Global Environment Facility

GEF

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

May 31, 2000

Dear Council Member:

The World Bank, as the Implementing Agency for the project, *China: Second Beijing Environment Project,* has attached the proposed project document for CEO endorsement prior to final approval of the project document in accordance with the World Bank procedures.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by the Council in December 1999 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the World Bank satisfactorily details how Council's comments and those of the STAP reviewer have been addressed. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.gefweb.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to down load the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

cc: Alternates, Implementing Agencies, STAP

GEF SECRETARIAT, 1818 H STREET NW, WASHINGTON, DC 20433 USA
TELEPHONE (202) 473 3202 FAX (202) 522 3240/3245

THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: May 31, 2000

TO: Mr. Mohamed El-Ashry, CEO/Chairman, GEF

FROM: Rohit Khanna, Acting GEF Executive Coordinator

EXTENSION: 34188

SUBJECT: **China: Second Beijing Environment Project**
Final Council Review and CEO Endorsement

1. Please find the electronic attachment of the project appraisal document (PAD) for the above mentioned project for review by Secretariat staff, prior to circulation to Council and your final endorsement.

2. The project document is fully consistent with the objectives and scope of the proposal endorsed by Council as part of the December 1999 work program and reflects comments made during work program endorsement by GEFSEC, STAP, and Council members as follows:

(a) The level of incentives to be provided by the GEF and the arrangements for distributing new equipment. The GEF equipment subsidy should be limited and the number of units covered by the program should be increased, with a view to early dissemination. A significant share of the GEF support will benefit all 2,500 natural gas boilers to be installed under the project. This will be provided through technical services for pre-feasibility evaluation and design of boiler conversions, installation supervision, training of boiler operators, and trouble-shooting for the initial three years of operation.

The complementary GEF equipment demonstration subsidies have been carefully designed to achieve maximum impact at minimum cost. This will be achieved by: (i) initially focussing the demonstration subsidies on the five most common boiler size classes and technical types that have the highest replication potential, and limiting the demonstration subsidies on these units to an average of one third of their cost; (ii) in years three and four, focussing the demonstration program on distributed heating systems (which provide the greatest incentive for efficiency improvement), and supporting the installation of only one smaller gas boiler at each site to replace just part of the previous coal-fired capacity, thus maximizing the number units that can be supported; and (iii) where technically feasible, supporting only the replacement of burners and associated equipment, rather than the entire boiler unit. Please refer to PAD Annex 2 and Annex 3 for details.

(b) The project's role in relation to the housing sector. Beijing's housing system is undergoing a radical change, that involves a sale of the majority of housing stock to individuals and a large increase in rents for the rest, from the system of employee-

provision of housing at nominal rents. However, employers are still responsible for paying their employee's residential heating cost. Therefore, benefits and costs of boiler conversion and heating energy conservation still accrue directly on boiler house owners and employers. Please refer to PAD Section E.5 and E.7.a.

(c) Modalities how the grant administration and commercial operations of this company [a new gas boiler promotion company] shall be handled to avoid market distortion (kind of support given to different gas boiler manufacturers in improving designs and reducing cost). Commercial operation of SJET, the new gas boiler promotion company, is limited to the **distribution** of boilers. It will procure boilers through competitive processes from manufacturers (domestic manufacturers are largely limited to assembly at present) and their agents. Its technology development activities financed by the GEF grant would be available to all manufacturers and service providers. Please refer to PAD Section C, paragraphs 1.1, 1.2, especially 2.1 and 2.2, and Annex 2.

(d) Domestic benefits should be included as part of the IC analysis baseline, quantified to the extent possible. An estimation of medical cost savings is included in the revised IC analysis (PAD Annex 11, paragraph 16).

(e) Further confirmation of abatement potential. The estimated abatement potential presented in the IC analysis remains a very conservative one, as the extent of consolidation of scattered coal-fired boilers to less polluting district heating boilers, assumed for the baseline is highly optimistic. If the baseline is taken at little consolidation but persistence of scattered boilers, the annual abatement potential in 2006 is estimated at 1.8 million ton (according to a air quality modeling completed), rather than the estimated 0.7 million ton abatement using the baseline used in the IC analysis.

(f) The project's complementary character, building on all relevant portfolio lessons learned available. The Implementation Completion Report for the first Beijing Environmental Project (BEP I) is under preparation but main lessons are fairly clear and are incorporated in the design of the proposed project (BEP II). A main insight gained during BEP I is the intractability of institutional and incentive issues in the centralized district heating system, which constrain the efficiency improvement in heat distribution and use. In view of this, BEP II focuses on more decentralized systems consisting of self-generation of heat, including distributed gas boilers, as well as the Heating Energy Conservation Center that would provide technical and institutional support that the small-scale heat suppliers need. An experiment with end-user heat control and metering got under way at the end of the BEP I implementation, and the results are not yet available. The results would be evaluated under the proposed study on environment and energy and incorporated in the implementation of the heating energy conservation component. Please refer to Section D.2 and D.3.

(g) Beneficiary population. Almost the entire population of the Beijing urban area, about 5.3 million people, would reap major health benefits as well as economic benefits indirectly resulting from increased economic investments. The benefits would in general

be proportional to the residents' incomes, except that the lowest-income population with little climate control systems would benefit more significantly. Please refer to PAD Sections C.3, E.5, and Annex 4.

(h) Institutional arrangements. Roles of various agencies involved have been greatly clarified, as summarized in PAD Section C.4.

3. Since Work Program entry, responsibilities and grant amounts for two elements of the project have been reallocated between the two implementing agencies, the Shihuan Jietian Energy Technology Corporation (SJET), a new gas boiler promotion company responsible for the Gas Boiler Technology and Market Development component, and the Heating Energy Conservation Center (HECC), responsible for the Heating Energy Conservation component. Most of the responsibility for a heating energy conservation subcomponent to improve the efficiency of heat systems based on natural gas boilers has been reallocated to SJET, in order to maximize the complementarity of this subcomponent with the boiler fuel conversion. On the other hand, the primary responsibility for a study of energy and environmental management has been reassigned from SJET which is a market-based company to HECC which is a governmental entity, in view of the study's main aim to review and improve public policy and regulations. Mainly due to these reassignments, proposed grant allocation for the Gas Boiler Technology and Market Development component has changed from $17 million to $16.5 million, and that for the Heating Energy Conservation component from $8.0 million to $8.5 million. The total proposed grant amount remains the same at $25 million.

4. Please let me know if you require any additional information to complete your review of the project document prior to circulation to Council. We look forward to hearing from the Secretariat as soon as possible, whether this document can now be circulated for their review. Many thanks.

Attachments

cc: Messrs./Mmes. King, GEF Program Coordination (GEFSEC); Khanna, Aryal (ENV); Huang, Sun (EACCF); Varma, Plant, Nickerson, Choi (EASUR); Broadfield (EASES); ENVGC ISC; EASURFiles

Document of
The World Bank

Report No: 20284-CHA

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$349 MILLION

AND A

GEF GRANT

IN THE AMOUNT OF SDR 18.9 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

SECOND BEIJING ENVIRONMENT PROJECT

May 26, 2000

Urban Development Sector Unit
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective March 1, 2000)

Currency Unit = Yuan (Y)
Y 1 = US$ 0.12
US$ 1 = Y 8.28

FISCAL YEAR
January 1 to December 31

ABBREVIATIONS AND ACRONYMS

BCIC	Beijing Comprehensive Investment Corporation
BDC	Beijing Drainage Company
BEP1	The (first) Beijing Environmental Project
BEMPS	Beijing Environmental Master Plan Studies, carried out under the first Beijing Environmental Project
BEPB	Beijing Environmental Protection Bureau
BEPO	Beijing Environmental Projects Office
BGGC	Beijing Gas Group Corporation
BMG	Beijing Municipal Government
BPC	Beijing Planning Commission
CFB	Coal-fired Boiler or Burner
DG	District Government
EA	Environmental Assessment
EDSS	Environmental Decision Support System
FMS	Financial Management System
GEF	Global Environment Facility
GHG	Greenhouse Gas
HECC	Heating Energy Conservation Center (reporting to RHAO)
ICB	International Competitive Bidding
M	Million
m^2	Square Meter
m^3	Cubic Meter
NCB	National Competitive Bidding
NGB	Natural Gas Boiler
RAP	Resettlement Action Plan
RHAO	Residential Heating Administration Office
SJET	Shihuan Jietian Energy Technology Development Company, Ltd.
tph	Tons per Hour, of water boiled, an imprecise but common boiler capacity designation approximately equivalent to 625 kilowatts
WWTP	Wastewater Treatment Plant

Vice President:	Jemal-ud-din Kassum
Country Manager/Director:	Yukon Huang
Sector Manager/Director:	Keshav Varma
Task Team Leader/Task Manager:	Songsu Choi

CHINA
SECOND BEIJING ENVIRONMENT PROJECT

CONTENTS

Annexes

MAP(S)
IBRD 30782 Second Beijing Environment Project

CHINA

Second Beijing Environment Project

Project Appraisal Document

East Asia and Pacific Region
Urban Development Sector Unit

Date: May 26, 2000
Team Leader: Songsu Choi
Country Manager/Director: Yukon Huang
Sector Manager/Director: Keshav Varma
Project ID: P042109
Sector(s): US - Urban Environment, VP - Pollution Control / Waste Management
Lending Instrument: Specific Investment Loan (SIL)
Theme(s): Environment; Urban
Poverty Targeted Intervention: N

Project Financing Data

☒ Loan ☐ Credit ☒ Grant ☐ Guarantee ☐ Other (Specify)

For Loans/Credits/Others:

Amount (US$m): 349 loan + 25 GEF grant

Proposed Terms: Variable Spread & Rate Single Currency Loan (VSCL)

Grace period (years): 5 **Years to maturity:** 20

Commitment fee: 0.75%

Front end fee on Bank loan: 1.00%

Financing Plan: Source	Local	Foreign	Total
GOVERNMENT	157.00	0.00	157.00
IBRD	0.00	349.00	349.00
GOVERNMENT OF CHINA	154.00	32.00	186.00
GLOBAL ENVIRONMENT FACILITY	0.00	25.00	25.00
BENEFICIARIES	355.50	0.00	355.50
OTHER PRIVATE COMMERCIAL SOURCES	182.50	0.00	182.50
Total:	849.00	406.00	1255.00

Borrower: PEOPLE'S REPUBLIC OF CHINA
Responsible agency: BEIJING MUNICIPAL GOVERNMENT
World Bank and Asian Development Bank Loan Beijing Environment Project Office
Address: Ding 2, Southern Street,
Fuxingmen, Xicheng District
Beijing, 100031
P.R. China
Contact Person: Guo Junqing
Tel: (86-10) 66411754 Fax: (86-10) 66411638 Email: bepo@public.bta.net.cn

Estimated disbursements (Bank FY/US$M):

FY	2001	2002	2003	2004	2005	2006	2007
Annual	48.7	75.2	90.5	67.8	47.9	32.9	11.0
Cumulative	48.7	123.9	214.4	282.2	330.1	363.0	374.0

Project implementation period: 6 years
Expected effectiveness date: 10/15/2000 **Expected closing date:** 12/31/2006

OCS PAD Form: Rev. March, 2000

A. Project Development Objective

1. Project development objective: (see Annex 1)

The proposed project aims at a visible and sustained alleviation of air and water pollution in Beijing by helping to:

(a) convert scattered coal-fired boilers to natural gas boilers;
(b) promote energy conservation in heating systems;
(c) construct key wastewater trunk interceptors and associated treatment facilities; and
(d) strengthen environmental management institutions of Beijing.

The GEF-financed components support activities (a) and (b) above, by helping to establish viable models and markets of natural gas usage and heating energy conservation. In addition to the direct and significant reduction of greenhouse gas (GHG) emissions, these will make an effective demonstration of GHG reduction measures for China as a whole and thus help to decrease the risk of global climate change significantly.

2. Key performance indicators: (see Annex 1)

	Unit	1997 (Baseline)	2005 (Target)	Difference
Beijing population exposed to air quality worse than Class III over 60 days a year*	people	5,100,000	20,000	- 99.6%
Carbon Emission from Heating in Beijing*	ton/year	4,370,000	2,560,000	- 41.5%
COD discharged to Liangshui River	tons/year	72,000	32,000	- 55.5%
Net internal cash flow of Beijing Drainage Company	% of current expenses	24%	132%	+108%

* These targets assume the achievement of the overall target for the city-wide program of converting scattered coal-fired boilers to cleaner fuels, for which the project provides major inputs for technical and market development as well as about 20% of physical investment.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

Document number: R98-107 **Date of latest CAS discussion:** 05/28/98

Environmental protection is one of five CAS themes for China, along with macroeconomic growth and stability, infrastructure development, human development, and rural development. Among operations to assist in environmental protection, urban wastewater management has traditionally been a main focus of Bank operations. This project is the first to direct major attention to urban air pollution issues in China.

China ratified the United Nations Framework Convention for Climate Change on January 5, 1993. Fuel conversion from coal to natural gas is an element of China's global environmental strategy. The project is consistent with the GEF Operational Program #5 for promoting the removal of barriers to energy efficiency and energy conservation.

2. Main sector issues and Government strategy:

2.1 **Environmental Policy of China.** The recent rapid growth of industries and cities of China has added heavy pressures on its environment which had already suffered significant degradation during the earlier industrialization drives. To stop and reverse the degradation, the Government of China has pursued active environmental policies, requiring environmental assessment and licensing for new investment projects, pollution levies, extensive environmental monitoring, and major national environmental performance targets. These policies are implemented in a decentralized fashion through a network of Environmental Protection Bureaus (EPBs) at all levels of government, overseen by the State Environmental Protection Agency (SEPA). National standards, targets, and regulations usually specify only the broad framework and minimum requirements, and local EPBs can set more stringent local standards and implement various programs to achieve their own environmental plans as long as they are consistent with higher-level regulations.

2.2 The active policies, combined with rapid industrial renovations with cleaner technologies, have yielded substantial environmental benefits over the last decade. Pollution discharge per industrial output value has declined rapidly in most localities, and many cities have reduced the concentrations of total suspended particles (TSP) in the ambient air, and toxic metals in wastewater. In general, however, industrial production and urban waste generation are increasing at such a rate that aggregate pollution is still at unhealthy levels and even rising. High levels of air pollution, especially with sulfur dioxide (SO2), remain a major issue in most cities due to China's heavy reliance on low-quality coal. Domestic sewage and automobile emissions are growing as serious urban pollution issues.

Air Pollution in Beijing

2.3 Beijing is a preeminent showcase of these old and new environmental issues, aggravated by its semi-arid climate and highlighted by its status as the national capital. Arguably the most critical environmental issue in Beijing is air pollution. Table 1 shows that average ambient concentrations of particulates and nitrates exceed the daily healthy limit for residential areas (Chinese standard Class II, similar to WHO standards) year-round. During the heating season, sulfur dioxide and nitrogen oxides grow to levels posing acute health risks, beyond limits allowed even for industrial areas (Class III). About 5.3 million Beijing residents are estimated to be exposed to more than 150 micrograms of sulfur dioxide for more than 60 days a year. Although another critical pollutant, ultrafine particles (PM-10), are not yet systematically measured, their concentration is expected to show a similar pattern.

Table 1. Air Quality in Beijing, 1998

Maximum 24 hour concentration in micrograms/m^3

	Maximum for Standard		Beijing Actual	
Pollutant	Class II	Class III	Heating Season	Other Times
Suspended particulates (TSP)	300	500	**431**	348
Sulfur Dioxide (SO_2)	150	250	**252**	42
Nitrogen oxides (NOx)	100	150	**201**	122
Carbon Monoxide (CO)	4000	6000	**4400**	2600

Note: Ultrafine particle (PM-10) concentration was incorporated into the national standards in 1996 but are not yet systematically measured.
Heating season in Beijing runs November through March.

Source: Beijing Municipal Environmental Research Institute, Updated Beijing Environmental Master Plan Studies Database, 1999

2.4 The main source of pollution is **coal**, which remains the city's dominant (about 75%) source of energy. Especially important is coal-fired heating that contributes most of sulfur dioxides and a major share of other pollutants. Industrial boilers and power plants burn about half of all coal used in Beijing year-round, but they are responsible for only about 15% of ambient pollution of sulfur dioxide and particulates during the heating season, thanks to pollution control equipment. "Scattered" heating boilers - those with capacity of less than 20 tons of steam per hour (capable of heating up to 160,000 m^2 of floor space) and chimneys lower than 35 meters - are responsible for about 70% of these pollutants and even smaller stoves, tea and bath boilers contribute another 10%. Next in importance are emissions from the increasing vehicle population, which increased from about 0.5 million in 1991 to 1.36 million in 1998 and has increased the year-round ambient nitrogen oxides by about one-third.

2.5 **Beijing's air quality improvement plan**, typical for Chinese cities, traditionally emphasized large investment projects to control pollution from industries and coal burning. Industries were given supports to install less-polluting production systems or end-of-pipe pollution treatment. To reduce pollution from scattered boilers, coal gas and district heating systems have been built. The Beijing Environmental Project, BEP I (Ln. 3415, Cr. 2312-CHA) implemented from 1992 to 1999 with Bank Group support, accordingly devoted most of the financing to industrial pollution reduction and district heating. The policy environment had shifted, however, as rapid economic growth and liberalization changed the valuation between the environment and production and between the government and the market. In addition, statistics such as those above have illuminated the limitations of point source control strategies. The primary focus of attention of the Beijing Municipal Government (BMG) for air pollution control has, therefore, shifted toward fuel conversion and strengthening of regulatory and pricing measures against pollution. BMG has invested heavily in natural gas supply infrastructure, strengthened emissions control, and closed an increasing number of polluting industries.

2.6 In October 1998, BMG started a major '**clean air' program** with State Council support, partly spurred by policy deliberation during preparation of this project. The major part of the program is to convert all small scattered coal boilers and burners within the urban area to cleaner fuel or into larger district heating boilers by 2003. A sulfur tax has been imposed and the use of low-sulfur coal is mandated. Another main part of the program strengthens controls of vehicle emissions, including the mandatory use of unleaded gasoline and catalytic converters in gasoline-powered light vehicles. Other measures include strengthened control of construction dust and programs to expand vegetation.

Water Pollution in Beijing

2.7 Due to the scarcity of water resources and heavy population pressure, water quality has traditionally been another major environmental issue for Beijing. The earlier emphasis was primarily on protection of upstream water, most of which is diverted for potable uses. On the other hand, less than one-third of the wastewater is treated. As a result, the city's natural streams receive a large volume of wastewater compared with little natural flows, and hence little capacity to dilute the pollutants. Downstream flows of the urban streams thus are not suitable for even the least critical economic use such as industrial cooling or irrigation. In addition, such pollution has degraded the city's groundwater sources, which supply 40% of water for the city, and which can be used only for less critical purposes such as industrial use. Since the main river, Haihe, which receives these streams has relatively small flows, these heavily polluted discharges cannot be fully diluted, threatening the irrigation downstream. The central government recently accorded one of the highest national priorities to reducing the critical pollution of the Hai River.

2.8 In view of these concerns BMG has recently begun a major expansion of wastewater and solid waste management capacities with bilateral financing. On-going and planned works are expected to almost quadruple the current sewage treatment capacity of about 560,000 m^3 per day. To put this expanded sewerage system on a sustainable financial and institutional footing, BMG is taking measures to increase tariffs and strengthen the institutional capacity and autonomy of the Beijing Drainage Company (BDC) established under BEP I.

3. Sector issues to be addressed by the project and strategic choices:

Air Pollution

3.1 BMG's new clean air program includes strong measures against the two main air pollution sources: scattered coal burning and vehicle emission. Vehicle emission will be controlled mostly with regulatory measures of BMG. The project would assist BMG for the other main part of the clean air program by supporting the conversion of coal-fired heating boilers to natural gas and by reducing the coal use in the remaining ones. The main traditional means of reducing pollution from coal have been smokestack controls and the consolidation of scattered coal boilers into large district heating boilers. While these will continue, their potential is limited. Most of the cost-effective measures to control point sources have already been implemented, and the feasibility of district heating is constrained by difficulties in the consolidation process and the availability and cost of large sites. Aside from the local and global environmental benefits, natural gas boilers have higher fuel efficiency and save on labor and land, which make them also a financially viable alternative to coal-fired ones of small or medium capacity. (See detailed analysis in Annex 4).

3.2 Fuel gas has been available in Beijing for some time, consisting mainly of coal-based town gas which proved to be problematic for both financial and environmental reasons. Natural gas was available in a small quantity (0.5 million m^3/day) enough for domestic cooking only. To expand the natural gas supply, the Beijing Gas Group Corporation (BGGC) has invested about $470 million for a new natural gas pipeline and $380 million for a distribution network in the city - the former in a joint venture with the China National Petroleum Corporation, and the latter partly financed by the Asia Development Bank (ADB). As a result over 2 million m^3/day of natural gas has been available in the city since 1998 but little of the additional capacity is being utilized, thus idling the large investments. To facilitate the conversion, in early 1998 BMG designated about 20% of the urban area as "Coal-Free Zones" (CFZ) where no coal-burning devices under 20 tph would be allowed after 1999. This program, reinforced with the new clean air program, resulted in the conversion of 600 out of 1556 medium-sized scattered boilers (1-10 tph) by the end of 1999. The clean air program and associated subsidies succeeded in converting most small stoves and boilers (less than 1 tph) in the entire city. However, this still leaves over 8,000 scattered medium-sized coal-fired heating boilers, which are responsible for about 63% of all sulfur dioxide and particulates during the heating season. Most of these medium-sized boilers are operated by various entities to heat their own office buildings and employee housing. Their conversion to natural gas would be the primary focus of the project; the supplementary aim is to increase the efficiency of all heating systems, including the remaining large coal boilers.

3.3 **Barriers to Coal to Gas Conversion.** The large infrastructure investments and strengthened environmental regulations by BMG provide the first necessary conditions for conversion from coal to gas. Being the first in China to attempt a massive fuel conversion, however, Beijing is facing barriers typical of introducing any new product: small and uncertain market size and newness of technology. These deter the suppliers from investing in production and distribution facilities, leading to high cost. On the demand side, the high cost and high uncertainty of the product discourage purchases especially as it involves large expenditures. In addition, various features of the economy in transition pose additional barriers, indicating

that the conversion would take even longer in China. When these are surmounted, natural gas heating will have a sustainable competitive position in the urban space heating market, and replication in China will be facilitated. Major barriers to conversion from coal to natural gas include the following:

(a) Small market and industry capacity. Until recently in China, natural gas was reserved mainly for industrial processes. Almost all gas burners are imported, including the few heating boilers. As a consequence, domestic manufacturing, assembly, distribution, installation, and services of natural gas boilers and ancillary equipment are limited, inefficient, and costly.

(b) Underdeveloped technical models and capacity. An aspect of the underdeveloped technological capacity is a lack of established technical practices to make the best use of natural gas. A review of several installed gas boilers indicates excessive capital, operation and maintenance expenses carried over from coal use practices. Also, most coal boilers are simply replaced one-to-one with gas boilers, without taking advantage of improved fuel efficiency and possible savings of land and transmission heat loss.

(c) Technical risk and information gap. Boiler conversion involves a major technological and behavioral transition from manual operation of simple mechanical boilers using stored coal to fully automated operation with invisible gas. Adequate knowledge of gas boilers is limited to only a small number specialists. As a result there is a widespread, exaggerated perception of the cost, risk, and technical complexities of natural gas heating. For example, many believe natural gas boilers pose significant risks of explosion, and few recognize the advantages of natural gas.

(d) High operating costs. The price of natural gas is up to three times as high as the coal price, as the latter does not reflect the full social cost of pollution. The imported parts and technical services are scarce and expensive. As heating services are generally paid for not by end-users themselves but by their employers, it is difficult to internalize the environmental benefits of gas boilers. The operating efficiencies of gas boilers are not yet fully exploited due to insufficient technical models and capacities.

(e) High capital costs and financing constraints. The current equipment and installation cost of gas boilers is about one-third higher than coal-fired ones in Beijing, whereas the reverse is generally true in developed markets. The gap is due partly to pollution control requirements for coal burning in other countries and to the small market and technical capacity for natural gas boilers in China. In the long-run, conversion can be financially justified with savings in operating costs and the gain from converting the land now occupied by boiler houses and coal yards. Few boiler owners, however, can access long-term financing from banks which are reluctant to lend for non-productive investments, or cash in on land savings in the short term.

3.4 Some of the issues such as fuel pricing and environmental regulations are being corrected under the new BMG regulations. Technical assistance, financed by the loan and grant under the proposed project, would provide an input toward improving these issues. Others are symptoms typical of a new product market lacking economies of scale and technological maturity. Without strong intervention, the barrier removal and market growth will be slow and incremental. In other countries, similar conversion took decades, usually with natural gas companies taking the lead to ease the barriers. In Beijing, numerous entities were involved in gas delivery with partial mandates and weak accountability. These were combined into a Beijing Gas Group Corporation (BGGC) in 1999 to improve efficiency and accountability, but still in its establishment phase, it is not in a position to devote full attention to the new, uncertain venture of

boiler conversion. BMG therefore entrusted the Beijing Comprehensive Investment Company (BCIC), a diversified company involved in various industrial and commercial joint ventures, with the lead in bringing about rapid boiler conversion. In turn, it has established Shihuan Jietian Energy Technology (SJET) as a limited company in partnership with BGGC and the Yuanshan Energy Management Company. The latter was established in 1996 with GEF and Bank support as a commercial venture to offer energy conservation services to industrial customers. SJET will utilize the Bank loan of $165 million to ease financing barriers for about one-third of the medium-sized boilers to be converted, and a GEF grant of $16.5 million to remove technical and information barriers. The expected result is a rapid scaling-up of the market and a significant reduction in the cost of gas boiler equipment and associated services – by about 30% in 6 years - which will benefit all conversions including those not financed directly under the project, and further in other cities of China.

3.5 Heating Energy Efficiency. BMG's new clean air program, including the massive fuel conversion, increases the relative importance of heating energy conservation. For the environment, the remaining coal-fired boilers and energy loss in the heat delivery systems represent a major remaining source of pollution. In the medium-term, many of the larger district heating houses and some of the scattered boilers in the city's periphery (outside the fourth Ring Road) will remain coal-fired. A survey of 457 district heating boilers in Beijing shows that they need about 38 kg of coal to heat a square meter of floor space on average, compared with the good practice standard of 26 kg/m^2 achieved even with some medium-sized boilers. These inefficiencies are due to inefficiencies in both the boilers and heat delivery systems even in these supposedly efficient systems. There is likely to be significant room for energy efficiency for all heating systems including the ones switching to gas or oil. For heat suppliers and users, the high cost of gas increases the incentive for conservation. The project would therefore include a GEF-supported component to step up energy conservation in heating.

3.6 Barriers to Energy Conservation. Progress in energy conservation has been slow especially in heating due mainly to the nature of the heating sector. In the cities of China heating has been generally provided as a social necessity with little financial reward. Further, typical boiler houses are too small to justify allocation of significant investment or highly trained manpower, although in aggregate the heating sector is the largest consumer of energy. As a result, energy conservation in the heating sector faces the following major barriers:

(a) Insufficient and scattered knowledge base. Because individual payoffs are small, there has been relatively little systematic research to import or develop heating energy conservation technologies. A few public agencies including the Ministry of Construction and BMG's Residential Heating Administration Office (RHAO) have been conducting some relevant research and promotional activities, but as these efforts are not part of their main mandate, they have been limited and sporadic.

(b) Lack of financial and human resources. Typical heating boilers get little more financial and human resources than needed for routine operation, rarely having high level technical resources and investment funds to carry out modifications.

(c) Difficulty in identifying and evaluating conservation options. As a natural result of weakness in both source and receiver of technical knowledge, there is insufficient readily available information on the range and details of conservation options. When they are available in the form of technical descriptions or actual examples, it is difficult to evaluate their technical and financial feasibility in specific situations.

(d) Risk. Without systematic information, the general perception is that many of the energy conservation measures will not, in practice, provide any significant financial benefits and instead will waste the scarce capital resources available to the heating supply entities.

(e) End user motivation. Heat is generally paid for on the basis of area heated, and residential heating charges are paid not by residents but by their employers. There is thus no incentive for the end-user to conserve energy. In addition, the single-pipe supply system used in most buildings does not allow individual temperature control. As a result, in more than 10% of apartments, excess heat is vented by opening windows during winter.

Wastewater Management

3.7 The Liangshui River catchment area in the southwestern part of Beijing is the most recently developed of the city's four major catchment areas, and partly as a result has relatively small coverage of sewers and no wastewater treatment. As a result the lower reaches of the Liangshui river system carry virtual sewage with the greatest pollution load among the four urban streams. Elsewhere in the city about 40% of the wastewater, or about 560,000 m^3/day, is currently treated. The capacity is expected to double soon with the completion of on-going works, treating nearly all wastewater in these areas. Next to be built is a 0.4 million m^3/day wastewater treatment plant (WWTP) in the Qing River sub-basin. The project will be financing the major trunk sewers in the Qing River catchment, bringing significan enviornmental improvement. Given that the Liangshui River system generates about 40% of the city's total estimated 2.3 million m^3/day of wastewater, however, the project's focus for wastewater management is to meet the major part of the area's sewerage needs with three new WWTPs with a total capacity of about 0.9 million m^3/day and associated sewers.

3.8 Institutional and Financial Issues. On-going and planned works, including those under the project, would about quadruple the current sewerage capacity, requiring a large expansion of the financial and institutional capacities to manage it. Beijing Drainage Company (BDC) was established under the recently completed BEP I, but its financial and institutional bases are not sufficient to fully discharge its current responsibilities, let alone the vastly expanded ones. Wastewater tariff revenues in 1999, although much increased over the last several years, fall short of operating expenditures, and they are given to BDC on an as needed basis. BDC also is limited to operation and maintenance of a limited range of storm and sanitary drainage. The current policy environment, however, encourages moves toward stronger financial and institutional autonomy. Under the broad governmental and enterprise reform initiatives of the state, the new BMG leadership has been reorganizing various public and quasi-public entities toward consolidation of fragmented functions, greater separation from the government, and increased financial and managerial autonomy and accountability. In addition, the central government has provided strong support to strengthen the finances and management of sewerage by promulgating a "Circular of the State Development Planning Commission, Ministry of Construction and the State Environmental Protection Administration on Strengthening the Collection of Wastewater Tariff and Establishing a Sound Operation Mechanism on the Discharge of Urban Wastewater and Central Treatment" in September 1999. The Circular stipulates, *inter alia*, that wastewater tariffs should be collected by water supply enterprises with the water tariff and transferred monthly to the wastewater management enterprises, strictly limiting exemptions; the tariff should cover all operations, maintenance, including depreciation, a reasonable margin of profits and if justified, investment costs; and that the tariff should replace various similar charges. It also stipulates that wastewater treatment entities shall adopt corporate-style management and independent accounting.

