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Report No: 30747 - CN

PROJECT APPRAISAL DOCUMENT  
ON A  
PROPOSED GLOBAL ENVIRONMENT FACILITY (GEF) GRANT  
OF US\$18 MILLION  
TO THE  
PEOPLE'S REPUBLIC OF CHINA  
FOR THE  
HEAT REFORM & BUILDING ENERGY EFFICIENCY PROJECT

February 17, 2005

Energy & Mining Sector Unit  
Infrastructure Department  
East Asia and Pacific Region

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**CURRENCY EQUIVALENTS**  
(Exchange Rate Effective November 15, 2004)

Currency Unit = Chinese Yuan (Y)  
Y8.27 = US\$1  
US\$1.51 = SDR1

**FISCAL YEAR**  
January 1 – December 31

**ABBREVIATIONS AND ACRONYMS**

BEE	Building Energy Efficiency
CAS	Country Assistance Strategy
CO <sub>2</sub>	Carbon Dioxide
EIA	Environmental Impact Assessment
ESCO	Energy Service Company
EUEEP	China End-use Energy Efficiency Project
GEF	Global Environment Facility
GHG	Green House Gas
GOC	Government of China
HRBEE	Heat Reform and Building Energy Efficiency
LPMO	Local Project Management Office
MOC	Ministry of Construction
NPMO	National Project Management Office
PDF B	Project Development Facility, Block B
SO <sub>2</sub>	Sulfur Dioxide
TRV	Thermostatic Radiator Valve
TCE	(Metric) Ton of Coal Equivalent
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change

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CHINA

CHINA: GEF - Heat Reform and Building Energy Efficiency

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CHINA

GEF - Heat Reform and Building Energy Efficiency

Project Appraisal Document

East Asia and Pacific Region  
EASEG

Date: February 17, 2005	Team Leader: Robert P. Taylor
Country Director: David R. Dollar	Sectors: District heating and energy efficiency services (100%)
Sector Manager/Director: Junhui Wu	Themes: Climate change (P);
Project ID: P072721	Small and medium enterprise support (S)
Lending Instrument: Specific Investment Grant	Environmental screening category: B
	Safeguard screening category: S2

**Project Financing Data**

Loan  Credit  Grant  Guarantee  Other:

For Loans/Credits/Others: US\$18 million

**Financing Plan (US\$m)**

Source	Local	Foreign	Total
BORROWER/RECIPIENT	0.90	0.00	0.90
GLOBAL ENVIRONMENT FACILITY	14.00	4.00	18.00
CHINESE CORPORATIONS	30.00	3.70	33.70
Total:	44.90	7.70	52.60

**Borrower: People's Republic of China**  
Ministry of Finance, San Li He Lu, Beijing 100820

**Responsible Agency: Ministry of Construction**  
Bai Wan Zhuang, Beijing 100835

**Estimated disbursements (Bank FY/US\$m)**

FY	2005	2006	2007	2008	2009	2010	2011	2012	
Annual	0.1	1.7	4.4	3.5	3.4	2.3	1.7	0.9	
Cumulative	0.1	1.8	6.2	9.7	13.1	15.4	17.1	18.0	

Does the project depart from the CAS in content or other significant respects? <i>Ref. PAD A.3</i>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Does the project require any exceptions from Bank policies? <i>Ref. PAD D.7</i>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Have these been approved by Bank management?	<input type="checkbox"/> Yes <input checked="" 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"? <i>Ref. PAD C.5</i>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Does the project meet the Regional criteria for readiness for implementation? <i>Ref. PAD D.7</i>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Project development objective. <i>Ref. PAD B.2, Technical Annex 3</i>
Achievement of sustained and growing increases in energy efficiency in urban residential buildings and heating systems in China's cold climate regions.
Global Environment objective. <i>Ref. PAD B.2, Technical Annex 3</i>
As above.
Project description [ <i>one-sentence summary of each component</i> ]. <i>Ref. PAD B.3, Technical Annex 4</i>
(a) Demonstration of integrated heat reform and building energy efficiency approach in Tianjin Municipality;
(b) Support for Ministry of Construction on national policy development and project management; and
(c) Replication of the integrated heat reform and building energy efficiency program in 4-6 other northern cities.
Which safeguard policies are triggered, if any? <i>Ref. PAD D.6, Technical Annex 10</i>
Environmental Assessment, Involuntary Resettlement
Significant, non-standard conditions: <i>Ref. PAD C.6</i>

## **A. STRATEGIC CONTEXT AND RATIONALE**

### **1. Country and Sector Issues**

China consumed about 1.5 billion TCE of primary commercial energy in 2002, second to the US in the world. Even with large improvement of the economy's energy efficiency China's energy demand is expected to double in the next twenty years. Much of this future growth in energy demand will be met by coal, which accounts for two thirds of current primary commercial energy consumption in China. This prospect has very significant global as well as local environmental ramifications, since coal is not only the most carbon intensive but also the most polluting fossil fuel.

Improving end-use energy efficiency is among the most economic short to medium-term options to mitigate the global and local environmental impacts of burning coal. Few end-use sectors represent a more compelling and urgent case of the abundant opportunities for and the critical role of energy efficiency than the urban space heating sector in China. The urban residential space heating sector also is an obstacle to greater energy sector market and environmental reforms. Roughly half of China's population lives in northern regions where temperatures fall below 5°C for over 90 days. Centralized heating, predominantly coal-fired systems, has expanded rapidly in the last two decades, replacing portable heating stoves, and now serves about two thirds of the urban households in northern China. The central heating sector currently has no mechanism for consumers to respond to energy service costs, and the heating systems are based on Soviet technologies that do not allow consumers to control their heating. Heat metering is basically non-existent, and billing is based on a flat per square meter price. Moreover, many employers pay heat bills of employees, representing one of the last vestiges of the old-style welfare system.

China's construction boom is overwhelming efforts to enforce the country's new building energy codes, and the housing development industry in general has little incentive to adopt energy-efficient building designs, materials and practices. These risks locking in lax energy use parameters and high heating bills for consumers. China's urban residential building stock is expected to more than double in the next 20 years. Due to its major cost advantage, and shortages of alternatives, coal is expected to be the dominant fuel for central heating systems for the foreseeable future. Coal-fired heating plants are already the primary source of serious air pollution in northern Chinese cities. The situation will get worse under present conditions without major efforts to improve energy efficiency in urban space heating.

The potential for energy savings in the urban heating sector is huge. Heating energy use per unit floor area of existing Chinese residential buildings is at least double those in similar climates in Western Europe or North America. The Government estimates that heating energy use per unit floor area in new residential buildings can be cut in half, compared with the existing building stock, if compliance with the current energy code is ensured. Readily available and cost-effective energy efficiency measures can further reduce heating energy demand of new buildings. The World Bank's initial study work and dialogue with Chinese officials and experts concluded that the most effective way to promote heating energy

conservation is by having government and corporate actors in the heating service and housing development industries work together. Thus far, efforts at the central and local government levels have dealt separately with issues relating to supply of heat and with measures to improve end-use efficiency. The results of this piecemeal approach have been limited.

An integrated, “two-handed” approach is necessary. On one hand, the creation of a market mechanism is needed through heat reform and heat system modernization so consumers pay for actual consumption (by passing responsibility of payment to households from employers, metering consumption and introducing consumption-based billing), and to enable consumers to control how much heat they consume (by using manual or thermostatic valves to control indoor temperature and by adopting demand-driven variable-flow heating systems). On the other hand, major improvements in the thermal integrity of urban residential buildings are needed to reduce building heat losses substantially, requiring widespread adoption of more energy-efficient designs, new or improved materials and components, as well as adjustments in construction practices.

Chinese leadership has made it clear that urban heating sector reform must proceed. In July 2003, eight central government ministries and commissions jointly issued Heat Reform Guidelines calling for each of the 16 northern provinces/autonomous regions to implement heat reforms in several pilot municipalities from 2004 to 2006. The principles of these Guidelines are the commercialization of urban heating, promotion of technical innovation of heating systems, application of energy-saving building construction, and improvement of living standards. The central and local governments have stepped up enforcement of the mandatory national building energy code in recent years. This and the rapidly growing private housing ownership offer a growing opportunity to design applications and end-user incentives in support of sustained increases of energy efficiency in residential space heating.

## **2. Rationale for Bank Involvement**

There are complex and interwoven barriers that need to be removed to achieve efficiency in heat supply and its use in China. Organizational and institutional challenges need to be overcome to implement reforms within each affected industry (i.e. introduction of proper pricing methods, metering equipment, billing practices, new management procedures to handle demand-driven heating systems, and incorporation of building energy efficiency enforcement into design and construction regulation systems at the local levels). In addition, there is the challenge of integrating efforts across industry and government entities – the heat supply industry, the housing development industry and the government units responsible for their regulation need to work closely together to optimize and synchronize approaches. There is a lack of experience and knowledge of how to apply international experience in energy efficiency in heat supply and residential buildings to Chinese conditions. To achieve results, efforts will need to overcome the facts that: (i) there is virtually no experience in China with consumption-based billing and operating demand-based heating systems; (ii) few cities have adopted systematic procedures for enforcing building energy codes; and (iii) consumer benefits of heat reform and building energy efficiency improvements are unproven (although expected to be large).



The Government, working together with heating industry and housing developers, over a number of years, can overcome these challenges and barriers through a sustained effort. The proposed project, to be supported by a Global Environmental Facility (GEF) grant, is a central part of a World Bank-led international assistance program to the Government for its heat reform and building energy efficiency (HRBEE) efforts. This program has been underway for several years. Two key studies supporting the two-handed approach already have been completed: *China Opportunities to Improve Energy Efficiency in Buildings* (August 2000), and *Heat Metering and Billing: Technical Options, Policies and Regulations* (August 2002). Two on-going activities include: *Development of Pro-poor National Heat Pricing and Billing Policy*, and *Economic Analysis of Energy Efficiency Measures for New Residential Buildings in Northern China*, which are expected to be available to Chinese policy makers early in project implementation. Additional analytical and advisory activities are planned as the program progresses, and IBRD lending is under discussion. The proposed GEF project will provide a core mechanism in the Bank's assistance program for comprehensive and consistent support over the required multi-year period, at first through pilot city efforts to demonstrate the feasibility and benefits of the two-handed approach, and subsequently through national replication efforts.

### **3. Higher Level Objectives to which the Project Contributes**

The proposed project will co-finance incremental investments in energy efficiency innovations in residential buildings and heat supply systems and support the implementation of heat reforms that will reduce coal consumption, which is the primary fuel used for heating residential buildings in Northern China. Through these interventions, the project supports the CAS objective of *facilitating an environmentally sustainable development process*, through investment lending in natural resource management, watershed rehabilitation and wastewater treatment, energy, global environment projects supported by the Global Environment Facility and Montreal Protocol, and policy work. The project also supports a second CAS objective of *improving the business environment and helping accelerate the transition to a market economy*, mostly through knowledge transfer activities. The project is expected to improve knowledge of ways to introduce market economy principles to centralized heating, which is one of the last vestiges of the welfare system in China.

The proposed project is fully consistent with GEF Operational Program 5 (Removal of Barriers to Energy Efficiency and Energy Conservation) and GEF Business Plan Strategic Priorities (S1) Transformation of markets for high volume, commercial, low GHG products or processes, and (S3) Energy sector policy frameworks supportive of renewable energy and energy efficiency. The proposed project will combine market transformation activities with heat reform, heating system modernization and building energy efficiency improvements, representing the holistic approach to sustainable and significant market expansion on a national scale that is the defining element of S1. The proposed project fits within S3 by helping to consolidate key energy efficiency policies and facilitates regulatory frameworks supportive of demand-driven heat supply, demand-side measures, and creation of market mechanisms that allow consumers to pay for actual heat consumption. The proposed project was endorsed by the GEF focal point on October 28, 2002. China ratified the United Nations Framework Convention on Climate Change (UNFCCC) on January 5, 1993.

## **B. PROJECT DESCRIPTION**

### **1. Project Development Objective and Key Indicators**

The objective of the proposed project is to achieve substantial, sustained and growing increases in energy efficiency in urban residential buildings and central heating systems in China's cold climate regions. The project will leverage corporate resources and work in close collaboration with the Government to reduce energy waste in space heating by: (i) improvement of the thermal integrity of buildings, through improved enforcement of building energy efficiency standards, improved design, and use of improved insulation and other energy efficiency measures; (ii) reform of heat pricing and billing, through implementation of heat metering, cost-based pricing and consumption-based billing; and (iii) modernization of heat supply systems to enable end user control and demand-driven operation.

The key performance indicator for the project is coal savings capacity at project completion (2011) achieved by implementation of heat reform and building energy efficiency programs in the project cities. Other indicators and benchmarks, detailed in Annex 3, include:

- Residential floor area subjected to heat metering and consumption-based billing in the project cities by project completion; and
- Residential floor area constructed according to the current and possibly more stringent energy efficient design standards in the project cities during project period.

Total estimated coal savings resulting from project implementation in the *project cities* are some 13 million tons of coal equivalent (TCE), avoiding emissions of about 10 million metric tons of carbon. These are cumulative amounts based on the achieved coal-saving capacity in project cities at project completion (2011) over a 20-year span. The long-term *national impact* of this project is expected to be much larger than these numbers, as broad replication of the pilot city program throughout the cold climate regions will follow (Annex 9).

### **2. Project Components**

The proposed project, described further in Annex 4, has three components: (a) demonstration of the two-handed approach in Tianjin Municipality; (b) support for the Ministry of Construction (MOC) for national policy development and project implementation; and (c) replication of the two-handed approach in 4-6 other northern cities. Integrated development of improved heat supply and billing approaches with more energy efficient buildings will be first launched in Tianjin Municipality, where implementation of heat reforms is already well advanced. With intensive support from MOC, provincial and national governments similar integrated development will be rolled out in additional northern cities which have been designated as pilot cities for the Government's heat reform program.

Total project costs are estimated at US\$52.6 million, including \$46.7 million for energy-efficiency investments, and \$5.9 for technical assistance, including project management and monitoring (see Annex 5). The total proposed GEF grant financing is US\$18 million, including \$6 million for the Tianjin component, \$2 million for the national component, and

\$10 million for the other northern cities component. Proposed GEF co-financing for investment across the components totals \$13 million, while GEF technical assistance support totals \$5 million. The balance of energy efficiency project investment will be financed by housing and heating company project beneficiaries, while Government agencies will co-finance the technical assistance and project management activities. The associated cost of the housing developments and new or improved heating systems with which the project's energy efficiency investments will be integrated is expected to exceed \$1 billion, financed by Chinese companies.

Tailored to be an effective tool for the Government to promote implementation of the heat reforms, utilizing and adapting new approaches and international experiences, a flexible framework has been designed for project implementation, to meet needs as they arise. Participating cities can apply for GEF investment subproject or technical assistance support during project implementation, and these proposals will be reviewed, appraised and approved by MOC and the Bank as the project proceeds (see Annex 6). Project proposals must support the application of the project's two-handed approach. Investment support proposals will involve incorporation of innovative energy-efficiency measures in new, large heat system developments and major residential housing complex development (or renovation). Investment project beneficiaries will include local heating companies and local housing development companies. GEF co-financing will not exceed 30% of the assessed incremental cost of the energy efficiency measures proposed, whereas beneficiary companies must commit co-financing for both the balance of the incremental costs and for the completion of the overall projects as part of their subproject proposals. Based on preparation to date, the main focus of investment support is expected to include:

- Improvement of building thermal integrity (examples: increased thickness and quality of roof and external wall insulation, heated stairwells, windows with higher thermal resistance);
- Improvements of building internal heating system (examples: installation of apartment-level heat meters, thermal control valves, and improved piping and radiators); and
- Improvements of heat supply system (examples: energy-efficiency improvements in boiler plants, adoption of variable-flow capability, and use of small substations).

**Tianjin Municipality Component.** This component seeks to provide the project's first operational demonstrations that the greatest energy efficiency gains and cost savings in residential space heating can be achieved through an integrated effort that simultaneously addresses the thermal integrity of buildings, the operational efficiency of heat supply systems, the provision of means for heat control by consumers, and the implementation of heat metering, cost-based heat pricing and consumption-based heat billing. Proposed GEF support includes \$5 million for incremental investment co-financing, and \$1 million for technical assistance.

The Bank, MOC and Tianjin Municipal Construction Commission have cooperated closely on a variety of HRBEE issues since 2001, beginning with analytical and policy development, and moving into intensive preparation of the proposed project component. The Bank and MOC

have appraised the feasibility study for a first integrated demonstration project at Xindu Garden, which involves financing of energy efficiency innovations in a 740,000 m<sup>2</sup> new housing complex and a new 58 MW heat-only variable-flow district heating system (also supplying adjacent residential areas), to be completed in phases during 2005-2010. Incremental investment cost in energy efficiency innovations totals \$8.7 million, with proposed GEF co-financing of \$2.6 million. A first subproject of the Xindu development has been appraised by the Bank and MOC. This subproject, to be implemented in 2005, includes energy efficiency measures above and beyond current code requirements in 100,000 m<sup>2</sup> of new housing, installation of apartment-level heat meters and temperature control system, and adoption of a more energy-efficient configuration of the associated external heating network. Additional subprojects, outside of the Xindu Garden complex, also are under active preparation.

The Tianjin technical assistance package has been fully prepared, and will include support for technical studies and analytical work, development of building energy efficiency code enforcement capacity, public education activities, and monitoring and evaluation work.

**National Policy Support and Project Management Component.** This component provides the vehicle to support the critical role of the central government to provide policy direction to localities, bring the best national and international expertise to bear on issues surrounding implementation of reform and development of new technical approaches, coordinate and guide implementation of local project activities, undertake central project management and monitoring functions, and disseminate successful ideas and results outside of participating cities. Total costs are estimated at \$2.3 million, with proposed GEF support of \$2.0 million, including a subcomponent on Policy Advice, Technical and Institutional Support, and another subcomponent for Project Management, Monitoring and Evaluation. Specific studies and activities for support during the first 18 months of the project have been detailed and agreed.

**Other Northern Cities Component.** This component will promote simultaneous development of both heating sector reforms and building energy efficiency improvements in 4-6 additional northern Chinese municipalities, achieving broad, national impact. With emerging results from the Tianjin Component, and national-level support, comprehensive development of HRBEE measures must be rolled out in the coldest regions of China. In most cases, the challenges also are greater than in Tianjin, due to greater heating requirements in colder climates, relatively slow economic development in the northeastern and northwestern regions, and less progress in heat reform to date.

Both investment and technical support activities will be approved during project implementation, based on proposals prepared by cities designated as national pilot heat reform cities including those in the national 2004-2006 heat reform program. Expectations are that final participant cities will be selected from Heilongjiang, Jilin, Liaoning and one other province. The MOC and Bank teams have already engaged in dialogue with more than seven cities, concerning the proposed project, and in the implementation of previous and ongoing technical assistance/policy development activities on HRBEE executed by the Bank. Total estimated incremental investments in demonstrating energy efficiency improvements beyond current practice and requirements in the 4-6 other northern cities are about US\$26.7 million,

and proposed GEF co-financing is \$8 million. Technical assistance and institutional capacity building subcomponents total \$2.4 million, with proposed GEF support of \$2.0 million (\$1.0 million earmarked to help support the preparation of investment subproject proposals under this component).

### 3. Lessons Learned and Reflected in the Project Design

The proposed project design builds on lessons learned from several Bank/GEF projects in Europe and Central Asia (ECA) and several district heating and energy efficiency projects in China (Annex 2). The overall Bank HRBEE program in China, of which the proposed project is a part, has already provided rich early lessons through its technical assistance activities. The building energy efficiency projects in ECA have focused on an array of energy efficiency problems in residential buildings, public facilities as well as industrial sectors.<sup>1</sup> There are several differences to keep in mind when applying lessons in ECA countries to the situation in China. One is that ECA countries have focused mainly on renovation issues in the building sector. Due to China's continuing construction boom in the residential sector, this project focuses primarily on energy efficiency issues in new construction.

Some important lessons from previous Bank experience taken into account include:

- Enabling consumers to control the quantity of heat and to pay according to their consumption needs to be addressed from the very beginning of heat reform. This allows consumers to adjust their heat bills to their income and can help prevent massive problems with bill collections;
- Other Bank/GEF projects in China have contributed to major improvements in district heating, industrial coal-fired boiler design, and the development of energy service companies (ESCOs). This project is able to build on these experiences, but the residential building sector presents new challenges not yet faced by either the supply side or demand side projects. During many consultations with national, provincial and municipal officials it became clear that a *one-handed* approach limited to supporting investment for building energy efficiency would ultimately not achieve potential energy savings. Without responsibility for paying heat bills, and ability to control and pay according to heat consumption, prospective homebuyers have no incentive to purchase or take advantage of more energy-efficient housing. Lessons learned from previous projects in Eastern Europe also suggest that investments on the demand side need to be accompanied by improvements on the supply side; and
- Individual and collective preferences need to be carefully considered when aiming to accelerate market penetration of energy efficiency measures. In demand-side demonstration projects in ECA, homeowners have become interested if savings are demonstrated, but energy savings may not be the top priority when making investment

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<sup>1</sup> 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, *Krakow 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*, 2004), Ukraine (*Kiev District Heating Improvement*, 1998).

decisions. This project adapts a market-driven mechanism, through real estate developers, to introduce energy efficiency measures which can be commercially marketed to new homebuyers. Through project implementation experience, more knowledge will be gained on the appropriate positioning of energy efficiency in the order of consumer preferences to maximize its marketing potential.

#### **4. Alternatives Considered and Reasons for Rejection**

Sole focus on technical assistance on heat system reform or on building energy efficiency was initially considered. However, the MOC and Bank teams decided that these two initiatives must be supported simultaneously in this project. Without implementation of heat reforms, improvements in the thermal integrity of buildings will yield minimal real energy and cost savings results. Efficiency improvements also provide a key financial savings, which can smooth the path for heat system reforms.

The MOC and Bank teams considered it essential to pursue both strong technical assistance efforts and direct involvement in implementation of new approaches in large-scale modern heating systems and residential buildings, to provide energy savings and the technical conditions for successful implementation of reforms. GEF support for both investment and technical assistance is by far the best vehicle to achieve this in China. On the investment side, the GEF financing provides a small incentive to local Chinese companies to break with tradition and try new, more risky energy efficiency innovations. At least equally important, however, is the fact that GEF financing provides a platform for direct Bank and central Government involvement in the development, implementation and dissemination of national pilot projects, packaging technical innovation with implementation of policy reforms, which enables on-the-ground results and program success. Finally, GEF financing allows small levels of investment support throughout the integrated projects – including heat supply, heat distribution, heat use and measurement, and building energy efficiency improvements. The institutional complexities of lending, repayment, and especially provision of counter-guarantees to so many potential borrowers for small sums would preclude loan financing packages (especially IBRD loan financing).

IBRD lending packages for large investments in modernization of district heating systems in participating cities, however, could have an important role in the Bank's overall HRBEE program in China. The Bank continues to explore potential interest among municipalities, and remains open to consider such lending. Given the complexities of IBRD borrowings, however, firm project proposals had not yet been received from relevant authorities at the time of project appraisal.

### **C. IMPLEMENTATION**

#### **1. Partnership Arrangements**

Collaboration with other international donor partners has been a critical part of the overall Bank HRBEE program so far, and this collaboration will continue, and further expand. The challenges faced by China in the various interrelated technical and economic aspects of its HRBEE agenda are large, but the Government recognizes that they must be addressed. There

are tremendous needs at all levels for assistance to introduce and adopt new technical approaches and new market-oriented concepts, and to disseminate lessons from abroad. The proposed project offers a good framework for marshalling assistance, with a strong central and local organizational setup and policy underpinning, and a focus on generating new and innovative approaches which then will be concretely implemented with GEF co-financed investment support.

