SinoSpring	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00
	Stora Enso	20.83	0.00	0.00	4.17	11.00	0.00	0.00	0.00
2005	Stora Enso	29.17	0.00	0.00	20.83	0.00	0.00	0.00	0.00
2006	Stora Enso	50.00	0.00	0.00	175.00	0.00	0.00	0.00	0.00
2006	TBK	4.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
2006	VeriSilicon	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
	Wanjie High-Tech	9.89	0.00	0.00	0.00	9.89	0.00	0.00	0.00
2004	Wumart	0.00	1.62	0.00	0.00	0.00	1.62	0.00	0.00
2003	XACB	0.00	17.95	0.00	0.00	0.00	0.64	0.00	0.00
2004	Xinao Gas	25.00	10.00	0.00	0.00	25.00	10.00	0.00	0.00
2006	Zhejiang Glass	50.00	24.96	0.00	18.00	0.00	0.00	0.00	0.00
2003	Zhengye-ADC	10.43	0.00	0.00	4.87	10.43	0.00	0.00	4.87
2002	Zhong Chen	0.00	4.78	0.00	0.00	0.00	4.78	0.00	0.00
2006	Zhongda_Yanjin	21.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total portfolio:		733.58	577.30	181.40	340.89	470.95	371.06	29.61	108.03

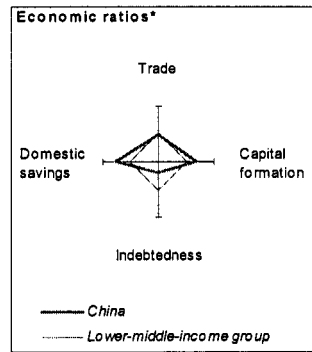
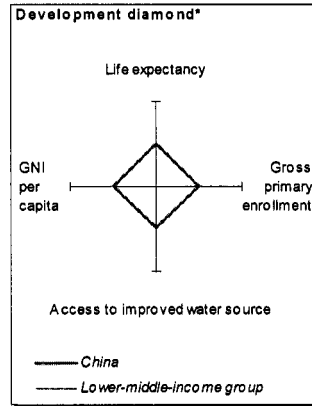
FY Approval	Company	Approvals Pending Commitment			
		Loan	Equity	Quasi	Partic.
2002	SML	0.00	0.00	0.00	0.00
2004	NCFL	0.00	0.00	0.02	0.00
2007	Xinao CTC	0.04	0.01	0.00	0.14
2004	China Green	0.00	0.00	0.01	0.00
2006	Launch Tech	0.01	0.00	0.00	0.00
2005	MS Shipping	0.00	0.01	0.00	0.00
2003	Peak Pacific 2	0.00	0.01	0.00	0.00
Total pending commitment:		0.05	0.03	0.03	0.14

Annex 14: Country at a Glance

CHINA: Liaoning Third Medium Cities Infrastructure Project

POVERTY and SOCIAL	China	East Asia & Pacific	Lower-middle-income
2006			
Population, mid-year (millions)	13118	1900	2,276
GNI per capita (Atlas method, US\$)	2,000	1863	2,037
GNI (Atlas method, US\$ billions)	2,623.6	3,539	4,635
Average annual growth, 2000-06			
Population (%)	0.6	0.9	0.9
Labor force (%)	10	13	14
Most recent estimate (latest year available, 2000-06)			
Poverty (% of population below national poverty line)
Urban population (% of total population)	41	42	47
Life expectancy at birth (years)	72	71	71
Infant mortality (per 1000 live births)	23	26	31
Child malnutrition (% of children under 5)	8	15	13
Access to an improved water source (% of population)	77	79	81
Literacy (% of population age 15+)	91	91	89
Gross primary enrollment (% of school-age population)	113	114	113
Male	113	115	117
Female	112	113	114

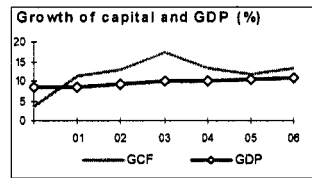
KEY ECONOMIC RATIOS and LONG-TERM TRENDS	1986	1996	2005	2006
GDP (US\$ billions)	295.7	856.1	2,243.9	2,644.7
Gross capital formation/GDP	38.6	40.4	43.9	44.6
Exports of goods and services/GDP	11.8	20.1	37.3	40.1
Gross domestic savings/GDP	35.8	42.5	49.4	52.5
Gross national savings/GDP	35.9	41.3	51.0	54.1
Current account balance/GDP	-2.8	0.8	7.2	9.4
Interest payments/GDP	0.2	0.5	0.1	..
Total debt/GDP	8.0	15.0	12.6	..
Total debt service/exports	8.2	8.7	3.0	..
Present value of debt/GDP	12.3	..
Present value of debt/exports	30.6	..
(average annual growth)				
GDP	10.1	9.0	10.4	10.7
GDP per capita	8.6	8.2	9.7	10.1
Exports of goods and services	10.0	21.8	24.3	23.3



STRUCTURE of the ECONOMY

(% of GDP)	1986	1996	2005	2006
Agriculture	27.1	19.5	12.5	11.7
Industry	44.0	47.5	47.5	48.4
Manufacturing	35.2	33.5	33.5	..
Services	28.9	33.0	39.9	39.9
Household final consumption expenditure	49.3	43.5	36.1	33.2
General gov't final consumption expenditure	14.9	14.0	14.5	14.3
Imports of goods and services	14.7	16.0	31.7	32.2