3.9 In keeping with these broad reform directions, BMG has recently increased wastewater tariffs from an average of 26 fen/m^3 to 41 fen/m^3. BDC's responsibility and staff have also been expanded during project preparation, transferring part of those that formerly belonged to the Beijing Municipal Engineering Bureau, the BDC's parent authority. This includes the responsibility for managing capital investment starting from those under the project. The project would support the institutional and technical strengthening of BDC required by the restructuring and expansion of its responsibilities, paying attention to aspects commonly overlooked in the pursuit for financial and institutional autonomy: building of technical capacity to manage the sewerage facilities efficiently, and building of an institutional framework to ensure adequate accountability.

C. Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

1.0 The project targets the two main pollution issues of Beijing - air pollution and wastewater. The principal air pollution control component would assist with converting scattered coal boilers to natural gas. A GEF-financed component (B) would support this as well as enhance the replicability and sustainability of the conversion by helping to develop the gas boiler market and technology. A second GEF-financed component (C) would complement the conversion by helping to improve the energy efficiency of overall heating systems. The main two wastewater management components would complete the trunk sewer network and provide secondary sewage treatment for the Liangshui River sub-basin. A third wastewater component would provide trunk interceptor sewers in the neighboring section of the Qing River sub-basin. The sewers will eventually discharge to a WWTP to be constructed under government and bilateral financing. The project also includes components to support institutional development for air quality and wastewater management. The components, their estimated costs, and financing are listed in the table below, followed by a brief description of the main features and goals of each component.

Component	Sector	Indicative Costs (US$M)	% of Total	Bank-financing (US$M)	% of Bank-financing
A. Boiler Conversion	Pollution Control / Waste Management	488.13	38.9	165.00	44.1
B.*Gas Boiler Market and Technology Development	Pollution Control / Waste Management	33.13	2.6	16.50	4.4
C.*Heating Energy Conservation	Pollution Control / Waste Management	13.62	1.1	8.50	2.3
D. Air Quality Monitoring and Decision Support	Institutional Development	3.88	0.3	3.30	0.9
E. Liangshui River Sewers	Sewerage	106.74	8.5	34.50	9.2
F. Liangshui River Wastewater Treatment Plants	Sewerage	231.00	18.4	116.65	31.2
G. Qing River Sewers	Sewerage	65.28	5.2	20.11	5.4

H. Beijing Drainage Company Development	Institutional Development	6.45	0.5	5.95	1.6
I. Land acquisition and resettlement	Resettlement	303.28	24.2	0.00	0.0
Total Project Costs		1251.51	99.7	370.51	99.1
Front-end fee		3.49	0.3	3.49	0.9
Total Financing Required		1255.00	100.0	374.00	100.0

* Amounts shown in the Bank financing column for components B and C are GEF grant amounts.

Air Pollution Control Components

1.1 **Boiler Conversion**. The project would assist BMG in carrying out its program of converting all small and medium-sized coal-fired boilers within the fourth Ring Road and Shijingshan District (Smoke-Control Area) by 2005. As discussed in Section B.3, speedy and efficient conversion from coal to gas requires (i) regulatory and pricing measures to internalize the environmental cost of coal, (ii) gas distribution infrastructure, and (iii) easing of financial and technical barriers to conversion at individual and market levels. With the Bank loan provided for Component A, SJET would import gas boilers and associated equipment and sell them to boiler owners on installments over a period of up to 18 years. Under the common configuration, imported equipment takes up about one-third of the total cost of conversion. The Bank loan of $165 million (net of front-end and commitment charges) would finance the equipment needed for converting 2000-2500 scattered coal-fired heating boilers of medium capacity (1-10 tph, 3.2 on average). These represent about one-third of medium-sized boilers that have access to natural gas within the Smoke-control area, and about two-thirds of those that are believed to require and afford installment financing. These include some 670 boilers owned by entities fully or partly funded by BMG or district government budgets. The rest would be sold by SJET at its own full risk. The eventual number of boilers financed under the project would depend upon the size mix of boilers, extent of equipment provided (from a full complement of heating equipment to just a natural gas burner core), and actual prices that are expected to decline during the project (see below C.3). In general, the market and the program are both too novel to design implementation with great certainty. Therefore, the major elements of the component would be evaluated and if necessary adjusted after about two full years of operation.

1.2 **Gas Boiler Market and Technology Development** (Global Component). Major market barriers to conversion to natural gas are largely those usually associated with any product introduction: small market size, weak infrastructure for sales and services, the resultant inefficiency, high cost of equipment and technology, information gap and high perceived risks. To ease these barriers, SJET would carry out the following activities:

Technology Development and Capacity Building Activities (using about $7.4 M of GEF grant)

- Introducing and developing efficient models of boiler configuration, installation, and operation, to increase efficiency. This will cover not only boilers but the broad heating system elements associated with gas boilers, in conjunction with the heating energy efficiency component;
- Introducing advanced technologies such as condensing boiler sections, zone and radiant heating systems;
- Monitoring and evaluation of converted boilers, to improve technical efficiency and information;
- Training and documentation to raise technical levels of boiler assemblers, technical service firms, and boiler operators to increase technical capacity and efficiency and to reduce technical risks and costs; and

- Advisory services to assist with the design and installation of boiler conversion and trouble-shooting during operation, to reduce costs and the negative public perception, and to provide on-the-job technical training.

Market Development and Demonstration Activities *(*using about $9.1 M of GEF grant)

- Arranging cooperative procurement to lower costs, through demand surveys, order aggregation and assistance for procurement packaging;
- Disseminating information to boiler owners, operators and the general public, and individual conversion pre-feasibility analyses, to develop technical and marketing capacity, and to reduce information gap and capital costs; and
- Developing standard configurations and piloting installation of dispersed heating supply systems with gas boilers for individual buildings and even apartment units, that allow land savings and individual control of heating made possible by conversion to gas.
- Installing and monitoring model gas boilers replacing at least 45 coal-fired boilers (the number of the gas boilers could be larger if smaller, distributed gas boilers replace a given size coal boilers - see Annex 2) around the city in various size categories, types (steam and water) and locations, for training and demonstration purposes to strengthen technical capacity and reduce the technical risk and information gap.

1.3 **Heating Energy Conservation (Global Component).** Taking advantage of opportunities created by the boiler conversion program, a newly established Heating Energy Conservation Center (HECC) would carry out the following activities for sustained energy efficiency improvements in the heating systems as a whole, including the remaining large coal-fired boilers:

- Development of a heating energy efficiency promotion system consisting of HECC, a network of specialists and contractors, and a long-term program of best practice development and promotion;
- Development and dissemination of best practice models for heat delivery systems covering elements from boilers to end-users, for coal-fired boilers, and to a limited extent, oil- and gas-fired boilers, for insulation and other broad heating energy conservation measures;
- Energy auditing of heating system chains and providing advice on appropriate energy conservation options;
- Assistance to motivated heat suppliers to prepare technical and financing plans for energy conservation investments;
- Assistance for implementation of selected heating energy conservation measures that will be used for demonstration purposes around the city;
- Pilot installation and evaluation of individual heat metering and control, to establish policies to ensure end-user motivation for conservation;
- Pilot retrofit of selected buildings for heat control and metering and for improved insulation, for experimentation and policy evaluation; and
- Studies and training to improve the data base and policy and institutional frameworks of incentives and regulations to facilitate the use of cleaner energy, energy conservation, and environmental management, supplementing the air quality management support component described below.

1.4 **Air Quality Monitoring and Decision Support.** To assist in improving BMG's ability to acquire, analyze, and use information on air quality and pollution sources for timely policy and planning purposes, the project would support BEPB's procurement of various types of equipment and software for monitoring, analysis, simulation, and evaluation as well as training of policy-makers and its own staff and related

agencies (transportation, health, and planning departments). This will be carried out in conjunction with the energy and environment study carried out under the Global component C.

Wastewater Management Components

1.5 **Liangshui River Sewers.** BDC will construct approximately 48 km of trunk sewers to intercept sanitary sewage now discharging to watercourses in the Liangshui River watershed. These include Xingkai Ditch trunk interceptor sewer, Liangshui River Southern Bank trunk interceptor sewers, Fengcao River trunk interceptor sewer, the Songjiazhuang trunk interceptor sewer and trunk sewers related to the Wujiacun, Lugouqiao and Xiaohongmen wastewater treatment plants (WWTP).

1.6 **Liangshui River Sewage Treatment.** This component includes three secondary WWTPs treating sewage intercepted by the trunk sewers described above: (a) the Wujiacun WWTP, with a capacity of 80,000 m^3/day; (b) the Lugouqiao WWTP, with a capacity of 200,000 m^3/day; and (c) the Xiaohongmen WWTP with a capacity of 600,000 m^3/day.

1.7 **Qing River Sewers.** This component includes construction of about 26 km of trunk interceptor sewers along the northern bank of the Qing River, trunk sewers along the eastern bank of the Xiaoyue River, the Dangxiaodong trunk sewer, trunk interceptor sewer downstream of Wangquan River, and trunk interceptor sewers along the planned Tuchenbei and Chengfu Roads. The Qing River WWTP which will eventually treat wastewater conveyed by the Qing River trunk sewers will be constructed in the future with government and bilateral funding outside of the project.

1.8 **Beijing Drainage Company Institutional Development.** The Beijing Drainage Company (BDC) will undertake a comprehensive institutional development program through policy actions, technical assistance and training to improve its technical and managerial capacity to execute and maintain capital works. A set of equipment for improved maintenance operations will be procured. These will enable BDC to become an autonomous, self-financing entity responsible for planning, construction, financing and operation of the drainage, sewerage, and sewage treatment systems of Beijing.

2. Key policy and institutional reforms supported by the project:

2.1 For air quality management, the project's main institutional focus is on developing the market basis for and technical capacity of commercial entities to support expanding, sustained, and efficient use of natural gas and expanded and sustained heating energy conservation. Accordingly, SJET and HECC would maintain only small staffs of their own and carry out most of the project activities through local consultants and contractors. After the project, HECC would continue as the currently lacking institutional focus for policy-setting, promotion, and information dissemination. SJET would retain up to 20 technical experts under its direct employment during peak project implementation, but would wind down most of the technical operation as the project comes to the close. The technical specialists are expected to join commercial consulting or service firms and utilize the skills learned on the job. After project completion, SJET would maintain a small staff to manage the continuing inflow of installment payments. It is also expected to continue as an importer and distributor of heating and energy equipment in Beijing and elsewhere in China on a competitive basis.

2.2 To a limited extent, the project would also contribute to improvements in policy and regulatory frameworks to complement the market-oriented activities. A study to be financed by GEF would review the incentives and structure of energy and heating markets, regarding both the suppliers and users, to provide an analytical basis for the municipal planning of energy supply and pricing, and for the continuing reform

of the energy and heating markets. The study would also review the implications of the changing energy use to the air quality and its regulation and help the establishment of BMG's air quality management framework. This would supplement the strengthening of air quality monitoring and decision support systems improvement component financed with the Bank loan. The pilot installation and evaluation of heat metering is also included to introduce market-based management of energy demand.

2.3 For wastewater management, the project pursues a more traditional set of institutional development goals and strategies, except that it takes an incremental step beyond what has now been established as the norm in China, building on the achievements under BEP I and the strong reform orientation of BMG and BDC leadership. BMG has committed to key steps to bring about full financial and managerial autonomy of BDC, establishing a new corporate structure for BDC with autonomous Boards of Directors and Supervisors, transferring authority to BDC to retain and manage all tariff revenues, and transferring all sewerage and drainage assets to BDC by the end of 2001. These reform efforts would be guided by a policy-level Leading Group chaired by a vice mayor. Technical assistance, training, and equipment provided under the project would assist with detailing the actions necessary for the reform steps, as well as helping to ensure competent execution of the project and operation of vastly increased sewerage facilities. BMG has also raised tariffs and agreed to allow further increases as needed to cover full costs including depreciation or debt service, whichever is larger.

3. Benefits and target population:

Air Quality Improvement

3.1 At current prices and common boiler configurations, the Bank loan allocated for boiler conversion is estimated to be able to cover about 1900 boilers. However, organized cooperative procurement of this magnitude and market and technical efficiency improvements achieved with the GEF financing are expected to result in considerable reduction in the price of the equipment and technical services. The project target of 2175 boilers assumes a reduction of these costs by 30% in real terms over the project period. That would bring these prices roughly in line with those in the international market, but no change in other locally produced goods. These market development benefits would be shared by others, around 4000 boilers to be converted in Beijing which will not be directly financed under the project, as well as future buyers of gas boilers in Beijing and elsewhere in China.

3.2 With project assistance, a total of about 6000 medium-sized heating boilers, with an average capacity of about 3.2 tph, are projected to be converted to natural gas within the Smoke-free area by 2005, as well as a small number of industrial and district heating boilers. In areas where natural gas is not available, some 1500 similar boilers are expected to be converted to oil or coal gas. In addition, the conversion of all small stoves and boilers to various clean fuels, started in the winter of 1998-99 with BMG directives and subsidies, is expected to be fully completed by 2001. The combined effects of these are the reduction of nearly 7 million tons of coal used per year and about 1.7 million tons of carbon dioxide emission per year, for significant global environmental benefits. Reductions in ambient air pollutants during the heating season include: about 60% of sulfur dioxide, about 30% of carbon monoxide and nitrogen oxides, and by inference, ultrafine particles. The resulting air quality would meet Class III standards during the heating season in the urban area of Beijing. Around 20% of these reductions would be directly attributable to the boiler conversion and energy conservation under the project. With the expected significant reduction in vehicle emissions resulting from the other part of BMG's clean air program, the year-round air quality is expected to be close to the Class II standards for healthy urban air. This would bring enormous health benefits to all residents of the urban area of Beijing where an estimate 5.3 million people are now exposed to air quality worse than Class III for over 60 days during the heating season.

Wastewater Management.

3.3 The project would provide wastewater collection and treatment to the entire Liangshui River sub-basin and a part of Qing River sub-basin that together account for nearly half of all wastewater discharges in the Beijing urban area. This would improve the surface and ground water quality and make the surface stream water available for irrigation in the city as well as downstream. These investments will provide significant benefits to residents of the basins and more generally to the entire Beijing urban area, through the reduction of health hazards from potential exposure to discharges of untreated sewage to open watercourses and improvement of environmental conditions due to improved surface water quality. The estimated populations of the Qing River and Liangshui River catchments are currently about 0.9 million and 2.3 million, respectively.

3.4 In the Liangshui River basin the trunk interceptor sewers and three major WWTPs will intercept and treat to China national discharge standards, the untreated sewage now being discharged directly to the watercourses of the basin, and currently being used for irrigation on agricultural lands south of the urban area. The facilities will result in significant (about 76%) reductions in surface water pollution levels, and a 72% reduction in the quantities of untreated sewage infiltrating to groundwater underlying the basin. The loadings of hardness, nitrate-nitrogen, total dissolved solids and sulfates on the groundwater will be reduced on average about 50%, 40%, 40 % and 35 %, respectively, resulting in improvement of groundwater quality.

3.5 The construction of the trunk interceptor sewers in the Qing River basin is an essential part of BDC's overall program to improve water quality in the basin. These facilities alone will significantly reduce the current pollution of watercourses throughout the basin which are now receiving untreated wastewater directly at many locations and conveying it downstream. Following secondary treatment at the Qing River WWTP, to be constructed in future outside this project, effluent will meet the applicable National surface water discharge standards. Long term benefits will accrue downstream of the WWTP in the form of improved quality of water used for irrigation.

4. Institutional and implementation arrangements:

4.1 Agencies primarily responsible for preparation and implementation of individual project components are listed in Table C.2 below. The overall project would be coordinated by the Beijing Environmental Project Office (BEPO) headed by the Executive Vice Director of the Beijing Municipal Development Planning Commission. Policy guidance and support would be provided by the Project Leading Group, chaired by the Executive Vice Mayor of BMG and including two Vice Mayors, Directors of BEPB, Construction Commission, and BEPO, and Vice Directors of Beijing Finance Bureau and Municipal Administration Commission. This in turn will be guided by the municipal leading group for environmental improvement, headed by the Mayor.

Table C.2 Agencies Responsible for Project Preparation and Implementation

Project Component	Implementing Agency
A. Boiler conversion	Shihuan Jietian Energy Technology Corp., Ltd. (SJET), working with the Beijing Gas Group Corporation, District Governments, and Beijing Environmental Protection Bureau
B. Gas boiler market and technology development	SJET, in cooperation with Heating Energy Conservation Center

C. Heating energy conservation	Heating Energy Conservation Center under the Residential Heating Administration Office, working with SJET on tasks involving gas boilers
D. Air quality monitoring and decision support	Beijing Environmental Protection Bureau in coordination with relevant research institutes
E-I. All wastewater management components	Beijing Drainage Company, assisted by Beijing Municipal Engineering Corporation

4.2 Boiler Conversion. Eight district governments (DG) had been given the primary administrative responsibility to assist and ensure conversion of coal-fired boilers and stoves under BMG's overall fuel conversion programs, coordinating with BEPB and BGGC for the necessary regulatory and technical support. These responsibilities will continue, even though the further financial and technical assistance available under the project would be provided through the newly established SJET on a commercial basis. To overcome the barriers to conversion and hence its sales volume, SJET will work with these agencies in identifying and assisting the buyers of its natural gas boilers. Although SJET would manage the operation as an autonomous enterprise, its pricing and installment terms would be subject to agreement with BMG in return for the concession for utilizing the Bank loan and for supplying boilers for units belonging to BMG and DG. The initial terms of the boiler sales would include the following:

- Price: including a mark-up of 2% of the manufacturer's price for the first 1,000 buyers (expected by 2002), 5% for others;
- Down payment additional 5.5% of the boiler price paid on signing the sales contract, which will be before SJET signs contract with boiler suppliers;
- Financing charge: the same rate as the World Bank loan for BMG and DG units; the same plus up to 2% per annum for others depending upon SJET's credit evaluation;
- Installment: in equal installments over a period, at the buyer's choice up to one year less than the remaining maturity of the Bank loan (in practice 12-18 years depending upon the year of sales) in the case of BMG and DG units; up to 12 years for others as agreed between buyer and SJET. There would normally be no grace period, unless SJET specifically agrees as an exception and at a charge; and
- Security: BMG guaranty for units fully funded under BMG budget; real estate or other assets required as collateral in addition to or in lieu of third party guarantees for others.

4.3 These terms are set to provide incentives for SJET to maximize the volume and speed of conversion while minimizing its expenses and collection losses. The installment payment would be added to the natural gas bill and collected by BGGC and transferred within a month of receipt to SJET. The arrears on the gas bills have been about 10% in the recent past, but this may well go up as the usage expands beyond the early, more affluent converters. SJET therefore would need to take careful measures to secure its receivables. Major criteria for appraisal of the buyer's credit would be the current liquidity and heating expenses, as well as the quality of collateral and guarantees. The current estimation is that there are about 350 boilers that belong directly to BMG units, and another 350 owned by DG units or those partly funded by BMG or DG, such as hospitals and research institutions. The former present little credit risk as BMG guarantee can be enforced at the point of SJET's repayment of the Bank loan. Others present a higher risk as guarantees can be difficult to enforce in the case arrears or default. Collateral would be therefore required from these units even with BMG or DG guarantees. SJET may refuse to provide the gas boiler even for these government units, as well as non-governmental buyers, if it is not satisfied with the credit security.

4.4 In practice, however, the more serious risk would be a lack of sufficient demand, given the barriers discussed in Section B.3, the burden of large counterpart financing (about two-thirds of the total cost), and

the cost of the Bank loan which is, on simple comparison, higher than domestic commercial loans though it provides much longer maturities. Therefore SJET is encouraged by the incentives built in the pricing structure as well as BMG to adopt an aggressive rather than cautious sales strategy. Market development measures financed by GEF would aid in promoting the market demand. In order to encourage conversion during the early years when the market barriers would remain especially strong, BMG would provide counterpart financing resources for its own units to convert within the first two years. For others, BMG would make available to needy boiler owners about Y 32 million for subsidies that would decline from Y 150,000 for conversion in 2000 to Y 50,000 in 2002, and none thereafter. Financial analyses (Annex 5) show that the above terms would provide room for up to 5% in collection losses. After two years' experience these implementing arrangements would be reviewed and adjusted as necessary with a view to balancing BMG's objective of maximizing conversion and SJET's interest in maximizing profit. SJET would be allowed to enter into other businesses as long as they are strictly separated for accounting purposes and not in conflict with the operations supported by the Bank and GEF.

4.5 Global Components. SJET will manage the GEF-financed component (B) under a separate account on a cost-reimbursement basis, except that the administrative overheads will be absorbed in the main account, to be recovered through the sales margin on the Bank-financed boilers. GEF-financed component C would be the only operation of HECC during the project period. These components involve large amounts of free technical assistance for boiler owners, operators, and technical specialists by consultants hired by SJET and HECC. The assistance would be limited to promoting conversion and conservation and building relevant technical capacity. For example, assistance provided to boiler owners interested in conversion or conservation investments would include initial evaluation, identification of available options and sources of further technical assistance. Further technical services would be independently obtained and paid for by the beneficiaries. For a small number of demonstration installations, GEF financing would be applied to a greater extent, including full technical design services and core equipment, but in general they would still be not more than one-third of the total cost.

4.6 Wastewater Management Components. All wastewater management components would be managed under BDC's responsibility, except for the restructuring of BDC itself, for which the BMG Leading Group for BDC restructuring would retain policy decision authority. Accordingly, one of three consulting teams that deals with BDC's institutional structure and accountability would report to the Leading Group. The Beijing Municipal Engineering Bureau, now reconstituted as Beijing Municipal Engineering Corporation, carried out the sewerage component under BEP I, and has led the preparation of the sewerage works components until it changed its status as agent and advisor to BDC in this matter in 1999. It would continue to serve in this capacity. Financing sources of the wastewater components would be broadly distributed: $179 M from the Bank, $182.5 M from domestic banks, BDC internal funds $155 M, central government $154 M, and BMG $150 M.

4.7 Onlending and Disbursement. A Bank loan of $349 M and a GEF grant of $25 M will be made to the Government of China. The terms of the Bank loan would include a maturity of 20 years including 5 years' grace, the standard interest rate for variable spread US dollar single currency loans, and standard front-end fees and commitment charges. GOC would pass on the loan proceeds to the Beijing Municipal Government on the same terms and conditions, and the grant to BMG free of any charge, commission or fees. BMG will onlend $166.7 M of the loan to SJET and $179 M to BDC, both on the same terms and conditions. SJET would also receive $16.5 M from the GEF grant proceeds free of any charge, commission, or fees. The remainder, $8.5 M of GEF grant and $3.3 M of the loan will be made available to BMG's own units, HECC and BEPB, for project components C and D, respectively. The loan and grant proceeds would be disbursed according to the traditional procedures, through two Special Accounts managed by BEPO, with an authorization of $18 M and $2 M respectively for Bank loan and GEF grant.

Details are described in Annex 6.

4.8 Monitoring, Reporting and Mid-term Review. Implementing agencies would prepare semiannual progress reports summarizing the implementation progress and financial expenditures by component, details of resettlement actions and revisions to the RAP, measurements of monitoring indicators, and other information requested by the Bank. The reports will be consolidated by BEPO and submitted to the Bank by February 15, 2001 and every six months thereafter. The progress report due on August 15, 2002 would contain in-depth information and evaluation of the implementation experience up to then. This would be used for a thorough mid-term review by the end of 2002 to determine the need and nature of adjustments to the project implementation plan. The focus of the mid-term review and adjustment would be: (i) the pace and risks of boiler conversion, (ii) effectiveness of GEF-financed components, and (iii) a comparison of projected and actual wastewater generation. The project is scheduled to be completed by June 30, 2006 and the loan and grant accounts to close on December 31, 2006.

D. Project Rationale

1. Project alternatives considered and reasons for rejection:

1.1 BMG's initial proposal would have devoted the major part of the project to a large solid waste incinerator. This was rejected as it was at best premature and the solid waste issues in general are far less serious an environmental risk as air pollution or wastewater. Similarly a proposed improvement in a water supply channel was excluded in the interest of limiting the project scope and in view of the little value-added by the Bank.

1.2 For air pollution control, a large part of the initial proposal consisted of various industrial renovations that would reduce pollution. This was rejected in view of the primarily commercial nature of the proposed investments and the bad repayment record of past industrial subloans. One proposed industrial component that has remained under consideration would have supported a reduction of air and water pollution from the Coking plant of the Capital Iron and Steel Corporation, the city's noted polluter. This proposal was rejected, however, as the Corporation was not prepared to provide satisfactory assurance regarding the financial obligation as well as a company-wide environmental improvement program.

1.3 Another air pollution control initiative considered was pilot conversion of motor vehicles to use liquefied petroleum gas. This proposal was, however, was largely preempted by BMG's new regulation requiring three-way catalytic converters on all small passenger vehicles, which would control vehicle emissions to levels little different from LPG-fueled cars. A more promising avenue for air pollution control is the program to expand the use of low sulfur coal, which BMG started recently. The Bank's potential contribution, however, would be limited and its global benefits are minimal.

1.4 For fuel conversion, conversion of specific industrial boilers was rejected in view of the issues of industrial financing discussed above as well as the dominant environmental importance of scattered heating boilers. The first main alternative evaluated carefully for conversion of the scattered heating boilers was to use the existing network of financial institutions and boiler dealers. This was, however, considered insufficient to overcome the multitude of barriers to conversion existing at this early stage of the gas boiler market and technology and support the pace of conversion BMG wished. Individually, their interest or accountability would have been weak without a focal point to generate and aggregate sufficient demand and provide the necessary technical and institutional support. Given the difficulty of BGGC to exercise such a

leadership as it goes through difficult corporate transition itself, SJET was established to act as the focal agency to develop the technology and the market.

1.5 For wastewater management, the Qing River and Liangshui River catchment areas have been chosen for the project, over an initial proposal to support more scattered sewerage works. This approach was adopted because of the existing and expanding trunk interceptor and treatment facilities capacity in other major catchment areas of Beijing compared with the complete lack of such major critical facilities in these areas --as well as the opportunity to markedly improve wastewater management on a catchment-wide basis. Representing about 50% of the existing Beijing urban area and more than half of Beijing's population, the Qing River and Liangshui River catchments are clearly priorities for implementation.

1.6 For wastewater treatment in the Liangshui River catchment, five WWTPs were originally considered. An analysis, however, showed that Xiaohongmen WWTP could be enlarged to accommodate sewage flows that would have been directed to two other proposed WWTPs, at Zhengwangfen and Nanyuan, avoiding the high resettlement and land acquisition costs. The Xiaohongmen WWTP, that would have 600,000 m^3/day capacity, can be expanded further to 900,000 m^3/day. Before 2010, however, the necessity of a WWTP at Zhengwanfen would have to be re-evaluated.

1.7 At Wujacun WWTP, the original proposal was to build a smaller, tertiary treatment facility (40,000 m^3/day). Analysis during project preparation showed, however, that the larger sewage flow was likely to materialize sooner than originally projected, and that secondary effluent would be close enough to the discharge standard, that the trade-off between the capacity and treatment level should be made in favor of capacity.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned).

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
Bank-financed			
District Heating, Industrial Pollution Control, Wastewater and Solid Waste Management	Beijing Environmental Project (completed 1999)	S	S
Energy conservation	China Energy Conservation Project (Bank/GEF financing, ongoing)	S	S
Energy Conservation	Efficient Industrial Boilers (with GEF, ongoing)	S	S
Other development agencies			
District Heating; Natural Gas distribution; Wastewater	Beijing Environment Project (Asian Development Bank, ongoing)		
Industrial energy conservation	Energy Conservation in Township and Village Enterprises (UNDP with GEF financing, ongoing)		

Energy conservation	High Efficiency Refrigerator (UNDP with GEF financing, ongoing)		

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

GEF Energy Efficiency Programs for China. The overall GEF program to assist China to reduce GHG emissions through energy conservation seeks to alleviate the barriers to energy conservation by helping to: (a) improve access to relevant information, (b) facilitate the transfer of advanced technology, especially for the production of high efficiency equipment, (c) decrease the costs of adoption of energy efficiency measures, and (d) develop institutions that can more effectively spur energy conservation under the market economy. The program is currently supporting two UNDP-implemented technical assistance projects (the approved Energy Conservation in Township and Village Enterprises Project, and the High Efficiency Refrigerator Project) and two Bank-implemented investment projects (the approved Efficient Industrial Boilers Project, the Energy Conservation Project). The two UNDP-implemented projects target subsectors not directly relevant to the urban heat supply.

The Efficient Industrial Boilers Project, supporting the technology transfer for manufacturing of efficient coal boilers, would indirectly help improve efficiency of coal-fired district heating boilers. The Energy Conservation Project supports energy management companies in order to develop market-based energy conservation services. The current project complements these projects with the focus on urban heating and fuel conversion which are closely related but lie largely outside the scope of these projects. It also draws upon technology and capacity built under these projects, such as the diagnosis made of coal-fired boilers and the market for energy and energy conservation. Involvement of the Beijing Yuanshan Energy Management Company as a minority shareholder of SJET is an attempt to benefit from the energy market skills built under the project.

3. Lessons learned and reflected in the project design:

3.1 Difficulties in utilizing the natural gas distribution mains point to a serious blind spot in BMG's planning system in transition: the assumption that end-users, financial institutions and suppliers would carry out their part to complete the fuel conversion program. The failure of this assumption, risking serious under-utilization of the large investments, prompted BMG to accept the Bank's offer of assistance to finance and promote end-user conversion. On the other hand, experiences with industrial pollution control subloans, financed under BEP I as well as other projects, have confirmed problems associated with industrial lending outside the normal market mechanism in general. Most of the subprojects resulted in significant pollution reduction. However, the promise of high financial returns, which motivated most of the subprojects, failed to materialize for many borrowers due to market or management weaknesses, casting doubt on the viability of any investment in such borrowers. Even where the financial returns are positive, subloan repayment has been poor due mainly to the lack of accountability on the part of the financial agent and the government. This lesson highlights the need for clear accountability and commercial incentives for market entities, and the indispensability of regulatory enforcement. These lessons have been reflected in the project design which features substantial risks and incentives for SJET, working in conjunction with municipal and district regulations to discourage coal burning.