Activities financed by bilateral donors through ESMAP, ASTAE or consultant trust funds, and executed by the Bank, have provided much of the analytical and technical underpinnings for the overall program to date. The Governments of Finland, the Netherlands, Canada, Denmark and Germany have provided key support for this work. Government counterparts at both national and local levels have expressed a high appreciation for this applied assistance. Through ASTAE, the Government of Canada also will support application of international expertise during the earliest phases of project implementation, as local entities seek to develop new approaches and concepts in line with the “two-handed” approach of the project. The proposed project will be complemented by, and integrated with, a closely-related new French Fonds Français pour l'Environnement Mondial (FFEM) project of about US\$ 3.3 million to support improving building energy efficiency in China, especially in Harbin City. The French bilateral assistance will support building energy efficiency innovations, and the GEF project will aim to create the supportive policy framework and assistance to improve the efficiency of heat supply.

The proposed GEF project will help reinforce building energy efficiency technical assistance efforts of the parallel UNDP/GEF *China End-Use Energy Efficiency Project* (EUEEP). The EUEEP supports the strategic plan of the Chinese Government to dramatically improve the efficiency of major energy end-use sectors: buildings and industry. With its thrust in the building energy efficiency area on the development and implementation of building energy efficiency codes and standards across all of China's climatic zones, the EUEEP complements this proposed project very well. Most aspects of the specifics of building energy efficiency code development and implementation needed in northern China have been omitted from the proposed project, except for certain specific local or bridging activities, and the proposed project will rely on EUEEP activities on this topic. In return, this proposed project offers an ability to reinforce the EUEEP efforts in areas in northern China, through synergies with planned support on heat payment, pricing and billing reforms, investment and local implementation efforts in modern heat supply and innovative highly energy efficient building design and construction, to make a very effective medium-term support package.

## **2. Institutional and Implementation Arrangements**

MOC will be responsible for overall project coordination and implementation. A National Project Management Office (NPMO) has been established by MOC, led by MOC's Science and Technology Department, and working in concert with MOC's Urban Construction Department. Long-term experts financed through the project will provide key, full-time expertise for the PMO. Tianjin Municipal Government has assigned responsibility for implementation of the Tianjin Component to its Construction Commission, which has designated a local PMO (LPMO) for overseeing the Tianjin Component. Other project cities

are expected to establish similar project management offices within local Construction Commissions.

The LPMO and Bank team will need to continue the close cooperation established throughout project preparation, jointly reviewing and approving (a) proposals of cities to participate in the project, (b) terms of reference for technical assistance activities, and (c) investment subproject proposals. Subproject proposals will need to include: (i) reference to an agreed city-wide HRBEE program, including description of the value added of the proposed investments for the overall program and energy savings targets and other monitorable indicators; (ii) reference to satisfactory project implementation organization and financial management systems; (iii) a satisfactory feasibility study; (iv) a satisfactory procurement plan; (v) financial commitments from beneficiaries for all non-GEF project financing; and (vi) environment and social analysis documentation (Annex 6). Disbursement of GEF investment co-financing funds for subprojects will be made to beneficiaries in tranches, based on municipal-government certified evidence of progress achieved in installing energy efficiency equipment in quantities and according to technical specifications agreed during subproject approval (see Annex 7).

### **3. Monitoring and Evaluation of Outcomes/Results**

Monitoring and evaluation will form a basis for dissemination of practical applications of heat reform to urban areas across Northern China. Surveys and analysis will be conducted to monitor progress in integrated HRBEE programs at the national as well as at the city levels, as well as specific energy savings achieved in demonstration projects. All participating cities will engage experts to prepare annual monitoring reports detailing actions undertaken and results achieved in their respective city HRBEE programs and demonstration projects, agreed with MOC and the Bank. International specialists will be engaged to advice on a methodology for these efforts. The NMPO will be responsible for developing and implementing, with the support of local authorities, the monitoring and evaluation system for the entire project, including collecting project performance information and reporting on the impact and results of this project.

### **4. Sustainability and Replicability**

**Sustainability.** The heat reforms and the introduction of meters and controls will allow consumers to control their heat use and pay according to their consumption. This will, together with awareness campaigns and education of consumers, provide an incentive for them to use heat more wisely, thus creating a demand-pull for more energy-efficient housing, which is missing now. By demonstrating and disseminating practical and cost-effective energy-efficiency improvements in residential buildings, as well as strengthening regulations and enforcement in building energy code compliance, market transformation in building energy efficiency will be accelerated. The integration of demand-driven modern heating systems with energy efficient buildings provides not only superior comfort and heat quality to consumers, but also energy and cost savings, and a much-improved environmental performance. Together with other heat reform measures this can result in development of a commercially viable heat supply industry. Project sustainability is enhanced by the strong



commitment to reform and project ownership by the national government and, as a precondition for participation, local governments and housing developers.

**Replicability.** Heat reform and building energy efficiency improvements supported by the project will be replicated through the continuation of the Government's own heat reform agenda. This project is joining the Government's program to pilot the reforms in Tianjin and 4-6 other cities. The project will strengthen the pilot efforts by providing advice on international lessons learned and by supporting practical demonstrations of the feasibility and major benefits of integrating efficiency improvements in heat supply and buildings together with the heat reform. Continuation of the Government's national reform will provide the incentives for change in additional municipalities. The project also will further spur replication through the National Component, which includes: (i) coordination of the pilot efforts with the overall national reforms; (ii) comprehensive monitoring and evaluation of the pilot efforts, to provide the concrete information on results, benefits and lessons learned; and (iii) implementation of a major dissemination program across northern urban areas.

## 5. Critical Risks and Possible Controversial Aspects

<b>Risks</b>	<b>Risk Mitigation Measures</b>	<b>Risk Rating</b>
<b>To project development objective</b>		
Heat reform is reversed or scope is significantly reduced.	China's central government has <b>made it clear that</b> market reforms of urban heating service must proceed. The focus has shifted to how these reforms are to be implemented from whether they are needed. Private housing ownership and household awareness of the tangible benefits will increase the pressure on reform.	Moderate
<b>To component results</b>		
Demonstration projects might be slow to develop due to a lack of coordination among levels of government departments, as well as with housing developers and heating companies, involved in heat supply and building energy efficiency. The challenges of implementing the two-handed approach could overwhelm cities, which lack capacity to organize and manage change.	The risk is mitigated by several measures: (i) a strong focus of the project on national-level project and policy coordination, monitoring and evaluation, and dissemination of lessons learned to local levels in China – strengthening channels of support between levels of government; (ii) selecting cities for participation in the project that have integrated heat reform, heat supply modernization and BEE aspects in their proposed programs and which demonstrate strong commitment to their program at the municipal government leadership level.	Substantial

## 6. Grant Conditions and Covenants

### Conditions for Board Presentation

- None

### Conditions for Grant Effectiveness

- The Recipient has adopted and put into effect the Financial Management Manual, acceptable to the Bank;
- The Recipient has appointed to the NPMO financial and accounting staff in adequate numbers, with experience, qualifications, technical skills and terms of reference, satisfactory to the Bank; and
- The Recipient has adopted a Sub-project Preparation Manual satisfactory to the Bank.

### Condition for Disbursement

- No withdrawals shall be made in respect of payments for the Tianjin Component (subgrants and consulting services) until the Recipient and Tianjin has entered into an Implementation Agreement, satisfactory to the Bank.

### Legal Covenants Applicable to Project Implementation

- Schedule 4 of the Grant Agreement details institutional requirements for project execution, reporting requirements, and criteria and procedures for selection of participating cities and subproject review and approval.

## **D. APPRAISAL SUMMARY**

### **1. Economic and Financial Analyses**

An incremental cost analysis was undertaken for the proposed project (Annex 9). Since the proposed project supports a comprehensive national policy reform and regulatory agenda that requires many years to implement, its impact is not limited to the activities and investments which the project directly supports and will not fully materialize until many years after the project implementation is completed. The incremental cost analysis attempted to assess the long-term aggregate impact of implementing the national HRBEE agenda, which the proposed project will support. It is estimated that by 2024 this national effort will have resulted in cumulative coal savings of about 240 million TCE (2005-2024), avoiding emissions of about 180 million tons of carbon. Under this broad definition of project impact boundary the undiscounted cost of carbon emission reduction to GEF is about \$0.10/ton-carbon. More monitorable undiscounted emissions reductions in only the project cities, including only the coal-saving capacity achieved during project implementation (2005-2011) are estimated to cost about \$1.8/ton-carbon.

Analysis of costs and benefits of incremental investment on energy efficiency innovations is required for all demonstration projects receiving GEF support. This analysis compares the costs of implemented energy efficiency measures with the energy cost-savings over the life of these measures. Analysis of the Xindu demonstration project in Tianjin indicates that the benefit of life-cycle heating cost-savings outweighs the incremental investment in higher

thermal integrity of buildings by about 300%, provided that cost-based heat pricing and consumption-based billing are implemented.<sup>2</sup>

## **2. Technical**

Successful development, adaptation and cost-effective implementation of new, more energy-efficient technologies will be one of the major challenges of the demonstration subprojects of this project. Some of these challenges include design and operation of new demand-based variable flow heat networks, adaptation of different types of heat metering and billing techniques for widespread use in China, more efficient and comfortable approaches for indoor heating networks, development of building designs which are both energy efficient and attractive to consumers, efficient building material development, development of cost-effective approaches to renovation of existing, energy-inefficient buildings.

Some of the project's demonstration efforts will certainly be more successful than others. To maximize opportunities for success, national and international experts will work together with local authorities and experts to design practical approaches for the local areas. Further international partnerships for technical assistance are being actively sought. The project also includes a strong monitoring and evaluation component, so that lessons learned can be articulated and disseminated.

## **3. Fiduciary**

The financial management assessment for this project has concluded that the project meets minimum Bank financial management requirements as stipulated in BP/OP 10.02, and 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 agreed reporting format and as required by the Bank. GEF grant funds will flow to the project's special account, established at and managed by the Ministry of Finance (MOF). Payments will be made from the special account to project beneficiaries, following MOC review and approval. Counterpart funds from corporate resources will be confirmed for each investment subproject at appraisal in the form of loans/equity and government appropriation. No outstanding audits or audit issues exist with the national implementing agency and Tianjin local implementing agency. The Bank will continue to be attentive to financial management matters and audit covenants during project supervisions and as the other cities component is implemented. Results of the financial management assessment and agreed arrangements are provided in Annex 7.

A summary of the procurement capacity assessment and details of the procurement arrangements are provided in Annex 8. The procurement capacity assessment concluded that NPMO and Tianjin LPMO have the capacity to carry out procurement and the risk grade is defined as "average". Procurement plans for the first 18 months of project operation have been completed. The beneficiary companies will conduct procurement of goods for implementation of investment subprojects using commercial practices acceptable to the Bank.

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<sup>2</sup> Based on results of the ASTAE study: Economic Analysis of Energy Efficiency Measures for New Residential Buildings in Northern China (Report forthcoming in Spring 2005).

Disbursement of GEF funds will follow a rigorous compliance review process for energy efficiency investments (Annex 7).

#### **4. Social**

No land acquisition or resettlement is expected to be required for the implementation of the project's energy-efficiency investment subprojects. However, due-diligence social impact reporting will be required from project heating and housing development company beneficiaries as part of subprojects appraisal, with reference to the overall heating system or housing development projects within which the project's energy-efficiency investments will be made. These reports must provide description of all land acquisition, resettlement or ethnic minority impacts (if any) associated with the broader developments, provide evidence that all national and local laws and regulations have been strictly followed, and identify any relevant issues. These reports must be satisfactory to both MOC and the Bank. Given that most subproject proposals will be appraised during project implementation, MOC and the Bank also have developed a social impact framework for use during subproject appraisal. The framework provides for a screening of the energy efficiency investments, as to any land acquisition, resettlement or ethnic minority impacts and hence identification of any requirements for completion of Resettlement Actions Plans or Ethnic Minority Development Plans, in order to comply with Bank policies. For investments not requiring these plans, the framework details the due-diligence reporting requirements (see Annex 10).

An outline of agreed public participation strategies, satisfactory to MOC and the Bank, also is required in investment subproject proposals. Tianjin Municipality has completed a satisfactory outline as part of its first investment subproject proposal.

#### **5. Environment**

Environmental impacts of the project's energy-efficiency investment subprojects are expected to be overwhelmingly positive, in terms of reduced local, regional and global pollution resulting from energy use. However, as for social impacts, due-diligence environmental impact reporting will be required from project heating and housing development company beneficiaries as part of subproject proposals, with reference to the overall heating system or housing development projects within which the project's energy-efficiency investments will be made. These reports must provide description of any negative environmental impacts associated with the broader developments, provide evidence that all national and local laws and regulations have been strictly followed, and identify any relevant issues. These reports must be satisfactory to both MOC and the Bank. Given that subproject proposals will arise during implementation, MOC and the Bank also have developed an environmental impact framework for use during subproject appraisal. The framework provides for a screening of the energy efficiency investments, as to substantial negative environmental impacts, and hence identification of any requirements for completion of Environmental Management Plans, in order to comply with Bank policies. For investments not requiring these plans, the framework details the due-diligence reporting requirements (see Annex 10).

## 6. Safeguard Policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP/GP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Cultural Property (OPN 11.03, being revised as OP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[X]	[ ]
Indigenous Peoples (OD 4.20, being revised as OP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP/GP 7.60)	[ ]	[X]
Projects on International Waterways (OP/BP/GP 7.50)	[ ]	[X]

## 7. Policy Exceptions and Readiness

No policy exceptions are anticipated for the proposed project.

### Readiness Filter:

A/ Funding for the 1 <sup>st</sup> year of implementation allocated in the budget or firm arrangements in place for financing before Board approval; <b>Yes.</b>
B/ Land acquisition and resettlement plans are ready, and satisfactorily arrangements made for financing land acquisition and resettlement, for the 1 <sup>st</sup> year of civil works before Board approval; <b>N/A</b>
C/ Projects with Project Management Units established and staffed by Negotiations; <b>Established – Yes. Some PMO experts to be hired under the project.</b>
D/ Monitoring and Evaluation performance indicators, including key data, in place before Negotiations; <b>Yes.</b>
E/ Procurement and financial management systems, including audit arrangements in place before Negotiations; <b>No.</b> FMS in place by effectiveness. Procurement systems in place before negotiations.
F/ Request for proposals for consulting services, and bidding documents (for goods and civil works) for the 1 <sup>st</sup> year of implementation ready before Negotiations; <b>N/A.</b>
G/ No conditions of effectiveness; <b>In addition to standard conditions, there are three effectiveness conditions.</b>
H/ Social and Environmental assessments completed, including action plans that are reflected in the project cost. <b>Yes.</b>



## **Annex 1: Country and Sector or Program Background**

### **CHINA: GEF - Heat Reform and Building Energy Efficiency**

#### **China's Energy Demand and the Role of Energy Efficiency**

China consumed about 1.5 billion TCE of primary commercial energy in 2002, second to the US in the world. Even with large improvement of the economy's energy efficiency China's energy demand is expected to double in the next twenty years. Much of this future growth in energy demand will be met by coal, which accounts for two thirds of current primary commercial energy consumption in China. This prospect has very significant global as well as local environmental ramifications, since coal is not only the most carbon intensive but also the most polluting fossil fuel.

Improving end-use energy efficiency is among the most economic short to medium-term options to mitigate the global and local environmental impacts of burning coal. Few end-use sectors represent a more compelling and urgent case for the abundant opportunities for and the critical role of energy efficiency than the urban space heating sector in China, with its tremendous growth prospect and its appalling current state of energy waste and air pollution. All new housing developments in the urban areas of cold climate regions, where half of China's population live are required to provide heating services. The predominant choice is coal-fired central systems. The urban housing stock in the cold regions is projected to more than double in the next 20 years, implying similar level of increase in space heating energy use, if space heating energy efficiency is not improved. Proven technologies and economic measures are available to reduce heating energy demand of the new housing stock by 50% or more, compared with the existing housing stock. This will require concerted efforts from the government and the urban housing and heating industries.

#### **Challenge to Reform and Modernize Urban Residential Heat Supply and Use**

***Energy Use for Urban Heating.*** China currently consumes about 180 million tons of raw coal each year for space heating of urban residential and commercial buildings. Energy use per unit floor area is at least double that of buildings in similar cold climates in Western Europe or North America, with still far less comfort. In cold and severe cold regions, defined as regions, which have at least 90 days of average outdoor temperature at or below 5°C, urban space heating relies on coal-fired central heating systems. 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. During winter, emissions from coal-fired central heating facilities are the primary cause of the severe air pollution prevalent in northern Chinese cities. The situation is likely to be exacerbated if the overall efficiency of space heating is not greatly improved.

***Current Heat Supply Systems.*** China's cold and severe cold regions cover about two thirds of national territory and account for nearly one half of the total residential floor area of the country. In the mid twentieth century, most homes were heated with small coal stoves. Gradually, these have been replaced with centralized, hot water radiator heating systems in

areas of relatively high population density, so that currently about two-thirds of urban residential buildings in cold and severe cold regions are heated by centralized systems. In most cases, centralized heating began with small, “block” systems, using relatively small, heat-only boilers for one or several buildings. Gradually, and increasingly during the late 1980s and 1990s, larger district heating systems have been developed to cover parts of most northern cities. Today, most medium and large northern cities have one or several major district heating systems within the city center, and a fairly large number of smaller, “block” systems. Use of small coal stoves is limited mostly to homes in older and smaller buildings, as well as in small cities and towns. Government policy continues to strongly promote increasing development of larger district heating systems, to capture the economies of scale and reduce air pollution.

China’s centralized heating systems are based on standard Soviet-era technology except that only heat, and not domestic hot water, is provided. These systems rely on flow of water at constant speed through the piping networks, with changes in water temperature made at the heat source or substation to accommodate major changes in outdoor temperatures. The systems allow little flexibility, and the use of the traditional vertical single-pipe systems (radiators are sequentially connected from top floor to bottom floor) within buildings is not readily compatible with consumer control and metering. The advantage of these systems is that they are relatively simple and inexpensive to construct. However, they carry major efficiency penalties, and consumers have no means to control their heat supply. Heating levels are often too high (so that people open their windows, resulting in additional heat waste), or uncomfortably too low.

*Ownership and management of heating companies.* Local heating sectors used to be highly fragmented. In many cities the number of heating companies is in the hundreds, with several dominant companies, but most owning a small heat-only boiler with a network supplying enterprise housing. Independent of ownership (local government, independent companies), all heating companies are subject to the supervision of the Municipal Heating Offices, but management, taxation and accounting rules are specific depending on ownership. Consolidation and commercialization is now starting, enabled by government decree 272/2002, issued in December 2002, which opens the municipal utility sector to competition, franchising and foreign investment. Mergers of heating companies could help to: (i) reduce the costs of regulation and supervision of these enterprises; (ii) allow to benefit from the economies of scale (mostly in terms of personnel costs and heat generation costs); (iii) create interconnected networks more suitable for cogeneration; and (iv) lead to more efficient, cleaner production units. Joint ventures, for example, of municipal heating companies and real estate developers can now be observed, or the creation of holding companies as in Harbin.

*Current Heat Billing and Pricing Systems.* As in other countries using Soviet-era centralized heating technology, consumers are billed each season according to a flat rate per square meter of floor area. There is no measurement of heat consumption in apartments or even at the building or substation level. In order to change the existing payment system to a consumption-based system, which provides incentives to consumers to use heat efficiently, consumers must have the ability to control their heat consumption. This requires major



technical adjustments. Essentially, the fixed flow systems must be changed to variable flow systems, so that consumers can adjust their heat use by adjusting the flow of hot water. This requires very different internal piping configurations, use of measurement technology, and adoption of totally new heat pricing policy.

Currently, most urban dwellers with central heat supply also are not responsible for paying their own heat bills—this is still typically the responsibility of employers or local governments. Stemming from coal subsidy programs in northern China in the 1950s, heat supply in major northern urban centers has been considered a public welfare entitlement. Indeed, heat supply is the last unreformed element of the public welfare system from the previous planned economy. Although reform of urban housing to individual ownership has proceeded strongly since 1996, employers continue to pay for employee heating. To both free employers from the social burden of heat supply, and to provide incentives to consumers to use heat efficiently, major reforms are required to transfer employer heating payment responsibilities and funds to employees.

The need for heat system reform is well understood. Yet, the technical, organizational, and financial challenges of this reform are particularly great, and socially sensitive: it is not by accident that this reform has been put off to the end.

***Building Energy Efficiency Levels.*** Northern China's existing urban apartment housing stock, largely constructed since 1950, is known for its low upfront cost design and construction, and disregard for energy efficiency, similar to buildings of Eastern Europe constructed in the Soviet era. Very different from Eastern Europe, though, is the rate of new housing construction: China's urban residential building stock is expected to more than double in the next twenty years. Demand for heating and cooling services in new buildings will be greater than ever.

Attention to energy efficiency in new housing construction is of critical importance because the rate of construction is so high, and because the new buildings will lock in energy use parameters for fifty years or more. The technologies exist to reduce building heat losses in China by at least one half at reasonable cost. However, there are strong incentives among the various building design, materials supply, and construction players in the housing development industry to maintain existing, easily understood designs and practices, avoid change, and minimize upfront costs. Even in economies subject to market forces for many years, consumers may pay some attention to future heating costs when purchasing a home, but housing developers know that home purchase costs, location, convenience, lay out, appearance and other factors tend to far outweigh heating cost concerns among purchasers. Countries, which have made major improvements in reducing energy losses in new buildings, have all achieved this through regulation, forcing transformations in the market by successfully implementing building energy efficiency codes.

China issued its first mandatory national energy efficiency standard for centrally heated new residential buildings in cold and severe cold regions in 1995. This design standard requires new buildings and associated heating systems to achieve a combined 50% improvement in energy efficiency over buildings and heating systems constructed on standard designs of the

early 1980s. However, it has been difficult to implement the regulation. The housing industry has continued to resist real changes. Ministry of Construction (MOC) officials estimate that by 2000 only 6% of new urban residential buildings in northern China conformed to the energy efficiency standard. Since 2000, there has been some improvement in implementation. However, achievement of better results will require sustained development of stronger implementation and enforcement mechanisms at local levels, and targeted assistance to the housing development industry to develop low-cost, yet efficient building designs, materials and construction options.

China has a complete and elaborate building quality regulation and inspection system in place, although the effectiveness depends on the efforts and diligence of people who are involved in the process. Housing construction quality is regulated by the national government (Ministry of Construction and National Technology and Standard Bureau) through various building codes and is implemented by local (municipal/city-level) construction commissions, which also issue local building codes based on national codes. The planning and design branch of local construction commissions approves architectural designs based on national and/or local building codes. The construction quality inspection branch of local construction commissions is responsible for ensuring compliance. Housing developers are required to hire qualified construction supervision firms to conduct continuous on-site monitoring and supervision, involving verification of materials/component quality and installation, as well as inspection of workmanship and construction quality. Documented proof of compliance with approved architectural designs is required for each phase of the construction and each aspect of the quality control. These documents must then be signed off by the responsible government building inspectors, who also conduct random inspections to check the quality of on-site supervision. In principle, buildings must pass all inspection requirements before occupation.

For historical reasons, ensuring building energy code compliance in most localities is the responsibility of the Wall Renovation Office, which had its roots in the former government building materials line of bureaucracy and is now folded under the local construction commissions. Most local Wall renovation Offices simply does not have the technical capacity and human resources to conduct necessary BEE compliance review and inspection.

***The Government's New Heat Reform Program.*** In July 2003, eight central government ministries and commissions jointly issued a Government Circular calling for each of the 16 northern provinces/autonomous regions to implement heat system reforms in several pilot municipalities, according to guidelines specified in the document ("Heat Reform Guidelines"). The principles of these Guidelines are the commercialization of urban heating, promotion of technical innovation of heating systems, application of energy-saving building construction, and improvement of living standards. The reforms are being implemented in the pilot municipalities during 2004-2006, and, if successful, will be expected to be implemented more broadly thereafter. During the Fall of 2003 each of the provinces was in the process of selecting the pilot municipalities, which will then prepare and implement the local heat reform programs.