(average annual growth)	1986-96	1996-06	2005	2006
Agriculture	4.3	3.5	5.2	5.0
Industry	13.5	10.1	11.7	12.5
Manufacturing	12.8	10.2	12.1	..
Services	9.4	9.8	10.5	10.3
Household final consumption expenditure	10.9	7.8	5.8	6.3
General gov't final consumption expenditure	10.4	9.5	11.6	10.9
Gross capital formation	11.9	10.2	11.6	13.2
Imports of goods and services	11.9	16.5	11.4	14.3



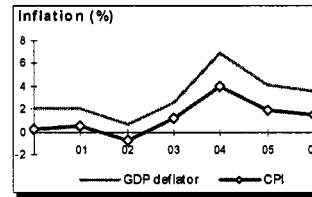
Note: 2006 data are preliminary estimates.

This table was produced from the Development Economics LDB database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

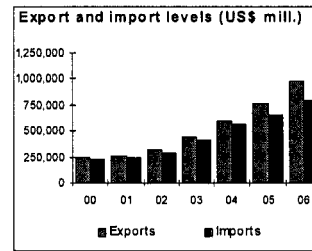
PRICES and GOVERNMENT FINANCE

	1986	1996	2005	2006
Domestic prices				
<i>(% change)</i>				
Consumer prices	..	8.3	18	15
Implicit GDP deflator	4.6	6.4	4.2	3.6
Government finance				
<i>(% of GDP, includes current grants)</i>				
Current revenue	0.0	10.5	17.2	16.4
Current budget balance	-17.7	0.2	2.4	3.0
Overall surplus/deficit	-24.8	-14	-13	-0.7



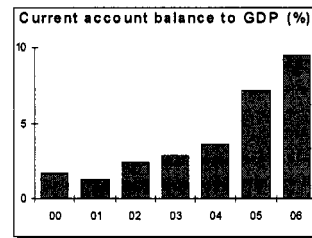
TRADE

	1986	1996	2005	2006
<i>(US\$ millions)</i>				
Total exports (fob)	30,942	51,048	78,199	96,073
Food	4,448	10,231	22,481	25,722
Mineral fuels, lubricants, and related materials	3,683	5,931	17,621	17,776
Manufactures	19,870	29,123	72,960	96,147
Total imports (cif)	42,904	38,833	68,018	79,164
Food	1,625	5,672	9,388	9,997
Fuel and energy	504	6,877	63,957	89,002
Capital goods	18,781	54,763	290,628	357,107
Export price index (2000=100)	59	122	104	107
Import price index (2000=100)	76	108	118	124
Terms of trade (2000=100)	77	113	88	87



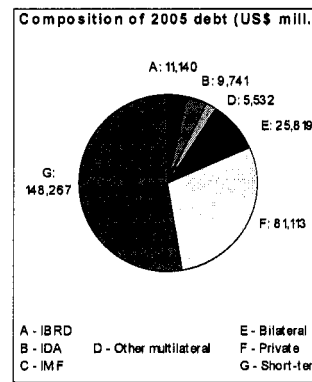
BALANCE of PAYMENTS

	1986	1996	2005	2006
<i>(US\$ millions)</i>				
Exports of goods and services	34,952	17,167	836,888	1,061,681
Imports of goods and services	43,453	54,127	712,090	852,769
Resource balance	-8,501	17,551	24,798	208,912
Net income	-23	-12,437	1,635	11,755
Net current transfers	378	2,129	25,365	29,200
Current account balance	-8,146	7,243	16,838	249,867
Financing items (net)	6,419	24,462	46,198	-2,842
Changes in net reserves	1,727	-31,705	-207,016	-247,025
Memo:				
Reserves including gold (US\$ millions)	..	111,717	83,142	104,465
Conversion rate (DEC, local/US\$)	3.5	8.3	8.2	8.0



EXTERNAL DEBT and RESOURCE FLOWS

	1986	1996	2005	2006
<i>(US\$ millions)</i>				
Total debt outstanding and disbursed	23,719	128,817	281,612	..
IBRD	965	7,616	11,140	114,15
IDA	774	7,579	9,741	9,997
Total debt service	2,973	5,756	27,361	..
IBRD	66	840	1,139	1,443
IDA	8	73	296	316
Composition of net resource flows				
Official grants	155	245	332	..
Official creditors	1,155	4,401	844	..
Private creditors	3,693	6,454	5,144	..
Foreign direct investment (net inflows)	1,875	40,180	79,127	..
Portfolio equity (net inflows)	0	0	20,346	..
World Bank program				
Commitments	120	1,900	1,277	0
Disbursements	607	2,097	1,131	1,170
Principal repayments	0	364	1,004	1,144
Net flows	607	1,734	127	27
Interest payments	75	549	430	616
Net transfers	532	1,185	-303	-588



Note: This table was produced from the Development Economics LDB database.

9/28/07

Annex 15: Maps

CHINA: Liaoning Third Medium Cities Infrastructure Project



CHINA LIAONING MEDIUM CITIES INFRASTRUCTURE PROJECT III

- C.H.** CENTRAL HEATING
- GAS** GAS
- PROJECT CITIES
- SELECTED CITIES AND TOWNS
- ◎** PROVINCE CAPITAL
- RIVERS
- PROVINCE BOUNDARIES
- INTERNATIONAL BOUNDARIES

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