3.2 An insight gained during the implementation of BEP I was the apparent limitation to scale economies in large-scale central heating systems, although this needs to be confirmed by a systematic study. Large boilers hold higher efficiency in heating generation due to combustion efficiency and labor savings, as well as in emission control. Nevertheless, unit cost of heating by the wide-area system has turned out to be higher than smaller local district heating, with about 20-50 tph, by about 20%. In other words, there appears to be an optimal scale of district heating far below the large integrated system of Beijing that supplies heat to around 2 million m2. One aspect of the inefficiency appears to be the heat losses during the long distance transmission. Another high cost factor is the high cost of capital investments and maintenance that appears to offset the efficiency gains in operation, at least for the system used for less than half of the year. Further limiting the efficiency are the institutional and incentive problems associated with a large public monopoly. This lesson has resulted in reduced emphasis on the city-wide district heating system by BMG. The benefits and costs of various central heating systems would be a part of the study on energy and environment, proposed under the project.

3.3 The Beijing District Heating Company which operates the wide-area heating has continued to introduce various mechanical measures to increase the combustion efficiency as well as automatic systems for improved monitoring and optimization of heat generation. As the efficiency of large boilers is high, however, these efforts have had a relatively marginal effects. While inefficiencies in heat distribution was recognized, little efforts were directed in this direction mainly due to the difficulty of having to deal with a large number of end-users. Smaller heating facilities are operated either by entities for their own use or by commercial heat providers that charge regulated heat tariffs. These heating facilities have considerably less efficient coal boilers compared with the wide-area heating, but little conservation efforts have been made due to a lack of investment and technical resources available to these small facilities. In all of these cases, one of the most important inefficiency factors is the lack of end-user motivation and control, given the flat heating prices and the old heating supply network that does not allow individual control of heat. A pilot program to introduce end-user control and metering of heat was added to BEP I toward the end of its implementation, but the result is not yet available. The heating energy conservation component under the proposed project would, in light of these experiences, focus on assisting smaller scale heating facilities on overall heating system efficiencies, including heat end-use, by augmenting technical resources and examples available to the smaller heat providers and end-users.

3.4 The most important lessons learned under many wastewater projects around the world have been that coordination of different parts of the system, between trunk sewers and secondary sewers and between collection and treatment, determine the efficacy of the investment and the institutional and financial frameworks determine the sustainability. The wastewater management component of the project incorporates these lessons by integration of wastewater collection and treatment, and by comprehensive and substantial financial and institutional development programs.

4. Indications of borrower commitment and ownership:

4.1 The proposed project represents an unusually strong convergence of the city's critical needs, the government's strategy, and the Bank’s interest and ability to assist. The proposed components are measures that have been at various stages of planning or implementation by BMG on its own. Decisions to take the large steps such as broad conversion of boilers have been difficult to reach due to the magnitude of the difficulties and fragmented responsibilities of various line agencies. The new senior leadership of BMG has, however, provided an unambiguous policy direction to commit BMG to these components and further, elevated them as the major priority of the city and the nation. The national government has committed Yuan 6 billion to support these initiatives.

4.2 BMG's air pollution control programs have been announced as a series of measures in the winter of 1998-99, and are being carried out. Noticeable actions taken so far include: enforcing the requirements for catalytic converters for passenger vehicles and banning those that cannot be retrofitted, regulatory orders and partial subsidies to convert small stoves and tea and bath boilers to clean fuels, allocation of counterpart funds for its own units to convert heating boilers, and enforcement of a ban on open burning within the Smoke Control Area. As a result of these actions, the air quality of Beijing has significantly improved already, especially during non-heating seasons. BMG has also started to publish daily summary air quality reports.

4.3 BMG raised its domestic and industrial wastewater tariffs in 1999 to levels sufficient to cover existing operations and maintenance costs and depreciation of fixed assets on its sewerage operations (although its drainage operations are still under-financed). As early as three years ago, domestic consumers were not charged a wastewater tariff, but as of July 1999, domestic consumers pay Y0.30/m^3 of water consumed. Industrial consumers, three years ago paid Y0.30/m^3 on 80% of water consumed, but since October 1999, industrial consumers have been paying Y0.50/m^3 of water consumed. Part of the revenues generated from these increased tariffs will be used as BDC's internal cash contribution to the new project investments, and should provide financing for about 20% of total wastewater investments during the project implementation period.

4.4 BMG taken the opportunity presented by a general reorganization to restructure the oversight and management of the wastewater sector. In the past, the Beijing Municipal Engineering Bureau controlled the construction of wastewater assets, oversaw operations and maintenance of the sewage networks, and planned new investments for the sector. Currently, BDC reports directly to the Beijing Municipal Administration Commission on all these aspects and is expected to enter a contractual relationship with BMEB (now BMEC) for the repair and maintenance of its sewage network. A high level leading group, headed by the Vice Mayor of Beijing, is being established to ensure that reforms within the sector, including raising tariffs, are carried out. Internally, BDC has reformed its organization, adding needed departments, and strengthening its management and technical staff.

5. Value added of Bank support in this project:

5.1 During project identification the Bank has played a catalytic role for the BMG leadership to establish clear priorities and commit to major steps to improve its air and water quality, which has resulted in city-wide programs that go much beyond the project. Analyses and discussions during project preparation assisted in developing more effective implementation arrangements, advances in institutional structuring, and generation and adoption of more efficient technical alternatives discussed above. These contributions are expected to continue during implementation, especially as the boiler conversion program is only at the start of an experimentation, and the institutional development of BDC would benefit from the related experiences around the world.

5.2 For boiler conversion component, the Bank would provide the critically needed financing that commercial banks and suppliers have not been willing at this stage to extend due to unfamiliarity with the technology and with the borrowers. The financing would also allow aggregation of demand at significant scales to afford economies of scale that is lacking at this stage. The GEF support associated with boiler conversion would serve as a public investment in the market and technology infrastructure for Beijing as well as China, that individual companies or even a city would be reluctant to make. GEF support for energy efficiency and conservation for the heating systems and remaining coal heating boilers complements the conversion program. While an active product market and financing may eventually develop without Bank support, the process would be long and wasteful. The technical and market frameworks as well as

the enlarged installed base of boilers would encourage broad participation of market entities.

5.3 For wastewater management in the Qing and Liangshui River systems, the Bank financing allows coordinated construction of related facilities in an integrated fashion. A more piecemeal approach may result in underutilized facilities, such as the case where WWTPs are constructed without sufficient complementary investment in the sewage collection systems. Further, the Bank's involvement would help establish technical, financial, and institutional frameworks necessary for sustained operation and expansion of the wastewater management system. The Bank has had extensive and successful experience in wastewater management elsewhere in China and this experience is being applied in this project.

E. Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (see Annex 4):

● Cost benefit NPV=US$4 million; ERR = 12.1 % (see Annex 4)
○ Cost effectiveness
○ Other (specify)

1.1 The project's singular aim is environmental improvement, whose global and social benefits are broadly recognized but not easily quantified. Our analysis, however, provides an interesting indication of the types and magnitude of financial and economic benefits that is useful in designing the project. The following Table lists approximate magnitudes of the main project benefits and costs:

Table E.1 Project Benefit and Cost Streams, 2000-2030
(Present Value in $ million, 2000 prices, discounted at 12% per year)

	Yuan Million	$ Million
Boiler Conversion		
Operation and Maintenance Cost savings:	1384	167
Land Savings	654	79
Medical Cost Savings:	439	53
Additional Capital Cost:	-1412	-171
Net Total	1064	129
Economic Internal Rate of Return	19.8%	
Sewerage		
Contingent Valuation	1876	227
Groundwater for Industries	235	28
Agricultural benefit, Beijing	259	31
Agricultural benefit, Tianjin	1028	124
Investments, including connections	-3814	-461
Operation and Maintenance	- 616	- 74
Net Total	- 1032	125
Economic Internal Rate of Return	8.7%	

1.2 In the case of wastewater management investments, the internal rate of return, about 8.7% per year, is lower than the standard discount rate and hence the net present value is negative. It does not include any direct measure of health benefits that are recognized as one of the most important benefits of

wastewater management. Such benefits are likely to be captured at least partly in the contingent valuation inferred of the residents of the Liangshui and Qing River catchment areas, which is estimated to provide the major share of benefits. It is followed with improved agricultural production and savings for industrial ground water resources. If per capita contingent valuation is assumed to increase by 7% a year, as has the per capita income during the last two decades, instead of 3.5% we assumed, the rate of return would match the 12% threshold. Such a break-even point can also be reached if industrial and residential water use benefits, not estimated here, are assumed to be the same as agricultural benefits. Both, or at least the latter, appears to be a plausible assumption.

1.3 The boiler conversion shows a substantially positive net present value of some $48 million largely thanks to the operating cost savings of the natural gas boilers which more than offset their higher capital cost. The operating efficiency of gas boilers is partly due to the nature of the fuel, but on this account, the natural gas is still far more expensive than coal, even after factoring in the municipal requirement of sulfur tax and of the more expensive cleaner coal. The most important efficiency gain comes from savings in labor cost. As wages rise fast along with economic development of Beijing, the comparison turns more favorable to natural gas boilers. Another substantial financial and economic gain from the boiler conversion is the savings in land by the elimination of coal yards - about 500 m2 per average boiler. There are further efficiency advantages of gas boilers, but the above appear sufficient to offset the higher capital cost of gas boilers. In addition, the well-known health benefits of reduced air pollution is also substantial though not as dominant as commonly thought.

1.4 Details of the analysis is provided in Annex 4. The analysis in general does not include estimates of benefits that are highly indirect and conjectural, such as those from institutional development components, the energy conservation promotion, demonstration and market development effects of the boiler conversion. The relative costs of carbon abatement are evaluated separately in Annex 11, comparing the costs of the coal-to-gas conversion compared with that of an alternative strategy focusing on district heating, rather than comparing the former with scattered coal boilers.

2. Financial (see Annex 5):

NPV=US$ million; FRR = % (see Annex 4)

Financial NPV and FRR are not applicable.

2.1 As indicated in paragraph 1.3 above, boiler conversion does not impose a clear financial burden on most boiler owners as long as long-term financing of the capital cost conversion is provided. Nevertheless, some boiler owners would not be able to mobilize the substantial counterpart financing that is required. In Beijing, a large part of cash-short entities are various units under the control of the central, municipal, and district governments. Most of them are being allocated sufficient funds to finance the boiler conversion. For others, BMG has set aside funds to subsize the conversion. There still are likely to remain some entities, estimated to own between 10% and 20% of all scattered boilers, that cannot afford the conversion and they are likely to be given deferrals or exemptions.

2.2 SJET's main financial task in the initial phase is to generate sufficient liquidity to cover its upfront costs including the front-end fee and commitment charge on the Bank loan as well as other start-up costs. Its longer-term financial objective is to maintain sufficient quantity and quality of installment assets to balance the Bank loan obligations. Currently proposed terms and conditions of its installment sales of boilers are considered adequate to meet these objectives. Collection of the installment payments through the natural gas bill provides an efficient procedure. Although arrears in the natural gas bills are about 10%, additional guaranties and collateral that SJET will secure, along with careful appraisal of the buyers, are likely to limit the loss. SJET is a new limited liability company with only Y 1 million paid-in capital.

90% of its ownership is however held by two major corporations - BCIC and BGGC, both fully owned in turn by BMG, and with Y 5 billion and Y 10 billion capital, respectively.

2.3 BDC's long-term financial objective is to generate sufficient revenues and manage them efficiently to adequately operate and maintain the drainage and sewerage facilities that are expanding rapidly, and to meet its debt obligations, with room to finance further capacity expansion. As a project covenant, BDC would be required to generate sufficient revenues to cover all its current operating expenses plus depreciation or debt service, whichever is larger (the projection shows that the former is likely to be larger always). BMG's recent steps and commitments made on occasion of this project make this objective realistic. The financial projection shows that BDC's annual revenues are likely to reach over $100 M before the end of the project, and BDC would be able to provide as much to capital investment projects including this one as well as others. The project period would be a peak expansion period, and investments after the projects would be relatively minor that BDC is expected to be able to finance with its internal funds.

Fiscal Impact:

2.3 BMG provides relatively little financing for the execution of the project, directly financing only about 15% of the total project cost. This would amount to, at the peak, about 1% of its budgetary revenues. In the unlikely event that BMG will have to assume all the Bank loan repayment obligations, they will amount, similarly, only about 1% of its budget. A successful execution of the boiler conversion program would provide a significant financial relief to BMG. It is responsible for the debt incurred for the natural gas distribution network (some $380 M in total cost so far). It is estimated that sales of each additional cubic meter would contribute about Y 0.22 toward debt service, after variable cost and sales of about 1 billion cubic meters a year would be needed to fully recover the fixed cost. A successful boiler conversion, beyond the project, would be crucial to reach the sales volume, allowing BGGC to service the debt without BMG's help.

3. Technical:

3.1 Beijing is at an early stage of developing local skills and experience in natural gas boilers, but they are well concentrated in a few technical institutions and BGGC, providing an efficient basis for rapid development. Through experiences in coal gas installations and a small number of existing natural gas boilers, they have acquired good understanding of basic elements of natural gas boiler characteristics and installation including safety. Natural gas boilers are supplied mostly as integrated packages requiring little detailed design or calibration work, which the current technical base would be able to handle adequately given the small volume of installation expected in the initial year. The GEF-funded technical assistance would help develop a larger corps of technical personnel and an ability to optimize the selection, installation and operation of natural gas boilers for more varied operations.

3.2 There are a variety of technical institutions involved in heating, but the technical capacity and knowledge are dispersed and insufficiently applied or developed. The creation of HECC and technology development and promotion with the GEF support is expected to help resolve these issues.

3.3 BDC's mandate had been limited to operation of trunk wastewater facilities, under the direction of BMEB which controlled planning and execution of capital works. These responsibilities were recently realigned, with BDC taking over the capital investment responsibility, starting with this project, and some of BMEB's staff. BMEB has been reconstituted as a corporation, and will assist BDC in the implementation of the project, along with the design institutes which it had retained for design of the

sewerage components. In addition, BDC will retain a team of engineering advisors and supervisors, financed under the project, to help the implementation of the investment as well as upgrading of its operation and maintenance programs and skills.

4. Institutional:

a. Executing agencies:

Agencies responsible for preparation and implementation of individual components are listed in Section C.3. They have either sufficient prior experience, or in the case of the newly established SJET and HECC, are attached to parent institutions which have strong relevant experiences and skills. In all cases, however, their further institutional and technical development is one of the major goals and activities of the project.

b. Project management:

The project will be coordinated on a day-to-day basis by BEPO, an office that has competently managed the Bank-financed BEP I as well as a similar project financed by ADB. Maintenance of adequate staffing would be a continuing issue to monitor as the Office has a small staff. It would be guided by a Leading Group chaired by the Executive Vice Mayor and includes two other Vice Mayors of Beijing as members. This in turn reports to the Municipal Leading Group for environmental improvement, chaired by the Mayor. The composition of these leading groups indicate an unusually high degree of attention of the senior leadership to the city's environmental improvement.

c. Procurement Issues:

A Procurement Capacity Assessment (PCA) was carried out by the Bank on all of the procurement and executing agencies to be involved in this project and concluded that there are no major issues. Procurement under the project will be carried out with the assistance of the International Tendering Company (ITC) of the China Technology Import & Export Corporation, which is one of the state-approved and controlled international tendering companies which are certified by the central government as being proficient in international procurement. The ITC also was the procurement agency for the first Beijing Project, financed by the Bank, and is the tendering company for the ongoing ADB project.

The PCA determined that while BDC has the experience and capacity to satisfactorily conduct the procurement required in this project, the procurement units of Shihuan-Jietian and the EPB will receive adequate assistance from experienced PMO staff for procurement, and the ITC will provide additional procurement training to all three agencies. All procurement in the project will be carried out in accordance with World Bank guidelines. The PCA concluded that there are no unusual features in this project which could give rise to concern with respect to procurement matters, and considering the record of procurement implementation and management in China and in Beijing Municipality, the risks on this project are considered to be average. The enactment of the national procurement law, effective from January 1, 2000, should serve to further reinforce this conclusion.

d. Financial Management and Disbursement

The detailed analysis and assessment of the adequacy of the project financial management system is shown in "Financial Management System Assessment Summary" attached as Annex 13. The results of the Review and corresponding Action Plan to address measures needed to improve capacities are included in Attachment 1 of the Review. The Review has concluded that this project meets minimum Bank financial management requirements. The project will be utilizing traditional disbursement procedures rather than the

PMR-based disbursement system. The status of the borrower's and the project implementing entities' compliance with audit covenants in existing Bank-financed projects is satisfactory. The auditors issued an unqualified opinion and no major outstanding issues exist with the prior project, Beijing Environment Project, with the exception of delay in counterpart funding. Details regarding agreements reached with the borrower on standards and formats for audited financial statements and timetable for their submission are shown in "Review" Section V for Internal Controls and Section VII Project Reporting Requirements.

5. Social:

5.1 The project benefits will be broadly distributed across income levels and areas. Heating boiler conversion and energy conservation would directly impact the ambient air quality at the ground level, rather than such controls in industrial installations whose effects would have less direct impacts on residents of the city. While the subjective benefit of improved air quality is in general likely to be proportional to income levels, it is also crucial to persons without the protection of climate control systems. Similarly, wastewater management would have a particularly beneficial effects on farmers and residents in the outskirts of the city as well as further downstream who rely on surface and ground water sources for farming as well as washing and recreation.

5.2 The cost of the project would also be distributed without specific regard to income levels. Wastewater tariffs are levied in linear proportion to water usage, which is relatively inelastic with respect to income. Due to relatively low wastewater tariffs, they are not likely to take more than 0.5% of household income even at the lowest income levels even with the large planned tariff increases. For boiler conversion, it is important to note most of the conversion would be done by institutions and companies that operate scattered boilers to heat their own business premises and some employee housing, although there are buildings that have resident tenants. The majority of residential complexes where diverse tenants live, however, are heated by heat supply companies that operate district heating boiler houses most of which are larger than the conversion targets. These tenants would see little change in their heating bills. In other words, the financial burden of boiler conversion is weighed heavily on corporate or institutional entities than individuals. Among those affected, the major issue is the willingness to convert, given the contrast between the dispersed benefits and the seemingly selective burdens in the initial stage when few boilers are converted.

5.3 **Land acquisition and resettlement.** All of the land acquisition and resettlement for this project is related to the Wastewater Management component. No minority issues have been identified. During project preparation, measures have been taken to reduce resettlement as much as possible. A Resettlement Action Plan (RAP) has been prepared by the Borrower in accordance with the national standards and the Bank's policies. The final report was received in March 2000, reviewed and approved by the Bank, and copies were deposited in the PIC. The RAP states that the project will affect about 1840 households, 6,586 persons, 345 enterprises and 5,475 staff. The total land area to be acquired permanently is about 1,255 mu (83.7 hectares) and the total number of people to be moved is 2,555. The RAP cites the legal framework for its preparation, the types and levels of compensation to be paid, the appropriate processes and procedures needed to implement the RAP, and a schedule for carrying out the work. The total estimated cost of the program is about $303.3 M.

5.4 Labor for Coal Boilers. The main financial cost of scattered boilers for their owners is labor cost. China's rapidly increasing urban wages are making the older scattered boilers obsolete, in favor of newer and more efficient boilers. The labor savings, whether by gas boilers or by more efficient coal boilers, would imply reduced demand for manual labor to handle coal and ash. Coal boiler operators currently fill the labor need, which is seasonal and arduous, by pressing their own staff into duty on rotation, or by recruiting farmers from outside the city looking for off-season jobs, and in many cases both. The conversion to automatic gas boilers would worsen labor surplus issues for many of the enterprises and

reduce off-season job opportunities for farmers outside the city. Some 2200 boilers to be converted under the project could involve an order of magnitude of about 5,000 full-time equivalent of such labor, or nearly 0.1% of total employment in Beijing. Some or all of the lost job opportunities would be replaced by new jobs generated by increased economic investment following the environmental improvement. Neither the jobs lost or gained could not be estimated with confidence due to the diversity of situations. Specific safeguard policies cannot be applied as there are no specific groups of people who would be laid off. BMG would however continue to monitored the employment impact, especially that for poor laborers, and provide them with the usual job placement and social protection services.

6. Environmental assessment: Environment Category: A (Full Assessment)

A comprehensive environmental assessment has been carried out for the project by the Beijing Municipal Research Institute of Environmental Protection in accordance with the policies and procedures of China and the Bank. The detailed EA reports and a summary EA report, each incorporating Bank comments, have been reviewed and found to be satisfactory.

The environmental impact of the project is very positive overall and the benefits far outweigh the limited negative impacts. The air quality improvement component involving fuel switching from coal to gas and use of more efficient boiler technologies will significantly reduce concentrations of SO2, NOx, TSP and CO and improve the ambient air visibility within the target areas (inside 4th Ring Road and Shijingshan District). The wastewater management component in the Qing and Liangshui River basins will reduce pollution of watercourses resulting in improved water quality, removal of nuisance from odors, reduced health hazards and improved environment for economic development. The projected reduction in untreated sewage entering the groundwater in the Liangshui catchment will assist in improving the quality of aquifers from which water is being withdrawn for drinking water supply in Beijing. Significant potential impacts will occur during construction, including excavation, dust, noise, spoil disposal, and disruptions of urban services. The EA reports include an Environmental Management Plan (EMP). The detailed EA reports and EA summary report were sent to the Bank's Public Information Center in February 2000 and copies are in the project files. These documents also have been available to the public in Beijing. The details of the consultations and discussions during EA and RAP preparation are provided in Tables 2 and 3 in Annex 12.

7. Participatory Approach (key stakeholders, how involved, and what they have influenced or may influence; if participatory approach not used, describe why not applicable):

a. Primary beneficiaries and other affected groups:

Project benefits are distributed broadly, but as the economic analysis indicates, primary beneficiaries of wastewater management components are the residents and institutions in the Liangshui and Qing River basins. Public consultations have been held in the form of public hearings in these areas as a part of the EA process, as well as consultation with a panel of experts, all of which reportedly concluded with overwhelming support for the project. To reduce the land acquisition and resettlement, and thereby minimize adverse impacts and costs, much consideration has been given during the assessment of various sewer alignment alternatives. Residents of the areas identified for likely resettlement or land acquisition were notified of the actions, consulted on compensation measures, as laid out in the resettlement information booklet distributed to the affected population. The new resettlement regulation of BMG provides full control of relocation decisions to the affected people and entities.

In the case of boiler conversion, beneficial impacts are extremely dispersed, whereas the financial and implementation responsibilities appear limited to a relatively narrow groups of boilers as some 40% of

boilers (in terms of capacity) are not required to convert, and even among the scattered boilers, the conversion will proceed gradually. In order to stimulate initial conversion, therefore, it would be useful to combine strong public awareness campaigns focusing on small areas at a time, along with regulatory and financial measures. The first line responsibility for issuing conversion orders and providing necessary assistance lies with the District Governments, which have traditionally been responsible for grassroots mobilization and administration. They will work with SJET, BGGC, and BPB to mobilize the necessary assistance. After that, the decision to convert or improve boilers would be made by the boiler owners themselves. Most of small and medium-sized boilers to be converted under the project are owned and operated by entitites for their own use, to heat the work space or housing provided to their own employees. In the latter case, heating cost is not borne by the tenants. Even though a housing reform program to sell the majority of residential housing is now in progress, the practice of employer payment of heating tariffs is being maintained, without a clear plan to transfer the responsibility. Consequently, the cost of conversion would fall entirely on the boiler owners, and therefore the conversion is unlikely to take place in the case of boilers owned by entities in financial difficulties.

Participation in the heating energy conservation programs will be on fully voluntary basis, except that monitoring of boiler performances would be an enhanced version of the required inspection by BEPB and RHAO. Many of the larger district heating boilers that would be the main target of the energy conservation programs supply heat to offices, shops, and residential apartments on the basis of a flat tariff proportional to the floor area. Financially, therefore, benefits of energy conservation would accrue entirely on the heat providers. In the case of residential housing, the heating tariff is usually paid by the tenants' employers either directly or through heating allowances given to the tenants. Without heat metering and the transfer of responsibility for heating tariff payment, therefore, there would be relatively little incentive for end-user level energy conservation. End-user energy conservation such as insulation would be more relevant in the case of small and medium-sized boilers, using either coal or gas, that are operated to heat the owner's own work premises or their employees' housing.

Groups that will benefit both commercially and technically from the air pollution control components are technical specialists and industries involved with natural gas boilers, and other heat supply systems. They will receive technical training and information from foreign consultants, as well as provide inputs to them, and take contractual assignments from SJET and HECC. BMG and the Bank team consulted with a large number of such institutions during project preparation. Most of the sector institutions are expected to participate in the project implementation, with several institutions selected competitively as consultants under the GEF-supported components.

b. Other key stakeholders:

As mentioned in Para 7. (a), public officials in the project areas participated in public hearings in which the project proposals were described and discussed in detail, and feedback received from the officials and citizens present, and this information was taken account of in the EA studies and recommendations made for adjustments to designs. Officials of downstream counties have been informed of the project, as an input to their water resource planning.

F. Sustainability and Risks

1. Sustainability:

The project investments will continue to produce environmental benefits into the future provided that they are properly operated and maintained. The benefits, however, would be overwhelmed by the growing pollution unless the pollution growth is restrained and such environmental facilities as built under the project continue to be expanded. Policy, financial and institutional development measures would be supported under the project to ensure the proper operation and expansion of the facilities, and that the growth of pollution is controlled. The fuel conversion component, in particular, is aimed at creating continuous momentum for market-based expansion. A major long-term constraint would be the supply of clean fuels which would depend not only on proper sustainable pricing, but also on the central government' s energy policy.

The GEF financed institutional strengthening activities for (i) improvement of EPB air quality monitoring capacity; (ii) techincal capacity building and market development for gas boilers and (iii) energy conservation will contribute to the sustainability of air pollution control and energy conservation initiatives in Beijing.

Institutional support for restructuring Beijing Drainage Company through upgrading management systems, providing greater flexibility in setting appropriate tariffs, and staff development in parallel with outside monitoring would aim at assuring the sustainability of the sewerage/drainage system and wastewater treatment plants.

2. Critical Risks (reflecting assumptions in the fourth column of Annex 1):

Risk	Risk Rating	Risk Minimization Measure
From Outputs to Objective		
Growth of air pollution and carbon emissions outpacing reduction by boiler conversion and energy efficiency	N	BMG program to control other emission sources; improving air quality information and management
Effect of boiler conversion limited due to slow conversion of other boilers	S	Regulatory and financial support by BMG and central government; gas boiler market and technology development actions
Facilities not operated properly due to weak financial and technical capacity	M	Technical and market efficiency improvement; Financial and institutional strengthening components and covenants
Growth of wastewater discharges in the Liangshui and Qing River systems and upstream outpaces treatment capacity	S	National and municipal programs to strengthen control of wastewater discharges
From Components to Outputs		
Boiler conversion delayed or limited due to insufficient demand	H	financial and regulatory measures to encourage conversion; market and technology development measures (GEF-financed) to promote conversion, reduce cost and ease technical constraints
Boiler conversion delayed due to insufficient capacity or incentives for implementing agencies, or fiscally costly due to failure to recover cost	S	Establishment of SJET, technical and marketing support (GEF-financed), pricing terms that balance incentives.
New facilities poorly designed or constructed	M	Review of designs and provision of high quality implementation suport and supervision
Sewerage construction delayed due to counterpart financing or resettlement bottlenecks	S	Ensure realistic financing and resettlement plans, proper and speedy compensation and resettlement
Overall Risk Rating	S	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N(Negligible or Low Risk)

3. Possible Controversial Aspects:

There have been no major potential controversies under the project identified.

G. Main Loan and Grant Conditions

1. Effectiveness Condition

- Execution of subsidiary loan agreements by BMG with SJET and BDC, satisfactory to the Bank;
- Finalization of SJET's Operations Manual satisfactory to the Bank; and

- Execution of a subsidiary grant agreement between BMG and SJET, satisfactory to the Bank.

2. Other [classify according to covenant types used in the Legal Agreements.]

Assurances have been obtained from BMG that it will carry out the following or cause them to be carried out:

Project Implementation

- Maintain the Beijing Environment Project Leading Group and Office with composition, staffing, resources and terms of reference satisfactory to the Bank.
- Make available the loan proceeds to BDC, SJET, and EPB on terms and conditions satisfactory to the Bank.
- Make available the GEF grant proceeds to SJET and HECC for implementation of programs to remove barriers to gas market development and heating energy conservation as agreed with the Bank.
- Make available or assist to obtain counterpart financing required for implementation of the project.
- As a part of the subsidiary loan agreement with SJET, cause District Governments, BEPB, and BGGC to promptly provide administrative, regulatory, and technical inputs necessary to encourage and assist conversion of coal-fired boilers to cleaner fuel.
- Boiler conversions are to be carried out by SJET in accordance with the criteria, procedures and terms and conditions specified in the Operations Manual satisfactory to the Bank.

Institutional Development of BDC

- Maintain a task force, reporting to the Environmental Project Leading Group, to oversee the restructuring the sewerage services with composition and qualifications satisfactory to the Bank until replaced by a supervisory authority forming a part of the restructured institutional framework.
- Cause BDC to retain consultants to provide advisory services to plan and design institutional development of BDC and to assist implementation of the wastewater works, by November 30, 2000.
- Carry out the institutional development plan to constitute BDC as an autonomous enterprise with the governance structure as specified in the Company Law, including a Board of Directors and a Board of Supervisors, the full autonomy to retain and dispose of all sewerage tarriffs, and ownership of and responsibility for all sewerage and drainage facilities in the Beijing urban districts, and begin implementing the plan by December 31, 2001.

Financial Performance

- Allow SJET to sell natural gas boiler equipment at prices and installment terms that would cover all reasonable expenses it incurs for the sale and installment, including the cost of equipment, transportation, insurance, management, all financing expenses, as well as reasonable provision for bad debts and profits.
- As a part of the subsidiary loan agreement, cause SJET to produce, by March 31 each year starting from 2002, a projection of its balance sheet and cash flow statements in the next two years and have them reviewed by BMG and the Bank to identify actions necessary to meet the above objectives;
- Cause BDC to generate revenues from wastewater and drainage operations sufficient to cover current operational expenses and depreciation charges or debt service payments, whichever is greater; and
- Cause BDC to produce, by September 30 each year, a projection of its finances in the next two years and have them reviewed by BMG and the Bank to identify actions necessary to meet the above financial performance objectives.

Safeguards

- Cause project implementing agencies to carry out environmental impact mitigation measures specified in the Environment Assessment of the project and land acquisition and resettlement in accordance with the Resettlement Action Plan.