The goals of the heat reform program to be piloted are to:

- Reform the system of employers paying for heating, discontinue welfare heating, and monetize and commercialize heating. Households will become responsible for paying their heat bills, and former in-kind wages will be transformed into a transparent payment for heat added to the wage. Transparent subsidies will be provided to low-income households. Heat prices will be set locally to recover costs;
- Introduce heat metering and consumption-based billing, promote the application of new wall construction materials and energy-saving construction technologies and technological reform of heating facilities, enhance the efficiency of heat utilization, and improve the air quality of urban areas;
- Continue to develop and perfect the economic, safe, clean and highly efficient urban heating systems based on centralized heating, together with various other methods; and
- Accelerate the reform of heating enterprises, introduce competition mechanisms, and foster and standardize the urban heating market.

MOC, the National Development and Reform Commission, the Ministry of Finance, the Ministry of Personnel, the Ministry of Civil Affairs, the Ministry of Labor and Social Security, the State Taxation Administration, and the State Environmental Protection Administration have set up an inter-ministry coordinating and leading team to provide leadership for the implementation of the pilot reforms. These agencies have created a system of inter-ministry joint conferences to coordinate the reform work and to research policies related to support for the work. The office of the team is located in the MOC and members of this team are involved in the preparation of the proposed GEF project.

***Strengthening Implementation of Building Energy Efficiency Standards.*** MOC issued a Ministerial Order entitled “Residential Building Energy Conservation Management Regulations” in October 2000. The Management Regulations specify requirements for designers, developers, construction units and agencies responsible for review, approval and inspection to implement the 1995 Standard. They also stipulate that new residential central heating systems should adopt indoor temperature control, apartment-level heat metering and amenable piping system, and implement consumption-based billing (although the latter can only be implemented in due course, following enactment of other, accompanying reforms). Since 2000, many local governments have stepped up their efforts to implement the standards, and to begin to include enforcement of building energy efficiency standards as part of the regular building construction permitting and inspection systems. While much work remains to be done at local levels, results have noticeably improved during 2001-2003.

***Adoption of a Comprehensive Approach.*** The two major agendas of implementing heat reforms and building energy efficiency standards at local levels mutually reinforce each other, and are best adopted in concert. This is increasingly recognized among government leaders and experts. Some of the most compelling examples include: (a) the importance of reducing consumer heat costs through building energy efficiency measures as a means to defray impacts of billing and pricing reforms; (b) needs to provide heat more efficiently to

consumers who are required to pay for heating for the first time; (c) needs for consumer heat control to make building energy efficiency measures effective; and (d) needs to integrate heat system technology modernization both inside and outside of buildings.

### **Assisting Ongoing Government Initiatives**

The Bank's program and the proposed GEF project is a vehicle to bring lessons learned, international experience and new ideas to bear to the Government's ongoing reform work. They also can assist at times as a mechanism for convening relevant parties and concentrating attention on key issues. In particular, the proposed GEF project can provide a means to try out pilot demonstration efforts on development and reform packages which are particularly challenging, breaking ground which has not yet been broken, but which, if successful, can have a major practical demonstration impact for the broad national initiatives.

As described before, one of the main reasons for limited success in energy efficiency gains in residential heating in China to date has been a general lack of integration of the heat supply modernization and reform efforts with building energy efficiency efforts. This project will concentrate its support on implementation of a comprehensive "two-hand" approach, including simultaneous efforts on both heat reform and system modernization, and on building energy efficiency, in distinct projects in a series of municipalities. This approach was developed in the initial study work completed by the Bank in 2000 to review building energy efficiency issues in China, and it has been a theme in the Bank's assistance program since.<sup>3</sup>

**Heat Reform.** On the "left hand", heat system reform policies and programs must be implemented to make heat a commodity—creating a market mechanism to enable consumers to be able to control how much they consume, and pay according to actual consumption. This market mechanism will give consumers the incentives to realize the benefits, which can be obtained from more efficient use. Commodification of heating also is key to developing truly commercial operation of the heating utilities. There are four, interrelated necessary reforms:

- (a) Change in the responsibility for payment of heat bills, so that individuals pay for their heat use, rather than their employers or the state. This is perhaps the most difficult reform in most northern cities. Whereas some high-income families now purchase new homes with heating systems, which require personal payment, assumption of these costs by middle and low-income households is a major issue. Heat bills at current prices are equivalent to 15-30% of average household income in the three northeastern provinces. In principle, funds currently used for payment of employee heat bills can be distributed to employees for them to then pay their heat bills. However, there are complex issues concerning: (i) formula to ensure equity in such distributions of supplemental wages; (ii) how to proceed in the cases where enterprises are currently unable to pay heat bills due to financial distress (common for many industrial enterprises in northeastern China); and (iii) how to proceed concerning the unemployed, fixed-income pensioners, and various other lowest income groups;

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<sup>3</sup> China: Opportunities to Improve Energy Efficiency in Buildings, August 2000. Funded by ASTAE and the World Bank. World Bank Discussion Paper.

- (b) Adoption of technical measures to allow consumers to control their heat consumption. For new systems, this requires a variable-flow, two-pipe design, and use of manual valves or thermostatic radiator valves (TRVs) in radiator systems. Horizontal pipe configurations for each apartment work best. Existing constant-flow, vertical, single-pipe systems can be retrofitted to allow consumer control by adding control valves, radiator by-pass pipes, and making adjustments at the building/substation level to accommodate the flow variations;
- (c) Adoption of some means to determine actual heat consumption and allow billing accordingly. The minimum requirement is for centralized heat use at the building or apartment complex level to be metered and billed. Heat costs can then be allocated to individual apartments based on floor area (as, for example, in Finland), or through the use of heat allocation meters, water flow meters or heat meters (as in most continental western European countries). New buildings should be constructed with horizontal/dual pipe systems, which entail virtually no extra cost, compared with the vertical single pipe systems, but allow apartment-level supply and cut-off flexibility, and apartment-level metering at any desired time in the future; and
- (d) Reform of heat tariffs, so that heat is priced according to cost recovery principles, billed according to actual heat demand and use, as opposed to heated area, and is fair to consumers. This is necessary to provide incentives for consumers to use heat efficiently. A two-part tariff is required, including: (i) a capacity charge, based on heated square meters or contracted maximum demand (e.g. GJ/hour), designed to defray at least a large portion of the costs of fixed assets of heat supply companies, and (ii) an energy charge, based on heat consumed.

***Building Energy Efficiency.*** The “right hand” of the two-handed approach is to cause major improvements in the energy efficiency of urban residential buildings. New more energy-efficient buildings can save 50% or more of heat energy through better building design and application of good insulation and improved windows with relatively small increases in construction costs (e.g., 3-10%, depending upon the circumstances). Investment in such energy efficiency improvements is cost effective over the lifecycle of the buildings.

Widespread adoption of more energy-efficient designs, materials/components and construction methods, a phenomenon often called building energy efficiency market transformation, requires some basic changes in customary practices by a large number of different actors, and hence, a major organizational effort. At least three key measures are required:

- (a) Mechanisms must be developed at local levels to ensure that implementation of the energy efficiency standards becomes an integral and regular part of the general building code inspection and enforcement system. Most localities are just beginning to develop ways to integrate energy efficiency standard enforcement into existing inspection systems, and, based on international experience, developer acceptance, procedural changes, inspector training, and improvement in technical knowledge of the topic all take concentrated effort and time;
- (b) Model designs and specifications, and detailed regulations, must be developed and issued for those key aspects of building and heat system design and construction

- where changes are critical, and professionals working on building design and construction management must be trained in the new methods; and
- (c) Information dissemination and other programs to help spur the rapid, market-based development of new, more energy efficient building designs, materials and products, and technical approaches (such as testing and certification or organization of large-scale procurement packages) need to be implemented. New approaches need to be tested in practice. The actual performance of many of the new materials is not well known, and costs vary sharply. Housing development companies are justified in their skepticism until the real costs and benefits of major changes are better known under Chinese conditions.

## Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

### CHINA: GEF - Heat Reform and Building Energy Efficiency

Sector Issue	Project	OED Rating	Latest Supervision (PSR) Ratings (Bank-financed projects only)	
			Implementation Progress (IP)	Development Objective (DO)
<b>Bank/GEF-financed</b>				
Energy-efficiency and environmental improvements	Energy Conservation Project		S	S
Energy-efficiency and environmental improvements	Second Energy Conservation Project	NA	S	S
Energy-efficiency and environmental improvements	Efficient Industrial Boilers	NA	S	S
Energy-efficiency and environmental improvements	Shandong Environment Project	NA	S	S
<b>Other development agencies</b>				
Energy-efficiency and environmental improvements	UNDP China: End-Use Energy Efficiency Project (EUEEP)	NA	NA	NA

IP/DO Ratings: S (Satisfactory), U (Unsatisfactory)

The specialists on the client and Bank side involved in the overall Bank-led international assistance program in heat reform and building energy efficiency are working on related projects and studies in China. This has helped to link stakeholders involved in one or other activities with each other, greatly enhancing knowledge-sharing and incorporating lessons learned into project design. The UNDP GEF *China: End-Use Energy Efficiency Project (EUEEP)* is being managed by the same MOC department involved in the preparation and implementation of this project. This is helping ensure real coordination and complementarity take place among the two project activities. The EUEEP has helped inform in particular project design on testing and certification of building material equipment, helping identify gaps and capacity constraints that need to be addressed. The *GEF Industrial Boiler* project has helped to inform project design in the case of *Xindu* in Tianjin with information from Chinese boiler manufacturers on the various environmentally friendly boiler options that could be used. The *ASTAE Economic Analysis of Energy Efficiency Measures for New Residential Buildings* is helping to open lines of consultation among project stakeholders, research units and building material manufacturers in China to promote best energy efficiency practices in site planning, building designs, materials/products selection, and construction techniques, as well as to strengthen the capacity for building energy efficiency compliance. The *ESMAP study on Development of Pro-Poor Heat Pricing and Billing Policy* is also working in a similar fashion, linking NGOs, research units and specialists in ongoing consultations in particular on social impacts of heat reform.

### Annex 3: Results Framework and Monitoring

#### CHINA: GEF - Heat Reform and Building Energy Efficiency

##### Results Framework

<b>PDO / GEO</b>	<b>Outcome Indicators</b>	<b>Use of Outcome Information</b>
Sustained and growing increases in energy efficiency in residential buildings and the heating systems which supply them in China's cold climate regions.	By the end of 2011: Cumulative coal savings capacity achieved: 660,000 TCE/year 50% of new residential stock billed according to heat consumption 80% of current-year new housing completion compliant with applicable building energy code	YR1 – YR2 Assess development and implementation of integrated heat reform and building energy efficiency programs of cities in project. YR 3 Determine if project approach for the policy agenda, technical assistance and investment activities needs to be adjusted YR 4-7 Evaluate results and build into strategy for replication across the cold climate regions.
<b>Intermediate Results One per Component</b>	<b>Results Indicators for Each Component</b>	<b>Use of Results Monitoring</b>
<p><b><u>Component One:</u></b></p> <p><b>Tianjin Municipality Component</b> Development and implementation of Tianjin city heat reform and energy efficiency program:</p> <ul style="list-style-type: none"> <li>• Cost-based heat pricing and consumption-based billing implemented; and</li> <li>• Building energy code compliance inspection integrated into regular construction supervision system.</li> </ul>	<p><b><u>Component One:</u></b></p> <p>Residential floor area billed according to heat consumption.  % of annual new housing completion compliant with applicable building energy code.</p>	<p><b><u>Component One:</u></b></p> <p>YR 1-7 Slow uptake may signal weak effects of training and dissemination activities, weak policy buy-in, poor coordination among key city departments and developers, or lack of corporate financing for real estate developers and heat supply companies.</p>
<p><b><u>Component Two:</u></b></p> <p><b>National Policy Support and Project Management</b> Strong project coordination Consolidation of national heat reform and building energy efficiency policies. Dissemination of practical application of aspects of heat reform to other cities in China.</p>	<p><b><u>Component Two :</u></b></p> <p>Number of cities, which will have implemented consumption-based billing. Number of cities, which have integrated building energy code compliance into regular construction supervision. Number of specialists/officials trained through national seminars or workshops.</p>	<p><b><u>Component Two:</u></b></p> <p>YR 1-7 Signals effectiveness of policy support, project implementation support and replication strategy at central level.</p>
<p><b><u>Component Three:</u></b></p> <p><b>Other Northern Cities</b> Development and implementation of integrated city-wide heat reform and energy efficiency programs in 4-6 cities:</p> <ul style="list-style-type: none"> <li>• Cost-base heat pricing and consumption-based billing implemented; and</li> <li>• Building energy code compliance inspection integrated into regular construction supervision system.</li> </ul>	<p><b><u>Component Three:</u></b></p> <p>Residential floor area billed according to heat consumption.  % of annual new housing completion compliant with applicable building energy code.</p>	<p><b><u>Component Three:</u></b></p> <p>YR 1-7 Slow uptake may signal weak effects of training and dissemination activities, weak policy buy-in, poor coordination among key city departments and developers, or lack of corporate financing for real estate developers and heat supply companies.</p>

Note: Outcome indicator figures need to be reassessed when the final candidates of project cities are determined.



### Arrangements for Results Monitoring

Outcome Indicators	Base Year 2004 Condition	TARGET VALUES							Data Collection and Reporting			Responsibility for Data Collection
		YR1	YR2	YR3	YR4	YR5	YR6	YR7	Frequency and Reports	Data Collection Instruments		
		YR7	YR6	YR5	YR4	YR3	YR2	YR1				
<p><b>By the end of 2011:</b> Cumulative coal-savings capacity achieved: 660,000 TCE/year</p> <p>Percent of cumulative new residential stock billed on heat consumption basis: 50%</p> <p>Percent of current-year new housing completion compliant with BEE standard: 80%</p>	0	5,500	21,000	60,000	146,000	263,000	419,000	660,000	Annual and final reports of overall progress of city HRBEE programs.	Government statistics, surveys of local housing construction and heating system operation, energy audits of sample buildings and heating systems.	MOC and commissions of Tianjin and project cities.	
	0	1%	3%	8%	18%	28%	38%	50%	Periodic project monitoring reports.			
	40%	43%	47%	52%	58%	64%	72%	80%				
<p><b>Results Indicators for Each Component</b></p> <p><b>Component One:</b> Percent of cumulative new housing stock billed on heat consumption basis</p> <p>Percent of current-year new housing completion compliant with BEE standard</p>	0	2%	5%	15%	25%	35%	45%	60%	Annual and final progress report of Tianjin City HRBEE program.	Statistics and reports of local government agencies, surveys, and energy audits of sample buildings and heating systems.	Tianjin Construction Commission	
<p><b>Component Two:</b> Number of cities, which will have implemented consumption-based billing.</p> <p>Number of cities, which have integrated building energy code compliance into regular construction supervision.</p> <p>Number of specialists/officials trained through national seminars or workshops.</p>	0	1	2	5	10	15	25	30	Annual and final reports of national level progress of implementing reforms and dissemination activities.	Reports from MOC and review of project monitoring reports.	MOC	
<p><b>Component Three:</b> Percent of cumulative new housing stock billed on heat consumption basis</p> <p>Percent of current-year new housing completion compliant with BEE standard</p>	0	0	2%	5%	15%	25%	35%	50%	Annual and final progress reports of city HRBEE program from each participating municipal government.	Statistics and reports of local government agencies, surveys, and energy audits of sample buildings and heating systems.	Construction commissions of project cities.	
	35%	37%	40%	45%	50%	55%	65%	75%				

Target values need to be reassessed when the final candidates of project cities are determined.

## Key Performance Indicators and Monitoring Methods

The objective of the proposed project is to achieve substantial, sustained and growing increases in energy efficiency in urban residential buildings and central heating systems in China's cold climate regions. The project will achieve this by work in close collaboration with the Government to reduce energy waste in space heating through: (i) improvement of the thermal integrity of buildings, through improved enforcement of building energy efficiency standards, improved design, and use of improved insulation and other energy efficiency measures; (ii) reform of heat pricing and billing, through implementation of heat metering, cost-based pricing and consumption-based billing; and (iii) modernization of heat supply systems to enable end user control and demand-driven operation.

Total estimated coal savings resulting from project implementation in the *Tianjin* and *project cities* are some 13 million tons of coal equivalent (TCE), avoiding emissions of about 10 million metric tons of carbon. These are cumulative amounts over a 20-year span (2012-2032) based on the achieved coal-saving capacity in Tianjin and project cities at project completion (2011). The long-term *national impact* of this project is expected to be much larger than these numbers, as broad replication of the pilot city program throughout the cold climate regions will follow.

The key performance indicators for the project are coal-saving capacity and corresponding carbon-reduction capacity achieved through the implementation of the heat reform and building energy efficiency (HRBEE) program in Tianjin and project cities, as follows:

Overall Project Outcome Indicators	Year 2004 Conditions	2005	2006	2007	2008	2009	2010	2011
Cumulative coal-savings capacity achieved (TCE/year)	0	5,500	21,000	60,000	146,000	263,000	419,000	660,000
Cumulative carbon-reduction capacity achieved (ton of carbon)	0	4,158	15,876	45,360	110,376	198,828	316,764	498,960

Other indicators and benchmarks which will be monitored for the project include:

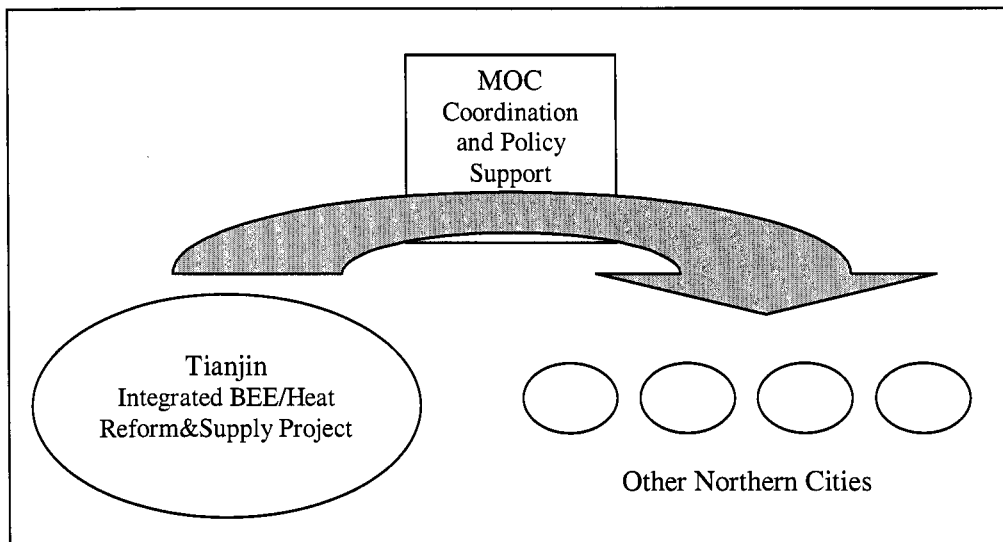
- Residential floor area subjected to heat metering and consumption-based billing in Tianjin and project cities;
- Residential floor area constructed according to the current and more stringent BEE standards in Tianjin and project cities during project period; and
- Overall progress of national heat reform and building energy efficiency efforts.

The "Coal-Savings Capacity" and corresponding "Carbon-Reduction Capacity" achieved will be calculated using a methodology agreed by MOC and the Bank. The performance evaluation involves comparison of the monitored results in Tianjin and project cities with pre-determined baselines. The main data collection requirements for each city include: annual completion of new housing area, amount of the new housing area subjected to consumption-based heat billing, and amount of the new housing area compliant with current and more stringent BEE standards. Other critical data include the average energy efficiency of local heating systems with variable-flow operation technology, as well as the average energy efficiency of those with constant-flow operation technology, based on field studies and/or surveys of respective local systems.

## Annex 4: Detailed Project Description

### CHINA: GEF - Heat Reform and Building Energy Efficiency

The project is designed to support the removal of barriers to heat reform, modernization of heat supply and improvements in building energy efficiency in China. The proposed project has three components: (a) demonstration of the two-handed approach in Tianjin Municipality; (b) support for the Ministry of Construction on national policy development and implementation capacity building; and (c) replication of the two-handed approach in 4-6 other northern cities. This design allows the project to develop a model integrated city HRBEE program in Tianjin, which is at the forefront of heat reform and building energy efficiency in China, and follow up with adaptations to a spectrum of other northern cities so as to fully establish the applicability of the two-handed approach in the cold climate region of China. This learning by doing approach with simultaneous knowledge sharing and parallel replication activities in multiple cities will be facilitated by a strong national coordination and policy support of MOC.



The total estimated cost of the proposed project is about US\$52.6 million, covering incremental investments in energy innovations in new residential buildings, existing buildings (where appropriate), and associated heating systems included in the integrated demonstration projects in Tianjin and 4-6 other cities, as well as costs of technical and institutional capacity building at local and national levels. The proposed GEF support is US\$18 million, including \$13 million incremental investment co-financing in energy efficiency innovations and \$5 million in technical assistance to national and local capacity building and project implementation.

The project will be complemented by, and integrated with, a closely-related new French Fonds Français pour l'Environnement Mondial (FFEM) project of about US\$ 3.3 million to support for improving building energy efficiency in China, especially in Harbin City. The French bilateral assistance will support building energy efficiency innovations, and the

proposed project will create the supportive policy framework and an efficient heat supply system.

#### **(A) TIANJIN MUNICIPALITY COMPONENT**

Tianjin is a municipality of provincial rank, 150 km southeast of Beijing, with more than 9 million permanent inhabitants. Current urban residential building stock in Tianjin is about 140 million square meters; about 70% is heated by central heating systems.

Central heating started in Tianjin only in the early 1980s and slowly reached a market share of 33% by 1997, based mostly on supply from coal-fired small boiler houses. To reduce air pollution and improve living standards, the municipal government embarked on a 3 year plan in 1999 to increase the rate of connection to central heating systems to more than 70% with a substantial increase in the provision of heat from large boiler houses and combined heat and power plants. The Tianjin heating sector is very fragmented with more than 400 heating companies. Over one half of installed heating capacity is made of boilers with less than 7 MW unit capacity. As a consequence, the heating industry is the biggest contributor to air pollution in Tianjin during the winter. To address this, the Municipal Government is completing a 2003-2015 heat supply development plan, including the interconnection of the local systems, scrapping of the small boilers, and development of larger heat source stations which can provide heat with suitable environmental controls. This would be in compliance with the Tianjin "Blue Sky Program" which calls for the elimination of all coal-fired boilers equal to or under 7 MW for heating and expanded use of district heating and cleaner fuels within Tianjin's ring road.

Tianjin was the first large city in China to embark on heat reform. The first step in 2000 was to transfer the responsibility for heat bill payment from the work unit to the heat consumer, accompanied by a salary reform for government employees, increasing their salaries by slightly less than the average heat bill. This reform has been completed. In several demonstration projects, different heat metering technologies were tried out and consumption-based billing was experimented. In 2003, work on developing a two-part heat tariff began with support from the World Bank's ESMAP program. With the implementation of such a new tariff system and installation of metering and control equipment, consumers will be able to adjust their heat consumption levels and thus their heating bills, providing in turn incentives to invest in more energy efficient housing.

Housing construction in Tianjin has proceeded at a rapid rate during the past few years, adding more than 10 million square meters of total construction area annually during the past 3 years. The Tianjin Municipal Government promulgated their own building energy efficiency standards in 1997, modeled on the 1995 national standard for residential buildings. Implementation rules, application drawings and management rules for wall material reform, forbidding the use of solid clay bricks, were issued as well. Developers are now reported to start using more energy efficient designs and materials, but coordination between the various parts of the chain from design to final supervision is still poor, implementation is uneven, materials are of varying quality, construction practices are not up to higher quality requirements, etc. It is estimated that less than half of all new residential construction abides by the current energy efficiency standard. Very few of the new developments, however,

incorporate heat meters or controls at the apartment level and heating systems still largely operate in a supply-driven mode, rendering energy efficiency improvements on buildings themselves ineffective in terms of real energy savings.