Financial Management

- Cause implementing agencies to prepare the following annual financial reports and submit to the Bank the financial reports, audited by an auditor satisfactory to the Bank, within six months after the end of the fiscal year, commencing with fiscal year 2000: (i) project accounts by component maintained by BEPO; (ii) Special Accounts; (iii) statements of expenditures (SOEs); (iv) financial statements of BDC; and (v) financial statements of SJET (starting from its 2000-01 fiscal year).

Monitoring and Reporting

- Cause BEPO to send consolidated semi-annual progress reports to the Bank by February 15 and August 15 each year starting from February 15, 2001 in a format satisfactory to the Bank including a summary of implementation progress by component, financial expenditures by component, resettlement actions, monitoring indicators, and other information requested by the Bank.
- Carry out with the Bank a mid-term review by December 31, 2002 or an alternative date to be agreed upon, and carry out actions agreed upon to enhance the project implementation.

H. Readiness for Implementation

☒ 1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.
☐ 1. b) Not applicable.

☒ 2. The procurement documents for the first year's activities are complete and ready for the start of project implementation.
☒ 3. The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.
☒ 4. The following items are lacking and are discussed under loan conditions (Section G):

Finalization of Financial Management Manual and its distribution to all project staff;

I. Compliance with Bank Policies

☒ 1. This project complies with all applicable Bank policies.
☐ 2. The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.

Songsu Choi	Keshav Varma	Yukon Huang
Team Leader	**Sector Manager/Director**	**Country Manager/Director**

Annex 1: Project Design Summary

CHINA: Second Beijing Environment Project

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Sector-related CAS Goal:	**Sector Indicators:**	**Sector/ country reports:**	**(from Goal to Bank Mission)**
Safeguarding the environment	N/A	Annual and Special Reports of the State Environmental Protection Administration	sound economic management and growth
Cost-effective and sustained reduction of green house gases (Global environmental objective)		Same as above	Control of other GHG sources
Project Development Objective:	**Outcome / Impact Indicators:**	**Project reports:**	**(from Objective to Goal)**
Improve ambient air quality of Beijing area	Ambient concentrations of major pollutants	Readings from monitoring stations	Adequate health care system
Decrease carbon emission to the global environment (Global Environmental Objective)	Carbon dioxide released from heating systems	Estimation based on fuel use and efficiency data	Control of other greenhouse gases
Protect surface and ground water quality in Beijing and downstream	Concentration of major pollutants (COD, BOD, NO3-N)	Sample analysis	Water pollution does not increase elsewhere in the Haihe basin
Output from each component:	**Output Indicators:**	**Project reports:**	**(from Outputs to Objective)**
Reduced use of coal for heating (GEF-supported)	Coal consumption for heating	public utility bureau data	Control of pollution and carbon release from other sources
Large and more efficient gas boiler market and technical capacity (GEF-supported)	costs of gas boilers, services, and operation	project progress reports and monitoring data	Pricing and regulation to even the playing field between coal and gas
Improved energy efficiency for heating systems and remaining coal boilers (GEF-supported)	Fuel consumption per heated area	boiler operating statistics and sample monitoring	Control of pollution and carbon release from other sources
Reduced pollutant emissions from heating (GEF-supported)	Emissions from heating boilers	compliance reports, sample monitoring data	Control of pollution from other sources
Improved air quality information and management (GEF-supported)	quality and timeliness of air quality data and analysis, regulatory responses	EPB management reports	the system to use the information is improved
Wastewater interception and treatment in Liangshui and Qing River systems	Treated wastewater volume and quality	Operational reports	discharges in the sub-basin and upstream do not surge
Expanded financial and technical capacity of Beijing Drainage Company	cost per wastewater collected and treated, operating cash flow	Operating and financial reports	utilization of improved financial and technical resources to improve services and efficiency

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Project Components / Sub-components:	**Inputs: (budget for each component)**	**Project reports:**	**(from Components to Outputs)**
Conversion of medium-sized coal-fired heating boilers to natural gas (GEF-supported)	Number and capacity of natural gas boilers installed (loan: $165 M)	progress reports	Sufficient demand for conversion; conversion outside the project; control of new coal boilers; minimize costs to the boiler owners and government
Gas boiler market and technology development (GEF-supported)	Technical documents, pilot boilers, conversion assisted, personnel trained (grant $16.5 M)	progress reports and technical documents	Absorptive capacity by industries and specialists
Heating energy efficiency promotion (GEF-supported)	Technical documents, pilot projects, modification assisted, personnel trained (grant: $8.5 M)	progress reports and technical documents	Heat and energy pricing that makes conservation valuable
Air quality monitoring and decision support	Consultant reports, MIS and GIS systems installed, staff trained, monitoring and analytical equipment (loan $3.3 M)	progress reports	quality of consultants and counterpart staff, proper use of the studies and equipment
Liangshui River sewerage	length of sewers and capacity of sewage treatment installed (loan $152 M)	progress reports	proper design, construction, operation and maintenance
Qing River Sewers	length of interceptors built (loan $20 M)	progress reports	proper design, construction, operation and maintenance; timely construction of the sewage treatment plant
Beijing Drainage Company Development	staff-months of studies and training; equipment procured (loan $5.6 M)	progress reports	quality, relevance and use of TA and equipment

Annex 2: Project Description
CHINA: Second Beijing Environment Project

Geography of Beijing: Beijing, the capital of People's Republic of China and its second largest city, is located in the northeastern part of China, in the Huabei Great Plain. Temperatures range from -16 C^0 to 38 C^0 and the average annual precipitation is 625 mm, concentrated in June-August. Beijing Municipality, one of four municipalities in China reporting directly to the central government, comprises 18 districts and counties, with eight of the districts fully urban and the others rapidly becoming urbanized. It covers an area of 16,800 km^2, of which 1,040 km^2 are under an "urban planning area" where nearly two thirds of the population and three quarters of energy consumption are concentrated. The permanent resident population of the municipality is about 12.3 million, of which about 7.4 million are formally classified as non-agricultural population. In addition, there is a so-called "temporary" population estimated around 2.5 million people most of whom are in effect long-term residents of the city. Gross municipal product in 1998 was Yuan 201 billion, 96% non-agricultural. Building floor space in the city total about 200 million m^2.

By Component:

Project Component 1 - US$488.13 million

Conversion of Medium-sized Heating Boilers from Coal to Natural Gas

1.1 Heating Fuel Conversion Program. Heating in Beijing is provided largely by coal, via city-wide district heating (16%), local district heating (22%), and scattered boilers for the remainder. Scattered heating boilers with medium capacity between 1 and 10 tph are estimated to number about 9200 within the Smoke-Control Area (SCA), which includes areas within the Fourth Ring Road and the Shijingshan District, encompassing most of the Beijing urban area. There are tens of thousands of smaller boilers and heating or cooking stoves. Use of coal and the lack of pollution control devices in these small and medium-sized devices have been responsible for some 80% of critical air pollution during the heating season as discussed in Section B. Under BMG's new clean air initiatives and with BMG's partial financial assistance, the majority of the smallest stoves and boilers have already been converted to cleaner fuels such as natural gas, town gas, LPG, oil, and eletricity and most of them are expected to be converted by the end of 2000.

1.2 Despite the strong promotion to convert the larger heating boilers since 1998, however, only about 700 medium-sized heating boilers have been converted by the end of 1999. Major apparent reasons include difficulties in financing the large investment required, and the lack of market and technical capacities to generate and respond to demand for natural gas boilers. The central government has allocated funds to convert boilers belonging to its units, estimated to number about 1,300, by 2001 and the most affluent owners of another 2000 boilers are expected to convert without external support. This still leaves about 5,200 boilers which would require extraordinary measures to require and support conversion. Of these, estimated 3,700 - 4,200 have or will have access to natural gas by 2002. The purpose of the component is to provide the financial and technical support to convert these boilers.

1.3 Institutional Responsibilities. In other countries, such conversion took decades, promoted mainly by natural gas companies. Having invested heavily in natural gas pipeline and delivery network, BMG also has a strong financial interest in promoting conversion but has not been able to do so due partly to institutional fragmentation. In Beijing, numerous entities were involved in various aspects of gas delivery. These were combined into a Beijing Gas Group Corporation (BGGC) in 1999 to improve the efficiency and accountability, but still in its establishment phase, it is not in position to devote full attention to a new, uncertain venture of boiler conversion. BMG therefore entrusted the Beijing Comprehensive Investment

Company (BCIC), a diversified company involved in various industrial and commercial joint ventures, to take the lead in bringing about rapid boiler conversion. In turn, it has established the Shihuan Jietian Energy Technology Company (SJET) as a limited company in partnership with BGGC (30% of stake) and the Yuanshan Energy Management Company (10%). The latter was established in 1996 with GEF and Bank support as a commercial venture to offer energy conservation services to industrial customers.

1.4 Eight District Governments under BMG have the primary administrative responsibility to assist and ensure conversion of coal-fired boilers and stoves under the overall fuel conversion programs, with necessary regulatory and technical supports from BEPB and BGGC. These responsibilities will continue, and SJET's function is to market the gas boilers on a commercial basis. To overcome the barriers to conversion and hence to its sales, SJET will work with these agencies in identifying and assisting the buyers of its boilers.

1.5 The Project. With the Bank loan, SJET would import natural gas boilers and associated equipment and sell them on installment over up to 18 years. Under the common boiler house configuration, the imported equipment takes up about a third of the total cost of conversion, and the Bank loan of $165 M (net of front-end and commitment charges) would finance the conversion of 2000-2500 scattered medium-sized coal-fired heating boilers of 1-10 tph capacity (average 3.2 tph). These represent about a third of medium-sized heating boilers that have access to natural gas within the Smoke-control area, and about 60% of those that are extimated to require and afford installment financing. SJET has identified and obtained basic information on 2,621 such boilers within the Smoke-Control Area but outside the first Coal-Free Zone (CFZ). These include some 670 boilers owned by entities fully or partly funded by BMG or district government budgets. The eventual number of boilers financed under the project would depend upon the size mix of boilers, extent of equipment provided (from a full complement of heating equipment to just a natural gas burner core), and actual prices that are expected to decline during the project.

1.5 Terms. Although SJET would manage the operation as an autonomous enterprise, its pricing and installment terms would be subject to agreement with BMG in return for the concession for utilizing the Bank loan and for supplying boilers to units belonging to BMG and DG. Initial terms of the boiler sales would include the following:

- Scope of sales: Natural gas burners, boilers and essential associated equipment, needed to convert coal-fired boilers between 1 and 10 tph, within the SCA or within 2 km of SCA.
- Price: the price of the equipment to SJET (wholesale price) plus 2% for the first 1000 converters (expected to be reached by the end of 2002) and 5% for those converting later.
- Down payment: additional 5.5% of the wholesale price paid on signing the sales contract, which will be before SJET signs contract with boiler suppliers.
- Financing charge: the same rate as the World Bank loan for BMG and DG units; the same plus up to 2% per annum for others depending upon credit rating by SJET.
- Installment: in equal installments over a period, at the buyer's choice, up to one year less than the remaining maturity of the Bank loan (in practice 12-18 years depending upon the year of sales) in the case of BMG and DG units; up to 12 years for others as agreed between buyer and SJET.
- Grace period: None, unless at a charge specifically agreed by SJET.
- Ownership of the equipment sold would be transferred to the buyer upon installation and satisfactory testing.
- Security: BMG guaranty for units fully funded under BMG budget; real estate or other assets required as collateral in addition to or in lieu of third party guarantees for others.

1.6 Associated Services. Along with the equipment, SJET will provide the buyers with the following services, part of which would be financed with GEF grant (see below):

- Conversion pre-feasibility analysis: including identification of technical options, preliminary estimation of their costs, provision of various technical documents relevant to technical and financial planning, including list of qualified technical consultants and contractors for detailed planning and installation;
- Review of conversion design and financing plan;
- Inspection of installation and testing;
- Provision of operating manual and training to boiler operators;
- Warranty services for two seasons or 18 months (including parts warranty provided by manufacturer);
- Evaluation of boiler operation, advice for maintenance and operational improvement and assistance to obtain necessary services - free for the first two years for boilers installed by 2002, one year for others.

1.7 Payment Risks and Security. The installment payment would be added to the natural gas bill and collected by BGGC, which will transfer the receipt minus a commission of 0.5% to SJET each month. The arrears on the gas bills have been about 10% in the recent past, but this may well go up as the usage expands beyond the early, more affluent converters. SJET therefore would screen the buyers' credit risk and require various securities. Major criteria for appraising the buyer's credit would be: the current liquidity and heating expenses, as well as the quality of collateral and guarantees. Based on these, buyers would be assessed one of five credit risks, which will affect the pricing and installment terms. Details of the criteria and procedures are provided in the Customers Assessment Manual in the project files. The current estimation is that there are about 350 boilers that belong directly to BMG units, and about the same number owned by DG units or those partly funded by BMG or DG, such as hospitals and research institutions. The former present little credit risk as BMG guarantee can be enforced at the point of SJET's repayment of the Bank loan. Others present a higher risk as guarantees can be difficult enforce. Collateral would be therefore required from these units even with BMG or DG guarantees, as well as all non-governmental buyers. Collaterals include land use rights, buildings, machinery and equipment, vehicles, receivables, etc. The collaterals would be registered as mortgages. SJET may refuse to provide the gas boiler to any unit that does not meet its credit and security criteria.

1.8 Market Demand. In practice, however, the more serious risk would be a lack of sufficient demand, given the barriers discussed in Section B.3, the burden of large counterpart financing (about two thirds of the total cost), and the cost of the Bank loan which is, on simple comparison, higher than domestic commercial loans though it provides much longer maturities. SJET is encouraged by the incentives built in the pricing structure as well as BMG to adopt an aggressive rather than cautious sales strategy. Under the sales terms described above, SJET would maximize its profit by maximizing the volume and speed of boiler sales and by minimizing its administrative and sales expenses, and collection losses. Financial analyses (Annex 5) show that the terms would provide a room for up to 5% in collection losses from non-governmental buyers. Market development measures financed by GEF would aid in promoting the market demand. In order to encourage conversion during the early years when the market barriers would remain especially strong, BMG would provide counterpart financing resources for its own units to convert within the first two years. For others, BMG would allocate Y 32 million to provide a subsidy of Y 150,000 for needy boiler owners converting in 2000, Y 100,000 in 2001, Y 50,000 in 2002, and none thereafter.

1.9 In general, the market and the program are both too novel to design the implementation with great certainty. Therefore, the major elements of the component would be evaluated and if necessary adjusted on the basis of evaluation of two full years of operation, if not sooner. The purpose of the adjustment would be to balance BMG's objective of maximizing conversion and SJET's interest in maximizing profit. SJET would be allowed to enter other businesses as long as they are strictly separated for accounting purposes and not in conflict with the operations supported by the Bank and GEF. Organized cooperative procurement of this magnitude and market and technical efficiency improvements achieved with the GEF financing are expected to result in considerable reduction in the price of the equipment and technical services. The reduction in capital costs, reduction in operating costs due to increased skills to operate them, and the increasing acceptance would make the conversion easier in later years. The project target of 2175 boilers assumes a reduction of these costs by 30% in real terms over the project period, that would bring these prices roughly in line with those in the international market, but no change in other locally produced goods. These market development benefits would be shared by other, over 4000 boilers to be converted in Beijing which will not be directly financed under the project as well as future buyers of gas boilers in Beijing and elsewhere in China.

Project Component 2 - US$33.13 million

Gas Boiler Market and Technology Development (GEF Grant $16.5 M)

2.1 Goals and Scope. In conjunction with its main business of boiler distribution, SJET will carry out various activities to develop industry-wide technical capacity and efficiency, to remove market information gaps, to facilitate and aggregate market demands, to reduce excess costs incurred by early converters, and to structurally reduce the costs of gas boiler equipment and services. The activities can be classified by technical focus, or by the mode of delivery – developing technical models, their demonstration, training and other dissemination, and assisting customers to implement the efficient conversion and operation. Each of the activities described below have primary targets on specific barriers, but they are complementary to each other as the barriers are closely interrelated.

A. Development of Technical Models and Capacity (Estimated grant ~ $3.3 M). In order to establish best practice models and technical capacity for natural gas boiler configuration, installation and services, SJET will engage consultants to carry out the following:

(a) Best practices of gas boiler system configuration. On the basis of evaluation of international best practices and current Chinese coal boiler practices, the consultants will develop model specifications of gas boilers individually and as a system, as well as conversion paths that are economically and technically most efficient. This is expected to yield recommendations different from simple one-to-one replacement of coal-fired boilers with gas boilers or standard international practices. For example, the model specifications would include: optimal siting of boilers, likely to be more *dispersed* compared with coal boilers; optimal *capacity*, to take advantage of spontaneous variability of gas intake; optimal control settings under the current heat distribution system which cannot be replaced in the short term. The consultants will also identify optimal *sequences of equipment replacement*, ranging from burners to heat exchangers, when wholesale replacement is not feasible.

(b) Best operating practices. A review of existing gas boiler operations indicates that operating and maintenance expenditures are significantly higher than necessary for the largely automated gas boilers, though lower than coal boilers. The consultants will recommend efficient operating and maintenance schedules and procedures.

(c) Advanced technologies. Consultants will evaluate various advanced technology options such as: high efficiency condensing boiler sections as additions to standard gas boilers, advanced water treatment systems, improved boiler automation for operation at low load and varying load levels, radiant zone heating, and low NOx burners. Their financial and technical feasibility would be evaluated and implementation protocols recommended.

(d) Best heat distribution practices. A substantial part of heat loss occurs in the delivery of heat from boilers to end-users. While a broad improvement of heat delivery systems would be a focus of the energy conservation component led by HECC, it would be efficient for SJET to assist in improving the heat delivery system in conjuction with its diagnostic and advisory services for gas boiler installation and operation. Therefore SJET's consultants would work with HECC to recommend best practice models for heat distribution out of gas boilers.

(e) Industry outreach and capacity building. The consultants will carry out industry analysis, documentation, and training to help encourage and improve the local manufacture and assembly of cost effective boilers and ancillary equipment, and efficient services for installation and maintenance of the boilers, instrumentation, and ancillary equipment. SJET will cooperate with technical institutions to set up a program to test local goods and services that do not yet have established track record. SJET will provide its gas boiler buyers a long list of these and other established manufacturers and service companies to facilitate their competitive participation in the conversion program.

(f) Specialist training. SJET consultants will carry out, in cooperation with technical institutes and/or a university, to provide training in technical requirements specific to gas boilers for thermal, mechanical, and electrical engineers. The training would be given first to technical specialists SJET would hire as individual consultants, but would eventually serve all qualified specialists on a first-come, first-served basis. GEF financing will be utilized for preparation of course curricula tailored to different specialization and levels of educational background, technical documents, and laboratory instruments. It will also support an in-depth training of 2-6 months overseas for about 6 selected specialists who would later act as local trainers, and short (3-6 week) study tours by up to 15 industry personnel. Another set of training will be offered to gas boiler operators in operation and maintenance of gas boilers.

B. Marketing and Support for Conversion (estimated grant $5.9 M). In order to reduce the information gap and the cost to early converters, the following activities would be carried out:

(a) Marketing and information campaigns. Targeted at the broad public, the consultants would prepare and provide informational leaflets, advertising boards, media spots, and information desks at district government offices to emphasize the environmental benefits and technical and financial feasibility of the conversion, so as to inform coal fired boiler owners of the assistance available and mobilize public pressure for conversion.

(b) Boiler survey and individual marketing evaluation. This would involve boiler surveys and pre-feasibility level analysis of technical and financial options for conversion of around 3500 boilers, by trained sales engineers and financial analysts.

(c) Market aggregation and procurement management. Based on the above, boiler requirements would be identified and grouped into a small number of most economical standard types broadly available in the world market. The consultants will help to prepare technical specifications and contractual terms that best meet technical and financial objectives, as well as ensuring competitive

procurement. Trips to major gas boiler markets by a team of about five procurement managers would be supported, to investigate the market conditions and procurement experiences. Feedback from the procurement process, boiler installation, and initial operation will be used to refine the specifications and contract terms for boilers procured in year 2001, and onwards.

(d) Installation and operation assistance. As a natural extension of the above activities, SJET consultants would advise the gas boiler customers on various technical and financing options for conversion as well as desirable modifications in the heat delivery systems, information on best practice models, and a list of available technical institutes for detailed technical work and installation contractors. They will also assist in supervision of installation; and provide initial training in its operation and maintenance. Further, the SJET technical team would also monitor and evaluate the operation of the installed gas boilers and provide free consultation, trouble shooting, and referral for the first three seasons of operation for boilers converted during the project period.

C. Pilot and Training Installations (estimated grant $7.3 M). To experiment with and demonstrate various best practice models and to train technical specialists and operators, and hence to help strengthen technical capacity, reduce information gap and technical risk. All demonstration boilers and their operating records would be used as case materials in the technology and market development activities.

(a) Full-time training and demonstration boilers. SJET will cooperate with a technical institute to operate a full range of gas boilers and heat delivery systems, including experimental equipment, for training and demonstration purposes year-round. Low-cost conversion alternatives such as replacing only the gas burner and other essential accessories would also be experimented and demonstrated. In order to save cost and to operate these with full real load, SJET will contract with a large boiler house which will pay for installation of the equipment and offer a part of the building for training purposes.

(b) In-use demonstration boilers including advanced and distributed heating systems. In cooperation with district governments, SJET will provide about five boilers in each of the eight districts, involving a representative range of boiler types including advanced pilot equipment, in return for their use for demonstration and occasional training of boiler operators. Alternative configurations of the boiler systems designed under the technology development (A (a) above) would be demonstrated as they become available (starting from 2001). These would include a set of dispersed gas boilers in each district replacing at least one larger coal boiler. For example, a 6-tph coal boiler could be replaced by five gas boilers of 0.5-2.0 tph. Further, low-cost conversion alternatives tested feasible under experiments, such as minimal conversion involving little more than the burner, would also be demonstrated widely. The number of actual beneficiaries of the demonstration program would depend upon the availability and acceptance of these alternative technical solutions. In the case of distributed gas boilers, for example, the GEF support may be limited to only one or a few of the smaller gas boilers for each of the larger coal boiler replaced, increasing the number of beneficiaries.

The program would also support a pilot installation of about 40 household-size gas boilers for individual houses and apartments in each district. For all in-use demonstration, only core equipment would be financed under the GEF program, and ancillary equipment and installation services would be financed by the owners.

2.2 Implementation Arrangements. SJET would manage the preparation and implementation of the

component, including the hiring and management of international consultants and some 12 full-time local engineers and financial analysts. The major part of the activities would be carried out, however, in close cooperation with district governments and local consultants and contractors to ensure industry-wide capacity building. Through competitive processes SJET will retain up to two technical design institutes and a team of marketing experts. They in turn would hire field survey and marketing teams to meet the occasional needs. For training and development activities SJET would explore a partnership with a local university.

SJET would mobilize most of the required foreign consultant input, about 90 person-months (p/m), through one contract awarded competitively by about September 2000. Other foreign consultants of up to 25 p/m needed for urgent work would be retained as individual hires. Most equipment financed with the GEF grant (about $6 M) would be procured through ICB, including some that would be included in the packages of boilers financed with the Bank loan. Minor goods (about $1 M) including office, communication, and transportation equipment and miscellaneous training and documentation supplies would be procured through shopping. In case savings are realized in program costs, the first priority of the savings utilization would be toward increasing the in-use demonstration of alternatives featuring dispersed boilers and lower-cost conversion. The component requires additional about $16.7 M financed by beneficiaries, for related expenses such as ancillary goods, installation of demonstration boilers, and parts of training expenses, procured through local commerical practices by beneficiaries themselves.

Project Component 3 - US$ 13.62 million

Heating Energy Conservation (GEF financing $8.50 M)

3.1 Background. BMG's new clean air program including the massive fuel conversion provides a major occasion to step up heating energy conservation. For heat suppliers and users, the high cost of gas increases the incentive for conservation. For the environment, the remaining coal-fired boilers represent a major remaining source of pollution. Gas boilers and large coal-fired boilers are generally much more efficient than the small and medium-sized coal boilers targeted for conversion under the current program, but there is still a large room to reduce energy consumption and pollution by the remaining coal-fired boilers. A survey of 457 district heating boilers in Beijing show that they need about 40 kg of coal to heat a square meter of floor space, compared with the good practice standard of 26 kg/m^2 achieved even with some medium-sized boilers. The data indicate significant inefficiencies both in the boilers and heat delivery systems.

3.2 Barriers to Energy Conservation. Progress in energy conservation has been slow especially in the heating sector due mainly to the nature of sector. In cities of China heating has been generally provided as a social necessity with little financial reward. Further, typical boiler houses are too small to justify allocation of significant investment or highly trained manpower, although in aggregate the heating sector is among the largest consumer of energy. As a result, energy conservation in the heating sector faces the following major barriers:

(a) **Insufficient and scattered knowledge base.** Because individual payoffs are small, there has been relatively little systematic research to import or develop heating energy conservation technologies. A few public agencies including the Ministry of Construction and Beijing's Residential Heating Administration Office (RHAO) have been conducting some relevant research and promotion, but not being their main mandate, these efforts have been limited and sporadic.

(b) **Lack of financial and human resources.** Typical heating boilers get little more financial and human resources than needed for routine operation, rarely having the high level technical resources

and investment funds to carry out modifications.

(c) **Difficulty to identify and evaluate conservation options.** As a natural result of weakness in both source and receiver of technical knowledge, there is insufficient readily available information on the range and details of conservation options. When they are available in the form of technical description or actual examples, it is difficult to evaluate their technical and financial feasibility in specific situations.

(d) **Risk.** Without systematic information, the general perception is that many of the energy conservation measures will not, in practice, provide any significant financial benefits and instead waste the scarce capital resources available to the heating supply entities.

(e) **End User Motivation.** Heat is generally paid for on the basis of area heated, and residential heating charges are paid not by residents but by their employers. There is thus no incentive for the end user to conserve energy. In addition, the single-pipe supply system used in most buildings does not allow individual apartment temperature control. As a result, more than 10% of apartments open windows to vent excess heat during winter.

3.3 Heating Energy Conservation Center. In order to overcome these barriers and promote a sustained and systematic program of heating energy conservation, BMG would set up a Heating Energy Conservation Center (HECC) attached to RHAO as the institutional focus of heating energy conservation efforts. HECC would consist of six to eight full-time professional staff working with designated RHAO staff in its district offices. The long-term role of HECC would be limited to setting standards, compile and disseminate information, and otherwise encourage research and investment in heating energy conservation.

3.4 Objectives and Scope of the Component. The GEF-financed component would support the establishment of the technical and institutional basis that would encourage sustained market-based energy conservation in various elements of the heating systems. To this end, the component would finance the following activities to help develop HECC, to help local professionals develop and acquire technical knowledge, and to motivate local officials, consultants, contractors, heat suppliers and users in conservation measures. While energy conservation in natural gas heating systems would fall under HECC' s purview, most of the specific technical activities would be carried out under the Gas Boiler Market and Technology Development component managed by SJET. HECC will draw on this work for its policy and standard setting.

A. Best Practice Development and Promotion (Indicative grant allocation $1.5 M).

Consultants would evaluate and establish best practice models and standards for energy efficiency in coal and other boilers, heat distribution systems, insulation, and other elements of the heating system. Criteria and methodology to evaluate the feasibility of various conservation measures will be established. These will be codified in technical manuals and disseminated to heat supply entities and technical specialists. This work will be based on the following:

(a) A detailed inventory of heating boilers that will remain coal fired in the medium to long term, containing all relevant performance and financial information, updated annually.

(b) A similar inventory of other heating boilers under the supervision of RHAO, and gas boiler best practice models developed by SJET.

(c) Comparative evaluation of the heating system performances to identify factors determining energy efficiency.

(d) Several specific measures for energy conservation in coal-fired boilers and heat distribution and control systems developed by the Beijing Society of Environmental Science,

(e) Measures developed under various national and local programs for improved insulation, heat metering, and individual heat control.

(f) International best practices.

(g) Financial and technical feasibility analysis of various best practice measures and standards under the circumstances in Beijing.

B. Energy Audits and Conservation Assistance ($2.0 M)

The Center will engage consultants and contractors to provide energy audit of heating systems, and initial advice for technical and financial planning for modifications to conserve energy. Considering the similar services provided initially by SJET to those installing gas boilers, HECC will aim to provide detailed energy audits and analysis to about 600 heating systems over five years, simple audits to about 1000, and advisory services to about 600.

C. Pilot and Demonstration Installations ($3.1 M).

HECC will provide key equipment and design services for pilot installation of diverse energy conservation measures developed under A above. These would include: varying levels of automation of coal boilers, improved coal preparation and feeding, heat distribution system balancing valves, timed heat delivery, high efficiency heat exchangers, insulation of heat pipes and windows, individual heat metering and control, retrofitting of heat distribution and control arrangements within buildings. The target would be to install all major modification examples represented and available for public inspection in each district. Experiences of the pilot installations will be evaluated in detail, published in technical journals and public information materials, and fed into refining best practice models. Selected measures that require public policies and regulations will be recommended, including heating metering and control.

D. HECC Establishment and Promotion ($0.7 M)

Consultant assistance and equipment would be provided to help the establishment of HECC including cooperating district RHAO offices, preparation of its operating programs, and training of the staff. The component would also include support for broad training and information dissemination to sector professionals and the general public.

E. Energy and Environment Study ($1.2 M).

BEPB and HECC would manage a study and related training to improve the policy and institutional frameworks for heating and energy supply, use, and pricing and air quality management. This will include projection of various energy demands, their air quality implications, review of strategies for market-based heat and energy supply and pricing, and design and compilation of stationary air pollution source inventory. The last item would extend the pilot work at Xicheng district on the stationary emission source database and management information system to other Beijing urban districts.

3.5 Implementation Arrangements. Consistent with the long-term objectives of HECC and the component, most of the work described above will be carried out by local consultants and contractors under the management of HECC, except the study on energy and environmental management frameworks which will be managed jointly with BEPB.

Most international consultants will be hired under two contracts to be awarded through competitive proposal process by about December 2000: about 55 p/m for activities A through C above, and an estimated 32 p/m for the energy and environment study. For preparatory assistance under activity D, individual consultants will be retained according to the Bank procedures. About six national technical institutions and companies, with different specialties, would be competitively selected to provide about 400 p/m of consultant input.

Some of the goods required for the component would be purchased in large quantities through ICB procedures. These would include various control and power equipment for coal boilers and heat distribution systems, heat meters and control valves, that would be installed for demonstration around the districts. Others include a great variety of goods required for various vintages of boiler and heat distribution equipment, a small number of various instruments, small quantities of office and transportation equipment and software. These will be procured by international and local shopping.

Details of estimated costs are provided in Annex 3.

Project Component 4 - US$3.88 million

Air Quality Monitoring and Decision Support System Improvement

4.1 Monitoring System Upgrade. Additional monitoring equipment will be required to upgrade the Beijing EPB's monitoring and analysis capabilities, both to extend the coverage of the existing monitoring system, and the range of pollutants monitored following the issuance in 1996 of standards for PM10 particulates. The project would support the equipment procurement required for the following (estimated cost of $3.5 M):

(a) upgrading and renovation of five existing monitoring stations;
(b) establishment of five additional monitoring stations in the outer districts of Beijing.
(c) expansion of monitoring of electromagnetic radiation;
(d) various equipment to calibrate monitoring equipment and analyze gases and multipollutants.

4.2 Air Quality Management Decision Support System(estimated cost $0.4 M). The expanded monitoring and computer network will provide the necessary sampling frequency and geographical coverage to support a real-time air quality management decision support system. Further, various monitoring programs related to heating energy and pollution in the 8 urban districts (supported under the preceding components with GEF financing) would provide the necessary supplementary data on stationary sources. The project would support technical assistance, software, and training to enhance the organization, analysis, and use of the data. The study will include the establishment MIS/GIS and an action program of measures to implement and integrate the EDSS into the operations of the BEPB, and those other agencies concerned with air pollution in planning and environmental assessment.

Municipal Wastewater Management

Beijing's watercourses, which flow easterly, are part of the Hai River system, including the Juma, Yongding, Beiyun, Chaobai and Juchuo Rivers. There are four major rivers (Tonghui, Liangshui, Qing and Ba) and thirty-three major branches running through the city area with a total length of about 520 km

and catchment area of 1,238 km^2. There are also 23 lakes within the city area, occupying 5.57 km^2. Functions of rivers in the city include drainage, supply of water for industrial/agricultural use, and supply of water to lakes around the city.

Water pollution in Beijing has reached a very high level, posing an increasingly serious threat to the groundwater system which constitutes a major part of the city's drinking water sources. Crops and soils also are being severely polluted due to irrigation practices using untreated wastewater. This has caused considerable damage to the ecological environment and serious health concerns to the local residents. The heavily polluted watercourses that pass through developed urban areas also cause serious environmental impacts. In addition, many new industrial factories and residential buildings must discharge wastewater directly into nearby river systems because of inadequate sewers and wastewater treatment plants (WWTPs), causing severe pollution to the waterbodies and surrounding environment.

Beijing's total wastewater in 1996 was approximately 2,450,800 m^3/day comprising 1,382,200 m^3/day from domestic sources and the rest from industries. Compared with 1995, this represents an increase of about 183,000 m^3/day of domestic wastewater and a reduction of some 122,000 m^3/d of industrial wastewater. Over the past ten years, wastewater quantities in Beijing have increased by about 1.7% per year. The pollution load from wastewater in 1995 was: SS 59,800 tons; BOD, 46,600 tons, and COD 112,800 tons.

There are 14 existing sewage pumping stations in Beijing, with a total capacity of 330,000 m^3/day, pumping sewage to either rivers or irrigation channels. There are about 2,625 km of existing sewers in Beijing, of which about 900 km are storm sewers, about 900 km are combined sanitary sewer/storm sewers, and about 825 km are sanitary sewers. The storm sewers service about 50% of the city area, and are mostly located in the city center.

Since the 1980s, Beijing Municipality has constructed a large quantity of sewers and four WWTPs on the downstream area of the city's drainage system, with a total treatment capacity of 1.085 million m^3/day. This increased the city's sewerage coverage to about 40%, and mitigated pollution problems to some extent. With the rapid growth of social and economic development and improvement of people's living standards, nevertheless, pollution control and improving surface water quality in the city's river system have become an increasingly important issue and a major focus of both Beijing Municipality and the central government. The project would help address these concerns by significantly increasing the coverage of wastewater collection and treatment. The wastewater management component includes construction of three secondary WWTPs and major trunk sewers for the Liangshui River system, major trunk sewers required to intecept and convey sewage to the more easterly reaches of the Qing River, institutional restructuring and development of BDC, and related resettlement and land acquisition.

Project Component 5 - US$106.74 million

Liangshui River System Sewers

a. Liangshui River South Bank Interceptor Sewer. The interceptor is approximately 10,950 meters in length with a varying diameter of 1950 mm to 3000 mm, covering a catchment area of 2,535 ha.

b. Xinkai Ditch sewer interceptor (upstream section). The total length of the sewer is about 4,840 meters with a diameter of 1000 mm to 1800 mm, covering a catchment area of 4910 ha.

c. Songjiazhuang industrial area sewer. The sewer is about 2,750 meters long with diameters varying

from 700 mm to 1400 mm, covering a catchment area of 1713 ha.

d. Fengcao River north bank sewer. The planned Fengcao River north bank sewer downstream section is 1,500 meters long with the diameter of 1600 mm.

Project Component 6 - US$231.00 million

Liangshui River System Wastewater Treatment Plants

a. Wujiacun WWTP. It is to have a secondary treatment process, including nutrient (P) reduction, with a design capacity of 80,000 m^3/day, including 6.65 km sewer pipe and 1.5 km outlet pipe totaling 8.15 km.

b. Lugouqiao WWTP. It is to have a secondary treatment process with a design capacity of 200,000 m^3/day. Its incoming sewer interceptor is 8.79 km in length and outlet pipe is 0.5 km.

c. Xiaohongmen WWTP. It is to have a secondary treatment process with a design capacity of 600,000 m^3/day (ultimate capacity 900,000 m^3/day. Its incoming sewer interceptor is 5.9 km and outlet pipe is 0.9 km, with an overflow channel/pipe of 1.0 km.

Project Component 7 - US$65.28 million

Qing River System Sewers

a. Qing River north bank sewer interceptor. The sewer interceptor is located along the north bank of Qinghe river in west-east orientation and then along Nanmafangxilu road northwards to the proposed Qinghe WWTP. The serviced catchment area is 15,942 ha, and pipe diameter varies from 1050 mm to 3000 mm over a total length of 10,200 meters.

b. Xiaoyue River east bank sewer interceptor. The sewer interceptor runs along the eastern bank of Xiaoyue River from south to the north, crossing the Qing River via a siphon before connecting to the proposed Qing River sewer interceptor. Covered catchment area is 4,245 ha, and pipe diameter varies from 1950 mm to 2400 mm over a total length of 6,200 meters.

c. Party School East Sewer. The sewer runs in south-north orientation crossing the Qing River via a siphon before connecting to the proposed Qing River sewer interceptor. The sewer size is 1400 mm in diameter with a total length of 1,520 meters.

d. Wanquan River sewer interceptor. The sewer runs in south-north orientation crossing Qing River via a siphon before connecting to the proposed Qing River sewer interceptor. The sewer is 720 meters in length.

e. Tucheng Road Diversion Sewer. The diversion sewer runs along Qinghuananlu road to the north, and then goes along Tucheng road from west to the east before connecting to the planned Xiaoyue River east bank sewer interceptor. Covered catchment area is 1,827 ha, and pipe diameter varies from 1350 mm to 1950 mm over a total length of 5,505 meters.

f. Chengfu Road Diversion Sewer. The diversion sewer runs along Chengfu Road eastward before connecting to the planned Xiaoyue River east bank sewer interceptor. The covered catchment area is 650 ha and pipe diameter is 1350 mm over a total length of 1,900 meters.

Project Component 8 - US$6.45 million

Beijing Drainage Company Institutional Strengthening, Implementation Support and Training

8.1 The Beijing Drainage Company was incorporated in December 1993 and formal operations commenced in September 1995 during the implementation of the first Beijing Environment Project. Although the change in legal status of the company from a government administrative unit to a government enterprise following the Enterprise Law was beneficial in separating the accounts of BDC from its parent, the authority for management of the overall company, especially the strong and independent wastewater treatment plant facilities wasn't consolidated. Many of the assets BDC was to manage have not yet been completed and therefore had not been transferred to BDC's ownership and management, and BDC had little influence over tariffs and is unable to retain the revenues and manage them on its own, which would improve its financial performance and accountability.

8.2 To build upon the institutional foundation developed under the first Beijing Environment Project, an Institutional Development Plan (IDP) for Beijing Drainage Company was prepared by BDC and BMG with the assistance and advice of international and local consultants during May-November 1999. The IDP proposes changes to the internal structure, systems and management of BDC, and to the external regulatory/oversight agencies responsible for BDC. BDC/BMG committment to the proposals laid out in the IDP has been demonstrated by the fact that a number of the proposals were being implemented even as the IDP was being drafted. The Bank has reached agreement with BMG to implement the findings of the IDP, and in particular, three key actions towards BDC's independent accounting and management have been agreed and included as dated covenants in the project legal agreements. The key recommendations of the IDP which have been covenanted are:

a. Revenue Retention. BDC to retain all revenues collected from wastewater tariffs and upon establishing an effective Board of Directors will have the authority to dispose of all revenues.

b. Transfer of Remaining Assets and Responsibility to Manage All Sewerage and Drainage Facilities. BDC to take over control and responsibility for managing all sewerage and drainage facilities in the urban districts including the transfer of remaining sewerage and pumping station assets.

c. Conversion to Corporate Structure. BDC to be converted to a limited liability state-owned enterprise with the structure specified under the Company Law, including fully autonomous Board of Directors and Supervisory Board.

8.3 The increased autonomy would need to be complemented by the establishment of a regulatory and supervisory framework on the part of BMG. This will require, beyond the Boards on which BMG would be represented, clear definition of BDC's mandates, and rules and procedures regarding pricing and other matters involving regulatory actions. In order to define such a framework and guide the restructuring process, BMG is establishing a leading group, headed by the Vice Mayor of Beijing in charge of planning. The project would finance the following technical assistance, training and equipment to assist BDC to implement the systems, processes and structural changes and ensure (i) sound corporate planning; (ii) secure internal financial controls; (iii) accurate and timely data collection of key financial and physical inputs; (iv) a suitable training program; and (v) improved operation and maintenance systems, to meet BDC’s needs:

Technical Assistance to Design the Corporate and Sector Structures, by reviewing options and make details recommendations on: sector regulatory frameworks, corporate mandates, corporate structure, financing options, capital planning systems, MIS and accounting systems, personnel systems, and training programs; to report to the Leading Group and BDC. Total consultant input: 20 person-months foreign and 40 p/m national, estimated cost $0.72 M.

Technical Assistance for Implementation of the above and operations improvement. Total consultant input 40 p/m international, 115 national, at an estimated cost of $1.55 M.

Technical Assistance for project management, design and bid document review, and facility commissioning assistance during project implementation: Total consultant input 40 p/m international. Total cost $1.2 M.

Computer system hardware and software for BDC systems, estimated cost $0.38 M.

Training overseas and in-house: Total cost $1.0 M.

Equipment for operation and maintenance: Total cost $1.6 M.

Project Component 9 - US$303.28 million
Land Acquisition and Resettlement

9.1 The trunk interceptor sewers and WWTPs in the Liangshui River system will permanently occupy ab out 84 ha of land and require an additional 85 ha temporarily during construction. This will require resettling 2,386 families or 8,300 residents, 357 institutions and commercial entities, and 277,147.5 m^2 of built structure. The Qing River trunk interceptor sewers will permanently occupy about 0.8 ha of land permanently and require 48 ha during construction. This will affect 259 families with 716 residents and houses and other structures with a total floor space of 61,300 m^2. The majority of affected residents are farmers and laborers.

9.2 In view of the urban setting, the resettlement and other compensations would be provided mainly in the form of cash compensations to enable replacement of the real property by at least equivalent properties of the relocatee's choice on the market, based on estimated market prices of comparable properties. The other main part of the compensation consists of employment assistance for those who wish or need to find new employment. Some residents who work as farm or construction laborers have applied for the assistance so far. BDC has committed to employing all the applicants in its subsidiary units on the same employment terms as existing workers. Other compensation includes moving costs and extra compensation for those who have ownership of their properties, beyond the more usual use rights. These follow the new resettlement regulations of BMG. Details of the standards, scope, and budgets for various compensations are provided in the RAP (Annex 8: project files.)

9.3 The RAP is, however, subject to two uncertainties. Currently only about 20% of all sewerage works details are confirmed, others being in the preliminary design stage. Detailed design of the remainder is scheduled to be completed by late 2001. This leaves considerable room to change the scope of resettlement and land acquisition. The more likely change is reduction in the scope, as has been done in the earlier stage of project preparation, but the possibility of increased scope exists. Further, the compensation would be determined on the basis of market prices of replacement properties, which may increase faster than projected. For these reasons, a generous budget has been allocated. A revised RAP with firm details

would be prepared as the detailed engineering designs are completed, and submitted to the Bank well before the start of the works bidding process so as to ensure completion of satisfactory resettlement and compensation before the work starts. The updating of the RAP and its implementation would be monitored by a team of professionals of Beijing University.

Annex 3: Estimated Project Costs

CHINA: Second Beijing Environment Project

Project Cost By Component	Local US $million	Foreign US $million	Total US $million
AIR POLLUTION REDUCTION			0.00
A. Boiler Conversion	181.96	235.41	417.37
B. Gas Boiler Market and Technology Development (GEF)	10.58	16.56	27.14
C. Heating Energy Conservation (GEF)	4.40	6.77	11.17
D. Air Quality Monitoring and Decision Support	0.89	2.30	3.19
SEWERAGE			0.00
E. Liangshui River Sewers	68.65	19.56	88.21
F. Liangshui River Wastewater Treatment	96.84	88.22	185.06
G. Qing River Sewers	40.83	12.61	53.44
H. BDC Institutional Development	0.48	5.66	6.14
I. Land Acquisition and Resettlement	250.82		250.82
Total Baseline Cost	655.45	387.09	1042.54
Physical Contingencies	87.60	45.25	132.85
Price Contingencies	47.20	28.92	76.12
Total Project Costs	790.25	461.26	1251.51
Front-end fee		3.49	3.49
Total Financing Required	790.25	464.75	1255.00

Project Cost By Category	Local US $million	Foreign US $million	Total US $million
Goods	123.87	276.05	399.92
Works	341.33	85.32	426.65
Services	48.84	72.82	121.66
Land Acquisition & Resettlement	303.28	0.00	303.28
Total Project Costs	817.32	434.19	1251.51
Front-end fee		3.49	3.49
Total Financing Required	817.32	437.68	1255.00

Note: Services include engineering, project management, and marketing as well as technical assistance and training.

Cost Estimation Details

Project base cost estimates are based on December 1999 prices and design estimates. Physical contingencies of 10% were applied to all wastewater expenditure categories in 2000 to reflect that estimates are based on preliminary design specifications, and of 15% for 2001 to 2005 to reflect less precise estimates. For boiler conversion component, a physical contingencies of 10% have been included in the estimated costs. For other components, 15% of contingencies are added.

Price contingencies are estimated using the World Bank projection of local and international price increases, shown below. The exchange rate of Renminbi Yuan to US dollar is assumed to change to maintain purchasing power parity. In the case of boilers, for reasons discussed in Sections B and C of this PAD, most of the excess margin over the international price that is present in current equipment prices in

Beijing is projected to be eliminated, resulting in the overall price reduction of these equipment by 30% over six years in real terms. The combined effect of this with the general price level increase would be a net nominal price reduction of 20% over six years. A similar reduction is projected in technical services costs. Details are shown in Table 1b below.

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Price Increases, Yuan	2.0%	5.0	5.0	5.0	5.0	5.0
Price increases, US$	1.6	2.5	2.6	2.5	2.5	2.6

The full nominal price costs of air pollution control components account for 42% of project costs; 57% for the wastewater components, including 26% in land acquisition and resettlement costs.

Table 1. DETAILED ESTIMATED COSTS OF BOILER CONVERSION

Table 1a. Unit Cost by Boiler Size

(Yuan Million in end 1999 prices, including physical contingencies)

Boiler Size: tph	2			4			6		
	Loc. RMB	For'n US$	Total RMB	Local RMB	For.n US$	Total RMB	Local RMB	For'n US$	Total RMB
Engineering	0.05	0.00	0.05	0.08	0.00	0.09	0.11	0.00	0.11
Civil Works	0.16	0.00	0.16	0.28	0.00	0.28	0.36	0.00	0.36
Equipment and Materials	0.27	0.05	0.71	0.48	0.10	1.28	0.61	0.12	1.61
Installation	0.28	0.00	0.29	0.50	0.00	0.52	0.64	0.00	0.65
Project Management	0.04	0.00	0.04	0.07	0.00	0.07	0.09	0.00	0.09
TOTAL	0.79	0.05	1.25	1.43	0.10	2.24	1.79	0.12	2.82

Boiler Size, tph	8			10		
	Loc RMB	For'n US$	Total RMB	Local RMB	For'n US$	Total RMB
Engineering	0.13	0.00	0.14	0.16	0.00	0.17
Civil Works	0.44	0.00	0.44	0.53	0.00	0.53
Equipment and Materials	0.76	0.15	2.00	0.89	0.18	2.37
Installation	0.79	0.00	0.81	0.93	0.00	0.96
Project Management	0.11	0.00	0.11	0.13	0.00	0.14
TOTAL	2.23	0.15	3.51	2.64	0.18	4.15

Table 1b. Projected Annual Conversion Schedule, Number of Boilers

Boiler Program	2000	2001	2002	2003	2004	2005	Survey	Project
2 tph	95	160	185	200	130	60	1004	830
4tph	90	160	250	257	180	80	1227	1017
6 tph	40	50	59	45	20	10	269	224
8 tph	3		3		0		4	6
10 tph	12	15	25	23	15	7	117	97
Total Number Boilers	240	385	522	525	345	157	2621	2174

Table 1c. Estimated Cost of Conversion
(US$ M)

Boilers	2000	2001	2002	2003	2004	2005	Total
Cost, 2000 prices	21.07	32.51	45.75	44.74	29.21	13.30	186.58
Reduced Cost, 2000 prices	20.40	29.51	38.91	35.66	21.83	9.31	155.62
Actual current prices	**20.57**	**30.35**	**41.04**	**38.58**	**24.20**	**10.58**	165.33
Other Goods							
Cost, 2000 prices	12.84	19.82	27.89	27.28	17.81	8.11	113.75
Reduced Cost, 2000 prices	12.84	19.82	27.89	27.28	17.81	8.11	113.75
Actual current prices	**12.95**	**20.39**	**29.42**	**29.51**	**19.75**	**9.21**	121.22
Works and Services							
Cost, 2000 prices	25.68	39.64	55.78	54.55	35.62	16.21	227.48
Reduced Cost, 2000 prices	24.88	35.98	47.44	43.48	26.61	11.35	189.74
Actual current prices	**25.08**	**37.01**	**50.04**	**47.04**	**29.51**	**12.90**	201.58
Total							
Cost, 2000 prices	59.59	91.97	129.42	126.56	82.64	37.61	527.81
Reduced Cost, 2000 prices	58.12	85.30	114.24	106.42	66.25	28.77	459.11
Actual current prices	**58.59**	**87.75**	**120.51**	**115.13**	**73.46**	**32.70**	488.13

Summary - Boiler Conversion Cost
(Notional base cost with price reduction and 10% physical contingency)

Year	2000	2001	2002	2003	2004	2005	Total
Equipment, Bank-financed	18.55	26.82	35.37	32.42	19.84	8.47	141.47
Equipment, Other	11.68	18.02	25.36	24.80	16.19	7.37	103.40
Works and Services	22.61	32.71	43.13	39.53	24.20	10.32	172.49
Total	52.84	77.55	103.85	96.75	60.23	26.15	417.37

Summary - Boiler Conversion Cost
(including physical contingencies and cost reduction)

Year	2000	2001	2002	2003	2004	2005	Total
Equipment, Bank-financed	20.40	29.51	38.91	35.66	21.83	9.31	155.62
Equipment, Other	12.84	19.82	27.89	27.28	17.81	8.11	113.75
Works and Services	24.88	35.98	47.44	43.48	26.61	11.35	189.74
Total	58.12	85.30	114.24	106.42	66.25	28.77	459.11

Summary - Boiler Conversion Cost
(in Current Price)

Year	2000	2001	2002	2003	2004	2005	Total
Equipment, Bank-financed	20.57	30.35	41.04	38.58	24.20	10.58	165.33
Equipment, Other	12.95	20.39	29.42	29.51	19.75	9.21	121.22
Works and Services	25.08	37.01	50.04	47.04	29.51	12.90	201.58
Total	58.59	87.75	120.51	115.13	73.46	32.70	488.13

Table 1d. Procurement Schedule, Packages including GEF-financed Boilers
Yuan M in 2000 prices

Year	2000	2001	2002	2003	2004	2005
Boilers	131.77	196.63	265.43	244.48	147.04	60.14
Gas Regulators, Valves, and other	37.17	55.46	74.86	68.96	41.47	16.96
Note: GEF-financed boilers $000		938.7	2190.3	2190.3	938.7	

Table 2. ESTIMATED COSTS OF GEF-FINANCED COMPONENTS

Summary: Total Cost

	Consultants		Training/Marketing		Goods/Works		Total	
	Base	Total	Base	Total	Base	Total	Base	**Total**
Gas Mkt/Tech.	$9,521	$11,620	$2,032	$2,480	$15,594	$19,032	$27,146	**$33,132**
Conservation	$3,350	$4,088	$1,177	$1,437	$5,594	$6,828	$10,121	**$12,353**
E&E Study	$883	$1,078	$94	$114	$67	$82	$1,044	**$1,274**
Total	$13,754	$16,787	$3,303	$4,031	$21,255	$25,941	$38,311	**$46,758**

Summary: GEF Financing

	Consultants		Training/Marketing		Goods/Works		Total	
	Base	Total	Base	Total	Base	Total	Base	**Total**
Gas Mkt/Tech.	$5,349	$6,528	$1,117	$1,363	$7,054	$8,609	$13,520	**$16,500**
Conservation	$2,103	$2,566	$845	$1,031	$3,033	$3,702	$5,981	**$7,299**
E&E Study	$838	$1,023	$94	$114	$52	$63	$983	**$1,200**
Total	$8,290	$10,117	$2,056	$2,509	$10,138	$12,374	$20,484	**$25,000**

Table 2.a Detailed Estimates: (Base Cost, $000)

Consultant Services

	-------- GEF-Financed Elements ---------					Other	
	Person-Months		Cost, $000				
	Foreign	Local	Foreign	Local	Total	Other Local	**Grand Total**
Technical Capacity Building	**77**	**741**	**$1,416**	**$1,972**	**$3,387**	**$3,109**	**$6,497**
Technology Transfer, General	18	45	$344	$120	$464	$60	**$524**
Advanced Technology Introduction	5	24	$96	$64	$159	$15	**$174**
Developing Best Practice Models	15	48	$287	$128	$415	$32	**$446**
Industry Analysis and Capacity Bldg	5	36	$96	$96	$191	$21	**$212**
Training	4	51	$77	$136	$212	$28	**$240**
Evaluation of Boiler and Heat Delivery	8	94	$153	$249	$402	$51	**$453**
Services for Initial Boiler Conversion							
Design and Installation	12	301	$230	$801	$1,030	$1,498	**$2,529**
Operations and maintenance	7	142	$134	$379	$513	$1,406	**$1,919**
Market Development	**40**	**450**	**$765**	**$1,196**	**$1,961**	**$1,063**	**$3,024**
Market survey, aggregation and							
Procurement management	15	72	$287	$192	$478	$413	**$891**
Marketing and Information Dissemination							
General Marketing and surveys	4	56	$77	$149	$225	$74	**$300**
Point-of-sales Appraisal	10	196	$191	$520	$712	$173	**$885**
Model boilers							
Full-time demonstration and training	2	45	$38	$120	$158	$144	**$302**
In-use boilers	3	45	$57	$120	$177	$144	**$321**
Distributed (small) gas boilers	6	36	$115	$96	$211	$115	**$325**
Total, Gas Technology and Market Develop.	**114**	**1191**	**$2,181**	**$3,168**	**$5,349**	**$4,172**	**$9,521**

Consultant Services

Heating Energy Conservation	**65**	**323**	**$1,243**	**$859**	**$2,103**	**$1,247**	**$3,350**
Best Practice Development							
Heat Distribution system, General	9	30	$172	$80	$252	$20	**$271**
Individual metering and control	4	15	$77	$40	$116	$10	**$126**
Insulation and other measures	6	20	$115	$53	$168	$13	**$181**
Refine coal best practices	7	30	$134	$80	$214	$82	**$296**
Audits and Assistance for Best Practice Impl.							
Coal boilers	2	36	$38	$96	$134	$115	**$249**
Non-coal boilers	1	15	$19	$40	$59	$48	**$107**
Heat Distribution system, General	4	48	$77	$128	$204	$153	**$357**
Insulation and other measures	3	30	$57	$80	$137	$96	**$233**
Marketing	2	24	$38	$64	$102	$77	**$179**
Advisor for Center and Training	18	18	$344	$48	$392	$180	**$572**
Demonstration projects							
Coal boiler systems	2	12	$38	$32	$70	$96	**$166**
Distribution systems	3	12	$57	$32	$89	$96	**$185**
Insulation and other	2	15	$38	$40	$78	$120	**$198**
Individual metering and control	2	18	$38	$48	$86	$144	**$230**
Energy and Environment studies	**32**	**85**	**$612**	**$226**	**$838**	**$45**	**$883**
Grand Total, Consultants	**211**	**1599**	**$4,036**	**$4,253**	**$8,290**	**$5,464**	**$13,754**

Table 2.b Costs for Training, Dissemination, and Marketing

		Persons	Unit Cost	For-eign	Local	Total	Other Local	Total
Technical Capacity Building				**$221**	**$280**	**$501**	$516	**$1,017**
3 month training (2-6 mo)	6	Person-trip	13000	$78		**$78**		**$78**
5-wk study tour (3-6weeks)	15	Person-trip	9500	$143		**$143**		**$143**
Specialist Training	50	Persons	3000		$150	**$150**	$450	**$600**
Training workshop for								**$0**
Gas boiler technicians	20	events	2000		$40	**$40**	$66	**$106**
Technical Documents	15	sets	6000		$90	**$90**		**$90**
Market Development				**$116**	**$501**	**$617**	$399	**$1,016**
World Market survey	15	Person-trip	7700	$116		**$116**		**$116**
Marketing Training	50	Persons	500		$25	**$25**	$75	**$100**
Conversion Guides	5	sets	6000		$30	**$30**		**$30**
Publicity								
Leaflets	10	sets	5000		$50	**$50**		**$50**
Exhibits	30	spots	1000		$30	**$30**		**$30**
Media	15	spots	10000		$150	**$150**		**$150**
District Info Centers	8	sets	12000		$96	**$96**	$144	**$240**
Training workshops (operators)	60	workshops	2000		$120	**$120**	$180	**$300**
Total				**$336**	**$781**	**$1,117**	**$915**	**$2,032**
Heating Energy Conservation				**$109**	**$736**	**$845**	**$332**	**$1,177**
3 month training (2-6 mo)	4	Persons	13000	$52		**$52**		**$52**
5-week study tour (3-6weeks)	6	Persons	9500	$57		**$57**		**$57**
Local Specialist Training	45	Persons	2000		$90	**$90**	$18	**$108**
Training/Dissemination								
Advertising								
Leaflets	40	sets	5000		$200	**$200**		**$200**
Exhibits	50	spots	1000		$50	**$50**	$50	**$100**
Media	12	spots	10000		$120	**$120**		**$120**
District Info Centers	8	sets	12000		$96	**$96**	$144	**$240**
Technical Documents	20	sets	3000		$60	**$60**		**$60**
Workshops	60	events	2000		$120	**$120**	$120	**$240**
Energy and Environment studies				**$83**	**$11**	**$94**	**$0**	**$94**
3 month training (2-6 mo)	2	Person-trip	13000	$26		**$26**		**$26**
5-week tour	6	Person-trip	9500	$57		**$57**		**$57**
Workshops/reports	3	events	3500		$11	**$11**		**$11**

Table 2.c Goods

	Num.	Unit	Unit Cost	Foreign Cost	Local Cost	Total	Other Local	Total
1. Technology and Market Development								
Boilers and accessories								
Full-time demo/Training	6	sets	140000	$672	$168	$840	$924	**$1,764**
In-use demo	32	sets	95000	$2,432	$608	$3,040	$3,952	**$6,992**
Advanced	20	sets	40000	$720	$80	$800	$1,040	**$1,840**
Distributed, medium	8	sets	110000	$704	$176	$880	$1,144	**$2,024**
Distributed, small	320	sets	2000	$480	$160	$640	$704	**$1,344**
Parts	5%	of above		$250	$60	$310	$388	**$698**
Subtotal				$5,258	$1,252	$6,510	$8,152	**$14,662**
Laboratory and Training Instruments	2	sets	100000	$180	$20	$200	$7	**$207**
Auditing instruments	20	sets	7500	$135	$15	$150	$5	**$155**
Mainten. Tools and Guages	20	sets	7000	$98	$42	$140	$14	**$154**
Subtotal				$413	$77	$490	$26	**$516**
Vehicles: Small	10		16000	$80	$80	$160	$27	**$187**
Vans	4		28000	$112	$0	$112	$37	**$149**
Mobile phones	16		1200	$0	$19	$19	$6	**$26**
Laptop Computers	20	sets	3000	$30	$30	$60	$20	**$80**
Office computer sets***	36	sets	3000	$54	$54	$108	$18	**$126**
Audio-visual Equipment and other training aids	6	sets	6000	$25	$11	$36	$4	**$40**
Other office equipment	3	sets	6000	$9	$9	$18	$250	**$268**
Subtotal				$310	$203	$513	$362	**$875**
Total Equipment - Gas				**$5,982**	**$1,532**	**$7,513**	**$8,540**	**$16,053**
2. Heating Energy Conservation								
Demonstrations								
Coal Boilers	8	sets	75000	$420	$180	$600	$900	**$1,500**
Heat distribution systems	8	sets	75000	$480	$120	$600	$900	**$1,500**