Tianjin's head start on heat reforms and its commitment to improve the energy efficiency of its new building stock made it an early partner of the Central Government and the World Bank in the development of a strategy to reduce energy consumption for space heating. Municipal leaders welcomed the opportunity to embark on a comprehensive program demonstrating energy efficiency investments in both the heating systems and the buildings they supply, the transformation of the heating systems from supply to demand-driven operation and the implementation of further steps in heat reform such as heat pricing and consumption-based billing. Several innovative developers of new residential building complexes have been interested in cooperating in such an effort. Feasibility study for a large residential building complex is already complete. Additional demonstration partners and sites are being identified.

The Tianjin Municipality Component comprises two subcomponents:

**(i) Energy efficiency investment in new residential buildings and heat supply systems**

This subcomponent will support the introduction of modern heat supply and energy efficient building design and construction in several new large housing development projects. In all developments, buildings will be designed and constructed to meet the goal set by the project of achieving 30 percent reduction in heat losses from the level specified by the current building energy efficiency standard in Tianjin, heat supply systems will adopt demand-driven variable flow technology and use small substations, and household heat consumption will be metered and billed accordingly. Specific areas of support include:

- Improvement of building thermal integrity (examples: increased thickness and quality of roof and external wall insulation, heated stairwell, windows with higher thermal resistance);
- Improvement of building internal heating system (examples: installation of apartment-level heat meters, apartment-level temperature controls, improved radiators, and higher quality risers with optimized placement of ducts for heat distribution); and
- Improvement of heating system and network (examples: energy-efficiency improvements in heat generation and dispatch, variable-flow capability, and use of small substations).

The proposed GEF co-financing for all demonstration projects in Tianjin is US\$5 million. The feasibility study for the first integrated demonstration project at Xindu Garden is completed and reviewed by the Bank and MOC teams. The estimated total incremental investment in energy efficiency innovations in the Xindu project is about \$8.7 million, and proposed GEF co-financing is \$2.6 million. Additional demonstration sites are being

identified.<sup>4</sup> The first proposed subproject in Tianjin, the Phase 1 construction at Xindu, is fully prepared, including 100,000 m<sup>2</sup> of new housing, the first of two 29 MW hot water coal-fired boilers and associated heat transmission and distribution network/facilities, to be developed in 2005. The estimated incremental investment in energy efficiency innovations for this subproject is about \$1.7 million. The proposed GEF co-financing is about \$0.5 million.

*Xindu Garden Demonstration Project.* Located just inside Tianjin city's ring road, the housing development at *Xindu Garden* will be developed by Tianjin Jintou Jinsha Real Estate Development Co. Ltd. in six phases over about six years (2005-2010). The whole development will comprise 740,000 square meters of new residential and public building construction area, and a 58 MW heat-only district heating system (also supplying adjacent residential areas). The total residential floor area is about 683,000 m<sup>2</sup> for some 7,000 families. The Phase 1 of the development will use floor heating, which is a heating system that is increasing in use in new construction.

GEF co-financing for incremental investments in energy efficiency improvements beyond current requirements and practices will be determined on a subproject basis as the each phase of the Xindu construction is prepared, appraised, and commenced. The incremental investments in energy efficiency improvements at Xindu that could be supported by GEF are likely to include *inter alia*: (a) installation of a variable flow heat supply system with state-of-the-art chain grate boilers, associated management system and environmental controls; (b) installation of improved pre-insulated pipes for the primary and secondary network; (c) installation of small, state-of-the-art substations; (d) installation of apartment level meters and temperature control equipment; (e) improvements in exterior wall construction, including use of higher quality and/or thicker exterior wall insulation; (f) improvements in roof construction, including higher quality water proofing material as well as better quality and / or thicker roof insulation; (g) installation of push-open PVC windows with higher thermal resistance and lower infiltration; and (h) installation of insulated doors to the building and apartments.

GEF support enables both international and national technical and organizational support, through MOC and the Bank, and assists the relevant corporate housing development companies to overcome the many risks involved in so many simultaneous changes, to allow this complex development of China's first large integrated demonstration project using the "two-hand" approach to proceed.

## (ii) Technical and Institutional Capacity Building

In addition to the demonstration subcomponent, the project will assist the Tianjin Municipal Government to broaden the impact of its HRBEE program as well as project implementation through targeted assistance in the following activities:

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<sup>4</sup> Should suitable additional investment subprojects not be prepared, successfully appraised and approved by the Bank and MOC by December 31, 2008, allocated financing may be reallocated to other project needs, and in particular the Other Northern Cities Component.

- Technical studies and analytical work essential to the implementation of heat metering, cost-based pricing, consumption-based billing, as well as more stringent BEE standard;
- Development of BEE compliance enforcement capacity through introduction of systematic inspection procedures compatible with the existing construction quality inspection system, and by strengthening the supervision capacity of the local BEE authority;
- Public education in the local area on the benefits of energy efficiency and in particular for new residents in the demonstration projects on the use and benefits of consumption-based billing and heat metering and consumer control equipment; and professional training for designers, construction supervisors, and building inspectors on energy efficiency compliance requirements and procedures; and
- Monitoring and evaluation of technical outcomes, as well as the economic and social impacts of the demonstration projects.

Total estimated incremental cost for this subcomponent is \$1.2 million. Proposed GEF support is \$1 million. The following box summarizes the specific TA activities proposed for implementation:

The technical studies and analytical work will include: (a) a series of technical studies to develop operational specifications and methodologies on BEE design, construction and acceptance in Tianjin municipality for the introduction of a more stringent BEE standard demonstrated in this proposed project; and (b) a series of special studies for: the revision of technical specifications of heat system design and construction to accommodate metering and demand-driven supply; the evaluation of supply/return water temperature and variable flow system management, economic/technical analysis of various metering models, small substations and water quality assurance and treatment methods. (\$650,000 GEF support proposed).

The development of BEE compliance enforcement capacity will focus on: (a) technical assistance to develop detailed compliance requirements for achieving the new BEE standard and associated regulatory oversight procedures; (b) technical assistance for the development of systematic and practical BEE compliance inspection procedures that are consistent with the existing construction quality inspection practice; and (c) complementary training sessions for design institutes, construction inspectors and other specialists in enforcement of BEE codes. (\$175,000 GEF support proposed).

The public education and professional training will involve dissemination and outreach activities, including: (a) study tours for officials, experts and managers dealing with special topics in heat reform, such as metering, consumption-based billing, commercial operation of heating systems, building energy efficiency enforcement; (b) training/workshops/seminars to disseminate knowledge developed through special studies and demonstration projects to developers, designers, building inspectors, heating system operators, and other specialists; and (c) development of a communications plan for rolling out heat pricing and billing reforms, and implementation of a broad awareness campaign aimed at consumers and apartment buyers. This will include the development and distribution of a homeowner's guide to building energy efficiency features and their use in homes. The guide will be complemented with practical training sessions for homeowners, especially the new residents in the demonstration projects, about features such as the use of meters for heating, controls, reading/interpreting heating bills and energy saving behavior. (\$100,000 GEF support proposed).

The monitoring and evaluation will support local project supervision, and regular progress reports, and monitoring and evaluation of project impacts and outcomes. (\$75,000 GEF support proposed).

## **(B) NATIONAL-LEVEL POLICY SUPPORT AND PROJECT MANAGEMENT**

As the focal point of the national heat reform and building energy efficiency programs, MOC's work on program development and implementation is critical for China to succeed in these overall efforts. The proposed project includes \$2.0 million in GEF support for partial funding of technical assistance efforts in policy and program development and implementation, to be complemented by other World Bank and donor financing, and for essential project management, evaluation and dissemination activities. It comprises two subcomponents:

### **(i) Policy Advice, Technical and Institutional Support** (\$1.15 million GEF support proposed)

In line with the project's national scope, MOC requires technical assistance financing in a wide range of specific areas to develop and implement national heat reform and building energy efficiency policies, and to assist localities in the detailed implementation of the reforms. Assistance is required both to be able to apply international experience, and, especially, to be able to organize the highest quality national experts to address critical issues in a concentrated way. Within the proposed GEF project, the technical assistance will be targeted and highly focused on policy development and implementation activities, especially those directly related to the implementation of specific demonstrations of the "two handed" approach at local levels. The Bank will also seek to mobilize and encourage additional international donor activities in support of the overall program of MOC, as the needs are so great. As such, the scope of technical assistance activities could include special studies, training/workshops/study tours, and dissemination/outreach activities for the following:

- transfer of responsibility for paying heat bills to the individual;
- heat pricing and consumption based billing;
- heat metering;
- heat supply enterprise reform;
- assurance of a social safety net for vulnerable heat consumers;
- building energy efficiency standards and enforcement measures for new and old buildings;
- national regulation on testing and certification of energy efficient building materials and components; and
- promotion and dissemination of knowledge in heat supply and building energy efficiency technologies.

These technical assistance activities will be organized in small packages over a period of seven years, reviewed and agreed with the Bank, giving the necessary flexibility to provide just-in-time assistance. The proposed activities for the first 18 months of project implementation include:

**Training/Workshops:** (a) principles and methods of consumption-based pricing and billing methods; (b) strategies and techniques in adjusting heating supply systems from constant flow to variable flow, introducing meters, and adjusting indoor heating systems;



(c) successful methods used by Chinese cities for enforcing existing building energy efficiency codes in designs and construction; (d) principles of and experiences with integrating heat reform and building energy efficiency policy measures (the two handed approach) in Chinese cities; and (e) introduction to various building energy efficiency technologies and their economic impact. Beneficiaries of training/workshops would primarily be specialists, real estate developers, vendors and government officials.

**Public Awareness** activities: (a) development and dissemination of brochures on basic aspects of heat reform; (b) on-site promotion and consulting activities in residential communities in partnership with local Residential Community Committees; (c) public service announcements through various media; and (d) consultants will be hired to survey and assess training and dissemination needs for key cities expected to participate in the project and develop a training and dissemination plan based on this assessment. The first two activities would be piloted in selected residential districts in three pilot cities participating in the project. The third activity would target a broader group of cities implementing heat reform. The fourth activity would inform the development of downstream training and dissemination activities.

**(ii) Project Management, Monitoring and Evaluation**  
(\$850,000 GEF support proposed)

Central support, organized through MOC, is critical for the innovative aspects of the project to be implemented smoothly, and to ensure that lessons learned under the various project components will have maximum impact in other parts of northern China and even beyond. The subcomponent will support the hiring of international and local experts to assist MOC in developing and implementing, with the support of local authorities, the monitoring and evaluation for the entire project, including collecting project performance information and reporting to the Government, within the MOC, the Bank, the GEF and others, on the impact and results of this project. This subcomponent will also support the hiring of experts and a limited amount of incremental operating costs to assist MOC with executing its project management responsibilities covering the investments, technical assistance, training, workshops and other activities across northern China supported by the project.

**(C) OTHER NORTHERN CITIES COMPONENT**

This component will promote simultaneous development of both heat systems restructuring and billing and pricing reform, and building energy efficiency improvements in 4-6 additional northern Chinese municipalities, in order to achieve broad, national impact. The component is critical for achievement of the project's overall objectives — with emerging results from the Tianjin Component in hand, and national-level support, comprehensive development of heat reform and building energy efficiency measures must be rolled out in the coldest regions of China. In most cases, the challenges also are greater than in Tianjin, due to greater heating requirements in colder climates, relatively slow economic development in the northeastern and northwestern regions, and less progress in heat reform to date.

This component will operate in close association with the Central Government's heat reform piloting program, which will be implemented during 2004-2006, based on the July 2003 Heat

Reform Guidelines. Participating municipalities will be selected from the list of pilot heat reform municipalities included in the national reform program in Heilongjiang, Jilin, Liaoning and one other province, primarily based upon the commitment of municipal leadership to the implementation of the two-handed approach. The component is designed to meet emerging assistance needs, and to respond to new ideas, as the national pilot Heat Reform Program unfolds, and lessons are learned from experience, in Tianjin and elsewhere. Hence, this component needs to be implemented in a phased approach.

Provincial and municipal governments, heating companies and housing development companies in the pilot municipalities in these provinces are increasingly being engaged as part of ongoing World Bank technical assistance work. In order to participate in the project, municipalities in the four project provinces must:

- (a) be designated by the Government as national pilot heat reform city;
- (b) demonstrate municipal leadership commitment to implementation of the heat reforms and to enforcement of building energy efficiency standards;
- (c) demonstrate commitment to the “two-handed” approach of the overall Program; and
- (d) demonstrate strong management and organization capacity for this project, including abilities to organize both building energy efficiency and heat system development and reform aspects in an integrated and effective manner.

In addition to demonstration of municipal leadership commitment to the heat reforms and enforcement of building energy efficiency standards, each participating municipality will need to agree with MOC and the Bank on a city-wide heat reform and building energy efficiency program, based on the two-hand approach, prior to agreement on any GEF investment financing support. These citywide programs will provide a road map for all project activities in each municipality, and, especially, the leveraging and linkages of these activities to the achievement of broader, sustainable results throughout the participating municipalities. The citywide programs will include a timeline of heat supply system modernization, heat reform, and building energy efficiency actions. The agreed programs will include specific energy efficiency targets, and other monitorable indicators, which will be evaluated under the national component of the project as local implementation proceeds.

The objective of the project in each of the 4-6 cities will be implementation of the agreed city-wide heat reform and building energy efficiency program, and achievement of the associated energy savings. Activities and investments receiving direct GEF support will be a part of the overall city-wide programs. In addition to TA activities targeted to resolve specific local issues, GEF support may be provided, depending upon local priorities, for demonstration projects which integrated packages of: (a) energy efficiency improvements in heating networks; (b) operational modernization in heat supply systems to accommodate variable flow technology and consumer control; (c) adoption of consumer controlled heating systems and energy efficiency improvements in the heating systems within buildings; (d) adoption of new heat billing and metering technologies, especially in conjunction with heat pricing reforms; (e) development and construction of state-of-the art energy efficient building designs; (f) energy efficiency renovations in existing buildings (where appropriate); and (g) activities to support improved local enforcement of building energy efficiency standards. Within the TA

activities, US\$1.0 million of GEF financing is earmarked for feasibility studies and other studies necessary to prepare demonstration projects in other cities for GEF financial support. Especially important is to bring experts from other parts of China and other countries to provide the necessary expertise on technologies and techniques in variable-flow heating systems with consumer control and energy efficient building designs.

As in Tianjin, energy efficiency measures are expected to concentrate on new buildings and heating systems. With the tremendous growth of the new building stock, the focus on new developments is more relevant in China. In the less dynamic three Northern provinces, however, governments are concerned about the improvement of existing buildings and heating systems. The project is therefore expected to support the implementation of **thermal renovation of existing residential buildings**, and, more importantly, the identification of a business model and financing structure for these investments which tend to have a long payback time.

The total estimated incremental investments in demonstrating energy efficiency improvements beyond current practice and requirements in the 4-6 other northern cities are about US\$26.7 million, and proposed GEF co-financing is \$8 million. (This assumes the allocation of the project's small "contingency" unallocated category to this component.) The total estimated incremental cost of technical and institutional capacity building is about \$2.4 million, and proposed GEF support is \$2 million, and \$250,000 of this amount will be administered by MOC for the exclusive purpose of assisting the development of potential subprojects, technical and policy analysis and studies critical to implementing HRBEE program in the project cities of the "Other Northern Cities Component". This earmarking is necessary to provide timely support for initial project start-up activities, prior to full execution of Implementation Agreements between the central government and project cities.

GEF support is very important, because it provides a platform for direct Bank and MOC involvement, a mechanism to concentrate international, national and local attention on the implementation details which are critical for success, and a modest incentive for local authorities to work to overcome the great organizational and institutional barriers associated with applications of the two-handed approach in heat and housing developments for the first time. Support will include assistance for local policy development and implementation, and financing for about 30% of the incremental costs of energy efficiency innovations in heating systems and buildings, selected by the municipalities and agreed with MOC and the Bank as having maximum value for assisting the municipalities in their implementation of their city-wide heat reform and building energy efficiency programs. The support package for each municipality will be based on the on-the-ground needs of the localities, with different climatic, socio-economic, infrastructure and even cultural characteristics.

MOC and the Bank, to further strengthen these efforts, will actively seek additional associated financing in support of the 4-6 municipal heat reform and building energy efficiency programs. The Bank will also strongly consider requests from the municipalities for IBRD loans to leverage GEF resources in participating cities, especially for heat supply investments.

<b>Demonstration Projects and Heat Policy Reforms in Other Northern Cities Component</b>		
	<b>Total Estim. Incremental Cost (USD M)</b>	<b>Total Indic. – GEF Support (USD M)</b>
<b>1 Investment</b>		
Total	26.7	8.0
Building Energy Efficiency	14.1	4.2
Internal Heating Network	6.0	1.8
Network and Substations	3.8	1.1
Heat Supply	2.8	0.8
<b>2 Technical Assistance</b>		
Total		
Technical Assistance	2.4	2.0
2.1 Project Development Support	1.2	1.0
2.2 Development and Piloting Heat Reform Support	1.2	1.0

## Annex 5: Project Costs

### CHINA: GEF - Heat Reform and Building Energy Efficiency

The total estimated cost of the proposed project is about US\$52.6 million, covering incremental investments in energy innovations in new residential buildings, existing buildings (where appropriate), and associated heating systems included in the integrated demonstration projects in Tianjin and 4-6 other cities, as well as costs of technical and institutional capacity building at local and national levels. The proposed GEF support is US\$18 million, including \$13 million incremental investment co-financing in energy efficiency innovations and \$5 million in technical assistance to national and local capacity building and project implementation. The associated costs required to complete the housing development and heating system construction of the demonstration projects are estimated at about US\$1,000 million.

#### Estimated Project Costs and Indicative GEF Support (US\$ million)

	Estimated Project Cost	Indicative GEF Support	Total Local Contribution	Associated Local Cost
<b>Total Project Cost</b>	<b>52.6</b>	<b>18.0</b>	<b>34.6</b>	<b>1050</b>
<b>A. Tianjin Municipality Demonstration Component</b>	<b>21.2</b>	<b>6.0</b>	<b>15.2</b>	<b>420</b>
A.1 Energy Efficient Investment in Buildings and Heat Supply	20.0	5.0	15.0	420
A.2 Technical and Institutional Capacity Building	1.2	1.0	0.2	
<b>B. National Policy Support &amp; Project Management Component</b>	<b>2.3</b>	<b>2.0</b>	<b>0.3</b>	
B.1 Technical Assistance to Ministry of Construction	1.35	1.15	0.2	
B.2 Project Management, Monitoring and Dissemination	0.95	0.85	0.1	
<b>C. Other Northern Cities Component</b>	<b>29.1</b>	<b>10.0</b>	<b>19.1</b>	<b>630</b>
C.1 Energy Efficiency Investment in Buildings and Heat Supply	26.7	8.0	18.7	630
C.2 Technical and Institutional Capacity Building	2.4	2.0	0.4	

## **Annex 6: Implementation Arrangements**

### **CHINA: GEF - Heat Reform and Building Energy Efficiency**

#### **Project Management Arrangements**

A Steering Committee including senior officials from MOC and the Ministry of Finance has been created to coordinate and consult on key project issues and monitor implementation of the project.

MOC has established a Project Leading Office which will be responsible for the implementation of the project. The Office will meet on a regular basis, including the Department of Science and Technology, the Department of Urban Construction, Department of Comprehensive Planning & Treasury and Department of Foreign Affairs, to consult on project implementation issues.

A National Project Management Office (NPMO) has been established by the Ministry of Construction (MOC) as the entity charged with day-to-day management of the project. The NPMO reports to the Project Leading Office. The NPMO will engage an appropriate number of experts for the implementation stage of the project, and will be organized into functional divisions for project management, procurement, technical and engineering, finance and administration. The NPMO will be responsible for preparing TORs and managing contracts, preparing annual budgets and procurement plans, managing project funds, and coordinating and monitoring counterpart funding.

The NPMO will also organize assistance to help local governments to prepare City-wide Heat Reform and Building Energy Efficiency Plans and will review these plans, organize experts to assist other cities with the design of subprojects and technical assistance plans, establish monitoring and evaluation and prepare evaluation reports with possible assistance from outside experts, and assist with dissemination as well as prepare periodic project progress reports.

The Tianjin Municipal Government has assigned responsibility for implementation of the Tianjin Component to its Construction Commission, under which a local Project Management Office (LPMO) has been assigned implementation responsibilities for this project. Tianjin's LPMO also is responsible for project implementation of other World Bank projects. As specific subcomponents are developed under the other northern cities component, other cities will also establish LPMOs, most likely within local Construction Commissions.

Implementation of the "two-hand" approach, involving both heat supply modernization and pricing and billing reform as well as building energy efficiency improvement, requires very active, day-to-day coordination across departmental and institutional lines both within MOC and within local and municipal governments. Both MOC and Tianjin Municipality have already created national and local experts groups that incorporate authority and expertise in the heat supply/reform, building energy efficiency, environmental engineering, building

administration, as well as experts in sociology, economics, and management areas. The municipalities joining the project later will need to further organize PMOs and experts groups which can devote sufficient time necessary to prepare and implement this complex, integrated project.

### **Project Implementation Mechanisms**

The NPMO will be responsible for implementation of all aspects of the National Component. The NPMO also will guide, supervise, monitor and evaluate the implementation of both the Tianjin Component and the Other Northern Cities Component. Implementation of those Components, however, will be the responsibility of the LPMOs in Tianjin and the other Participating Cities.

Aside from Tianjin, Participating Cities will be designated through joint agreement of MOC and the Bank as project implementation progresses. To participate, cities must:

- be designated by the Government as national pilot heat reform city;
- demonstrate municipal leadership commitment to implementation of the heat reforms and to enforcement of building energy efficiency standards;
- demonstrate commitment to the “two-handed” approach of the overall Program; and
- demonstrate strong management and organization capacity for this project, including abilities to organize both building energy efficiency and heat system development and reform aspects in an integrated and effective manner.

Priority consideration will be given to cities which demonstrate the strongest commitment to the Project’s objectives, and have concrete and sound ideas on how to proceed with both heat reform and building energy efficiency actions.

Participating cities will be eligible to receive both technical assistance and investment subproject support, as long as sufficient funding remains under the Other Northern Cities Component. Maximum grant allocation for any single municipality under this Component is expected to be US\$ 2 million, and based on demands, allocations for most cities are likely to be less.

Technical assistance support for Participating Cities will be based on needs, and priority will be given to activities of highest relevance to the HRBEE efforts of the cities, relevance for the national agenda, and needs for preparation of city plans and, in particular, preparation of innovative subproject investment proposals. Technical assistance activity Terms of Reference must be approved by both MOC and the Bank, and draft Terms of Reference from Participating Cities can be reviewed and considered in a flexible manner during project implementation.

An Investment Subproject Preparation Manual is under preparation by the NPMO, and will be completed and agreed between MOC and the Bank prior to project effectiveness. The Manual will stipulate the specifics of the criteria against which investment subproject proposals will be assessed by the Bank and MOC. The Manual also will stipulate the detailed

requirements of the contents of each proposal. In summary, subproject proposals will be assessed and prioritized for support based on (a) the contribution of the proposed subproject to furthering the national heat reform and building energy efficiency agenda; (b) the contribution of the proposed subproject to the city's stated HRBEE Plan; (c) adherence to this project's two-handed, integrated approach to HRBEE; (d) the extent of leveraging of GEF resources; and (e) the degree of innovation in the proposed project concept. Investment subproject proposals must be submitted to MOC through the governments of the participating cities.

Also in summary, each investment subproject proposal will need to include:

- a) Evidence of the establishment of an LPMO, with assessed sufficient project implementation, procurement, and financial management capacity, satisfactory to MOC and the Bank;
- b) Reference to a City-wide Heat Reform and Building Energy Efficiency Plan, endorsed by the city government. It is assumed that this Plan will be included in the first subproject proposal of each city, and then referred to in subsequent subproject proposals. The Plan should detail the specific plans of the city for heat supply development, heat network development, heat supply enterprise reform, heat billing and pricing reforms, consumer heat control, and building energy efficiency development and promotion. The Plan should provide a road map for all project activities in each city, and, especially, the leveraging and linkages of these activities to the achievement of broader, sustainable results throughout the participating municipalities. The citywide programs will include a timeline of heat supply system modernization, heat reform, and building energy efficiency actions. The Plan should include specific energy efficiency targets, and other monitorable indicators, which will be evaluated under the National Component of the project as local implementation proceeds;
- c) A detailed project feasibility study, including all technical, economic and financial aspects. If a subproject is part of a broader development (with potential additional GEF-supported subprojects), the feasibility study should focus on both the broader development and the specific subproject proposed for immediate support. The subproject feasibility study must include a very detailed list of energy efficiency/heat-reform-related measures which are considered "incremental" or "above and beyond" to local best practice in heat reform and building energy efficiency work, and demonstrating new concepts or innovations. Cost estimates of these incremental costs must be detailed and justified, and a financing plan provided whereby GEF co-financing is no more than 30% of the total;
- d) Social and Environmental Impact Reports, completed according to the relevant Frameworks agreed between MOC and the Bank and summarized in Annex 10;
- e) A public consultation plan, describing basic procedures and approaches to involve stakeholders, especially in heat reform process, and identifying channels for project information disclosure, as well as specific public awareness programs;
- f) A procurement plan for the incremental energy-efficiency measures of the subproject; and



- g) Evidence of committed full non-GEF co-financing for the proposed incremental energy efficiency measures, and full financing for the entire heating and housing developments within which these measures will be added.

Once approved by both MOC and the Bank, disbursements of GEF co-financing for investment subprojects will proceed as described in Annex 7. These disbursements will require strict verification, certified by the governments of Participating Cities, that all of the incremental energy efficiency/heat-reform-related measures agreed to at the subproject approval stage have been undertaken in line with the approved feasibility study, and according to design and equipment specifications established at the outset of subproject implementation.

## **Annex 7: Financial Management and Disbursement Arrangements**

### **CHINA: GEF - Heat Reform and Building Energy Efficiency**

An assessment of the adequacy of the project financial management system (based on guidelines issued by the Financial Management Sector Board on October 15, 2003) concluded that the project meets minimum Bank financial management requirements, as stipulated in BP/OP 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 agencies as required by the Bank. No outstanding audits or audit issues exist with any of the implementing agencies involved in the proposed project.

The project will be financed by GEF grants and counterpart funds. The grant agreement will be signed between the Bank and the People's Republic of China through its Ministry of Finance (MOF). Counterpart funds include corporate resources in form of loans or equity and government appropriation.

#### **AUDIT ARRANGEMENT**

In line with other Bank and GEF financed projects in China, the project will be audited in accordance with ISA and the Government Auditing Standards of the People's Republic of China (1997 edition). The China National Audit Office (CNAO) has been identified as the auditor for this project. Annual audit reports will be furnished to the Bank within six months of the end of each year.

#### **DISBURSEMENT ARRANGEMENT**

##### **Output-based Disbursement for Investment Subprojects of the Tianjin Component and Other Northern Cities Component**

Of the US\$18 million GEF grant, US\$13 million will be used to co-finance a portion of the incremental investments in demonstration projects in Tianjin and 4-6 other northern Chinese cities for energy efficiency improvements beyond current practices and requirements in new housing developments, energy-efficiency renovations of existing housing units (where appropriate), and their associated heating systems.

GEF grant support for eligible incremental costs will be disbursed against compliance evaluation reports for incremental energy efficiency measures identified in the incremental cost financing table of each subproject specified in each subproject design proposal. The subproject design proposal and its incremental cost financing table must be agreed between the Bank, MOC and relevant local government, prior to implementation. The agreed grant for a particular subproject will be disbursed to the housing developer and/or the heating system contractor at three points of the construction cycle as below:

**The first disbursement** (20% of total subproject grant support) will be made when the first order of the GEF co-financed items are shipped to the construction site and compliance is verified. A compliance evaluation report, certified by the agreed responsible local government authorities, should include the following four items. Non-compliant disbursement requests will be denied grant support.

- a. Official approval of the final building and heating system designs, which meet the technical specifications and requirements of the MOC and the Bank. The technical specifications of all GEF co-financed items (for examples, insulation materials, windows, thermostatic radiator valves, heat meters, and other building components and heating system equipments) in the final designs become the basic guide for compliance verification and construction supervision;
- b. Construction permits;
- c. Shipment invoices of the first batch of items identified in the agreed incremental cost financing plan, regardless of financing source; and
- d. Verification report that these items comply with design technical specifications based on inspections by the relevant authority in Tianjin or other northern city.

**The second disbursement** (60% of total) will be made when all incremental cost items are installed and compliance is verified by agreed responsible local government authorities.

- a. Proof of quality inspection of all additional shipments of incremental cost items (see above); and
- b. Proof of proper installation of all incremental cost items based on construction supervision records approved by government inspectors (general inspection methods and spot check procedures for incremental items need to be defined and accepted by MOC and the Bank prior to the construction of the subproject).

**The final disbursement** (20% of total) will be made when the subproject is complete and compliance is verified by the agreed responsible local government authorities, with proof of completion of the subproject, including completion inspection reports of buildings and heating systems.

The above disbursement procedures will be implemented with the full support of the BEE compliance enforcement, which, with the technical assistance provided by the proposed project, will be integrated into the regular government building quality inspection system (see end of Annex 1). A separate BEE compliance form will be added to the compliance documents required for building occupation. The Wall Renovation Office will supervise the construction supervision firms by checking for proper documentation and through random on-site inspections, very much like what the regular government building inspectors do now.

### **Traditional Disbursement Method for Technical Assistance Components**

The remaining US\$5 million, providing financing for the National Component and technical assistance for the Tianjin and other northern cities components, will use traditional World Bank disbursement methods.

## Allocation of Grant Proceeds

Disbursement allocations by category for the GEF grant proceeds and percentages to be financed are provided below:

Expenditure Category	Amount in US\$ thousand	Financing Percentage
<b>Part A (Tianjin Component)</b>		
1) Investment Subprojects	5,000	100% of eligible incremental costs
2) Consulting Services	1,000	91%
<b>Part B (National Component)</b>		
1) Consulting Services	2,055	91%
2) Incremental Operating Costs	150	100%
3) Goods	45	100% of foreign expenditures, 100% of local expenditures (ex-factory costs) and 75% of expenditures for other items procured locally.
<b>Part C (Other Northern Cities Component)</b>		
1) Investment Subprojects	7,700	100% of eligible incremental costs
2) Consulting Services	1,750	91%
<b>Unallocated</b>	300	

Note: \$250,000 of Part B Consulting Services is earmarked for the development of potential subprojects and related policy reforms in other northern cities.

## Reimbursement Procedures

All of the withdrawal applications for the World Bank should be submitted by the NPMO to MOF to the World Bank, with signature by authorized persons. The expenditures may incur in various entities. Each entity is responsible in collecting original financial documents and submitting them to the NPMO and MOF for reimbursement. MOF is responsible in preparing withdrawn applications together with other required documents for the World Bank.

## Use of Statement of Expenditure

Disbursement will be made against statements of expenditures (SOEs) for expenditures related to: (a) consultants' services under contracts awarded to consulting firms costing less than \$100,000 equivalent each; (b) consultants' services under contracts awarded to individual consultants costing less than \$50,000 equivalent each; (c) goods; and (d) all incremental operating costs. The supporting documents for SOEs would be retained by the NPMO. In case of contracts for services above these thresholds, disbursement would be made against the full documentation with contracts themselves and other supporting documents.

### Special Account (SA)

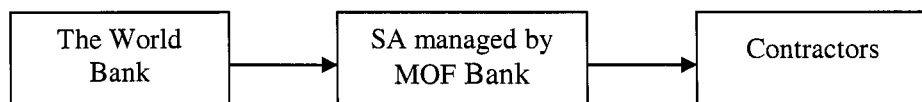
One special account (SA) will be established at and maintained by MOF for this project. The SA for the project will be in US dollar, with an authorized allocation at US\$1.8 million equivalent to about 4 months of eligible expenses reimbursable via special account.

MOF and the NPMO will be directly responsible for the management, monitoring, maintenance and reconciliation of the SA activities of the project in the provinces. Supporting documents required for Bank disbursements will be prepared and submitted by the NPMO to MOF for verification and approval before submission to the Bank for disbursement processing.

### FINANCIAL MANAGEMENT AND REPORTING ARRANGEMENTS

**Implementing Entity.** MOC has established the NMPO as the entity charged with day-to-day management of the project. The NPMO will also organize assistance to help prepare project activities in other cities.

**Funds Flow.** Funding for the project includes a GEF grant and counterpart funds. One special account will be established and managed at MOF. MOF will pay contractors directly after receiving disbursement requests from the NPMO of MOC, which will review and approve any expenditure. The NPMO of MOC will also maintain a comprehensive project accounting records for audit and management purpose. The funds flow is as follows:



**Staffing.** The required number of qualified project accounting staff will be in place at all levels where accounting and financial management will be performed. The NPMO is recruiting two financial management staff; one of them will be at senior level with rich experience.

To strengthen financial management capacity and achieve consistent quality of accounting work, a project financial management manual (the Manual) is being prepared. The Manual will provide detailed guidelines on financial management, internal controls, accounting procedures, fund and asset management and withdrawal application procedures. The Manual will be finalized and distributed to all the financial staff before project effectiveness.

**Accounting Policies and Procedures.** The administration, accounting and reporting of the project will be set up in accordance with MOF's Circular #13 - "Accounting Regulations for World Bank Financed Projects" issued in January 2000. The Circular provides in-depth instructions of accounting treatment of project activities and covers a chart of account,

detailed accounting instructions for each project account, a standard set of project financial statements and 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. It includes a balance sheet, a statement of implementation of grant agreement and a statement of special account.

NPMO and the LPMOs will be managing, monitoring and maintaining project accounting records for their own component. Original supporting documentation for project activities will be retained by them.

**Internal Audit.** Although MOC has its own internal audit department, the Bank team has not and will not assess the competency of the internal audit department due to the cost/benefit of doing such work. As such, reliance will not be placed on work performed by them.

### **Reporting and Monitoring and Format of Financial Statements**

The format and content of the following project financial statements represent the standard project reporting package agreed to between the Bank and MOF, and have been discussed and agreed with all parties concerned. In line with the newly issued Financial Monitoring Report (FMR) guidelines, the un-audited project consolidated financial statements will be submitted as part of FMR to the Bank on a semi-annual basis (prior to August 15 and February 15 of the following year), and include the following statements: Balance Sheet of the Project; Statement of Implementation of Grant Agreement; and Statement of Special Account.

**Information Systems.** A computerized financial management system will be utilized by project PMOs. "Golden Butterfly", a well-established accounting software package approved by MOF, will be used for this project. The task team will closely monitor accounting work to ensure proper recording and reporting in order to determine the effectiveness of this system.

**Financial Management Action plan.** The following proposed time-bound actions that have no major impact on project preparation or Board presentation, but should be adequately addressed by the project:

<b>Action</b>	<b>Responsible person</b>	<b>Completion Date</b>
1. Financial management manual finalized and issued	NPMO and Tianjin LPMO	Finalized and issued before effectiveness
2. Adequate and qualified financial and accounting staff should be recruited in position	NPMO	Before effectiveness
3. Financial management and disbursement training to accounting staff	NPMO and LPMO	Before effectiveness

**Supervision Plan.** A detailed supervision plan for this project will be included as part of the China Audit Strategy document which is currently in process. This document will take into consideration of the size of the project and the risks identified.

## Annex 8: Procurement Arrangements

### CHINA: GEF - Heat Reform and Building Energy Efficiency

#### A. GENERAL

1. Procurement for the proposed project will 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 provisions stipulated in the Legal Agreement. The general description of various items under different expenditure categories are described below. For each contract financed by the GEF Grant, the different procurement methods or consultant selection methods, the need for prequalification, estimated costs, prior review requirements, and time frame are agreed between the Borrower and the Bank project team 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:** No civil works will be financed by the GEF grant.

3. **Procurement of Goods:** Goods to be procured under the investment subprojects will include energy efficiency materials and equipment such as insulation materials, windows, thermostatic radiator valves, heat meters, and other building components and heating system equipment. The procurement will be undertaken by the respective beneficiaries of subprojects (i.e. housing developers and heat system contractors) in accordance with established local private sector or commercial practices that are acceptable to the Bank.

4. Goods to be procured for the national PMO will include office equipment (such as computers and peripherals). Such equipment will be small both in terms of quantity and value, thus will be procured following the shopping procedures.

5. **Procurement of Non-Consulting Services:** Not applicable.

6. **Selection of Consultants:** Consultants are expected to be hired to provide services in the following areas: project management, subproject preparation, technical training and information dissemination, studies on building efficiency renovation technology and heating company operation and management system reform, monitoring and evaluation, and other technical studies as needed. All consultant services financed by GEF grant will be procured according to the Bank's guidelines on the selection and employment of consultants and on terms and conditions acceptable to the Bank. The Standard Request for Proposals will be used. Except for exceptional cases where sole-source contracting is justified and approved in advance by the Bank, consultant services estimated to cost more than \$200,000 per contract will follow QCBS or QBS based on the feature of the assignment in line with the paras. 2.1 to 2.31 and paras. 3.1 and 3.2 of the guidelines; and consultant services estimated to cost less than \$200,000 per contract may be procured by Consultants' Qualifications (CQ) according to

paras. 3.1 and 3.7 of the guidelines. The individual consultants will be hired following Section 5 of the guidelines. The procurement plan for the first 18 months is attached.

7. Specialist consultants to work with the NPMO may be procured through sole-source contracting of a local firm, provided that suitable justification is provided to the Bank in advance. It is understood that a suitable contribution of experience in international project management, HRBEE technical expertise and understanding on the Construction Commission system in China may require unique qualifications.

8. Bank review of and no-objection to all terms of references (TORs) for consulting services are required.

9. **Incremental Operational Costs:** Incremental operational costs to be financed by the project would be procured using the PMO's administrative procedures, which were reviewed and found acceptable to the Bank.

## **B. ASSESSEMENT OF THE AGENCY'S CAPACITY TO IMPLEMENT PROCUREMENT**

10. There will be two levels of project management organization, i.e. National Project Management Office (NPMO) and Local Project Management Offices (LPMOs). While the NPMO will be set up at the central government level within the Ministry of Construction (MOC), LPMOs will be at the local government levels within the relevant line departments for each municipal/provincial component (such as the first Tianjin municipal pilot component). NPMO's mandates would include coordination of the project preparation and implementation in general, selection of consultants, as well as provision of guidance and assistance to the LPMOs. NPMO will act as the main entry of communications with Bank in general, supervising and monitoring the sub-projects' implementation and progress. NPMO will be responsible for management of their respective subprojects. Procurement of goods to be financed by the GEF grant under the subprojects will be the responsibility of respective subproject developers and heat system contractors.

11. A procurement assessment was conducted during the pre-appraisal period (the assessment report is available in project file) and established that the NPMO has been established under the Department of Science and Technology (DST) of MOC. The deputy director-general of DST will head the NPMO and take the leadership to coordinate and monitor the whole project. Long-term consulting experts will be contracted by the NPMO to execute a portion of the project management tasks. Two PMO experts will be assigned to handle procurement (mainly selection of consultants). The assessment also established that the LPMO for Tianjin component has been set up in the municipal Urban and Rural Construction Commission (URCC). The director of the office has been appointed. Two full-time staff is in place and at least four additional part-time staff will be assigned soon to handle procurement. They all have computer skills and procurement knowledge (acquired from the previous Bank and government financed procurement) will be in charge of procurement.

12. The conclusion of the assessment is that the NPMO and LPMO, are basically capable of carrying out procurement activities under the project. Nevertheless, areas that need



strengthening, such as the training in procurement procedures for new staff of NPMO and LPMO, as well as training for Bank new Procurement Guidelines, have been identified. An action plan for improving NPMO and LPMO staff's skills has been agreed. Considering the record of procurement implementation in China and Tianjin, as well as in the previous Bank-financed projects, the overall project risk for procurement is considered **average**.

### C. PROCUREMENT PLAN

13. The PMOs have developed Procurement Plans for project implementation, which provides the basis for the procurement methods. The plans have been agreed between the PMOs and the Bank team during the pre-appraisal mission, and are available at PMOs as well as in the Bank project file. The Procurement Plans will be updated in agreement with the Bank team annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

### D. FREQUENCY OF PROCUREMENT SUPERVISION

14. In addition to the prior review supervision to be carried out from Bank offices, the procurement capacity assessment has recommended the following frequency of procurement supervision missions: one at the project launch workshop, and thereafter one per every 6-8 months (including special procurement supervision for post-reviews or audits).

### E. PRIOR REVIEW THRESHOLDS

15. The following prior review thresholds have been recommended following the procurement capacity assessment:

Expenditure Category	Contract Value Threshold (US\$)	Procurement Method	Contracts Subject to Prior Review (US\$)
1. Works	NA		
2. Goods for PMOs (office equipment)	<50,000	Shopping	NA
3. Goods for investment subprojects	NA	Commercial practice	NA
4. Consultant services	>=200,000	QCBS, QBS	>=100,000 (firms)
	<200,000	CQ	>=50,000 (individuals) All SSS

QCBS: Quality and Cost Based Selection  
 QBS: Quality Based Selection  
 CQ: Selection Based on Consultant's Qualifications  
 SSS: Single Source Selection

**Attachment****Details of the Procurement Arrangement Involving International Competition****Goods and Works and Non-Consulting Services**

All procurement of goods under the subprojects will be conducted following established local private sector or commercial practices that are acceptable to the Bank. No ICB and direct contracting contracts are expected.

**Consulting Services****Procurement Plan (first 18 months)**

1 Ref. No	2 Description of Assignment with Ref.No.	3 Estimated Cost (US\$'000)	4 Selection Method	5 Prior Review by Bank (Prior/Post)	6 Indicative Expected TOR/RFP Submission	7 Indicative Expected RFP Issue	8 Indicative Expected Proposals Submission Date	9 Indicative Expected Estimated Contract Duration	10 Comments
<b><i>MOC Component</i></b>									
1	Project management	120 (109.2)	SSS	Prior Review	2005.03.1	2005.04.11	2005.04.20	2005.05.10 -2006.05.10	
2	For one unit to hire national experts to help preparation of other cities' investment projects	55 (50.05)	CQ	Post Review	2005.03.10	2005.04.10	2005.04.25	2005.05.20 -2006.05.20	
3	To compile training and dissemination plan of project	216 (196.56)	QBS	Prior Review	2005.03.10	2005.04.20	2005.05.20	2005.06.20 -2006.12.20	
4	Existing building efficiency renovation technology study	88 (80.08)	CQ	Post Review	2005.07.20	2005.08.20	2005.09.15	2005.10.10 -2006.12.30	
5	Heating company operation and management system reform study	98.9 (90)	CQ	Post Review	2005.07.20	2005.08.20	2005.09.15	2005.10.10 -2006.12.30	
6	Subproject preparation 1 <sup>*1</sup>	98.9 (90)	CQ	Post Review	2005.07.20	2005.08.20	2005.09.15	2005.10.10 -2006.10.10	
7	Subproject preparation 2 <sup>*2</sup>	98.9 (90)	CQ	Post Review	2005.07.20	2005.08.20	2005.09.15	2005.10.10 -2006.10.10	
8	Subproject preparation 3 <sup>*3</sup>	98.9 (90)	CQ	Post Review	2005.07.20	2005.010.20	2005.11.15	2005.12.10 -2006.10.10	
<b>Sub-total:</b>		<b>874.6 (795.89)</b>							

1 Ref. No	2 Description of Assignment with Ref.No.	3 Estimated Cost (US\$'000)	4 Selection Method	5 Prior Review by Bank (Prior/Post)	6 Indicative Expected TOR/RFP Submission	7 Indicative Expected RFP Issue	8 Indicative Expected Proposals Submission Date	9 Indicative Expected Estimated Contract Duration	10 Comments
<b>Tianjin Component</b>									
9	Monitoring and evaluation	76 (69.16)	CQ	Post Review	2005.03.1	2005.04.22	2005.06.08	2005.07.11 -2009.06.10	
10	BEE technical study	400 (364)	QCBS	Prior Review	2005.03.21	2005.04.30	2005.06.30	2005.07.18 -2007.07.17	Multi- contracts
	Enhancement of BEE implement capacity								
11	Study of new heating techniques	425 (386.7)	QCBS	Prior Review	2005.03.21	2005.04.30	2005.06.30	2005.07.18 -2008.07.08	Multi- contracts
12	Publicity and training of heating and BEE technologies (information)	99 (90.1)	CQ	Post Review	2005.04.20	2005.05.20	2005.07.8	2005.08.08 -2007.10.10	
<b>Sub-total:</b>		<b>1,000 (909.96)</b>							
<b>Total:</b>		<b>1,874.6 (1,705.85)</b>							

*Notes:*

1. *Figures in parenthesis are amounts to be financed by the GEF grant.*
2. *All dates are based on the availability of GEF funding in May 2005.*
3. *\*1, \*2, \*3 mean different investment subprojects in different cities.*

Consultancy services estimated to cost above \$100,000 per contract and all Single Source selection of consultants (firms) will be subject to prior review by the Bank.

**Short lists composed entirely of national consultants:** Short lists of consultants for all the services valued less than \$300,000 each may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. Of course, shortlisting of international consultants, even for very small contracts, will be considered, when appropriate.

## **Annex 9: Economic and Financial Analysis (Incremental Cost Analysis)**

### **CHINA: GEF - Heat Reform and Building Energy Efficiency**

#### *National Development and Global Environment Context*

About half of China's population lives in cold climate regions where three to six months of winter space heating is necessary. Space heating is a major coal-consuming activity and a primary cause of serious winter air pollution in northern cities. Coal-fired central heating systems have expanded rapidly along with the urban housing construction boom and now supply about two thirds of all urban residential buildings in the cold regions. Due to its big cost advantage, and shortages of alternatives, coal is expected to remain the dominant fuel for central heating systems for the foreseeable future. Continuing strong growth in urban housing construction is expected for the next 20 years or so and the total residential building stock in the cold regions is projected to more than double. To avoid large increases in coal consumption for space heating, China has to drastically increase the energy efficiency of coal-fired central heating. This will require simultaneous efforts to improve the thermal integrity of buildings (reducing heat losses), implement heat metering and consumption-based billing (creating conservation incentives), and modernize heat supply systems (optimizing operation) so as to capture major efficiency gains throughout the space heating chain.

Unfortunately there has been little real progress in improving space heating energy efficiency since the Government began to address the issue in the mid 1980s. As of year 2000, only 6% of new urban residential buildings in the cold and severe cold regions were constructed according to national building energy efficiency standards. The technologies and operations of centralized heating systems in China remain models of inefficiency. Heat metering and consumer control of heat are non-existent; heat consumption is billed per square meter of living space, not by energy consumed; and, in many cases, heat is paid for by employers, not consumers. Consequently, incentives to save energy in centralized residential heating system are minimal. It is critical to act now, with maximum effectiveness, to avoid perpetuating major energy waste in new residential buildings and major local and global environment damage for decades to come.

In response to the major local, national and global concern with urban space heating, this proposed project will support two key related national development reform goals: (1) transforming the urban heating sector from a government-supported welfare system into a market-based and self-sustaining commercial operation; and (2) achieving an energy efficiency market transformation in urban housing development. Only by concerted efforts in carrying out fundamental heat reforms and implementing building energy efficiency regulations will China succeed in achieving sustained and growing increases in space heating energy efficiency and environmental improvement. By supporting the Government in these endeavors, the GEF will help China achieve substantial and sustainable coal savings, and thus a large reduction of CO<sub>2</sub> emissions from the rapidly growing urban housing sector.

### ***Baseline Scenario***

The incremental cost analysis was carried out for a projected 6 billion m<sup>2</sup> of net growth in the urban residential building stock and associated heating systems in the cold and severe cold regions between 2004 and 2024.