Meters and valves	1200	sets	550	$462	$198	$660	$198	**$858**
Insulation, etc.	240	sets	1000	$120	$120	$240	$288	**$528**
Demonstration sets	8	sets	50000	$280	$120	$400	$120	**$520**
Subtotal				$1,762	$738	$2,500	$2,406	**$4,906**
Instruments and tools	12	sets	40000	$432	$48	$480	$16	**$496**
Audio-visual Equipment and other training aids	9	sets	6000	$38	$16	$54	$5	**$59**
Subtotal				$470	$64	$534	$21	**$555**
Vehicles: small	5		16000	$27	$53	$80	$18	**$98**
Vans	2		28000	$56	$0	$56	$0	**$56**
Mobile phones	6		1200	$0	$7	$7	$2	**$10**
Laptop Computers	7	sets	3000	$11	$11	$21	$4	**$25**
Office computer sets***	20	sets	3000	$30	$30	$60	$10	**$70**
Other office equipment	9	sets	6000	$27	$27	$54	$100	**$154**
Subtotal				$150	$128	$278	$134	**$412**
Total Equipment - Conservation				**$2,382**	**$930**	**$3,312**	**$2,561**	**$5,873**
3. Energy and Environment Study								
Laptop Computers	3	sets	3000	$5	$5	$9	$2	**$11**
Office computer sets***	5	sets	3000	$8	$8	$15	$4	**$19**
Modelling Software	1	sets	26000	$26	$0	$26	$7	**$33**
Other office equipment	1	sets	6000	$3	$3	$6	$3	**$9**
Total Equipment E &E Study				**$41**	**$15**	**$56**	**$16**	**$72**
Total Equipment				**$8,405**	**$2,477**	***$10,881***	**$11,116**	***$21,998***

TABLE 3: DETAILED COST - SEWERAGE

(Base Cost by Year, Yuan million in 1999 prices)

	2000	2001	2002	2003	2004	2005	Total
I. Investment Costs							
A. Civil Works							
1.1 Qinghe Interceptor - Upstream Section	25.620	34.160	19.820	-	-	-	79.600
1.2 Qinghe Interceptor - Central Section	21.120	42.240	2.240	-	-	-	65.600
1.3 Qinghe Interceptor--downstream section	15.070	20.090	11.670	-	-	-	46.830
1.4 Xiaoyuehe Sewer--Downstream Section	-	-	11.060	55.300	36.740	-	103.100
1.5 Xiaoyuehe Sewer--Upstream Section	-	-	-	11.540	57.700	38.360	107.600
2.1 Liangshuihe Interceptor--Upstream Section	26.880	53.760	44.660	-	-	-	125.300
2.2 Liangshuihe Interceptor--Downstream Section	25.300	50.600	42.000	-	-	-	117.900
2.3 Xinkai Ditch Interceptor	-	0.170	21.830	23.210	-	-	45.210
2.4 Fengcaohe Sewer	6.080	21.820	-	-	-	-	27.900
2.5 Songjiazhuang Sewer and Syphons	-	8.500	30.500	-	-	-	39.000
2.6 Xiaolonghe Interceptor & Main Branch	-	-	-	-	8.670	69.440	78.110
4.1 Wujiacun Interceptor	-	22.840	30.360	-	-	-	53.200
5.1 Shijingshan Ditch Sewer--Upstream	-	-	10.190	49.250	32.370	-	91.810
5.2 Shijingshan Ditch Sewer--Downstream Section	-	-	12.430	60.100	39.580	-	112.110
Subtotal Civil Works	120.070	254.180	236.760	199.400	175.060	107.800	1,093.270
B. Land Acquisition & Resettlement	346.620	715.990	420.460	207.420	155.380	58.140	1,904.010
C. Technical Assitance							
7.1 Construction Management Consultancy	5.000	5.000	5.000	5.000	5.000	-	25.000
7.2 Engineering Design & Management	-	2.000	34.500	7.200	22.300	13.500	79.500
Subtotal Technical Assitance	5.000	7.000	39.500	12.200	27.300	13.500	104.500
Total	471.690	977.170	696.720	419.020	357.740	179.440	3,101.780

TABLE 4: DETAILED COST - WASTEWATER TREATMENT
(Base Cost by Year, Yuan M in 1999 prices)

	2000	2001	2002	2003	2004	2005	Total
I. Investment Costs							
A. Civil Works							
3.2 Xiaohongmen WWTP Civil Works	-	-	0.520	76.810	102.420	50.540	230.290
3.3 Xiaohongmen WWTP Civil Works	-	-	0.520	76.810	102.420	50.540	230.290
3.4 Xiaohongmen WWTP Misc	-	-	-	-	-	23.230	23.230
4.3 Wujiacun WWTP Civil Works	-	-	23.380	44.670	-	-	68.050
4.4 Wujiacun WWTP Misc	-	-	-	3.440	-	-	3.440
5.4 Lugouqiao WWTP Civil Work	-	-	-	0.930	70.060	66.100	137.090
5.5 Lugouqiao WWTP Misc	-	-	-	-	-	6.910	6.910
Subtotal Civil Works	-	-	24.420	202.660	274.900	197.320	699.300
B. Equipment & Material							
3.1 Xiaohongmen WWTP Equipment Supply	-	1.860	234.500	132.120	7.520	-	376.000
4.2 Wujiacun WWTP Equipment Supply	-	26.190	47.110	-	-	-	73.300
5.3 Lugouqiao WWTP Equipment Supply	-	-	9.340	137.320	9.340	-	156.000
6.1 Sewer O&M Equipment	-	0.340	10.260	-	-	-	10.600
Subtotal Equipment & Material	-	28.390	301.210	269.440	16.860	-	615.900
C. Land Acquisition & Resettlement	-	29.420	286.810	77.190	8.580	-	402.000
D. Technical Assistance							
Engineering Design & Management	-	-	15.700	134.600	-	77.300	227.600
Total	-	57.810	628.140	683.890	300.340	274.620	1,944.800

Annex 4: Cost Benefit Analysis Summary
CHINA: Second Beijing Environment Project

ECONOMIC VALUES OF ENVIRONMENTAL BENEFITS

1. Benefits of environmental improvements such as those under the project are broadly acknowledged but not easily quantified. Understanding the types of benefits and costs and their approximate magnitudes, however, could provide strategic guides to practical project design and implementation.

BOILER CONVERSION

2. Technical Characteristics of Natural Gas Heating, listed below, provide the most relevant environmentally and economically significant comparison with coal:

a. substantial proportion of non-carbon fuel;
b. high combustion efficiency, about 80% on gross heat value basis, compared with 50-70% for coal;
c. little heat loss from boiler, rarely over 10%, compared with 10-30% in coal-fired boilers;
d. automatic gas delivery, eliminating the need for transportation and storage;
e. sealed, automatic operation;
f. little residue, compared with high volumes of ash from coal burning;

Global and local environmental benefits are due to factors a, b,, c, and f. Factors b through f provide for economic and financial efficiencies.

3. Fuel Cost. Factors b and c result in heating efficiency of natural gas about 50% higher than coal. Thus, although natural gas (Y 1.4 per cubic meter) is about three times as expensive as coal if compared on the basis of intrinsic calorific value, eventual cost per heat sent into the heating system would be about twice as high as coal. There are other efficiency factors such as the ability of gas boilers to reach desired temperature much more quickly than coal boilers.

The current bulk price of natural gas in Beijing (Y 0.99 at the city gate, or about $3.4 per million Btu) is about 60% higher than prices in Europe (as of September 1999); coal prices in China are close to or lower than international prices. It is probable therefore the cost gap between the two fuels can narrow significantly in the long run. Further, from 1999, coal has been subject to cost increases due to the new sulfur tax and requirement to use more expensive low-sulfur coal. This would increase coal costs by about 17%.

From the economic and fiscal point of view, the cost of natural gas is lower than the final price also due to the sunk capital in the distribution network which can carry far more natural gas than the current usage. For areas where the network already exists, the variable, marginal cost of gas for the Gas Corp. is about Y 1.1/m^3. The network requires expansion, estimated to cost about Y 700 M to supply the eventual delivery area of the city. These two would be the relevant economic cost of natural gas, not the sunk investment of about $380 M.

4. Operating costs differences. Technical estimation of non-fuel operating costs of natural gas and coal boilers indicate about Y 2.5 and Y 11.5 per square meter heated, respectively, due mainly to the high manual labor requirements of the latter. A very small set of actual operating data (summarized in Table A 4.1) we could obtain confirms the relative difference, but it shows considerably larger magnitudes. The most important and surprising implication of the data is that gas boiler operating costs are lower than the small and medium-sized coal boilers, as the fuel cost disadvantage of natural gas boilers is

overshadowed by other recurrent costs. The large operating costs for both the gas and coal boilers probably indicate the inclusion of labor involved in operation and maintenance of the entire heating system, beyond the boilers, whereas the district heating do not include costs outside the boiler houses. The costs also indicate the inexperience with gas boilers; and large maintenance needs of small coal boilers (about 40% of non-fuel costs). The data also revealed that unit heating costs differ only slightly across large capacity variation among the gas boilers and among small and medium-size coal boilers.

Table A4.1 Heating Cost by Element
(Yuan per square meter heated, 1998-99 heating season)

Boiler Type	Fuel	Labor	Other	Total O&M
Natural Gas Boilers	25.67	3.23	1.85	30.75
Small Coal Boilers	13.32	15.72	5.80	34.35
Coal District Heating	11.49	1.87	1.75	15.11

Four natural gas boilers (4, 6, 14, and 30 tph); six small and medium-sized boilers (0.6- 6 tph); and 2 large coal boilers (20 and 50 tph).
Source: Public Utility Bureau, Haidian District Heating Office, Far East Instrument Company

5. Labor. The main cost for coal heating is the labor. Given the large uncertainty associated with the very small sample, we have adjusted it downward by 10% in economic comparison. As China's urban wage continues to increase rapidly, this alone would put the older scattered boilers out of economic commission, in favor of newer and more efficient coal boilers if not gas boilers. The labor savings, whether by gas boilers or by more efficient coal boilers, would imply reduced employment of the manual labor to handle coal and ash. Currently the entities using the boiler fill the labor need, which is seasonal and arduous, by pressing their own staff into duty on rotation, or by recruiting farmers from outside the city looking for the off-season jobs, and in many cases both. The labor savings would therefore worsen labor surplus issues for many of the enterprises and reduce off-season job opportunities for farmers outside the city. Some 2200 boilers to be converted under the project may involve an order of magnitude of about 10,000 full-time equivalent of such labor, or nearly 0.2% of total employment in Beijing. Some or all of the lost job opportunities would be replaced by new jobs generated by increased economic investment following the environmental improvement. Neither the jobs lost or gained could not be estimated with confidence due to the variety of situations, but it would be important to monitor the employment impact on specific groups of poor laborers.

6. Capital Costs. The current large equipment price differential in favor of coal boilers, however, more than offsets the slight operating cost advantage of gas boilers. The differential on a per square meter basis is estimated at about Y 6. In addition, the economic cost of gas boilers should include the cost of gas distribution network and connection although a significant part of it is a sunk cost. The gap could become narrower. Coal boilers would have to include more automatic features for labor savings. Gas boilers have significantly longer life (25 versus 20 years) and their prices are projected to decrease significantly with market expansion.

7. Age of Boilers and Premature Conversion. On top of the high cost of gas boilers, the remaining life of coal-fired boilers is a major argument against conversion. Age distribution of district heating boilers in 1997 shows a median age of about 9.7 years with higher mode and average. Smaller scattered boilers are believed to be considerably older as new and more denser developments and the increasingly strict

environmental regulations favored larger boilers in recent years. This appears to be one reason why the small and medium sized boilers have such high operating costs in the above examples. Given the general observation that useful life of a coal boiler is about 18-20 years and boiler operating costs rise in linear proportion with age, less than 20% of small and medium sized boilers are likely to have more than half of its value remaining (which would be reached at about 5 years). In 2000, median-age small boilers would have only about 30% of its original value. If conversion proceeds from older boilers and reach newer boilers by 2005, therefore, it is unlikely that a large stock of valuable boilers would be scrapped.

8. Land for Boiler Houses. Coal boilers need coal and ash yards as well as considerable room for operation. A typical boiler house comprise three or four medium-sized boilers of 2-4 tph range, about 400 m^2 of building containing four boilers, and about 2000 m^2 of coal and ash yard. The project area consists of central urban districts where minimum land values on the open market would be about Y 2000/m^2. If the land is disposable for lease or other use, its value can cover the whole cost of installing about three 2-tph gas boilers. The social value of the land could be considerably less than this private value, as the higher density use of the land would require increased infrastructure. Also converting the land to a different use may also take some time for owners to find financing for land conversion.

9. Health Benefits. The current consensus considers that ultrafine particles (PM-10) is the most damaging to health and generated heavily from coal burning. Since we could not obtain a reliable estimate or projection of PM-10, however, we based our benefit estimation on that of health benefits from reduction of sulfur dioxide and total suspended particulates. The pollutant reduction was projected with a air quality modeling, and the medical costs were obtained by updating those estimated in a 1990 Bank study of coal boilers. This is likely to be an gross underestimation given the lack of the costs associated with PM 10 in the analysis, and of the human resource cost of the illness.

10. Economic Development. Air pollution and traffic congestion are two most widely cited physical factors against location or visit of international firms and personnel in Beijing. Cleaner air, therefore, is expected to promote investments and economic development though it is difficult to quantify.

11. Global Climate Benefits. Conversions under the project will reduce about 560,000 tons of carbon emissions a year. In addition, the project will provide the necessary impetus, organizational assistance as well as technical and market development for the broader conversion of more than 8000 coal-fired boilers that will result in reduction of nearly 2 million tons of carbon emissions. Using efficiency cut-off value of $10/ton, this alone would outweigh most of the other benefits. This, however, is not included in our analysis of local economic benefits, nor the indirect effect of the project on the rest of boilers in Beijing or elsewhere in China. The Incremental Cost Analysis (Annex 11) takes a different comparison from the above, as it compares the costs of the next most environmentally friendly alternative to scattered coal boilers - consolidation into district heating boilers.

BENEFITS OF HEATING ENERGY CONSERVATION

12. Heating energy conservation will reduce the fuel consumption and hence reduce both cost and pollution. We do not include these benefits in our evaluation as the project provides largely indirect, though essential, assistance to build the technical and institutional bases for conservation and only relatively small direct investments in conservation.

WASTEWATER MANAGEMENT

13. Economic evaluation of sanitation projects usually focuses on health benefits, which rarely are straightforward nor sufficient. We have instead focused on identifying more readily quantifiable benefit measure, two for sewage collection and two for treatment separately, and obtained a surprisingly large estimate of benefits, although still less than usual threshold of economic return.

14. Contingent Valuation. In 1999, Swanson, et al. conducted a systematic contingent valuation survey of 999 Beijing residents (Swanson, Timothy, B. Day, and S. Mourato, 1999. "Valuing water quality in China: purpose, approach and policy", *Journal of Environmental Sciences*, Vol. 11, No. 3). This shows an average contingent valuation of Y 186 per year per household for clean surface and ground water of Beijing, or about Y 500 M for the city of Beijing. This is remarkably close to the estimated willingness to pay derived by Mott McDonald in Chongqing in 1998, adjusted for income differences. For the 3.2 million residents of Liangshui and Qing River basins, the valuation total would be about Y193 M, which will increase by the rate of income and population increases (3% and 0.7% per year). This valuation is taken as a fair representation of health and aesthetic benefits of sewerage to the basin residents.

15. Ground water quality. Because of overall water shortage, groundwater is the dominant source of water for industries in Beijing. Most of the groundwater sources in the city including the two basins do not meet quality standards, making them useable only as cooling water or after expensive treatment. The cost of treatment ranges from about Y 0.3 to Y 1.5 per m^3 depending upon the type of use. Even at the high cost, industries do not have alternatives as piped water supply is in short supply and a cubic meter of fresh water, recycled on average four times, is an input to about Y 453 of industrial production. The interceptor sewers would improve the quality, although only gradually, improving the quality to near satisfactory level in about 20 years. On the other hand, discharge without interceptors would progressively worsen the water to levels requiring increasingly expensive treatment.

16. Downstream Benefits. A 1998 technical report on Hai River basin (Planning Group for Water Pollution Prevention in Haihe River Basin, Plan for Water Pollution Prevention in Hai River Basin) notes that raising water quality of the Hai, the most polluted main river of China in terms of percentage of tributaries below Class V standard, to the level mandated by the Government would raise the agricultural production by at least 5%, using an earlier water resource model. Beijing's discharge reduction amounts to about 20% of the total reduction required of the basin under the plan. This implies that the 880,000 m^3 treated in the Liangshui basin as a result of the project would amount to about 9.5% of the planned reduction in the whole Hai River basin. In Tianjin, where some 18% of farm area is irrigated with Hai River water, we apply this proportion to derive the agricultural production benefits. In the immediate downstream of Liangshui River WWTPs, the productivity effects would be much higher, and we assume 10% improvement in agricultural productivity.

17. Costs. In addition to the capital investment during the project, the sewerage systems in the two basins is expected to require branch sewers and connections costing, over the next 20 years, about 60% of the trunk sewers built under the project, and annual operation and maintenance cost costing about 4.5% of the trunk sewer and WWTP plant costs. On the other hand, we have excluded about 25% of the resettlement cost that is attributable to housing improvement above and beyond what would have been required strictly for compensation.

Summary of Benefits and Costs:

18. Present value of benefit and cost streams identified above, discounted at an annual real discount rate of 12% over 30 years, are listed below:

Table A 4.2 Summary of Benefits and Costs, Present Value

	Yuan Million	$ Million
Boiler Conversion		
Operation and Maintenance Cost savings:	1384	167
Land Savings	654	79
Medical Cost Savings:	439	53
Additional Capital Cost:	-1412	-171
Net Total	1064	129
Economic Internal Rate of Return 19.8%		
Sewerage		
Contingent Valuation	1876	227
Groundwater for Industries	235	28
Agricultural benefit, Beijing	259	31
Agricultural benefit, Tianjin	1028	124
Investments, including connections	-3814	-461
Operation and Maintenance	- 616	- 74
Net Total	- 1032	125
Economic Internal Rate of Return 8.7%		
Total Net Present Value, Project	**129**	**4**
Economic Rate of Return	**12.1%**	

19. The most striking information given by the above estimation is the large positive benefits from boiler conversion, including relatively concrete benefits only. Comparing the estimated health benefits with the contingent valuation of improved water resources in a part of the city (which appears to be a fair estimate but larger than the former) indicates that true health benefits are likely to be far higher. Further, the estimate does not include economic growth benefits nor the global climate benefits.

20. It is important to note that the economic evaluation shown here is the comparison between having natural gas boilers and keeping scattered coal boilers and replacing them with improved coal boilers. Probably the least cost option is likely to be consolidating coal boilers into large coal-fired district heating boilers, although its environmental and health benefits are likely to be far smaller than conversion to natural gas and the feasibility of such consolidation is limited. A comparison of economic costs and benefits between the conversion and consolidation is presented in Annex 11, incremental cost analysis.

21. A comparison was also made of net costs of conversion in 2002 versus keeping a scattered coal boiler and replacing them in about 5 years with an improved coal boiler, that would reduce much of the manual coal and ash handling. In the latter case, it was assumed that clean coal has to be used and the sulfur tax paid. The following table A4.3 presents the present value of various costs over the 25-year life span of the gas boiler (in Yuan 1000 in 2000 prices, discounted at 12% a year). This shows that the net

costs are about even, with the high cost of capital due to high boiler prices as well as premature replacement balanced by a large savings in labor and land.

Table A 4.3 Cost of 3-tph Coal and Natural Gas boiler heating, 2002-26
Yuan 1000

	Coal boiler	Natural gas boiler	Difference
Fuel cost	118	229	111
Labor	132	28	-104
Other O&M	55	19	- 36
Equipment	84	160	76
Land	49		-49
Total	439	426	- 13

22. While the estimated rate of return, 8.7%, of the sewerage investments falls below the usual threshold of 12%, this still represents a robust return compared with returns estimated for most other sewerage projects. A primary implication of this benefit estimation, depending most importantly on contingent valuation, appears to be that income and density of residents in Beijing have reached the point to fully justify the sewer investments. The more expensive wastewater treatment component appears to harder to justify on economic grounds alone, without including non-agricultural use of treated water which is not estimated here.

Main Assumptions:

23. Most of the assumptions are stated in the above discussion. Important ones used for estimation of boiler costs and benefits include: no increase in operating costs in coal boiler until its retirement in about 7 years from now; 30% labor savings with a new coal boiler which will remain in service without decreasing efficiency for another 20 years; 3% increase in unit labor cost; no sulfur tax or low-sulfur requirements; changes in coal and gas prices paralleling international price movements forecast; seven year waiting for development of saved land, with 50% deduction for additional investment required. Important assumptions for the sewerage evaluation include: increase in contingent valuation along with per capita income (3.5% a year) and population (0.7% a year) in the two basins; investment in branch sewers and connections costing about 60% of trunk sewer cost; annual operating cost of WWTP and sewers equivalent to about 4.5% of capital cost.

Sensitivity analysis / Switching values of critical items:

24. Labor cost is the most important element of cost comparison between the coal and natural gas boilers. But its estimate is subject to great uncertainty given the very small sample size. If the labor cost gap is reduced by 33%, the net present value of conversion would turn zero. Estimation of labor cost by technical analysis shows that this is likely to be the minimum labor requirement for coal-fired heating, indicating that the evaluation is robust. This robustness, however, does not extend to the private benefits of conversion to individual boiler owners, which does not include health benefits externality.

25. In the case of sewerage, most of the assumptions are very conservative, and the more interesting sensitivity analysis would be to identify switching values that would turn its net benefits positive. It shows that per capita contingent valuation increasing 7% a year, which is close to the actual per capita income growth, would be sufficient, as would adding non-agricultural benefits downstream that would be of the same magnitude as the agricultural benefits. These appear reasonable assumptions, indicating that the sewerage investments are close to being fully justified.

Annex 5: Financial Summary

CHINA: Second Beijing Environment Project

1. Finances of the Municipal and District Governments of Beijing

1.1 Beijing municipal tax revenues and expenditures in 1999 were Y 24.2 billion ($3.0 billion equivalent) and Y 18.5 billion ($2.2 billion equivalent), respectively. For the past five years tax revenues and expenditures grew annually at an average of 13% and 14%, respectively. Revenues are projected to grow at 10% annually in current terms through the project implementation period. Given that Beijing Municipality's economy has grown by around 10% in real terms in the last 10 years, this project is likely to be met easily. Its expenditures are expected to grow at a higher 12%. This would still leave the own budgetary revenues exceeding budgetary expenditures, an unusual situation among Chinese local governments since 1994 tax reform. The surplus would be transferred to District Governments and extra-budgetary accounts for various infrastructure and environmental expenditures. It has not been able to obtain data on extra-budgetary finances.

Table 1: BEIJING MUNICIPAL FINANCES
(Y billion, current terms)

	Actual						Projected						
	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Receipts	13.3	16.1	19.5	23.3	20.9	24.2	26.6	29.3	32.2	35.4	39.0	42.9	47.2
Expend.	9.6	15.1	18.0	23.0	13.5	18.5	20.7	23.2	26.0	29.1	32.6	36.5	40.1

1.2 BMG will on-lend more than 99% of the Bank loan to the Beijing Drainage Company and the Shihuan Jietian Energy Technology Co. (SJET). In addition, BMG would provide about Y 1.2 billion over the project period mainly (i) as an equity infusion to BDC to be used for a part of the counterpart financing for the wastewater component of the project, and (ii) allocation to units belonging to it for counterpart financing of boiler conversion. Smaller amounts would be allocated for (i) subsidies for a limited number of non-governmental entities converting their boilers by 2002, (ii) counterpart financing of the heating energy conservation component; and (ii) air quality monitoring and decision support. These will amount to less than 1% of the budgetary expenditures during the same period. In the unlikely event that these subborrowers should be unable to fulfill their obligations, BMG would have no problem in covering debt service as this is only about 1% of projected on-budget revenues.

1.3 Since 1994, annual on-budget revenues for the eight districts participating in the coal to gas conversion program have grown between 18% to 27%, and their on-budget expenditures have grown from 26% to 33%. For simplicity, both revenues and expenditures are projected to grow at a conservative 15% per annum during the project implementation period. The revenues are those from their own sources, and do not include allocations received from BMG.

Table A 5.2 Consolidated Budgets of Eight District Governments of Beijing
(Billion Yuan, in current prices)

Year	1998	1999	2000	2001	2002	2003	2004	2005
Revenues	8.23	9.94	11.43	13.15	15.11	17.39	20	22.98
Expenditures	9.57	11.44	13.15	15.14	17.4	20	23.01	26.46
Project Expenditures	0	0	0.60	0.60	0.60	0.60	0.60	0.60
Project as % of Revenue	0	0	5.2%	4.6%	4.0%	3.5%	3.0%	2.6%

2. SJET Financial Analysis

2.1 Business scope:

(1) Promotion of conversion, in cooperation with BMG, District Governments, and Beijing Gas Group Co (BGGC), financed partly with GEF grant.
(2) Procurement and sales of boiler equipment on installment terms, financed by Bank loan
(3) Technical support for selection, installation, testing, monitoring of boilers and operator training – supported largely by GEF grant, some covered by manufacturer warranty.
(4) Development of gas boiler technology and best practice models with GEF support.
(5) Assistance in selection, contracting, and supervision of design and installation contractors if requested by users (paid by users and partly supported by GEF grant).
(6) Assistance in arranging counterpart financing: to be considered after 2000.
(7) Assistance with disposal of old coal boilers, on commission basis
(8) Outside or after the Bank-financed project: technical development and consulting, boiler and other advanced energy equipment import and distribution.

SJET would keep strictly separate accounts between World Bank financed project implementation and other related or unrelated businesses. The following discusses only the former.

2.2 Financially, SJET's operation consists largely of credits. It has to generate and maintain a healthy balance of long-term receivables to be able to match its long-term liabilities, and generate cash flows to match the short-term imbalances. It would therefore address the financial tasks generated by the terms and conditions of the World Bank loan and its mandate of maximizing boiler sales as follows:

Maturity risk and credit risk:	limit terms of installment to those less than the World Bank loan
Foreign exchange risk	assumed by SJET, provided that BMG permits SJET to pass the risk on to the end-users through increase in tariff
Interest rate risk	pass on to buyer, or consider assuming it on premium in a later stage
Credit risk:	Appraise buyers' financial health especially the liquidity and credit history, the business prospect, the building to which boilers would be attached, etc.; Require guarantees and collateral; Assess higher interest margin (up to 2% over World Bank rate) to higher risk buyers, and provide reduction on good payment record Take strict credit follow-up steps
Cash flow mismatch: within a year - boilers sold in summer and recovery (through the gas bill) during winter and spring	Take short-term loans initially, and build up cash later Set fiscal year from July 1 to June 30.
Cash flow mismatch: Initial period - negative due to start-up expenses, World Bank's front-end and commitment charges	Take short-term advances from the parent company and short-term loans Defer accounting recognition of the financial charges to synchronize with sales Cover as much up-front expenses by downpayment (5.5% of wholesale prices) Minimize grace period to buyers
Cash flow mismatch: later period	Invest in marketable securities

2.3 Given these considerations on the part of SJET, and BMG's objectives in giving the concession to SJET, namely maximizing the volume and speed of boiler sales, the following terms are proposed, to be reviewed at the latest after two years' implementation:

Proposed Down Payment and Installment Terms

Item	Down Payment (% boiler cost)	Price Margin first 1000 boilers	Price Margin Others	Interest Rate	Maturity (years)
Institutions	5.5%	2%	5%	6.73%	12-17
Enterprise	5.5%	2%	5%	8.23%	5-15

2.4 Cost to be Recovered consist of the following:

- Full cost of boiler
- Interest charge: the same as the Bank loan (interest rate risk passed on to the buyers). Cost of management about 5%
- Premium to cover risk and profit 0-5%. Other financial costs including World Bank loan front-end fees and commitment charges SJET start-up cost, about 3% of procurement price of equipment to sell;
- Cost of financing and storage between delivery and installation, 1-2%;
- Procurement and customs cost, 1%.
- Local transportation and provision for local losses and damages, 1-2%.
- Cost of services provided at the request of buyer (equipment will not be subject to import duties and value added tax).

The first four items would in principle be recoverable through installment credits, last four up-front, and the one in the middle (up-front costs) divided between the two.

2.5 Cost recovery mechanism:

Maturity: Buyer's choice, up to World Bank loan maturity, e.g. 20 years for boilers installed in 2000, and 15 years for those installed in 2004. But it would be more prudent to try to limit them to shorter periods.

Channel of Installment Payment. Added to the gas bill as a fixed amount (except variation due to interest rate changes), subject to same terms, conditions, and late payment penalties as the gas tariff. 0.5% of collection will be paid to BGGC. SJET will call in the credit security (to be attached to the sales contract, and discussed in section E (below) on arrears of 1.5 years or longer. Partial payment will be applied proportionately to gas and boiler charges. The collection will be remitted directly to SJET account.

2.5 Appraisal of Users

a. Credit security: To be attached to the sales contract as an addendum.
BMG's full guaranty: if this is given, no further appraisal nor any risk premium. Applicable to an estimated 200-300 boilers.
DG and other third party guaranties
Collateral on building and liquid assets, and the boiler itself.

b. Record of boiler operation. If the user has incurred significant arrears on costs of operating the current boiler system (coal, labor, power, etc.), the user will not be eligible.

c. Condition of the building heated by the boiler: if the building is likely to be redeveloped within the installment period, the boiler will be at risk.

d. Financial status of boiler owner: If the above two are satisfactory, a brief assessment of the owner's financial status (through review of financial statements) and prospect (through SJET assessment) to determine, in conjunction with the credit security, the risk category and corresponding risk premium (1-5% of boiler cost)

e. Counterpart financing: A written plan of the buyer indicating the amount by source, and a brief assessment by SJET financial analyst of the feasibility.

2.6 **Accounts and Financial Projection.** Given the nature of SJET's business and its focus on balance sheet, only the balance sheet and cash flow projections are reproduced below. Income and expense statements are too susceptible to accounting treatment of various deferred items. The projections show that the above terms would provide a minimum but steady liquidity and profit for SJET as long as it keeps its defaults below 2% from government institutions and 5% from other entities. Technical details assumed are provided after the financial projections.