Under the baseline/business-as-usual scenario, improvements in the three key areas of the residential space heating “chain” will be very slow and limited in scale and scope, i.e.: (i) market penetration of more energy-efficient new residential buildings will occur very gradually, (ii) heat metering, consumer heat controls, and consumption-based billing will be introduced at a very modest pace; and (iii) a relatively small proportion of the huge and growing stock of residential building heat supply systems will adopt modern demand-driven operation and technologies.

More specifically, a realistic baseline scenario, based on current and likely future trends, is that:

- The share of buildings with relatively good energy efficiency performance (i.e. that are in compliance with the current national building energy efficiency standards) in the annual new construction will increase by about 2 percentage points per year, rising from 30% in 2004 to reach 70% in 2024;
- The share of buildings with heat metering, consumer controls and consumption-based billing in centrally-heated residential buildings constructed after 2004 will reach 50% by 2024, an average annual growth rate of about 2.5 percentage points; and
- Only those buildings that have installed consumer heat metering, consumer controls and consumption-based billing will install modern, variable flow control technology to operate their systems, which will enable consumers to adjust their heat demand.

In other words, under the baseline scenario, by 2024, a large portion of the 6 billion m<sup>2</sup> of residential buildings built between 2004 and 2024 will **not** be able to reap the full or even the partial benefits of simultaneous improvements in the three key, inter-related areas of the space heating reform chain. They will remain technically inefficient (with poor thermal integrity), requiring excessive energy to maintain comfort. Most consumers will continue to waste energy because the lack of means (consumer control and demand-driven variable flow systems) to save energy and/or incentives (metering and consumption-based billing) to reduce energy use.

There are three major barriers that, under the baseline scenario, will prevent much faster, broad-based and effective implementation of the heat reform program and compliance with building energy efficiency standards. These three barriers are:

1. Lack of the multi-faceted, comprehensive approach, comprising both policy reform and technical improvements that is needed to accelerate residential building energy efficiency improvement. It is clear from both a strategic perspective and from relevant (particularly eastern European) experience that the challenge of rapidly and sustainably improving the energy efficiency of the many large residential buildings in China’s colder regions

requires an integrated approach comprising simultaneous policy reform, regulatory enforcement and technical building energy efficiency design and operational improvements. Designing this complex, comprehensive or “two-handed” approach has, so far, been beyond China’s technical and organizational capacity.

2. The challenge of multi-institutional collaboration and coordination, at both the national and the city levels, on both the design and implementation of a multi-faceted reform and technical improvement program. A second and closely related barrier is that the comprehensive approach also requires a much greater degree of institutional collaboration and coordination between both the heat supply and the housing development industries and the government units responsible for their respective regulation than currently exists. For example, on the heat reform side, one of the key challenges is managing the risks of negative social impacts from the reform of heat payment responsibilities. In addition, “commodification” of heat requires developing and implementing completely new pricing systems, metering systems, and billing practices; explaining their rationale and benefits to consumers; and wholesale changes in the operation and management of heating systems required for the switch-over to demand-driven systems. On the building efficiency side, the challenges are to incorporate energy efficiency standards and enforcement into the building design and construction regulation system at local level, to develop the demand for and supply of energy-efficient building materials and components, and to ameliorate the cost and demand concerns of the housing development industry. This challenge of achieving multi-institutional commitment and coordination has heretofore proved too great for the many Chinese partners that have to be involved.

3. Limited Chinese experience, knowledge and no proven track record of the ambitious integrated reform and technical improvement program approach. Even though several other countries have experience in undertaking heat system reforms and achieving higher building energy efficiency standards, there is little experience conforming to Chinese conditions and no Chinese demonstration of a successful, fully-integrated approach. On the heating side, for example, there is virtually no experience in China with billing of heat according to actual use or with the operation of heating networks where supply is determined by consumers and not the supplier. The impacts of heat pricing reform on heating companies and consumers are also uncertain. On the building energy efficiency side, lack of knowledge on the performance of different energy-efficient materials and components impedes their market uptake. There are no systematic compliance inspection procedures at the local level to ensure that energy-efficient building designs and improvements are observed and implemented during construction. There is also no empirical knowledge of how consumers value investment in building energy efficiency improvements and the consequential effect on demand for energy efficient housing. Most crucially, there is no experience with implementing the full package of technical improvements and policy reforms that is needed to achieve a much more rapid, substantial and sustainable improvement in residential building energy efficiency.

### ***GEF Alternative***

Under the GEF Alternative Scenario, China will implement the comprehensive, multi-institutional package of reform and technical activities that is needed to overcome these barriers. This scenario will consist of three complementary initiatives - this proposed GEF co-financed project, (continued) World Bank technical assistance on policy analysis, and a parallel French GEF-supported building energy efficiency project in partnership with the city of Harbin.

The proposed GEF project has three major components that, in combination, will overcome the three main barriers that were outlined above:

**Component (a): Tianjin Municipality Integrated Reform and Technical Demonstration** (total cost about \$21 million, of which the GEF will finance \$6 million, \$5 million of which will co-finance energy efficiency improvements/innovations beyond current practice/requirements in demonstration new housing developments and associated heat systems; and \$1 million will fund technical assistance to the municipality to coordinate and support the heat reform and technical innovation programs. This component will demonstrate, for the first time in China and on a large and therefore convincing scale, a comprehensive, fully-integrated and simultaneously-implemented program of (i) residential building heat billing and pricing reform, (ii) introduction of modern, variable flow heat supply systems, and (iii) the construction of energy-efficiently designed new residential buildings.

This component will make a major contribution to removing barrier 1 by serving as the first Chinese demonstration of what a comprehensive residential building heat reform and technical improvement program comprises. It will also contribute to overcoming barrier 2 by showing how to achieve inclusive and effective institutional collaboration at the municipal level. And it will go a long way towards removing barrier 3 by generating the first “hard” experience in China of the technical, institutional and consumer behavioral challenges and results of applying a comprehensive approach to building energy efficiency improvement.

**Component (b): National-level Coordination and Policy Support** (total cost about \$2.3 million, of which the GEF will finance \$2 million. \$1.15 million of this will fund international technical assistance to the responsible central government institutions for design of the program’s reform and technical elements, the balance of \$0.85 million will co-finance project management). This component will ensure that China benefits from the best available international experience and expertise in designing and implementing an integrated building heat reform and energy efficiency program, which will enhance the effectiveness of both the Tianjin Demonstration and Other Northern Cities components. It will also ensure effective and efficient project management and dissemination of the results and lessons of the Tianjin demonstration, which is crucial for achieving widespread replication of Tianjin’s comprehensive reform and technical improvement model. In so doing, it will contribute significantly to the removal of barriers 1 and 3.

**Component (c): Other Northern Cities (Replication)** will replicate the comprehensive heating system and building energy efficiency investments and reform activities that were demonstrated in Tianjin in 4-6 other large northern Chinese cities, the selection of which will

be finalized as implementation for the first two components proceeds, but will definitely include Harbin, where a complementary French GEF residential building energy efficiency project will be implemented. The total cost of this component is estimated to be about \$29 million. Of this, the GEF is requested to co-finance \$10 million, of which \$8 million will fund the demonstration of energy efficiency improvements/innovations beyond current practice/requirements in new housing development, housing renovation (where appropriate), and associated heating systems, heat use controls, billing and metering equipment, and \$2 million will finance technical assistance to the 4-6 participating cities.

The objectives of this component are (a) to show how the Tianjin model approach can be tailored to and successfully applied in other Chinese city contexts; and, by so doing, (b) trigger replication of the Tianjin comprehensive reform and technical efficiency model throughout China's northern region. The component will broaden and deepen the range of practical experience gained from the Tianjin demonstration, both in terms of technical options/results and institutional situations. This broader range of experience will then empower China to accelerate the replication program and push it nationwide. The component will thus scale-up barrier removal to the national level.

The projected impact/outcome of the GEF Alternative on residential building energy efficiency in China's northern regions is as follows:

- The proportion of buildings that achieve good energy efficiency performance in the annual new construction will accelerate by 4 percentage points per year, reaching 70% by 2014 then falling to 40% by 2024. In the mean time, the proportion of buildings with advanced energy efficiency features will rise to 20% by 2014 (from 0% in 2004), and reach 60% by 2024;
- The share of buildings with heat metering, consumer controls and consumption-based billing centrally heated residential buildings constructed after 2004 will reach 100% by 2024, at an average annual increment of 5 percentage points; and
- By 2024, all the heating systems that supply the residential buildings constructed after 2004 will operate according to variable heat demand.

In other words, by 2024, all 6 million m<sup>2</sup> of the residential building stock built between 2004 and 2024 in the northern regions will be able to reap the full or at least significant partial benefits of the comprehensive reform and technical improvement program, which will yield very substantial energy and CO<sub>2</sub> savings.

### ***Incremental Costs and Global Benefits***

The project's estimated global environment benefit is based on the successful implementation of the Government's heat reform and building energy efficiency regulations, supported by the GEF Alternative. The analysis is based on an estimated net increase of 6 billion m<sup>2</sup> in centrally heated residential building stock located in China's cold and severe cold regions in the 20-year period between 2004 and 2024. The analysis does not attempt to separate out the impact of the GEF Alternative from the overall Government efforts it supports because there would be no rationale for implementing the GEF Alternative without the Government's



supportive reform and policy efforts. The impact of the GEF Alternative, together with the Government's complementary reform and policy program, will also extend beyond the new residential building stock to the existing centrally-heated residential building stock. This is not reflected in the analysis.

Similar analysis was performed for Tianjin and five prospective northern cities for the "other cities component." In this analysis of cities directly involved in this proposed project (i.e. receiving GEF grant assistance), the focus is on medium term results: coal-saving capacity achieved as of project completion (end of 2011).

### ***Incremental Costs***

The proposed GEF project will finance a portion (up to about 30%) of the estimated incremental costs incurred by real estate developers and heating companies to construct buildings and develop heating systems with demonstrable energy efficiency improvements beyond current requirements. As an example, the table below summarizes the key estimated cost information and the portion of incremental costs associated with the Xindu demonstration project in the Tianjin component that is proposed to be supported by the GEF.

<b><u>Xindu Demonstration Project</u></b>					
<b><u>Tianjin Component</u></b>					
<i>(in million US dollars)</i>					
	Baseline	Project	Incremental	GEF Support amount	GEF Support % of Incr.
Total Direct Cost	26.9	41.07	8.7	2.6	30%
o/w Heating System	8.6	13.3	4.7	1.4	30%
Building Envelope	16.3	20.3	4.0	1.2	30%
Associated housing development costs	312.3	312.3	0	0	0%

The proposed GEF project identified the incremental costs associated with an additional 30 percent reduction in average building heat demand, based on the current regulation for building energy efficiency, as well as with the introduction of state-of-the-art heating systems. The developers and heating companies agreed to cover the remaining costs from corporate resources. The proposed GEF support for demonstration projects in other cities in North China will follow a similar approach, i.e. GEF support for investment is to be limited to about 30 percent of the eligible incremental costs.

### ***Basic Assumptions***

The cold and severe cold regions of China cover more than half of the national territory with wide variation in winter climate, which affects heating degree-days and design requirements for building thermal performance and heating system design. In order to analyze space heating energy use for the all of cold and severe cold regions in a rational yet relatively simple manner, the average situation was chosen based on the medium value of heating degree-days of 110 of representative cities across the cold and severe cold regions. The key parameters for the average situation are summarized in the following table:

Official heating season duration	144 days
Corresponding heating degree-days (18 °C)	3240 degree days
Poor energy efficiency building heat consumption index	32.3 W/m <sup>2</sup>
Good energy efficiency building heat consumption index	21.0 W/m <sup>2</sup>
Advanced energy efficiency building heat consumption index	14.7 W/m <sup>2</sup>

Notes: *building heat consumption index* is a key indicator of building thermal integrity and is defined in Chinese building energy efficiency standards as: at outdoor mean air temperature during heating period, to maintain indoor design air temperature, heat consumed in unit time by unit floor area and to be supplied by indoor heating device.

Under current policies, the majority of the net new residential building stock is expected to be connected to large district heating systems. Scattered coal-fired centralized heating systems would be generally less efficient in terms of coal use. The analysis assumes that the new building stock is either connected to traditional constant-flow central heating systems which do not have heat metering and user-control installations (thus lower system efficiency), or connected to modern variable-flow central heating systems which have heating metering and user-control installations (thus higher system efficiency). Basic assumptions of the global efficiency indicators of the two alternative heating systems are:

<p><b>Traditional heating systems with constant-flow technology:</b>  Thermal efficiency of heat production 65%  Transmission and distribution efficiency of network 80%</p> <p><b>Modern variable-flow systems that responds to demand changes:</b>  Thermal efficiency of heat production 75%;  Transmission and distribution efficiency of network 90%</p>
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The following emission factors were used to estimate carbon dioxide emission rates:

25.8 kg of carbon per GJ of coal, or 1.98 metric ton CO<sub>2</sub> per metric ton of Chinese raw coal.

### Global Benefit

The cumulative coal savings over the 20-year span (2004-2024) as a result of the GEF Alternative are 240 million tons of coal equivalent (TCE), and reduction in CO<sub>2</sub> emissions due to the coal savings is 180 million tons of carbon. For the project cities (Tianjin and 5 prospective ones) which will receive direct GEF grant assistance, an estimated 660,000 TCE annual coal-saving capacity will be achieved by the end of 2011, generating over 13 million TCE coal-savings and reducing CO<sub>2</sub> emissions by about 10 million ton of carbon over a 20-year period.

If only the results of the project cities at project implementation completion (2011) are considered, the undiscounted cost of CO<sub>2</sub> emissions reduction to GEF is about US\$1.8/ton-carbon. Considering the long-term national impact of the proposed project the cost of CO<sub>2</sub> emissions reduction to GEF will be much lower than indicated by the medium term city-program results. Recent observed international prices for project-based greenhouse gas emission reduction credits usually fall in the range of US\$10-\$18/ton-carbon-equivalent.

*Table: Incremental Cost Matrix / Benefit Analysis Summary*

<u>Component Activity Area</u>	<i>Baseline</i>	<b>GEF Alternative</b>	<i>Increment</i>	<b>Incremental Benefits/Impacts</b>
<b><u>Building Energy Efficiency</u></b>	<p>The rate of compliance with the current national building energy efficiency (BEE) standards is low and the scaling up of the development of more energy-efficient residential buildings is very gradual due to a lack of effective enforcement mechanisms, cost and quality concerns over insulation materials/techniques and other efficiency measures, as well as a lack of consumer awareness and interest.</p> <p>There will be little chance for the adoption of advanced energy-efficient measures in new residential buildings</p> <p>More specifically, 50% of new housing construction in cold and severe cold urban regions will comply with the current BEE standard by 2014, reaching 70% by 2024. The rest in both years will be non-compliant new housing.</p>	<p>Barriers to BEE compliance is removed or mitigated and with the impetus provided by the heat reform and demonstration and replication of cost-effective and innovative BEE designs there is a fast increase of new residential buildings going above and beyond the current standards.</p> <p>More specifically, 70% of new housing construction will comply with current BEE standard by 2014, while 20% will comply with advanced BEE requirements. By 2024, 60% of new housing construction will comply with advanced BEE standard piloted under the GEF project, while the rest still complies with the current standard.</p>	<p>-- Demonstration and widespread replication of cost-effective and advanced BEE measures and techniques resulting in 30% reduction in building heat losses, compared with the current BEE standards;</p> <p>-- Technical assistance in promoting best BEE practices in site planning, building design and construction, resulting in much improved compliance capacity;</p> <p>-- Technical assistance in establishing an effective building energy efficiency compliance inspection system, resulting in much improved effectiveness of BEE compliance enforcement.</p>	<p><b><u>Domestic</u></b> Substantial improvement in thermal integrity of residential buildings, quality and cost-effectiveness of design, comfort in living quarters.</p> <p><b><u>Global</u></b> Combined with improvements in heating systems and a successful heat reform, heat loss reduction through BEE efforts will result in substantial and actual reduction of building energy use.</p>

<p><b><u>Heat metering, consumption based billing and consumer controls</u></b></p>	<p>Adoption of heat metering, consumer heat controls, and consumption-based billing will be introduced very gradually and in trickles, due to the slow progress in heat reform and a lack of full scale and convincing demonstrations to resolve technical uncertainties and remove serious doubts on the costs and benefits, penetrating only 50% of new urban housing construction in cold and severe cold regions by 2024.</p>	<p>Barriers to “commodifying” heat is removed, leading to rapid scaling up of heat metering and consumption-based billing, which will penetrate 40% of new housing construction by 2014 and 100% by 2024.</p>	<p>--Resolution of institutional and technical issues and uncertainties related to the introduction of consumer controls, heat metering and consumption-based billing in city heat reform programs and large scale demonstrations and replications, greatly accelerating the overall heat reform agenda.</p> <p>--Technical assistance in the formulation and implementation of cost-based pricing and consumption-based billing at national and local levels.</p>	<p><b><u>Domestic</u></b> Creating incentives and physical ability for consumers to save on heat bills and improve upon comfort in living quarters.</p> <p>Establishment of a rational and practical pricing and billing system.</p> <p><b><u>Global</u></b> Creates ability and incentive to reduce energy consumption through the combined effects of improved building energy efficiency and demand-driven heat supply.</p>
<p><b><u>Heat Supply Systems</u></b></p>	<p>Heating company technical innovation and upgrade are slow due to the slow pace of heat reforms. Incentives are weak for heating companies to improve their supply and management efficiency. The introduction of demand-driven variable flow heat supply system will reach only 50% of new urban housing in the cold and severe cold regions by 2024.</p>	<p>Barriers to heat supply system improvement and modernization are removed, forcing heating companies to become more efficient and use technologies that service variable heat demand.</p> <p>Specifically, 40% of new housing will be serviced with improved heating systems by 2014, reaching 100% by 2024.</p>	<p>--Demonstration and replication of design optimization, use of more advanced technologies with life-cycle cost savings and technical dynamics of a full scale and complete heat system under demand-driven operation.</p> <p>--Technical assistance in the operation and management of demand-driven systems to improve service and reduce costs</p>	<p><b><u>Domestic</u></b> Proliferation of modern variable-flow heat supply systems and improved heat supply operation and management efficiency.</p> <p><b><u>Global</u></b> The combined effect of improvements in heating chain reduces coal consumption used for space heating over 20 years (2004-2024) by 240 million tons of coal equivalent, avoiding emissions of 180 million tons of carbon.</p>

## **Annex 10: Safeguard Policy Issues**

### **CHINA: GEF - Heat Reform and Building Energy Efficiency**

#### **Project Approach to Social and Environmental Safeguards**

The proposed project includes three components: (a) demonstration of the integration of highly energy-efficient heat supply systems, heating system reform and high-energy-efficiency building development in Tianjin Municipality; (b) support for the Ministry of Construction (MOC) for national policy development and project implementation; and (c) further demonstration and replication of the integration of highly energy efficient heat supply systems, heating system reform and high-energy-efficiency building developments in 4-6 other northern cities. Each of these project components will include technical assistance support, which does not involve safeguards issues. The Tianjin Component and the Other Northern Cities Component will include a series of investment subprojects, with a total estimated cost of \$ 46.7 million, of which \$ 13.0 million will be financed through the proposed GEF grant, and \$ 33.7 million will be financed by the beneficiary Chinese housing development and heat supply companies. These investment subprojects will include incremental energy efficiency measures, above and beyond those being undertaken in China today, and in support of the project's strategy to link heat reforms and improvements in heating system and building energy efficiency. Investment subprojects will be proposed, reviewed and appraised by MOC and the Bank as project implementation proceeds. One subproject has already been reviewed and appraised under the Tianjin Component.

Based on preparation to date, the main focus of the investment subprojects is expected to include (a) improvement of residential building thermal efficiency, through measures such as increased thickness and quality of roof and external wall insulation, heated stairwell, and use of windows with higher thermal resistance); (ii) improvements in the internal heating systems of residential buildings, for example, through installation of apartment-level heat meters, thermal control valves, and improved piping and radiators); and (iii) improvements of the energy efficiency of heat generation and heating networks, for example, through, energy-efficiency improvements in heat generation, improved system control and dispatch, adoption of variable-flow capability, and use of small substations.

Few, if any, negative environmental or social impacts are expected to result from the implementation of the energy-efficiency measures financed in the project's investment subprojects. No land acquisition, resettlement, affect on indigenous peoples or impact on cultural properties is expected. On the environmental side, the impacts are expected to be overwhelmingly positive. The broad, direct and indirect energy efficiency gains from the overall project are expected to total about 240 million tons of coal equivalent over 20 years, avoiding very large levels of local particulate, sulfur-dioxide and nitrogen oxides emissions, and about 180 million tons of carbon emission. However, there may be some potential negative environmental impacts which need to be reviewed in a few cases, so that proper mitigation measures can be undertaken.

A Social Safeguards Framework and an Environmental Safeguards Framework have been developed and agreed between MOC and the Bank for the project. These Frameworks establish the analysis, reporting and approval requirements on social and environmental safeguards required in all investment project subproject proposals, and which must be satisfactory to MOC and the Bank for those proposals to be approved and financed through the project. The Frameworks serve two key functions:

- They provide a mandatory screening mechanism for all investment subprojects, to identify any components with land acquisition, resettlement, impact on indigenous peoples, impact on cultural properties, or negative environmental impacts. For such components, Resettlement Action Plans or Environmental Impact Assessments will be required, meeting World Bank standards, and will need to be reviewed and approved by MOC and the Bank; and
- They provide guidelines for completion of mandatory Social Analysis Reports and Environmental Analysis Reports for the broader heating system developments and/or housing developments within which the project's energy efficiency measures will be installed. These heating system developments and housing complexes, which are expected to involve investments of some 35 times the level of the project's incremental energy efficiency investments, have been planned and will proceed regardless of Bank, GEF and MOC involvement, and following Chinese environmental and social protection regulations. Although these broader developments are not part of the proposed subprojects, Bank due-diligence review and approval is still required. Bank review will be based on the Analysis Reports referred to above. The Analysis Reports will include: (a) clear descriptions of all matters relating to social and environmental impacts of the proposed broader developments; (b) evidence that all applicable national and local laws and regulations have been and will continue to be strictly followed; and (c) clear statements and description of any safeguards risks inherent in the broader developments.

Social and Environmental Analysis Reports for the first investment subproject in Tianjin, at the Xindu Gardens, have been prepared and are under review by the Bank.

### **Summary of the Project Social Safeguards Framework**

The purpose of the Project Social Safeguards Framework is to ensure that all investment subprojects supported under the project comply with the World Bank's OP/BP 4.12 (Involuntary Resettlement), and, if any applicable cases arise, OD 4.20 (Indigenous Peoples) and draft OP 4.11-OPN 11.03 (Cultural Property).

The Framework details a two-step process for review of social impacts for each investment subproject. The first step requires the completion of a brief social impact assessment data sheet. This data sheet should include the basic information concerning the proposed incremental energy efficiency investments. In particular it should describe any extent to which the proposed investments leave a "land footprint", and if so all the related details. In addition, the data sheet should provide basic information on the broader heating system or

housing developments, within which the project's investments will be installed. This information should include the total land area required and its location, affected communities, and the ethnic background of those communities and individuals, the status of any land acquisition and resettlement, and the identification of any cultural property impacts. The data sheet will be used to determine if Bank policies are specifically triggered for the energy efficiency investments under consideration, and next steps. MOC's NPMO should complete the first review of the data sheets, and forward them, together with any additional documentation and recommendations concerning next steps, to the Bank. The Bank, in consultation with the NPMO, will determine if any further analysis is required for the specific subproject investments, such as preparation of a Resettlement Action Plan (RAP) or Indigenous People's Development Plan (IPDP). The Bank and NPMO will notify the project proponents of the results of this first stage review, and recommend subsequent next steps. In the vast majority of cases, it is expected that special analysis of subproject investment social impacts will not be required, and the sole follow-up requirement will be completion of due diligence Social Analysis Reports for the broader developments.

The Framework provides guidelines on the preparation of RAPs and IPDPs, should these be required.