	Projected Key Financial Indicators of Beijing SJET Company								
		(RMB Million Yuan)							
FY	2001	2002	2003	2004	2005	2006	2007	2012	2017
Installment Outstanding	167	407	711	970	1,078	1,051	922	256	0
Total Assets	202	464	821	1,169	1,384	1,084	952	272	13
Long-term Debt	185	436	777	1,097	1,298	1,004	876	235	0
Equity and Reserves	9	27	44	71	86	80	76	37	13
	0	0	0	0	0	0	0	0	0
Cost of Boiler Procurement	-175	-252	-341	-320	-201	-88	0	0	0
Net Operating Cash Flow	-150	-206	-245	-169	-18	108	196	112	55
L-T Loan Taken or Repaid (-)	171	252	341	320	201	-294	-128	-82	-42
	0	0	0	0	0	0	0	0	0
Revenues (1)	17	37	64	91	108	97	88	45	8
Operating expenses	3	7	8	8	8	7	5	4	2
Financial Charges	9	24	44	67	84	94	71	24	5
Net Income	0.8	-0.5	3.0	7.8	9.9	-6.2	11.7	1.3	-2.6
Equity/Asset	4.6%	5.9%	5.4%	6.1%	6.2%	7.4%	7.9%	13.7%	100.0%
Gross Margin (2)	10.9%	12.4%	13.4%	14.9%	16.5%	18.2%	17.5%	20.6%	0.0%
Note: (1) Revenues include down payment, mark-up and interest received from installment and interest from liquid i									
but not include boiler wholesale cost.									
(2) Gross Margin = (revenue - financial charges)/principal installment outstanding									

Key assumptions for SJET Financial Projection

Buyers: It is estimated that about 40% of total boiler procurement will be for governmental institutions and 60% for others. Of the purchase amount for 2001, 90% are for institutions and 10% for enterprises. The remaining institution-boiler costs are divided into 60% to 40% in Year 2002 and 2003 respectively, and the rest of annual purchase amount for 2002 and 2003 go to enterprises. All annual purchase after 2003 are for enterprises.

Average Maturity: 15 years for institutional buyers, 8 years for others.

Procurement expenses: 2.5% of procurement price for the procurement agent, local transportation and insurance, inspection and custom charges, storage and damages and so on.

Sales expense is the salary paid to sales people, 80,000 RMB per year with 1% annual increase, as well as advertising and promotion expenses.

Sales tax and VAT: exempt

Operating expenses include: labor (15-39, depending upon year), expert, travel, entertainment, recruitment, office rent, insurance, utilities, supplies, communication, unpredictable expenses. The operating expense is expected to reduce to 80% of previous level in FY 2007 and further reduce 50% in FY 2013.

Collection commission is 0.5% of annual sales revenue (collection), which is paid to the Gas Company for collection of installment payment.

Cash and cash equivalent: Cash has been kept to minimum levels so that the remaining cash can be used for investment in marketable securities and other businesses, which will accumulate over time be ultimately used for loan repayment.

Receivable is receivable principal balance outstanding. Annual sales are amortized over 15-17 years for institution boilers with 6.73% discount rate, and over 8 years for enterprise boilers with 8.23% discount rate.

Provision for Doubtful Receivables: Directly write-off 2% and 5% respectively from the annual receivables for institutions and enterprises.

Fixed Assets: Original value of fixed asset will be RMB 0.6 million in the FY 2001 and 1.1 million in FY 2002. They will be replaced in 5 or 10 years after putting in use.

Amortization:
(a) The start-up cost is amortized over 5 years,
(b) World Bank front-end fee and commitment charges are amortized over 17 years.

Long-term Debt: World Bank loan: annual loan repayment is started from FY 2006 using previous years' accumulated investment and current years cash balance. After 2006, the loan principal repayment equals to current years net cash flow. The loan will be fully repaid in FY 2017.

Equity: is assumed to be shareholder's paid-in capital of RMB 1 million.

Shareholder's advance: RMB 8 million, which will be amortized over 5 years.

3. Beijing Drainage Company Financial Analysis

3.1 The financial objectives of the Beijing Drainage Company are for it to generate sufficient revenues from its wastewater operation and drainage payments received from BMG to cover its operations and maintenance expenses and depreciation, in line with the "Circular of the State Development Planning Commission, Ministry of Construction and the State Environmental Protection Administration on Strengthening the Collection of Wastewater Tariff and Establishing a Sound Operation Mechanism on the Discharge of Urban Wastewater and Central Treatment", promulgated in September 1999. BDC would maintain a minimum cash balance of approximately three months of operating expenses, and use the remaining cash to invest in on-going sewage investments, including this project. The tariff schedule, outlined in Annex 7, should provide BDC sufficient cash to finance about 20% of overall wastewater component financing requirements and meet its debt service obligations on existing loans and the World Bank loan.

3.2 **Corporate Financial Analysis.** A corporate financial analysis was prepared by BDC with the assistance of Bank staff and consultants. A summary of the assumptions to the financial analysis are shown below and the full financial analysis is in the project files. Assurances were obtained during negotiations that BMG would, commencing with fiscal year 2000, cause BDC to (a) produce revenues from their wastewater operations sufficient to cover operations and adequate maintenance costs plus depreciation or debt service whichever is higher. This could require the following wastewater tariff schedule:

Average Wastewater Tariff (Y/m^3)

2000	2001	2002	2003	2004	2005	2006
0.46	0.71	0.71	0.71	0.71	0.71	0.92

3.3 Assurances will be also obtained during negotiations that BMG would cause BDC to prepare, before September 30, 2000, and in each of the following fiscal years, forecasts satisfactory to the Bank Group, (a) review whether they would meet the covenanted requirements set forth above in such fiscal year, and (b) to furnish the results of such reviews to the Bank Group; if any such reviews would show that the entity would not meet the requirements set out above, the entity would take all necessary measures, including adjustments to the structure of its tariffs and charges, in order to meet the requirements.

Table 3: Actual and Projected Beijing Wastewater Tariffs (Y/m^3, current prices)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Average			0.26	0.32	0.46	0.71	0.71	0.71	0.71	0.71	0.92
Residential	0.00	0.10	0.13	0.30	0.30	0.47	0.47	0.47	0.47	0.47	0.60
Non-resid.		0.30	0.38	0.50	0.50	0.78	0.78	0.78	0.78	0.78	1.01
% Increase				44	54	0	0	0	0	0	30

Table 4: Key Beijing Drainage Company Financial Indicators (RMB Million, Current Price Unless Noted)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Fixed Asset	2260	4612	6815	6512	8760	8736	9404	10295	9792	9290
Total Assets	5125	6030	7377	8889	10075	10708	11079	11277	11114	11087
Total Long-term Debt	473	676	964	1392	1658	1798	1707	1562	1437	1313
Operating Revenue	266	396	655	691	747	805	865	1191	1224	1436
Operating Expenses	132	203	251	276	294	314	374	477	567	610
Depreciation	100	203	303	303	409	425	471	525	526	527
Net Income	34	(10)	101	112	43	65	21	189	131	299
Cash and Bank	21	221	176	90	57	117	147	887	1284	1874
Operating Ratio (%)	50	51	38	40	39	39	43	40	46	42
Current Ratio	0.8	3.0	2.7	1.9	1.4	1.1	1.2	4.9	7.1	9.8
Collection Eff. (%)	61	67	72	74	78	82	86	90	90	90
Capital Expenditure	509	1001	1576	1741	1526	969	705	26	27	29
Internal Cash Financing			311	370	334	245	160	26	27	29
Internal Cash/Current Expenses (%)	16	36	31	32	28	25	28	159	189	250
Financial Covenants										
Revenue >=	266	396	655	691	747	805	865	1191	1224	1436
O&M + Depreciation	232	406	553	579	704	739	844	1003	1093	1137
Debt Service	2.1	2.2	4.3	3.9	3.6	3.1	1.8	2.7	3.0	4.4
Avg. Tariff (Y/m^3)	0.32	0.46	0.71	0.71	0.71	0.71	0.71	0.92	0.92	0.92

3.4 **Assumptions to BDC Financial Analysis.** Assumptions to the projections of the main financial statements of the Beijing Drainage Company and remaining sewerage assets (1997 to 2000) and BDC alone (2001 to 2008) have been prepared. Below is a summary of the assumptions used. Detailed assumptions can be found in the project files in the report: Financial Analysis of the Beijing Drainage Company.

Income Statement:

Sales Revenue: is a multiplication of the following factors and the unit tariff rates in Table 3 to this annex. Tariffs have been set to allow BDC to cover its operations and maintenance costs, including costs of depreciation. Water sales volume projections are based on the lesser of "minimum demand" and "maximum capacity" figures.

	Unit	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Water Sales Volume – Residential	Million m^3 /yr	258	265	271	278	285	292	300	307	315	323
Water Sales Volume - Non-res.	Million m^3 /yr	910	933	957	981	1005	1031	1057	1083	1111	1138
Collection Efficiency	%	61	67	72	74	78	82	86	90	90	90

From 1997 to 2000, government shall provide Y34 M of drainage subsidies annually. Beginning in 2001, the drainage subsidies are assumed to increase by Y 3 M annually. Tariff collection rate is expected increase between 2% and 7% annually from 61% in 1999 to 90% in 2006 as BDC launches a campaign to increase awareness of its role among consumers, and takes over the responsibility for retaining and disposing of its own revenue.

Sales Tax: it is assumed that BDC will be able to obtain an exemption to payment of sales tax, even after BDC comes under Company Law.

Personnel: is assumed to increase per staff increases and domestic inflation (5%):

Item	Unit	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Salary Staff	person	296	296	296	346	396	446	496	536	546	556
Wage Staff	person	689	689	689	759	829	899	969	1225	1245	1265

Electricity: is assumed to increase based on the increasing pumping station and wastewater treatment volume flows and by domestic inflation (5%):

Item	Unit	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Pumping Station costs	Y mil.	4	5	5	6	7	7	8	9	10	10
WWTP costs	Y mil.	18	30	40	45	47	49	63	85	105	110

Materials: is mainly coal costs and polymer used in sludge dewatering. Material cost is assumed to be inflated by domestic inflation and wastewater treatment volume.

Selling Expenses: 1% of sales revenue is paid to the Water Supply Company for collection of wastewater tariff.

Administration: is assumed to be 8% of wastewater treatment volume.

Maintenance: is assumed to be 1% of fixed asset volume increased by domestic inflation.

Depreciation: is assumed to be 4% of gross fixed assets.

Income Tax: it is assumed that BDC will be able to obtain an exemption to payment of income tax, even after BDC comes under Company Law.

Balance Sheet:

Cash and Bank: is generated as the residual of the Sources and Applications of funds. Cash has been kept to minimum levels (assumed to be about 3 months of operating expenses) so that the remaining cash can be used for internal financing of capital investments.

Accounts Receivable: is assumed to be 30 days of sales revenue.

Inventory: is assumed to be 30% materials and maintenance expenses.

Other Accounts Receivable and Other Current Assets: is assumed to remain at the same level as in 1998, but increased by inflation.

Provision for Doubtful Receivables: is assumed to be 0.5% of accounts receivables per Chinese accounting regulations. .

Fixed Assets: According to the Evaluation Report made by Beijing Derway Evaluation Company in __, the total value of fixed assets was Y1.14 billion, among which:

(a) Building: Y43 M including:
Beixiaohe WWTP: Y23 M
Pumping Station Administration Agency: Y19.2193 M

(b) Equipment: Y15.9686 M, including:
Beixiaohe WWTP: Y10 M
Pumping Station Administration Agency: Y6 M

Tariff Collection Agency: Y0.5 M

(c) Sewerage network: Y1.08 billion

The gross value of fixed assets in 1997 is Y1.15 billion. Additional fixed asset increases are the result of the second World Bank project investments, new investments along the Qing River, WWTP expansion of the Gaobedian and Xiaohongmen plants, and replacement investments.

Accounts Payable: is assumed to be 10% of the materials and electricity expenses.

Short-term Loan: none is currently anticipated.

Other Accounts Payable and Other Current Liabilities: are assumed to remain at 1998 levels but increase by domestic inflation. .

Long-term Debt:
(a) OECF: annual loan repayment will be Y9 M from 1999
(b) French government loan: annual loan repayment will be Y4.44 M from 2000
(c) Swedish government loan: annual loan repayment will be Y24.5 M from 1999
(d) Existing WB loan: annual loan repayment is Y14 M from 1999
(e) World Bank loan: annual loan repayment is Y111 M from 2005

Equity: is assumed to be Government capital contributions from budget to finance on-going project investments.

Operational Indicators:
Water Supply Population: covers 8 districts in the main urban area
Wastewater Generation Rate: 2.59 million ton/day
Sewage Treatment Capacity: 21% in 1999, reaching a maximum of 67% in 2007
Sewage Treatment Volume: 570,000 ton/day in 1999, reaching a maximum of 2,350,000

Annex 6: Procurement and Disbursement Arrangements
CHINA: Second Beijing Environment Project

Procurement

1. General A Procurement Capacity Assessment Report (PCAR) was conducted by Bank procurement specialists in the World Bank Office in China in October/November 1999 (revised April 2000). The conclusions are reflected in the PCAR in the project file. Two of the three implementing agencies, i.e. Beijing Drainage Company and Beijing Environmental Protection Bureau, and Beijing Environment Project Office (BEPO), which is responsible for overall project management and coordination, as well as the procurement agent selected for the project, have prior experience with the Bank financed First Beijing Environment Project and are very familiar with the Bank's procurement policies and requirements. The newly-established Beijing Shi Huan Jie Tian Energy Technology Co, Ltd. (SJET) which is responsible for the air pollution control component has limited experience. However, this situation can be compensated for by intensified training program and guidance and assistance from the BEPO and the procurement agent, as noted in the PCAR. Other aspects such as laws and regulations and local procurement practice were also reviewed. The risk on this project in respect to both institutional capacity and general procurement environment is considered to be average and the overall risk assessment was determined to be average. The PCAR found that some local procedures were not in line with the Bank Procurement Guidelines. This deficiency can be resolved through a supplemental letter of understanding and through the provisions of the Chinese Bidding Law which became effective in January 2000.

Procurement procedures and arrangements satisfactory to the Bank Group, as reflected in Table A, were agreed upon with the BEPO and the implementing agencies. All goods, works and services to be financed by the IBRD Loan and GEF grant proceeds will be procured in accordance with the "Guidelines for Procurement under IBRD Loans and IDA Credits" published in January 1995 (revised January and August 1996 and September 1997, and January 1999) and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated January 1997 and revised in September 1997 and January 1999. Model Bidding Documents (MBDs) agreed between GOC and the Bank Group (in absence of MBDs, the Bank's Model Bidding Documents) will be used for all international competitive bidding (ICB) and national competitive bidding (NCB) procurement. The International Tendering Company under China National Technology Import and Export Corporation (CNTIC - ITC) has been contracted by BEPO as procurement agent for international tendering activities. The CNTIC-ITC is an experienced procurement agent familiar with, and has recent and relevant experience in, ICB work on World Bank-financed projects. The General Procurement Notice (GPN) was published in the *UN Development Business*, No. 526, dated January 16, 2000. To the extent practical, all works and goods contracts would be grouped into packages of a size to attract maximum national and international competition. Bid packages for boiler equipment in particular would be grouped in sizable bid packages so as to enhance competition and economies of scale. These packages would be procured through ICB procedures in accordance with the Bank's procurement guidelines as noted above.

2. Civil Works. The aggregate value of civil works contracts under the project is estimated to be about $427 million, of which $110 million will be contracted through ICB and $158 million through NCB procedures. The remaining $159 million of contracts are not subject to Bank/GEF financing.

The wastewater component of the project involves about 22 works contracts with a total estimated value of $268 million. The Bank will finance about 34% of this value. The ICB threshold for works contracts will be $15 million, which will cover at least four large contracts with an estimated total value of about $110 million, and possibly up to three more whose preliminary estimates are close to $15 million. The threshold of $15 million was agreed with the Regional Procurement Advisor because recent experience on similar projects in China has shown there is no interest from foreign firms in contracts below this level. The ICB process is longer and less efficient for the Chinese agencies so this change to the threshold for this project will have positive effects on implementation. The contract packaging was done with this rationale in mind. The remainder of works contracts under the wastewater component will be procured through NCB with estimated value of $158 million. Interested eligible foreign bidders would be allowed to participate in NCB. Prequalification of contractors will be carried out for all these ICB and NCB contracts. The air pollution control requires civil works worth about $159 million, mainly for boiler house modification and gas pipeline installation. These works will be procured according to local commercial practices and not be financed with the Bank Loan or GEF grant.

Chinese NCB procedures for works have been reviewed by the World Bank Group and found some deviations in the internal procurement procedures, such as bracketing and merit point system used in prequalification and bid evaluation. The implementing agencies are fully committed to strictly comply with the Bank's procurement procedures/policies for the Bank financed contracts. In case there are any discrepancy between local policy and Bank's requirement, the Bank policy and guidelines will prevail. The Beijing Municipal Government and the project implementing agencies shall pay particular attention to ensure that the following procedures are followed:

(a) all invitations to prequalify or to bid shall be advertised both in a newspaper of national circulation in China, and in a local newspaper with Beijing-wide circulation;

(b) such advertisement shall be made in sufficient time for prospective bidders to obtain prequalification or bidding documents and prepare and submit their responses; and in any event a minimum of 30 days shall be given to bidders between the date of advertisement in such newspaper and the deadline for submission of bids, and the advertisement and bidding documents shall specify the deadline for such submission;

(c) qualification requirements of bidders and the method of evaluating the qualification of each bidder shall be specified in detail in the bidding documents;

(d) all bidders shall be required to provide security in an amount sufficient to protect project implementing agencies in case of breach of contract by the contractor, and the bidding documents shall specify the required form and amount of such security;

(e) the time for opening of all bids shall be the same as the deadline for receipt of such bids;

(f) all bids shall be opened in public; all bidders shall be afforded an opportunity to be present (either in person or through their representatives) at the time of bid opening, but bidders shall not be required to be present at the bid opening;

(g) no bid may be rejected solely on the basis that the bid price falls outside any standard contract estimate, or margin or bracket of average bids established by the project implementing agencies; and

(h) each contract shall be awarded to the lowest evaluated bidder, that is to say, the bidder who meets the appropriate standards of capability and resources and whose bid has been determined (i) to be substantially responsive to the bidding documents and (ii) to offer the lowest evaluated cost. The winning bidder shall not be required, as a condition of award, to undertake responsibilities for work not stipulated in the bidding documents or otherwise to modify the bid as originally submitted.

3. Goods. The aggregate value of goods contract under the project is estimated about $400 million, among which $268 million will be procured through ICB and $8 million through international and local shopping procedures. The remaining $124 million are not subject to Bank/GEF financing. Goods worth about $251 million would be eligible for financing by the Bank, about $13 million by GEF. The ICB threshold is $250,000. Contracts with value less than $250,000 and with an estimated aggregate value up to $8 million would be procured through national and international shopping procedures. There will be no NCB for goods under this project. Ninety seven percent (97%) of the Bank and GEF financed goods will be procured through ICB. The Bank and GEF will finance 100% of ICB cost (CIF/CIP basis) and 70% for shopping. The most important items for shopping are miscellaneous pipe fittings and valves required for gas pipelines, gas boilers and heat distribution systems which have to be fitted to specific existing conditions. There will be numerous such items that cannot be procured with standard specifications and sufficient quantities. Other exceptions from ICB include: various small instruments to monitor and maintain boilers and heat distribution systems, spare parts for existing air quality monitoring and analysis equipment, and miscellaneous communication, transportation, and office equipment. Goods worth about $124 million required for gas pipelines and other parts of the heating systems would not be financed by the Bank or GEF and will be procured using local procurement procedures.

4. Services. The project would finance about $16.7 million of Bank loan and GEF grant for training and services for technical assistance, studies, design and project management, and marketing for: efficient conversion to natural gas boilers, energy conservation, institutional development of Beijing Drainage Company. Most of the consultants would be hired through firms selected competitively on the basis of quality and cost, rather than a team of consultants to be selected on the basis of quality alone for detailed planning of BDC institutional development elements. Several consultants would be hired as individual advisors to help with initial start up and operational planning for various components, and SJET would hire and directly manage about a third of national engineering and marketing personnel for gas boiler conversion individually on the basis of qualifications. Beneficiaries and implementing agencies would require additional services mainly for design and project management services for the project components, at a total estimated cost of about $105 million, which would not be financed by the Bank or GEF.

5. Advanced Contracting and Retroactive Financing: Retroactive financing of up to $30 million of the IBRD Loan and $2.5 million of the GEF Grant would be applied to eligible expenditures made after December 31, 1999 for: (a) four civil works contracts for construction of trunk interceptor sewers; (b) procurement of gas boilers and associated equipment packages; (c) office, transportation, and communication equipment; and (d) study tours and consultant services.

Procurement methods (Table A)

Table A: Project Costs by Procurement Arrangements
(US$ million equivalent)

Expenditure Category	Procurement Method[1]				Total Cost
	ICB	NCB	Other[2]	N.B.F.	
1. Works	109.87 (36.48)	157.85 (53.52)	0.00 (0.00)	158.93 (0.00)	426.65 (90.00)
2. Goods	268.00 (258.00)	0.00 (0.00)	8.05 (5.81)	123.87 (0.00)	399.92 (263.81)
3. Services and Training	0.00 (0.00)	0.00 (0.00)	16.91 (16.70)	104.75 (0.00)	121.66 (16.70)
4. Land and Resettlement	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	303.28 (0.00)	303.28 (0.00)
5. Front-end fee	0.00 (0.00)	0.00 (0.00)	3.49 (3.49)	0.00 (0.00)	3.49 (3.49)
Total	377.87 (294.48)	157.85 (53.52)	28.45 (26.00)	690.83 (0.00)	1255.00 (374.00)

[1/] Figures in parenthesis are the amounts to be financed by the Bank Loan/Grant. All costs include contingencies

[2/] Includes all goods and services procured following the respective Bank's Guidelines through international/national shopping, direct contracting, and standard selection methods for consulting services.

Note: ICB and NCB amounts for civil works is subject to change when detailed engineering design is completed.

Table A1: Project Cost by Procurement Arrangement
Bank-financed components
(US$ M Equivalent)

Expenditure Category	ICB	NCB	Other	NBF[1]	Total
1. Works	109.87 (36.48)	157.85 (53.52)	0.00 (0.00)	137.50 (0.00)	405.22 (90.00)
2. Goods	257.63 (246.47)	0.00 (0.00)	6.39 (4.94)	0.00 (0.00)	264.02 (251.41)

3. Service and Training	0.00 (0.00)	0.00 (0.00)	4.10 (4.10)	0.50 (0.00)	4.60 (4.10)
4. Front-end fee			3.49 (3.49)		3.49 (3.49)
Total Cost	367.50 (282.95)	157.85 (53.52)	13.98 (12.53)	138.00 (0.00)	677.33 (349.00)

Note: figures in parenthesis are the amount to be financed by the Bank loan.

Table A2: Project Cost by Procurement Arrangement
GEF financed component
(US$ M Equivalent)

Expenditure Category	ICB	NCB	Other	NBF[1]	Total
1. Works	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	21.43 (0.00)	21.43 (0.00)
2. Goods	11.05 (10.72)	0.00 (0.00)	1.66 (1.66)	0.00 (0.00)	12.71 (12.38)
3. Service and Training	0.00 (0.00)	0.00 (0.00)	12.62 (12.62)	0.00 (0.00)	12.62 (12.62)
Total	11.05 (10.72)	0.00 (0.00)	14.28 (14.28)	21.43 (0.00)	46.76 (25.00)

Note: figures in parenthesis are the amount to be financed by the GEF grant.
1/ NBF is included in Table A. Some ICB packages under air pollution control component are financed jointly by the Bank loan and GEF grant

Prior review thresholds (Table B)

The Bank's prior review procedures will apply to all goods packages with estimated value over $250,000, civil works packages over $10 million, consulting firm contracts over $200,000, individual consultant contracts over $50,000, and training packages over $50,000.

Table B: Thresholds for Procurement Methods and Prior Review [1]

Expenditure Category	Contract Value Threshold (US$ thousands)	Procurement Method	Contracts Subject to Prior Review (US$ millions)
1. Works	15,000	ICB	227
2. Goods	250	ICB	272
3. Services(Firms)	200	QCBS	16
4. Services (Individuals)	50	CQ	0.3
5. Training	50	Other	0.3
6. Miscellaneous			

Total value of contracts subject to prior review: about $515 million

Overall Procurement Risk Assessment

Average

Frequency of procurement supervision missions proposed: One every 6 months for the first two years and thereafter once every 8 months (includes special procurement supervision for post-review/audits)
This frequency is considered reasonable because the two procurement specialists for the project are located in the World Bank Office in Beijing. Thus they are readily accessible to the Borrower implementing agencies and the ITC for the project. This arrangement has worked well previously on other projects under implementation in China and during the review of contract being prepared for advanced contracting/retroactive financing under this project.

Ex-post Review

The Bank will carry out ex-post review of about 10% of contracts not subject to prior review.

Contract packaging for the project is provided in the table below, showing the goods, works and services contracts proposed for each component.

Table C. Schedule of Contract Packages

Contract No.	Description/Year	Procure. Method	Base Cost (RMB M)	Remarks
	GOODS			
Gas Boiler Equipment financed by Bank and GEF				
BCS 1.1	Year 2000	ICB	104.74	R
BCS 1.2	2001	ICB	156.29	
BCS 1.3	2002	ICB	210.98	
BCS 1.4	2003	ICB	194.33	
BCS 1.5	2004	ICB	116.88	
BCS 1.6	2005	ICB	47.80	
Gas Regulators, Valves and other related Equipment				
BCS 2.1	2000	ICB	64.19	R
BCS 2.2	2001	ICB	95.79	
BCS 2.3	2002	ICB	129.31	
BCS 2.4	2003	ICB	119.11	
BCS 2.5	2004	ICB	71.64	
BCS 2.6	2005	ICB	29.30	
Assortment of parts related to above, in small quantities (estimated value per year: about 3% of the value of the above two)		NS/IS	30.00	
Various heating system and boiler testing instruments, training materials, and tools				
GSHE I.1	2000	IS	1.50	R
GSHE I.2	2001	ICB	4.39	
GSHE I.3	2002	IS	0.80	
GSHE I.3	2003	IS	0.65	
Various boiler and heating system parts for energy efficiency				
GHE C.1	2000	NS	0.86	
GHE C.2	2001	ICB	2.37	
GHE C.3	2002	ICB	2.69	
GHE C.4	2003	ICB	2.69	
GHE C.5	2004	ICB	2.15	
GHE C.6	2005	NS	1.20	
GHE M.1	Heat Meters and Valves (supply and install) 2002	ICB	5.46	
GHE N.1-10	Local Misc. Goods for Heating Systems (10 packages)	NS	4.47	
GSHE O.1-8	Misc. Goods for Office, Training & Transportation (8 packages)	NS	7.46	R
Air Quality Monitoring and Analysis				
EPE 1.1	Analytical Equipment for gas, particulates, multipollutants, and others	ICB	5.82	
EPE 1.2	Laboratory and Particulate Testing Equipment	ICB	4.37	

EPE 2.1	Electro Magnetic Detection	ICB	2.18	
EPE 3.1	Air Quality Monitoring Equipment	ICB	3.64	
EPE 4.1	Spares for Existing Equipment	IS	3.86	
Wastewater Treatment Plants and Sewer Maintenance Equipment				
WWE 4.1	Xiaohongmen WWTP equipment	ICB	376.00	
WWE 5.1	Wujiacun WWTP equipment	ICB	73.30	
WWE 7.1	Lugouqiao WWTP equipment	ICB	156.00	
WWE 8.1	Sewer O & M Equipment	ICB	10.60	
WWE 9.1	BDC Computer Hardware/Software	ICB	2.86	
	CONSULTING SERVICES			
GSC I.1	Gas boiler and heat delivery engineering and marketing	QCBS	11.72	
GSC N.1	Gas boiler engineering and sales	QCBS	5.18	
GSC N.2	Gas boiler engineering	QCBS	2.72	
GSC N.3	Thermal engineering	QCBS	3.11	
GSC M.1	Marketing	QCBS	2.30	
GHC I.1	Heating energy conservation	QCBS	9.03	
GHC I.2	Energy and environment study	QCBS	5.07	
GHC N.1	Thermal engineering 1	QCBS	4.39	
GHC N.2	Thermal engineering 2	QCBS	2.96	
GHC N.3	Boiler engineering	QCBS	2.44	
GHC N.4	Energy market specialists	QCBS	0.75	
GHC N.3	Environmental specialists	QCBS	1.12	
BDCC 1	Detailed Planning of Institutional Development of BDC	QBS	5.69	
BDCC 2	Implementation of Institutional Development	QCBS	12.20	
BDCC 3	Project Implementation Assistance	QCBS	9.48	
	CIVIL WORKS			
WWC 1.1	Qing River interceptor upstream	NCB	79.60	R
WWC 1.2	Qing River interceptor central	NCB	65.60	R
WWC 1.3	Qing River interceptor downstream	NCB	46.83	
WWC 2.1	Xiaoyue River sewer downstream	NCB (1)	103.10	
WWC 2.2	Xiaoyue River sewer upream	NCB (1)	107.60	
WWC 3.1	Liangshui River interceptor upstream	ICB	125.30	
WWC 3.2	Liangshui River interceptor downstream	NCB (1)	117.90	R
WWC 3.3	Xinkai Ditch	NCB	45.21	
WWC 3.4	Fengcao River Sewer	NCB	27.90	R
WWC 3.5	Songjiazhuang Sewer	NCB	39.00	
WWC 3.6	Xiaolong River Sewer	NCB	78.11	
WWC 4.1	Xiaohongmen WWTP civil works	ICB	230.29	

WWC 4.2	Xiaohongmen WWTP civil works	ICB	230.29
WWC 4.3	Xiaohongmen WWTP Miscellaneous	NCB	23.23
WWC 5.1	Wujiacun sewer	NCB	53.20
WWC 5.2	Wujiacun WWTP civil works	NCB	68.05
WWC 5.3	Wujiacun WWTP miscellaneous	NCB	3.44
WWC 6.1	Shijingshan interceptor upstream	NCB	91.81
WWC 6.2	Shijingshan interceptor downstream	NCB (1)	112.11
WWC 7.1	Lugouqiao WWTP civil works	ICB	137.09

1/ Note: The final designation of these civil works contract as ICB or NCB will be determined when the final engineering design and cost estimates are completed, at the time the procurement documents are about to be prepared.

Legend

ICB = International Competitive Bidding
IS/NS = International Shopping/ National Shopping
NCB = National Competitive Bidding
PQ = Prequalification
QCBS = Quality-and-Cost-based Selection
QBS = Quality-based Selection
R = Retroactive financing (Advance Contracting)

[1] Thresholds generally differ by country and project. Consult OD 11.04 "Review of Procurement Documentation" and contact the Regional Procurement Adviser for guidance.