The second-step process detailed in the Framework is the requirements for the Social Analysis Report concerning the associated broader heating system and/or housing developments. This report should include three parts: (a) a basic description of the land to be developed, location, changes in ownership, administrative units responsible, past land acquisition actions, future land acquisition plans, any resettlement involved and compensation details; (b) a listing of the applicable relevant laws and regulations concerning social impact matters, description as to how these have been followed, and evidence of the required government approvals for the development; and (c) a description of any risks associated with the development, concerning land acquisition, resettlement, compensation, impact on ethnic minorities, or cultural properties impacts, and how these risks will be mitigated.

### **Summary of the Project Environmental Safeguards Framework**

The purpose of the Project Environmental Safeguards Framework is to ensure that all investment subprojects supported under the project are in full compliance with the World Bank's OP/BP 4.01.

Similar to the Social Safeguards Framework, the Environmental Framework details a two-step process for review of possible negative environmental impacts for each investment subproject. The first step requires the completion of a brief environmental impact data sheet. This data sheet should include the basic information concerning the proposed incremental energy efficiency investments. It should then describe any potential negative environmental impacts which may arise from these investments. Such impacts should include direct effects from the investments (such as any air or water discharge, or solid waste generation), and also impacts arising from installation (especially in the case of renovation projects). A few examples might include cases where project support is requested as part of new heat source development (geothermal energy or advanced coal-fired boiler technology might be two

possibilities), or where investments involve renovation of old heating systems which might contain asbestos insulation.

The data sheet will be used to determine if Bank environmental assessment requirements are specifically triggered for the energy efficiency investments under consideration, and next steps. MOC's NPMO should complete the first review of the data sheets, and forward them, together with any additional documentation and recommendations concerning next steps, to the Bank. The Bank, in consultation with the NPMO, will determine if any further analysis is required for the specific subproject investments, such as preparation of an Environmental Assessment according to World Bank standards. The Bank and NPMO will notify the project proponents of the results of this first stage review, and recommend subsequent next steps. In most cases, potential environmental impacts are expected to be minimal if any. However, the Framework provides guidelines on the preparation of Environmental Assessments (and Environmental Analyses, for Category B-type projects, where impacts are significant, but easily identified and mitigated), should these be required. In many cases the only follow-up requirement may be completion of due diligence Environmental Analysis Reports for the broader developments.

The second-step process detailed in the Framework is the requirements for the Environmental Analysis Report concerning the associated broader heating system and/or housing developments. This report should include three parts: (a) a basic description of the new heating system, heating system renovation, new housing development, or housing renovation; and all potential environmental impacts resulting from both construction and operation; (b) a listing of the applicable relevant laws and regulations on environmental protection, management and monitoring relating to these developments, environmental impact assessments completed and by whom, they government review process, and documentation of government approvals and permitting; and (c) a description of any environment or safety risks associated with the development, and how these risks will be mitigated.



## Annex 11: Project Preparation and Supervision

### CHINA: GEF - Heat Reform and Building Energy Efficiency

	Planned	Actual
PCN review		February 6, 2003
Initial PID to PIC		June 2, 2004
GEF Council Approval		May 19, 2004
ISDS to PIC		January 18, 2005
Appraisal	December 2004	January 18, 2005
Negotiations	January 2005	January 25, 2005
Board/RVP approval	March 8, 2005	
Planned date of effectiveness	May 2, 2005	
Planned date of mid-term review	June 15, 2007	
Planned closing date	December 31, 2011	

Key institutions responsible for preparation of the project:

- Ministry of Construction, Government of China
- Tianjin Construction Commission, Tianjin Municipal Government

A GEF PDF B Grant of US\$350,000 (MULT 51792) was received and used for project preparation by the Ministry of Construction and Tianjin Municipality to contract consulting services for the following preparation activities: Tianjin Municipality: (i) design and feasibility studies for heat supply system and demonstration of housing development incorporating energy efficiency measures; (ii) development of training plan for heat supply company enabling management and staff to operate a commercially and demand-based system; (iii) development of plans for concluding heat supply and billing reforms in Tianjin; (iv) detailed plans for activities in Tianjin to transform market for energy efficient buildings; (v) environmental and social impact assessment; (vi) an integrated project component implementation plan. National Level (MOC): (i) plans for national policy development and implementation studies supporting China's medium term program for heat supply and building energy efficiency reforms; (ii) an integrated Project Implementation Plan; (iii) a Project Component Implementation Plan for the component on northern cities. The grant is successfully executed by the Ministry of Construction, the project implementing agency for the grant. Planned outputs have been completed successfully.

Bank staff and consultants who worked on the project included:

<b>Name</b>	<b>Title</b>	<b>Unit</b>
Robert P. Taylor	Task Team Leader, Lead Energy Specialist	EASEG
Liu Feng	Consultant, Energy Specialist	EASEG
Anke Meyer	Consultant, Energy Economist	EASEG
Osmo Tammela	Senior Technical Specialist	EASUR
Gailius J. Draugelis	Urban Infrastructure Specialist	ECSIE
Wang Shenhua	Senior Operations Officer	EASUR/EASEG
Li Haixia	Financial Management Specialist	EAPCO
Guo Xiaowei	Procurement Specialist	EAPCO
Teri G. Velilla	Program Assistant	EASEG
Zhou Yuling	Senior Procurement Specialist	EASEG
Zhu Youxuan	Consultant, Resettlement Expert	EASEG
Marc Bellanger	Consultant, Energy Efficiency Engineer	EASEG
Eric Dubosc	Consultant, Architect	EASEG
Soren Christensen	Consultant, District Heating Engineer	EASEG
Douglas Clark	Consultant, Environmental Assessment Specialist	EASEG

Bank project completion costs through Board Presentation:

1. Bank resources: \$ 435,252 (BBGEF)
2. Trust funds: \$ 150,000
3. Total: \$ 585,252

Estimated Approval and Supervision costs:

1. Remaining costs to approval: 0
2. Estimated annual supervision cost: \$ 85,000

**Annex 12: Documents in the Project File****CHINA: GEF - Heat Reform and Building Energy Efficiency**

1. Feasibility Study Report for Xindu Component, Xindu housing developments and heating systems in the Tianjin Component.
2. GEF-China Heat Reform & Building Energy Efficiency Program – Tianjin Demonstration Project (November 24, 2004).
3. Tianjin Seven-Year Plan (2004-2011) for District Heating and Building Energy Efficiency (November 2004).
4. Environmental Screening and Social Safeguards Policy Frameworks
5. China Opportunities to Improve Energy Efficiency in Buildings (August 2000)
6. Heat Metering and Billing: Technical Options, Policies and Regulations (August 2002).
7. Tianjin Xindu Garden Phase 1 Subproject: Project Appraisal Report & related documents (November 24, 2004).

## Annex 13: Statement of Loans and Credits

## CHINA: GEF - Heat Reform and Building Energy Efficiency

Project ID	FY	Purpose	Original Amount in US\$ Millions				Cancel.	Undisb.	Difference between expected and actual disbursements	
			IBRD	IDA	SF	GEF			Orig.	Frm. Rev'd
P069852	2004	CN-Wuhan Urban Transport	200.00	0.00	0.00	0.00	0.00	200.00	0.00	0.00
P066955	2004	CN-ZHEJIANG URBAN ENVMT	133.00	0.00	0.00	0.00	0.00	133.00	0.00	0.00
P065463	2004	CN - Jiangxi Integrated Agric. Modern.	100.00	0.00	0.00	0.00	0.00	100.00	1.50	0.00
P073002	2004	CN-Basic Education in Western Areas	100.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
P065035	2004	CN-Gansu & Xinjiang Pastoral Development	66.27	0.00	0.00	0.00	0.00	65.61	4.53	0.00
P077615	2004	CN-GEF-Gansu & Xinjiang Pastoral Develop	0.00	0.00	0.00	10.50	0.00	10.50	0.80	0.00
P068058	2003	CN-Yixing Pumped Storage Project	145.00	0.00	0.00	0.00	0.00	133.25	-5.57	0.00
P040599	2003	CN-TIANJIN URB DEV II	150.00	0.00	0.00	0.00	0.00	148.50	-1.50	0.00
P067337	2003	CN-2nd GEF Energy Conservation	0.00	0.00	0.00	26.00	0.00	14.60	16.57	0.00
P076714	2003	CN-Anhui Hwy 2	250.00	0.00	0.00	0.00	0.00	250.00	15.33	0.00
P058847	2003	CN-3rd Xinjiang Hwy Project	150.00	0.00	0.00	0.00	0.00	106.13	9.47	0.00
P070191	2003	CN-SHANGHAI URB ENVMT APL1	200.00	0.00	0.00	0.00	0.00	198.00	-2.00	0.00
P070441	2003	CN-Hubei Xiaogan Xiangfan Hwy	250.00	0.00	0.00	0.00	0.00	156.78	-20.56	0.00
P064729	2002	CN-SUSTAINABLE FORESTRY DEV. PROJECT	93.90	0.00	0.00	0.00	0.00	76.07	1.58	0.00
P058846	2002	CN-Natl Railway Project	160.00	0.00	0.00	0.00	0.00	34.62	-2.04	0.00
P060029	2002	CN-Sustain. Forestry Dev(Natural Forest)	0.00	0.00	0.00	16.00	0.00	14.11	3.00	0.00
P070459	2002	CN-Inner Mongolia Hwy Project	100.00	0.00	0.00	0.00	0.00	88.82	6.49	0.00
P071147	2002	CN-Tuberculosis Control Project	104.00	0.00	0.00	0.00	0.00	92.67	-11.33	0.00
P068049	2002	CN-Hubei Hydropower Dev in Poor Areas	105.00	0.00	0.00	0.00	0.00	87.68	12.84	0.00
P058845	2001	Jiangxi II Hwy	200.00	0.00	0.00	0.00	0.00	132.10	7.44	0.00
P056516	2001	CN - WATER CONSERVATION	74.00	0.00	0.00	0.00	0.00	39.83	8.40	0.00
P056596	2001	CN-Shijiazhuang Urban Transport	100.00	0.00	0.00	0.00	0.00	85.41	52.47	0.00
P047345	2001	CN-HUAI RIVER POLLUTION CONTROL	105.50	0.00	0.00	0.00	0.00	87.18	-18.32	0.00
P051859	2001	CN-LIAO RIVER BASIN	100.00	0.00	0.00	0.00	0.00	70.70	28.00	0.00
P056199	2001	CN-3rd Inland Waterways	100.00	0.00	0.00	0.00	0.00	80.46	5.96	0.00
P045915	2001	CN-Urumqi Urban Transport	100.00	0.00	0.00	0.00	0.00	52.54	47.34	0.00
P049436	2000	CN-CHONGQING URBAN ENVMT	200.00	0.00	0.00	0.00	3.70	156.40	64.06	0.00
P056424	2000	TONGBAI PUMPED STORA	320.00	0.00	0.00	0.00	100.00	151.53	91.87	0.00
P045264	2000	CN-SMALLHLDR CATTLE DEV	93.50	0.00	0.00	0.00	0.00	12.84	6.87	0.00
P045910	2000	CN-HEBEI URBAN ENVIRONMENT	150.00	0.00	0.00	0.00	0.00	119.36	46.36	0.00
P058844	2000	3rd Henan Prov Hwy	150.00	0.00	0.00	0.00	0.00	57.58	23.24	0.00
P064924	2000	CH-GEF-BEIJING ENVMT II	0.00	0.00	0.00	25.00	0.00	26.13	18.84	2.86
P058843	2000	Guangxi Highway	200.00	0.00	0.00	0.00	0.00	102.57	46.57	0.00
P042109	2000	CN-BEIJING ENVIRONMENT II	349.00	0.00	0.00	25.00	0.00	286.54	180.67	0.00
P064730	2000	CN - Yangtze Dike Strengthening Project	210.00	0.00	0.00	0.00	0.00	111.52	95.52	0.00
P041268	1999	CN-Nat Hwy4/Hubei-Hunan	350.00	0.00	0.00	0.00	0.00	59.72	37.72	0.00
P051856	1999	ACCOUNTING REFORM & DEVELOPMENT	27.40	5.60	0.00	0.00	0.00	17.89	17.84	0.00
P051705	1999	Fujian II Highway	200.00	0.00	0.00	0.00	0.00	65.73	63.07	0.00
P050036	1999	Anhui Provincial Hwy	200.00	0.00	0.00	0.00	9.60	34.96	34.16	0.00
P057352	1999	CN-RURAL WATER IV	16.00	30.00	0.00	0.00	0.00	21.81	15.87	8.72
P058308	1999	CN-PENSION REFORM PJT	0.00	5.00	0.00	0.00	0.00	1.77	1.75	0.00

P056216	1999	CN - LOESS PLATEAU II	100.00	50.00	0.00	0.00	0.00	24.54	26.67	0.00
P060270	1999	CN-ENTERPRISE REFORM LN	0.00	5.00	0.00	0.00	0.00	2.71	4.29	4.07
P038121	1999	CN-GEF-RENEWABLE ENERGY DEVELOPMENT	0.00	0.00	0.00	35.00	0.00	24.14	27.18	7.95
P051888	1999	CN - GUANZHONG IRRIGATION	80.00	20.00	0.00	0.00	0.00	32.26	25.50	0.00
P046051	1999	CN-HIGHER EDUC. REFORM	20.00	50.00	0.00	0.00	0.00	5.70	7.31	0.00
P043933	1999	CN-SICHUAN URBAN ENVMT	150.00	2.00	0.00	0.00	0.00	91.74	78.60	24.15
P042299	1999	TEC COOP CREDIT IV	10.00	35.00	0.00	0.00	0.00	36.03	-11.40	0.00
P041890	1999	CN-Liaoning Urban Transport	150.00	0.00	0.00	0.00	0.00	33.14	33.14	0.00
P036953	1999	CN-HEALTH IX	10.00	50.00	0.00	0.00	0.00	36.85	22.30	0.00
P003653	1999	CN-Container Transport	71.00	0.00	0.00	0.00	18.61	3.16	21.74	0.32
P049665	1999	CN-ANNING VALLEY AG.DEV	90.00	30.00	0.00	0.00	0.00	19.19	10.38	0.00
P046829	1999	RENEWABLE ENERGY DEVELOPMENT	100.00	0.00	0.00	0.00	0.00	12.87	99.87	8.23
P046564	1999	CN - Gansu & Inner Mongolia Poverty Red.	60.00	100.00	0.00	0.00	13.30	40.00	29.66	-11.15
P035698	1998	HUNAN POWER DEVELOP.	300.00	0.00	0.00	0.00	145.00	31.45	173.45	-18.46
P003619	1998	CN-2nd Inland Waterways	123.00	0.00	0.00	0.00	37.00	19.18	54.54	6.46
P003566	1998	CN-BASIC HEALTH (HLTH8)	0.00	85.00	0.00	0.00	0.00	38.40	23.65	0.00
P003539	1998	CN - SUSTAINABLE COASTAL RESOURCES DEV.	100.00	0.00	0.00	0.00	2.06	46.65	45.38	35.83
P037859	1998	CN-GEF Energy Conservation	0.00	0.00	0.00	22.00	0.00	0.71	22.06	0.00
P049700	1998	CN - IAIL-2	300.00	0.00	0.00	0.00	0.00	3.97	3.97	0.66
P040185	1998	CN-SHANDONG ENVIRONMENT	95.00	0.00	0.00	0.00	1.40	20.07	21.47	1.58
P003614	1998	CN-Guangzhou City Transport	200.00	0.00	0.00	0.00	20.00	100.31	120.31	100.31
P046563	1998	CN - TARIM BASIN II	90.00	60.00	0.00	0.00	2.67	7.14	9.24	0.00
P045788	1998	Tri-Provincial Hwy	230.00	0.00	0.00	0.00	0.00	19.18	16.12	0.00
P003606	1998	ENERGY CONSERVATION	63.00	0.00	0.00	22.00	0.00	33.80	16.74	0.00
P051736	1998	E. CHINA/JIANGSU PWR	250.00	0.00	0.00	0.00	86.00	47.81	133.81	10.72
P036414	1998	CN-GUANGXI URBAN ENVMT	72.00	20.00	0.00	0.00	0.00	71.56	66.02	25.79
P046952	1998	CN - FOREST. DEV. POOR AR	100.00	100.00	0.00	0.00	0.00	29.62	-71.61	9.25
P036949	1998	CN-Nat Hwy3-Hubei	250.00	0.00	0.00	0.00	0.00	21.15	21.15	0.00
P003590	1997	CN - QINBA MOUNTAINS POVERTY REDUCTION	30.00	150.00	0.00	0.00	0.00	13.16	16.34	-0.95
P003637	1997	CN-NAT'L RURAL WATER 3	0.00	70.00	0.00	0.00	0.00	0.56	3.77	3.35
P003650	1997	TUOKETUO POWER/INNER	400.00	0.00	0.00	0.00	102.50	37.31	139.81	27.57
P035693	1997	FUEL EFFICIENT IND.	0.00	0.00	0.00	32.80	0.00	6.88	32.81	0.00
P036405	1997	CN - WANJIAZHAI WATER TRA	400.00	0.00	0.00	0.00	75.00	22.58	97.58	10.00
P003654	1997	Nat Hwy2/Hunan-Guangdong	400.00	0.00	0.00	0.00	0.00	48.52	48.52	20.68
P044485	1997	SHANGHAI WAIGAOQIAO	400.00	0.00	0.00	0.00	0.00	75.02	46.56	34.56
P038988	1997	CN - HEILONGJIANG ADP	120.00	0.00	0.00	0.00	0.00	7.72	7.72	4.54
P003602	1996	CN-HUBEI URBAN ENVIRONMENT	125.00	25.00	0.00	0.00	28.32	39.72	70.08	32.41
P003599	1996	CN-YUNNAN ENVMT	125.00	25.00	0.00	0.00	19.48	35.68	56.92	7.10
P003594	1996	CN - GANSU HEXI CORRIDOR	60.00	90.00	0.00	0.00	0.00	73.92	58.83	0.00
P003589	1996	CN-DISEASE PREVENTION (HLTH7)	0.00	100.00	0.00	0.00	0.00	1.88	10.93	0.00
P034618	1996	CN-LABOR MARKET DEV.	10.00	20.00	0.00	0.00	0.00	5.66	7.75	0.00
P040513	1996	2nd Henan Prov Hwy	210.00	0.00	0.00	0.00	19.00	16.69	35.69	23.69
P003648	1996	CN-SHANGHAI SEWERAGE II	250.00	0.00	0.00	0.00	0.00	39.94	39.94	4.81
P003571	1995	CN-7th Railways	400.00	0.00	0.00	0.00	119.00	10.28	129.28	20.28
P003647	1995	China Economic Law Reform -LEGEA	0.00	10.00	0.00	0.00	0.00	0.50	0.83	0.00
P003639	1995	CN-SOUTHWEST POVERTY REDUCTION PROJECT	47.50	200.00	0.00	0.00	0.01	1.21	25.36	25.36
P003596	1995	CN-Yangtze Basin Water Resources Project	100.00	110.00	0.00	0.00	1.92	0.34	4.75	4.75
P003603	1995	CN-ENT HOUSING & SSR	275.00	75.00	0.00	0.00	57.46	37.74	93.12	1.43
P003540	1994	CN-LOESS PLATEAU	0.00	150.00	0.00	0.00	0.00	1.12	0.50	0.00
P003632	1993	CN-ENVIRONMENT TECH ASS	0.00	50.00	0.00	0.00	0.00	1.11	1.73	1.41
Total:			11,919.07	1,722.60	0.00	214.30	862.03	5,115.78	2,865.17	438.28

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

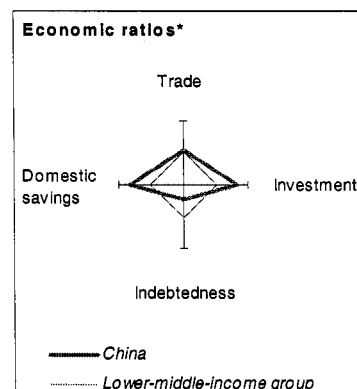
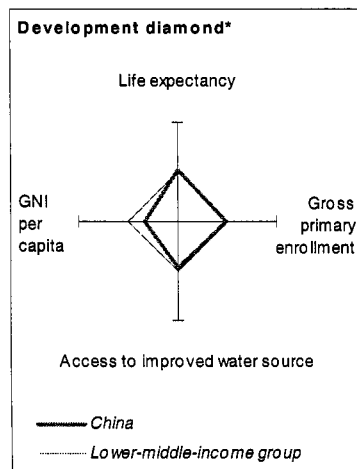
FY	Company	Committed				Disbursed			
		Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
Approval									
2001	Peak Pacific	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00
2003	SAIC	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	SBTS	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
2000	SSIF	0.00	4.50	0.00	0.00	0.00	1.02	0.00	0.00
1998	Shanghai Krupp	27.50	0.00	0.00	61.43	27.50	0.00	0.00	61.43
	Shanghai Midway	0.00	16.02	0.00	0.00	0.00	16.02	0.00	0.00
1999	Shanxi	15.36	0.00	0.00	0.00	12.81	0.00	0.00	0.00
1993	Shenzhen PCCP	3.76	0.00	0.00	0.00	3.76	0.00	0.00	0.00
2002	Sino Gold	0.00	4.00	0.00	0.00	0.00	4.00	0.00	0.00
2001	Sino-Forest	23.33	0.00	0.00	0.00	18.33	0.00	0.00	0.00
1995	Suzhou PVC	0.00	2.48	0.00	0.00	0.00	2.48	0.00	0.00
2000	Wanjie Hospital	13.64	0.00	0.00	0.00	13.64	0.00	0.00	0.00
1996	Weihai Weidongri	1.06	0.00	0.00	0.00	1.06	0.00	0.00	0.00
2004	Wumart	0.00	6.48	0.00	0.00	0.00	6.48	0.00	0.00
2003	XACB	0.00	19.93	0.00	0.00	0.00	0.00	0.00	0.00
1993	Yantai Cement	4.73	0.00	0.00	0.00	4.73	0.00	0.00	0.00
2003	Zhengye-ADC	15.00	0.00	0.00	7.00	2.00	0.00	0.00	0.00
2002	ASIMCO	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	Anjia	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	BCIB	0.00	0.00	11.60	0.00	0.00	0.00	0.00	0.00
1999/00/02	Bank of Shanghai	0.00	24.67	0.00	0.00	0.00	24.67	0.00	0.00
2002	CDH China Fund	0.00	15.17	0.00	0.00	0.00	2.09	0.00	0.00
2003	CSMC	0.00	12.00	0.00	0.00	0.00	7.20	0.00	0.00
2004	CUNA Mutual	0.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00
1998	Chengdu Huarong	6.28	3.20	0.00	7.04	6.28	3.20	0.00	7.04
1998	Chengxin-IBCA	0.00	0.36	0.00	0.00	0.00	0.36	0.00	0.00
1992	China Bicycles	4.50	0.00	0.00	0.00	4.50	0.00	0.00	0.00
2004	China Re Life	0.00	15.41	0.00	0.00	0.00	15.29	0.00	0.00
1994	China Walden Mgt	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
1995	Dupont Suzhou	7.79	0.00	0.00	0.00	7.79	0.00	0.00	0.00
1994	Dynamic Fund	0.00	8.05	0.00	0.00	0.00	6.40	0.00	0.00
2003	Great Infotech	0.00	3.50	0.00	0.00	0.00	2.10	0.00	0.00
1999	Hansom	0.00	0.08	0.00	0.00	0.00	0.08	0.00	0.00
2002	Huarong AMC	9.00	3.00	0.00	0.00	9.00	0.49	0.00	0.00
2004	IB	0.00	52.18	0.00	0.00	0.00	0.19	0.00	0.00
2002	IEC	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1998	Leshan Scana	5.21	1.35	0.00	0.00	3.61	1.35	0.00	0.00
2001	Maanshan Carbon	9.00	2.00	0.00	0.00	9.00	2.00	0.00	0.00
2001	Minsheng Bank	0.00	23.50	0.00	0.00	0.00	23.50	0.00	0.00
2001	NCCB	0.00	26.58	0.00	0.00	0.00	26.46	0.00	0.00
1996	Nanjing Kumho	0.00	3.81	0.00	0.00	0.00	3.81	0.00	0.00
2001	New China Life	0.00	30.70	0.00	0.00	0.00	23.32	0.00	0.00
1995	Newbridge Inv.	0.00	1.95	0.00	0.00	0.00	1.95	0.00	0.00
1997	Orient Finance	6.67	0.00	0.00	8.33	6.67	0.00	0.00	8.33
2003	PSAM	0.00	1.93	0.00	0.00	0.00	0.00	0.00	0.00
1997/00	PTP Holdings	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Total portfolio:		184.83	306.97	36.60	83.80	130.68	174.50	0.00	76.80

FY Approval	Company	Approvals Pending Commitment			
		Loan	Equity	Quasi	Partic.
2002	ASIMCO	0.00	0.00	0.01	0.00
2004	CCB-MS NPL	0.00	0.00	0.00	0.00
2003	Cellon	0.00	0.01	0.00	0.00
2002	Darong	0.01	0.00	0.00	0.01
2002	Huarong AMC	0.02	0.00	0.00	0.00
2002	IEC	0.00	0.00	0.01	0.00
2002	KHIT	0.00	0.00	0.00	0.00
2004	NCFL	0.00	0.02	0.00	0.00
2004	Nanjing Kumho Ex	0.03	0.01	0.00	0.00
2003	Peak Pacific 2	0.00	0.01	0.00	0.00
2004	SIBFI	0.00	0.00	0.00	0.00
2002	SML	0.00	0.00	0.00	0.00
2002	Sino Mining	0.01	0.00	0.00	0.01
2004	Vetroarredo	0.01	0.00	0.00	0.00
2002	Zhong Chen	0.03	0.00	0.00	0.03
Total pending commitment:		0.11	0.05	0.02	0.05

## Annex 14: Country at a Glance

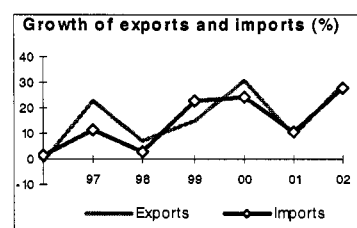
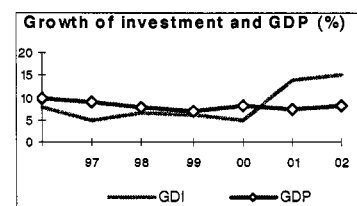
## CHINA: GEF - Heat Reform and Building Energy Efficiency

POVERTY and SOCIAL	China	East Asia & Pacific	Lower-middle-income	
<b>2002</b>				
Population, mid-year (millions)	12810	1838	2,411	
GNI per capita (Atlas method, US\$)	950	950	1,390	
GNI (Atlas method, US\$ billions)	129.1	1,740	3,352	
<b>Average annual growth, 1996-02</b>				
Population (%)	0.8	10	10	
Labor force (%)	0.9	12	12	
<b>Most recent estimate (latest year available, 1996-02)</b>				
Poverty (% of population below national poverty line)	5	..	..	
Urban population (% of total population)	38	38	49	
Life expectancy at birth (years)	71	69	69	
Infant mortality (per 1,000 live births)	30	33	30	
Child malnutrition (% of children under 5)	10	5	11	
Access to an improved water source (% of population)	75	76	81	
Illiteracy (% of population age 15+)	14	13	13	
Gross primary enrollment (% of school-age population)	106	106	111	
Male	105	105	111	
Female	108	106	110	
<b>KEY ECONOMIC RATIOS and LONG-TERM TRENDS</b>				
	<b>1982</b>	<b>1992</b>	<b>2001</b>	<b>2002</b>
GDP (US\$ billions)	2215	454.6	1,671.1	1232.7
Gross domestic investment/GDP	33.2	36.2	38.5	41.0
Exports of goods and services/GDP	8.9	19.5	25.5	29.5
Gross domestic savings/GDP	34.8	37.7	40.9	44.0
Gross national savings/GDP	35.1	38.0	40.0	43.8
Current account balance/GDP	2.4	19	15	2.9
Interest payments/GDP	0.2	0.6	0.5	0.5
Total debt/GDP	3.8	15.9	14.6	12.6
Total debt service/exports	8.0	8.6	7.7	6.1
Present value of debt/GDP	..	..	14.1	..
Present value of debt/exports	..	..	51.8	..
	<b>1982-92</b>	<b>1992-02</b>	<b>2001</b>	<b>2002</b>
(average annual growth)				
GDP	9.7	9.0	7.5	8.0
GDP per capita	8.1	8.0	6.7	7.2



## STRUCTURE of the ECONOMY

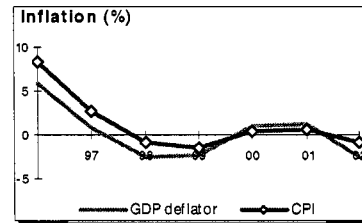
	1982	1992	2001	2002
(% of GDP)				
Agriculture	33.3	21.8	15.8	14.5
Industry	45.0	43.9	50.1	51.7
Manufacturing	37.3	33.1	34.2	44.5
Services	21.7	34.3	34.1	33.7
Private consumption	50.7	49.2	45.7	42.5
General government consumption	14.5	13.1	13.4	13.5
Imports of goods and services	7.3	18.0	23.1	26.5
	<b>1982-92</b>	<b>1992-02</b>	<b>2001</b>	<b>2002</b>
(average annual growth)				
Agriculture	4.6	3.7	2.8	2.9
Industry	11.6	11.3	8.4	9.9
Manufacturing	11.2	10.4	9.0	8.1
Services	11.7	8.4	8.4	7.3
Private consumption	11.4	8.1	2.8	1.9
General government consumption	9.9	8.4	10.5	7.0
Gross domestic investment	9.5	9.7	13.9	14.9
Imports of goods and services	9.7	12.8	10.8	27.5



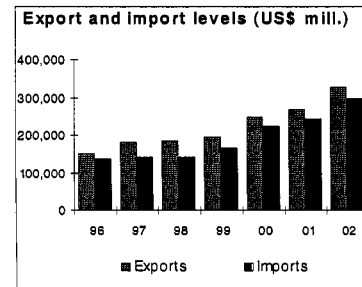


**PRICES and GOVERNMENT FINANCE**

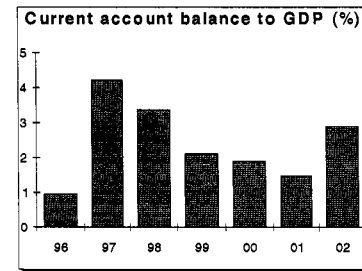
	1982	1992	2001	2002
<b>Domestic prices</b>				
<i>(% change)</i>				
Consumer prices	6.0	6.4	0.7	-0.8
Implicit GDP deflator	-0.2	7.9	12	-2.6
<b>Government finance</b>				
<i>(% of GDP, includes current grants)</i>				
Current revenue	22.9	14.7	17.1	17.9
Current budget balance	..	2.0	1.1	0.0
Overall surplus/deficit	-0.3	-1.0	-4.7	-3.0

**TRADE**

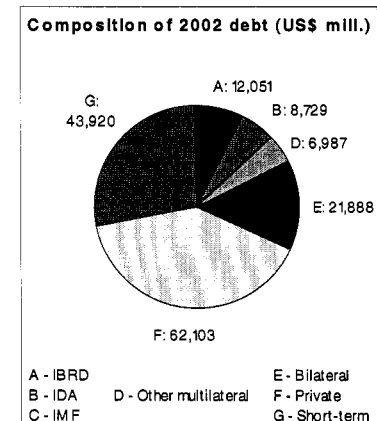
	1982	1992	2001	2002
<i>(US\$ millions)</i>				
Total exports (fob)	22,321	84,940	266,155	325,565
Food	2,908	8,309	12,780	14,623
Fuel	5,314	4,693	8,420	8,372
Manufactures	12,271	67,936	239,802	297,085
Total imports (cif)	19,285	80,585	243,610	295,203
Food	4,201	3,146	4,980	5,237
Fuel and energy	183	3,570	17,495	19,285
Capital goods	3,204	31,312	107,040	137,030
Export price index (1995=100)	41	85	83	78
Import price index (1995=100)	71	95	91	86
Terms of trade (1995=100)	58	89	91	90

**BALANCE of PAYMENTS**

	1982	1992	2001	2002
<i>(US\$ millions)</i>				
Exports of goods and services	24,906	94,198	299,409	365,395
Imports of goods and services	20,555	86,752	271,325	328,013
Resource balance	4,350	7,446	28,084	37,383
Net income	376	249	-19,174	-14,945
Net current transfers	486	1,155	8,492	12,984
Current account balance	5,212	8,850	17,401	35,422
Financing items (net)	-995	-10,952	30,046	40,085
Changes in net reserves	-4,217	2,102	-47,447	-75,507
<b>Memo:</b>				
Reserves including gold (US\$ millions)	..	24,842	220,051	297,721
Conversion rate (DEC, local/US\$)	2.4	5.9	8.3	8.3

**EXTERNAL DEBT and RESOURCE FLOWS**

	1982	1992	2001	2002
<i>(US\$ millions)</i>				
Total debt outstanding and disbursed	8,358	72,428	170,110	155,678
IBRD	0	3,752	11,550	12,051
IDA	1	4,287	8,654	8,729
Total debt service	2,125	8,618	24,297	23,688
IBRD	0	460	1,550	1,631
IDA	0	30	151	175
<b>Composition of net resource flows</b>				
Official grants	47	327	240	..
Official creditors	657	2,343	2,156	-839
Private creditors	-122	8,949	-4,017	-13,593
Foreign direct investment	430	11,156	44,241	49,308
Portfolio equity	0	1,243	3,015	2,286
<b>World Bank program</b>				
Commitments	330	1,865	782	563
Disbursements	1	1,331	1,791	1,733
Principal repayments	0	197	904	1,157



**Annex 15: STAP Roster Review****CHINA: GEF - Heat Reform and Building Energy Efficiency****1. STAP REVIEWER COMMENTS AND RESPONSE TO STAP REVIEWER COMMENTS****WORLD BANK CHINA: HEAT REFORM AND BUILDING ENERGY EFFICIENCY PROJECT****Review and Comments**

by

William Chandler  
Senior Staff Scientist,  
Battelle Memorial Institute, Pacific Northwest National Laboratory

28 February 2004

**Summary and Conclusion**

The goal of this project, to promote policy reform and energy efficiency in heating in China is a worthy one. In this reviewer's opinion, this is exactly the kind of project that the World Bank and the Global Environment Facility should be undertaking. The project is consistent with widely accepted principles of political economy and is technically feasible and manageable. It reflects priorities identified in studies undertaken by leading western and Chinese laboratories and institutes.

The technical problems identified by the World Bank are familiar and widespread in Soviet-style heating systems. The problems of constant hot water flow, single-pipe vertical feeders, sequential radiator connections, and the overall lack of controls and appropriate heat exchangers are well-known and very serious impediments to energy efficiency and economic efficiency.

I did find the "Summary" section a little too truncated and lacking enough specificity to inform the reader as to the "deliverables" for the project and its means of implementation. Adding one or two crisp sentences on these points would be useful to set the context for what is to come later in the document.

**Scientific and technical soundness of the project**

The technical problems identified by the World Bank are familiar and widespread in Soviet-style heating systems, including those in China. The problems of unregulated hot water flow, single-pipe vertical feeders, sequential radiator connections, and the overall lack of controls and appropriate heat exchangers are well-known, serious impediments to energy and economic efficiency. The proposed solutions—standards, metering, and controls—have been

proven in market economies as well as in dozens of demonstration and a few commercial projects in the transition economies.

Identification of the global environmental benefits and/or drawbacks of the project.

How the project fits within the context of the goals of GEF, as well as its operational strategies, program priorities, GEF Council guidance and the provisions of the relevant conventions.

This project is consistent with the climate change mandate of the GEF. The potential emissions reduction benefits are competently calculated using transparent, credible methodology.

### **Replicability of the project (added value for the global environment beyond the project itself)**

This proposal addresses barriers to energy-efficiency investment that have been well-documented in the literature. By demonstrating a creative, innovative, yet unified approach to overcoming these barriers, the project will help to create a sustained market-oriented activity of potential very large scope. The project is replicable throughout at least the northern half of China and probably, as rising incomes increase the demand for both heating and air conditioning, throughout all of China. Other nations of the transition economies may also benefit from this experience, including areas of Russia, North Korea, and Ukraine.

### **Sustainability of the project**

This project can be carried through to completion and then replicated only if adequate provision has been made for connecting decision makers for the policy and private financing aspects of the project. That is because the project planners expect to draw heavily on the use of private capital for construction. That assumption is not unreasonable, but there is no reason to expect that the incremental costs correctly identified as justifying the GEF investment in this project will not be a barrier to replication. That is, the incremental costs—the transactions costs—will not go away for the public policy measures proposed in this project unless the project designers find a way to entice the Chinese government to include them in future development projects, or simply mandate them.

In the case of target research project, it will be necessary to address the issue of the extent to which the project will contribute to the improved definition and implementation of GEF's strategies and policies, thus paving the way for more effective international, technical cooperation, assistance and investment projects.

### **Linkages to other focal areas**

No specific comment.

### **Linkages to other programs and action plans at regional or sub-regional levels**

No specific comment.

### **Other beneficial or damaging environmental effects**

Benefits from this proposed effort would converge with local environmental and economic benefits. Energy waste is directly related to emissions of sulfur, nitrogen, and other noxious wastes and the energy savings that will be generated by this project will reduce those emissions. Energy waste is an obstacle to energy-sector liberalization in China, and this effort would increase consumers' ability to respond to energy costs and thus facilitate market—and environmental—reform.

These “co-benefits” from reduced local air pollution and coal production and transportation activities are perhaps underemphasized in the project description. As the World Bank as prominently pointed out, air pollution costs several percent of GDP in China.

### **Degree of involvement of stakeholders in the project**

Appears appropriate to this reviewer.

### **Capacity-building aspects**

This project usefully would rely on a local center of expertise, the Chinese Center for Energy Efficiency in Buildings, as a project implementation unit. This direct engagement of local experts will provide the opportunity to develop leadership and management capacities.

### **Innovativeness of the project.**

This project is highly innovative in that it pulls together in a new way strategies for overcoming market barriers by using public policy solutions.

### **Scientific and technical soundness of the project: Has the most appropriate and effective approach been used to remove the barriers?**

Yes, in the opinion of this reviewer. This proposal is creative, well-designed and based on sound economic and technical knowledge and experience. This reviewer strongly endorses this proposal.

### **Has the most appropriate and effective approach been used to reduce the costs of the technologies?**

Yes, in the opinion of this reviewer.

**Was the potential market determined on the basis of RETs data and databases?**

NA

**Adequacy of the financing mechanism?**

More information is needed. It is not clear to this reviewer why the project developers are confident sufficient private financial resources will be brought to bear to accomplish the full project.

**Adequacy of the introduced financial incentives?**

See preceding comment.

**Comments on the design of demonstration project?**

NA?

**Will a process be put in place to monitor the project?**

NA.

**Is the barrier removal supported by an underlying policy framework?**

Yes, in the opinion of this reviewer.

**Is the proposed activity feasible from an engineering and technical perspective?**

Yes, in the opinion of this reviewer.

**Identification of global environmental benefits**

This proposal targets housing energy productive improvements and, as such, clearly will provide to achieving sustainable energy development. The proposed energy-efficiency measures offer cost-saving and productivity benefits to Chinese consumers and developers while at the same time cutting energy use. Because energy use ranks among the most important sources of environmental pollution, especially greenhouse gas emissions, energy savings measures provide important benefits to the global climate. Significantly, targets a nation that ranks among the most energy-intensive and energy-wasteful in the world. Because this project takes a market-based approach it can be replicated throughout much of the developing world—in conjunction with market reforms.

**How does the project fit within the context of the goals of the GEF**

Very well, in the opinion of this reviewer.

## Specific Comments

### *Sections A and B:*

I would like to suggest the following specific considerations to improve the Summary section, as well as Sections A and B on “Project Development Objective and Key Indicators,” and “Strategic Context:

- p.4. The document states that “Key performance indicators are likely to include total annual energy savings achieved through the project from adoption of energy-efficient improvements in buildings and heating system modernization and reform.” This statement sounds rather tentative, and could be improved to state specific, quantitative measures of success.
- p. 4. The document states that “In addition, a number of other quantitative and qualitative indicators will be monitored and reported in all regular project reports. The key performance indicators will be finalized during project appraisal and formally agreed at project negotiations.” These indicators could usefully be specified, at least in general terms, at this stage of project planning.
- p 5. The document states that “The project also supports a second CAS objective of *improving the business environment and helping accelerate the transition to a market economy*, mostly through knowledge transfer activities. The project is expected to improve knowledge of ways to introduce market economy principles to centralized heating, which is one of the last vestiges of the welfare state in China.” This reviewer would find it useful to read about the project designers’ “theory of change” for how these goals will be accomplished. Specifically, what is the leverage that the project provides to effect change?
- p. 17. The policies and measures articulated here are excellent, and could usefully be summarized early in the project document.
- p. 18. It would be useful to articulate whether the project will promote the adoption of “performance standards” or “construction standards,” and the degree to which “enforcement of standards” is an issue to be addressed by this project.

In summary, I find this an excellent project, indeed the type of project that is so clearly creative and innovative and so well-targeted to produce tangible sustainable development, that it should serve as a model for exactly the kind of climate and energy project that the GEF and World Bank should be doing.

Thank you for the opportunity to review this project.

## **Response to STAP Reviewer Comments**

Responses to Mr. Chandler's comments are presented following the order of the sections where the issues were raised. The original texts of the issues of concern are in italics.

### **Summary and Conclusion**

*I did find the "Summary" section a little too truncated and lacking enough specificity to inform the reader as to the "deliverables" for the project and its means of implementation. Adding one or two crisp sentences on these points would be useful to set the context for what is to come later in the document.*

The comments are taken into account in the text. More specifics on the "deliverables" of the project have been included in the text, especially concerning the adoption of the proposed integrated programs to reform heat pricing and billing, improve operational efficiency of heating systems, and increase building energy efficiency in 5 to 7 northern Chinese cities participating in the project, resulting in an estimated 660,000 TCE annual coal-saving capacity by the end of 2011, generating over 13 million TCE coal-savings and reducing CO<sub>2</sub> emissions by about 10 million ton of carbon over a 20-year period

The Tianjin program will proceed first, yielding lessons learned for other city-wide programs. Other cities' programs will operate in close association with the Central Government's heat reform piloting program, which will be implemented during 2004-2006, based on the July 2003 Heat Reform Guidelines. Four to six participating municipalities will be selected from the list of pilot heat reform municipalities included in the national reform program in Heilongjiang, Jilin, Liaoning and one other province, primarily based upon the commitment of municipal leadership to the implementation of the two-handed approach.

For more details of implementation please refer to Annex 9 of the Project Appraisal Document.

### **Sustainability of the Project**

*This project can be carried through to completion and then replicated only if adequate provision has been made for connecting decision makers for the policy and private financing aspects of the project. That is because the project planners expect to draw heavily on the use of private capital for construction. That assumption is not unreasonable, but there is no reason to expect that the incremental costs correctly identified as justifying the GEF investment in this project will not be a barrier to replication. That is, the incremental costs—the transactions costs—will not go away for the public policy measures proposed in this project unless the project designers find a way to entice the Chinese government to include them in future development projects, or simply mandate them.*

The design and text have been revised to reflect these comments. The project is joining the Government's own program of heat reform and improving building energy efficiency. The country's leadership has made it clear that reforms must proceed, and discussion has moved on to the specifics of how to implement a series of interrelated policy changes. The project will strengthen the Government's own heat reform program by providing concrete demonstrations of the benefits, especially the energy and cost savings, and practical feasibility of integrated reform. Implementation of the Government's program will provide the incentives for change among Chinese heating and housing development companies, while the project's demonstration activities will show means and benefits to change.

For more details please refer to Section C4 of the Project Appraisal Document and Section 3 of the Executive Summary.

### **Other Beneficial or Damaging Environmental Effects**

*These "co-benefits" from reduced local air pollution and coal production and transportation activities are perhaps underemphasized in the project description. As the World Bank as prominently pointed out, air pollution costs several percent of GDP in China.*

There are significant co-benefits produced by this project. The global environment objective of the project coincides strongly with priorities in urban air pollution control, one of China's key national environment policy priorities.

### **Adequacy of the Financing Mechanism**

*More information is needed. It is not clear to this reviewer why the project developers are confident sufficient private financial resources will be brought to bear to accomplish the full project.*

The scale of additional financing needed to cover housing developers' portion of the incremental costs is proportionately small compared to the overall financing. In the case of Tianjin the developers were drawn to the project in large part due to the credentials which the designation of an international and national demonstration will lend, a significant intangible marketing value to the developers. At least as important to the developers is the fact that compliance with national and local building energy efficiency standards and requirements of heat reform is a high priority to the Government and getting a head start could turn into long-term market advantages. The risk of early start is partially compensated by the international and national technical and financial assistance.

### **Specific Comments**

*I would like to suggest the following specific considerations to improve the Summary section, as well as Sections A and B on "Project Development Objective and Key Indicators," and "Strategic Context:*



- *p.4. The document states that “Key performance indicators are likely to include total annual energy savings achieved through the project from adoption of energy-efficient improvements in buildings and heating system modernization and reform.” This statement sounds rather tentative, and could be improved to state specific, quantitative measures of success.*
- *p. 4. The document states that “In addition, a number of other quantitative and qualitative indicators will be monitored and reported in all regular project reports. The key performance indicators will be finalized during project appraisal and formally agreed at project negotiations.” These indicators could usefully be specified, at least in general terms, at this stage of project planning.*

The main performance indicators are now more clearly defined in the text. See Section B1 and Annex 3 of the Project Appraisal Document and Section 1 (b), Section 3 (e) and Annex 1 of the Executive Summary.

- *p 5. The document states that “The project also supports a second CAS objective of improving the business environment and helping accelerate the transition to a market economy, mostly through knowledge transfer activities. The project is expected to improve knowledge of ways to introduce market economy principles to centralized heating, which is one of the last vestiges of the welfare state in China.” This reviewer would find it useful to read about the project designers’ “theory of change” for how these goals will be accomplished. Specifically, what leverage that the project provides to effect change?*

The design and text have been changed to reflect these comments. The Government has committed to a program that will change the heating and building energy efficiency industries. The project is joining the Government’s heat reform and building energy efficiency pilot in northern Chinese provinces that the Government is using to launch the entire program. The project will strengthen the pilot program with lessons and ideas from international experience, and demonstration of the benefits and practical feasibility of integrating heat reform, heating system modernization and building energy efficiency improvements in the coldest regions of China. It will also support dissemination of this knowledge and experience as part of the Government’s own national effort to support provinces and municipalities as the country’s national heat reform program proceeds.

For more details refer to Sections A1, A2, and C4 of the Project Appraisal Document.

- *p. 17. The policies and measures articulated here are excellent, and could usefully be summarized early in the project document.*

Agreed. Comments have been incorporated in the text.

- *p. 18. It would be useful to articulate whether the project will promote the adoption of “performance standards” or “construction standards,” and the degree to which “enforcement of standards” is an issue to be addressed by this project.*

The focus of this project with respect to building energy efficiency standards is on the aspect of local implementation with support in promoting best practices in site planning, building design, materials selection and construction techniques, as well as enforcement approaches, through both target technical assistance and demonstration in city programs. Such an approach compliments well the building energy component of the EUEEP (UNDP/GEF), which focuses on the more upstream work development and implementation of building energy efficiency codes across all of China’s climate regions. The project does not deliberately promote the adoption of “performance standards” or “construction standards”, which will become a more natural selection process as relevant local capacity improves and will depend on characteristics of particular housing development. Nonetheless, the prevailing characteristics of housing development in China require adoption of a set of key prescriptive requirements for residential designs and construction as well as the integration of key requirements into the conventional building quality and safety inspection system.