Disbursement

Allocation of loan/grant proceeds (Table C)

Table C: Allocation of Loan/Grant Proceeds

Expenditure Category	Amount in US$million	Financing Percentage
Civil Works for Parts E, F, and G	90.00	40%
Goods for Parts A and D	168.30	100% of CIF/CIP and Ex-factory costs; 70% of other costs of goods procured locally
Goods for Parts F and H	83.11	100% of CIF/CIP and ex-factory costs; 70% of other costs of goods procured locally
Consultant Services and Training for Parts D and H	4.10	100% of expenditure net of taxes
Consultant Services and Training for Parts B and C (GEF financing)	12.62	100% of expenditure net of taxes
Goods for Parts B and C (GEF financing)	12.38	100% of CIF/CIP and Ex-factory costs; 70% of other costs of goods procured locally
Total Project Costs	370.51	
Front-end fee	3.49	100%
Total	374.00	

Use of statements of expenditures (SOEs):

Disbursement will be made on the basis of Statement of Expenditures (SOE) for (a) civil works under contracts costing less than $10 million, (b) goods under contracts costing less than $250,000 (c) training (d) services provided by consulting firms under contract costing less than $100,000, and (e) services provided by individual consultants under contracts costing less than $50,000. Full documentation will be needed for disbursement for others. BEPO will retain copies of the documents supporting the SOE and make them available to Bank missions for inspection.

Special account:

Two Special Accounts will be established and maintained in US dollars by BEPO on terms and conditions satisfactory to the Bank. The authorized allocation will be $18 million for the Loan special account, and $2 million for the GEF grant special account, which approximately equal to average projected disbursements over four months. Replenishment application would be submitted monthly or when the balance falls below 50% of the authorized allocation, whichever comes first.

Schedules: The project is scheduled to be completed by June 30, 2006 and the Loan and Grant Accounts to be closed by December 31, 2006. The estimated loan and grant disbursement schedules are shown below:

IBRD Loan Disbursement Schedule

Bank FY	Semester	Cumulative Project (%)	Estimated Disbursement (million $)	Cumulative Disbursement (million $)
2001	First	6%	20.94	20.94
	Second	13%	24.43	45.37
2002	First	22%	31.41	76.78
	Second	33%	38.39	115.17
2003	First	46%	43.63	158.80
	Second	57%	40.14	198.93
2004	First	67%	34.90	233.83
	Second	75%	27.92	261.75
2005	First	82%	24.43	286.18
	Second	88%	20.94	307.12
2006	First	94%	20.94	328.06
	Second	97%	10.47	338.53
2007	First	100%	10.47	349.00

Note: Disbursement for the first semester of FY 2001 equals to initial deposit of SA plus front-end fee $3.49 M.

GEF Grant Disbursement Schedule

Bank FY	Semester	Cumulative Project (%)	Estimated Disbursemen (million $)
2001	First	6%	1.50
	Second	14%	1.88
2002	First	23%	2.38
	Second	35%	3.00
2003	First	48%	3.25
	Second	62%	3.50
2004	First	72%	2.50
	Second	82%	2.50
2005	First	88%	1.50
	Second	92%	1.00
2006	First	95%	0.75
	Second	98%	0.75
2007	First	100%	0.5

Annex 7: Project Processing Schedule
CHINA: Second Beijing Environment Project

Project Schedule	Planned	Actual
Time taken to prepare the project (months)		23
First Bank mission (identification)		05/15/98
Appraisal mission departure		04/17/2000
Negotiations		05/24/2000
Planned Date of Effectiveness	10/15/2000	

Prepared by:

SJET, BDC, RHAO, with assistance from five design institutes of Beijing; coordinated by the Beijing Environment Project Office and the Beijing Planning Commission, under the direction of the Beijing Environmental Project Leading Group

Preparation assistance:

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Annex 8: Documents in the Project File*
CHINA: Second Beijing Environment Project

A. Project Implementation Plan

1. Beijing Environment Project Office, Second Beijing Environment Project Project Implementation Plan, January 2000

2. Beijing Environment Project Office, Financial Management Manual for Second Beijing Environment Project, December 1999

3. Beijing Municipal Research Institute of Environmental Protection, Environmental Impact Assessment Report-Second Beijing Environment Project, January 2000

4. Beijing Shihuan Jietan Energy Technology Development, Co. Ltd.
   (a) Conversion of Coal-Fired Boilers in Beijing into Gas-Fired Boilers: Project Implementation Plan, Draft November 1999
   (b) Customers Assessment Manual, January 2000;
   (c) Draft Sales Contract: For Governmental Institutions, and For Non-Governmental Customers, January 2000;
   (d) Draft Collection Agent Agreement with Beijing Gas Group Corporation, January 2000

5. Beijing Gas and Heating Engineering Design Institute, with SOFREGAZ, France, Users' Handbook for Gas-Fired Boiler House, November 1999

6. Beijing Residential Heating Administration Office, Proposal for Heating Energy Conservation Program, October 1999

7. Beijing Environmental Protection Bureau, Environmental Decision Support System Development Plan, December 2000

8. Beijing Drainage Company, Liangshuihe and Qinghe Sewerage Project Implementation Plan, January 2000

9. Beijing Drainage Company, Institutional Development Plan for Beijing Drainage Company (Draft Final Report), November 1999

10. Beijing Drainage Company, Resettlement Action Plan - Sewerage Component of BEP2, March 2000

B. Bank Staff Assessments

1. Economic Analysis of Boiler Conversion and Sewerage (Background notes and Spreadsheets)

2. Procurement Capacity Assessment*

3. Financial Projection for SJET (Spreadsheet)

4. Financial Projection and Analysis of BDC (Spreadsheet)

5. Bank Mission Aide Memoires (November 1998, May, July, and December 1999)

C. Other

Major Policy Documents

Beijing Municipal Government, Urgent Measures for Air Pollution Control, 26 December 1998

Targets and Measures for Air Pollution Control, April 1999

Third Phase Measures for Air Pollution Control, 23 September 1999

Planning Group for Water Pollution Prevention in Haihe Basin, Plan for Water Pollution Prevention in Hai River Basin, approved by the State Council on 11 March 1999.

Beijing Environmental Protection Bureau and Parsons Engineering, Beijing Environmental Master Plan Studies, October 1996

Feasibility Reports and Other Technical Background Documents

Beijing Municipal Engineering Bureau, Beijing Municipal Engineering Design and Research Institute, Beijing Urban Planning Design and Research Institute:

- Feasibility Study Report of Sewer Engineering of Liangshui He River System Project, #97P032, 1999
- Feasibility Study Report of Zhengwangfen Wastewater Treatment Plant Project, #97P033, September 1999
- Feasibility Study Report of Sewer Engineering of Qing He River System-Project, #97P034, September 1999
- Feasibility Study Report of Xiaohongmen WWTP and Sewer System, #99P001, September 1999
- Feasibility Study Report of Wujiacun WWTP and Sewer System, #98P018, April 1999
- Feasibility Study Report of Lugouqiao WWTP, April 1999

Individual Consultant Team & Beijing Drainage Company, Final Report: Technical Review of Wastewater Component Feasibility Studies for Second Beijing Environment Project, March 1999
*Including electronic files

Annex 9: Statement of Loans and Credits
CHINA: Second Beijing Environment Project

Project ID	FY	Borrower	Purpose	Original Amount in US$ Millions			Difference between expected and actual disbursements[a]		
				IBRD	IDA	Cancel.	Undisb.	Orig	Frm Rev'd
P040513	1996	China	2ND HENAN PROV HWY	210.00	0.00	0.00	149.40	73.40	0.00
P003619	1998	China	2ND INLAND WATERWAYS	123.00	0.00	0.00	113.92	34.93	0.00
P003652	1996	China	2ND SHAANXI PROV HWY	210.00	0.00	0.00	92.41	49.41	0.00
P051856	1999	China	ACCNTG REFORM & DEV	27.40	5.61	0.00	30.88	11.29	0.00
P003559	1993	China	AGRIC. SUPPORT SERVI	0.00	115.00	0.00	4.37	-3.55	0.00
P050036	1999	China	ANHUI PROVINCIAL HWY	200.00	0.00	0.00	178.01	17.66	0.00
P003563	1996	China	ANIMAL FEED	150.00	0.00	0.00	133.27	129.96	53.27
P049665	1999	China	ANNING VALLEY AG.DEV	90.00	30.00	0.00	98.56	1.09	0.00
P003602	1996	China	CH-HUBEI URBAN ENVIRONMENT	125.00	25.00	28.32	78.87	87.34	1.29
P003603	1995	China	CHINA-ENTERPRISE HOUSING & SOC SEC REF	275.00	75.00	20.00	163.94	160.04	22.03
P057352	1999	China	CHINA-FOURTH RURAL WATER SUPPLY PROJECT	16.00	30.00	0.00	44.84	2.99	0.00
P036414	1998	China	CHINA-GUANGXI URBAN ENVIRONMENT PROJECT	72.00	20.00	0.00	88.11	12.48	0.00
P056491	1998	China	CHINA-HEBEI EARTHQUAKE REHABILITATION	0.00	28.40	0.00	0.43	-8.44	0.00
P003598	1995	China	CHINA-LIAONING ENVIRONMENT PROJECT	110.00	0.00	0.00	52.16	50.67	0.00
P003637	1997	China	CHINA-NATIONAL RURAL WATER III	0.00	70.00	0.00	59.21	24.37	13.69
P040185	1998	China	CHINA-SHANDONG ENVIRONMENT PROJECT	95.00	0.00	0.00	79.99	39.19	0.00
P003586	1994	China	CHINA-SHANGHAI ENVIRONMENT PROJECT	160.00	0.00	0.00	54.64	53.93	0.00
P003648	1996	China	CHINA-SHANGHAI SEWERAGE PROJECT II	250.00	0.00	0.00	123.99	95.70	0.00
P043933	1999	China	CHINA-SICHUAN URBAN ENVIRONMENT PROJECT	150.00	2.00	0.00	152.02	4.00	0.00
P003580	1993	China	CHINA-SO. JIANGSU ENVMT PROTECTION PROJ	250.00	0.00	0.00	3.25	2.45	0.00
P003568	1992	China	CHINA-TIANJIN URBAN DEV & ENVMT PROJECT	0.00	100.00	0.00	9.46	6.44	2.98
P003599	1996	China	CHINA-YUNNAN ENVIRONMENT PROJECT	125.00	25.00	0.00	132.17	49.33	-2.72
P003473	1993	China	CHINA-ZHEJIANG MULTICITIES DEVELOPMENT	0.00	110.00	0.00	13.43	13.01	2.75
P036952	1997	China	CN-BASIC ED. IV	0.00	85.00	0.00	23.90	-12.47	0.00
P036950	1996	China	CN-BASIC ED. POOR III	0.00	100.00	0.00	1.03	0.84	0.00
P003636	1995	China	CN-BASIC EDUC IN POOR & MINORITY AREA II	0.00	100.00	0.00	0.99	3.04	0.00
P003566	1998	China	CN-BASIC HEALTH (HLTH8)	0.00	85.00	0.00	75.76	9.70	0.00
P003646	1996	China	CN-CHONGQING IND POL CT	170.00	0.00	153.99	15.61	139.60	5.60
P003589	1996	China	CN-DISEASE PREVENTION (HLTH7)	0.00	100.00	0.00	40.55	45.61	0.00
P036953	1999	China	CN-HEALTH IX	10.00	50.00	0.00	56.75	1.89	0.00
P046051	1999	China	CN-HIGHER EDUC. REFORM	20.00	50.00	0.00	64.39	11.80	0.00
P003624	1992	China	CN-INFECTIOUS DISEASES (HLTH5)	0.00	129.60	0.00	22.92	18.39	18.35
P037156	1995	China	CN-IODINE DEFICIENCY DISORDERS CONTROL	7.00	20.00	7.00	0.31	9.98	2.98
P034618	1996	China	CN-LABOR MARKET DEV.	10.00	20.00	0.00	21.33	23.10	0.00
P003634	1995	China	CN-MATERNAL CHILD HEALT(HLTH6)	0.00	90.00	0.00	12.53	15.30	0.00
P058308	1999	China	CN-PENSION REFORM PJT	0.00	5.00	0.00	4.98	2.63	0.00
P003502	1994	China	CN-RURAL HEALTH MANPOWER (HLTH4)	0.00	110.00	0.00	11.47	10.30	0.00
P003635	1997	China	CN-VOC. ED. REFORM PROJ	10.00	20.00	0.00	5.57	-0.30	0.00
P003653	1999	China	CONTAINER TRANSPORT	71.00	0.00	0.00	70.29	45.19	0.00
P051736	1998	China	E. CHINA/JIANGSU PWR	250.00	0.00	0.00	234.74	185.74	46.34
P003647	1995	China	ECONOMIC LAW REFORM	0.00	10.00	0.00	5.22	5.76	0.00
P003606	1998	China	ENERGY CONSERVATION	63.00	0.00	0.00	61.20	6.29	0.00
P060270	1999	China	ENTERPRISE REFORM LN	0.00	5.00	0.00	4.97	3.01	0.00
P003632	1993	China	ENVIRONMENT TECH ASS	0.00	50.00	0.00	9.25	9.67	8.06

				Original Amount in US$ Millions				Difference between expected and actual disbursements[a]	
Project ID	FY	Borrower	Purpose	IBRD	IDA	Cancel.	Undisb.	Orig	Frm Rev'd
P003507	1996	China	ERTAN HYDRO II	400.00	0.00	0.00	11.64	-2.28	0.00
P003623	1993	China	FINANCIAL SECTOR T.A	0.00	60.00	0.00	17.41	19.33	12.61
P036041	1995	China	FISCAL & TAX REF. &	25.00	25.00	0.00	40.04	41.95	1.81
P003557	1994	China	FOREST RESOURCE DEV	0.00	200.00	0.00	16.81	4.51	-40.92
P046952	1998	China	FOREST. DEV. POOR AR	100.00	100.00	0.00	177.75	0.28	23.16
P051705	1999	China	FUJIAN II HWY	200.00	0.00	0.00	198.00	19.00	0.00
P003626	1994	China	FUJIAN PROV HIGHWAY	140.00	0.00	0.00	46.59	44.59	25.42
P003594	1996	China	GANSU HEXI CORRIDOR	60.00	90.00	0.00	112.62	36.84	0.00
P003627	1993	China	GRAIN DISTRIBUTION P	325.00	165.00	0.00	252.25	252.92	34.72
P003518	1993	China	GUANGDONG PROV. TRANSPORT	240.00	0.00	0.00	0.62	0.62	0.11
P058843	2000	China	GUANGXI HWY Project	200.00	0.00	0.00	200.00	0.00	0.00
P003614	1998	China	GUANGZ. CITY CRT.TRP	200.00	0.00	0.00	142.92	39.26	0.00
P051888	1999	China	GUANZHONG IRRIGATION	80.00	20.00	0.00	94.98	16.31	0.00
P003504	1994	China	HEBEI/HENAN NATIONAL	380.00	0.00	0.00	16.22	16.22	0.00
P038988	1997	China	HEILONGJIANG ADP	120.00	0.00	0.00	68.06	15.22	0.00
P003581	1993	China	HENAN PROV. TRANSPORT	120.00	0.00	0.00	6.55	6.55	0.00
P035698	1998	China	HUNAN POWER DEVELOP.	300.00	0.00	0.00	300.00	60.75	0.00
P003654	1997	China	HUNAN/GUANG HWY2-NH2	400.00	0.00	0.00	266.32	116.32	0.00
P049700	1998	China	IAIL-2	300.00	0.00	0.00	249.28	42.48	0.00
P003493	1995	China	INLAND WATERWAYS	210.00	0.00	0.00	37.43	3.83	0.00
P041890	1999	China	LIAONING URB TRANSP	150.00	0.00	0.00	141.50	27.50	0.00
P003540	1994	China	LOESS PLATEAU	0.00	150.00	0.00	14.16	-16.92	0.00
P056216	1999	China	LOESS PLATEAU II	100.00	50.00	0.00	143.62	22.75	0.00
P036949	1998	China	NAT.HWY 3-HUBEI	250.00	0.00	0.00	201.94	14.44	0.00
P041268	1999	China	NAT.HWY4-HUBEI/HUNAN	350.00	0.00	0.00	338.50	13.25	0.00
P003590	1997	China	QINBA MTS. POVTY RED	30.00	150.00	0.00	118.74	42.73	0.00
P003570	1993	China	RAILWAY VI	420.00	0.00	0.00	44.56	44.56	-19.31
P003571	1995	China	RAILWAYS VII	400.00	0.00	29.00	309.62	250.62	34.16
P003595	1994	China	RED SOILS II DEVELOP	0.00	150.00	0.00	30.88	19.62	2.94
P003592	1993	China	REF. INST'L.& PREINV	0.00	50.00	0.00	14.06	14.14	0.00
P046829	1999	China	RENEWABLE ENERGY DEVELOPMENT	100.00	0.00	0.00	100.00	0.00	0.00
P003638	1996	China	SEEDS SECTOR COMMER.	80.00	20.00	0.00	59.17	26.72	0.00
P003622	1994	China	SHANGHAI MTP II	150.00	0.00	0.00	6.75	6.75	0.00
P044485	1997	China	SHANGHAI WAIGAOQIAO	400.00	0.00	0.00	361.22	36.42	0.00
P003569	1996	China	SHANGHAI-ZHEJIANG HI	260.00	0.00	7.75	78.35	50.61	42.60
P003649	1996	China	SHANXI POVERTY ALLEV	0.00	100.00	0.00	25.87	5.96	0.00
P003585	1995	China	SHENYANG IND. REFORM	175.00	0.00	0.00	66.21	47.61	0.00
P003609	1994	China	SICHUAN GAS DEV & CONSERVATION	255.00	0.00	0.00	87.60	64.60	0.00
P036947	1995	China	SICHUAN TRANSMISSION	270.00	0.00	0.00	112.07	110.87	2.72
P045264	2000	China	SMALLHLDR CATTLE DEV	93.50	0.00	0.00	93.50	4.35	0.00
P003593	1994	China	SONGLIAO PLAIN ADP	0.00	205.00	0.00	14.37	-3.68	0.00
P003639	1995	China	SOUTHWEST POV. REDUC	47.50	200.00	0.00	60.13	46.40	0.00
P003591	1998	China	STATE FARMS COMMERCI	150.00	0.00	0.00	90.93	-7.47	0.00
P003539	1998	China	SUST COAST RES DEV	100.00	0.00	0.00	83.18	3.18	0.00
P003597	1993	China	TAIHU BASIN FLOOD CO	100.00	100.00	0.00	23.81	19.46	5.01

				Original Amount in US$ Millions				Difference between expected and actual disbursements[a]	
Project ID	FY	Borrower	Purpose	IBRD	IDA	Cancel.	Undisb.	Orig	Frm Rev'd
P046563	1998	China	TARIM BASIN II	90.00	60.00	0.00	130.42,	27.24	0.00
P042299	1999	China	TEC COOP CREDIT IV	10.00	35.00	0.00	44.42,	-0.10	0.00
P003600	1995	China	TECHNOLOGY DEVELOPME	200.00	0.00	0.00	89.92,	59.33	0.00
P003633	1994	China	TELECOMMUNICATIONS	250.00	0.00	30.00	13.80,	43.80	5.40
P003616	1993	China	TIANHUANGPING HYDRO	300.00	0.00	0.00	62.05, 6.70,	53.35	0.00
P003533	1993	China	TIANJIN IND. II	150.00	0.00	40.35	320.00,	44.55	4.44
P056424	2000	China	TONGBAI PUMPED STORA	320.00	0.00	0.00	194.84,	0.00	0.00
P045788	1998	China	TRI-PROVINCIAL HWY	230.00	0.00	0.00	338.73,	55.34	0.00
P003650	1997	China	TUOKETUO POWER/INNER	400.00	0.00	24.00	280.10,	235.68	22.02
P036405	1997	China	WANJIAZHAI WATER TRA	400.00	0.00	0.00	158.61,	67.10	0.00
P046564	1999	China	WESTERN POVERTY RED	60.00	100.00	0.00	219.17,	20.55	0.00
P034081	1997	China	XIAOLANGDI MULTI. II	430.00	0.00	0.00	0.25, 17.59,	125.60	0.00
P003562	1994	China	XIAOLANGDI MULTIPURPOSE	460.00	0.00	0.00	20.67,	4.78	0.00
P003644	1994	China	XIAOLANGDI RESETTLEMENT	0.00	110.00	0.00	211.52,	10.45	0.00
P003612	1995	China	XINJIANG HIGHWAY I	150.00	0.00	0.00	9.26, 39.65,	20.67	0.00
P003643	1997	China	XINJIANG HWY II	300.00	0.00	0.00	47.48,	110.52	0.00
P003596	1995	China	YANGTZE BASIN WATER	100.00	110.00	0.00	103.68,	-6.70	0.00
P063123	1999	China	YANGTZE FLOOD EMERGY	40.00	40.00	0.00	12.88	15.39	0.39
P003641	1994	China	YANGZHOU THERMAL POW	350.00	0.00	0.00		47.18	0.00
P003642	1995	China	ZHEJIANG POWER DEVT	400.00	0.00	0.00		12.88	0.00
P003534	1992	China	ZHEJIANG PROV TRANSP	220.00	0.00	0.00		12.88	12.38
			Total:	15790.40	3955.61	340.41	9799.06	3982.42	344.28

CHINA
STATEMENT OF IFC's
Held and Disbursed Portfolio
31-Jul-1999
In Millions US Dollars

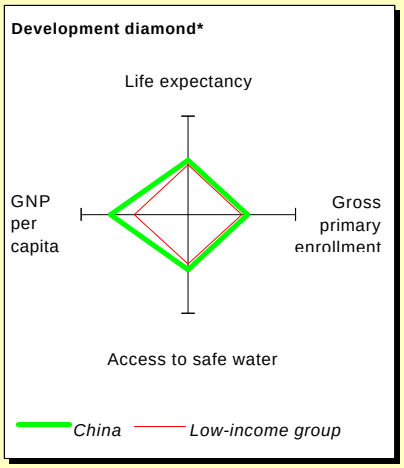
		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic	Loan	Equity	Quasi	Partic
1999	Bank of Shanghai	0.00	21.76	0.00	0.00	0.00	21.76	0.00	0.00
1996	Beijing Hormel	4.28	0.50	0.00	4.40	4.28	0.50	0.00	4.40
1998	CIG Port Holding	0.00	1.50	0.00	0.00	0.00	1.50	0.00	0.00
1998	Caltex Ocean	21.00	0.00	0.00	45.00	21.00	0.00	0.00	45.00
1998	Chengdu Chemical	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00
1998	Chengxin-IBCA	0.00	0.36	0.00	0.00	0.00	0.36	0.00	0.00
1987/92/94	China Bicycles	0.00	0.95	0.00	0.00	0.00	0.95	0.00	0.00
1994	China Walden JV	0.00	4.63	0.00	0.00	0.00	4.63	0.00	0.00
1994	China Walden Mgt	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
1994	Dalian Glass	10.39	2.40	0.00	18.97	10.39	2.40	0.00	18.97
1999	Dujiangyan	25.59	0.00	0.00	30.00	0.00	0.00	0.00	0.00
1995	Dupont Suzhou	20.25	4.15	0.00	36.40	20.25	4.15	0.00	36.40
1994	Dynamic Fund	0.00	12.35	0.00	0.00	0.00	10.70	0.00	0.00
1999	Hansom	0.00	16.10	0.00	0.00	0.00	16.10	0.00	0.00
1996	Jingyang	40.00	0.00	0.00	100.00	40.00	0.00	0.00	100.00
1998	Leshan Scana	6.10	1.35	0.00	0.00	3.50	1.35	0.00	0.00
1996	Nanjing Kumho	11.68	3.81	0.00	33.22	11.68	3.81	0.00	33.22
1995	Newbridge Inv.	0.00	2.13	0.00	0.00	0.00	2.13	0.00	0.00
1997	Ningbo	0.00	2.00	0.00	0.00	0.00	2.00	0.00	0.00
1997	Orient Finance	13.33	0.00	0.00	16.67	13.33	0.00	0.00	16.67
1997	PTP Hubei	12.63	0.00	0.00	25.38	12.63	0.00	0.00	25.38
1994/97	PTP Leshan	3.60	0.00	0.00	0.00	3.60	0.00	0.00	0.00
1996	Pacific Ports	0.00	3.64	0.00	0.00	0.00	3.64	0.00	0.00
1998	Rabobank SHFC	2.03	0.00	0.00	2.03	2.03	0.00	0.00	2.03
1998	Shanghai Krupp	30.00	0.00	0.00	68.80	0.00	0.00	0.00	0.00
1999	Shanxi	19.00	0.00	0.00	0.00	4.50	0.00	0.00	0.00
1993	Shenzhen PCCP	3.76	0.99	0.00	0.00	3.76	0.99	0.00	0.00
1995	Suzhou PVC	20.17	2.48	0.00	20.35	20.17	2.48	0.00	20.35
1998	WIT	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996	Weihai Weidongri	3.80	0.00	0.00	0.00	3.80	0.00	0.00	0.00
1993	Yantai Cement	11.43	1.95	0.00	6.10	11.43	1.95	0.00	6.10
1998	Zhen Jing	0.00	2.00	0.00	0.00	0.00	2.00	0.00	0.00
	Total Portfolio:	264.04	88.26	0.00	407.32	186.35	83.41	0.00	308.52

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic
2000	BOS RI	0.00	0.00	3841.37	0.00
2000	CIG Hld ltd	0.00	0.00	3000.00	0.00
2000	CIG Zhapu	6000.00	5000.00	0.00	0.00
1998	Chengdu Chemical	7400.00	0.00	0.00	8600.00
1997	Chinefarge	12800.00	0.00	0.00	20000.00
1998	Orient Fin A Inc	3333.33	0.00	0.00	0.00
1997	PTP Holdings	0.00	0.00	1500.00	0.00
1998	PTP Hubei BLINC	0.00	0.00	0.00	1500.00
2000	Shizuishan Carbn	6300.00	0.00	1700.00	6000.00
1998	XIB	50000.00	0.00	20000.00	0.00
1998	Zhen Jing	4500.00	0.00	0.00	0.00
	Total Pending Commitment:	90333.33	5000.00	30041.37	36100.00

Annex 10: Country at a Glance

CHINA: Second Beijing Environment Project

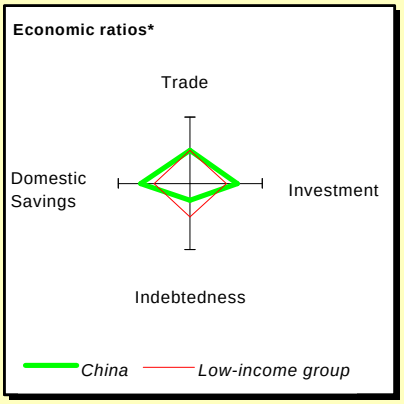
POVERTY and SOCIAL	China	East Asia & Pacific	Low-income
1998			
Population, mid-year *(millions)*	1,238.6	1,817	3,515
GNP per capita *(Atlas method, US$)*	750	990	520
GNP *(Atlas method, US$ billions)*	928.9	1,802	1,844
Average annual growth, 1992-98			
Population *(%)*	1.0	1.2	1.7
Labor force *(%)*	1.3	1.6	1.9
Most recent estimate (latest year available, 1992-98)			
Poverty *(% of population below national poverty line)*	6	..	..
Urban population *(% of total population)*	33	35	31
Life expectancy at birth *(years)*	70	69	63
Infant mortality *(per 1,000 live births)*	32	37	69
Child malnutrition *(% of children under 5)*	16	20	..
Access to safe water *(% of population)*	83	77	74
Illiteracy *(% of population age 15+)*	17	15	32
Gross primary enrollment *(% of school-age population)*	120	117	108
Male	120	119	113
Female	120	118	103



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

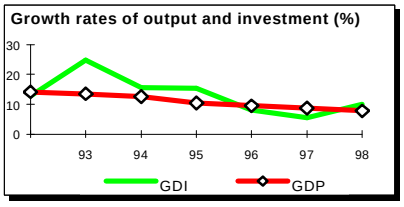
	1977	1987	1997	1998
GDP *(US$ billions)*	172.3	268.2	902.0	960.9
Gross domestic investment/GDP	28.5	36.1	38.2	38.8
Exports of goods and services/GDP	4.8	13.6	23.0	19.1
Gross domestic savings/GDP	29.0	36.2	42.6	43.4
Gross national savings/GDP	29.0	36.2	41.5	41.4
Current account balance/GDP	0.2	0.1	3.8	3.4
Interest payments/GDP	..	0.4	0.6	0.7
Total debt/GDP	..	13.2	16.3	16.2
Total debt service/exports	..	9.6	9.8	9.5
Present value of debt/GDP	..	..	14.9	..
Present value of debt/exports	..	..	62.7	..

	1977-87	1988-98	1997	1998	1999-03
(average annual growth)					
GDP	9.8	10.3	8.8	7.8	7.0
GNP per capita	8.5	8.8	7.4	6.5	6.2
Exports of goods and services	18.4	14.4	23.1	4.6	4.4

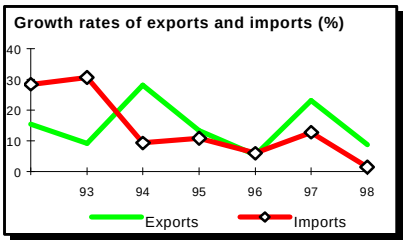


STRUCTURE of the ECONOMY

	1977	1987	1997	1998
(% of GDP)				
Agriculture	29.4	26.8	18.7	18.0
Industry	47.1	43.9	49.5	49.2
Manufacturing	31.1	34.4	37.3	36.8
Services	23.4	29.3	32.1	32.8
Private consumption	63.4	51.3	45.7	44.5
General government consumption	7.5	12.5	11.6	11.9
Imports of goods and services	4.2	13.5	18.5	14.3



	1977-87	1988-98	1997	1998
(average annual growth)				
Agriculture	6.4	4.4	3.5	3.5
Industry	10.9	14.1	10.8	9.2
Manufacturing	11.4	13.4	9.9	8.9
Services	12.7	8.6	8.2	7.6
Private consumption	9.7	8.6	7.7	6.7
General government consumption	9.0	9.9	8.2	8.4
Gross domestic investment	10.7	11.7	7.6	7.6
Imports of goods and services	19.2	12.5	12.7	1.5
Gross national product	10.0	10.0	8.5	7.4

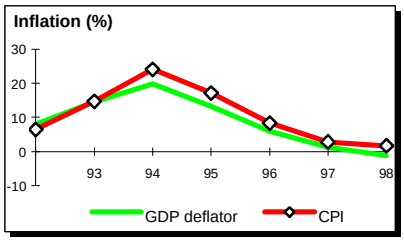


Note: 1998 data are preliminary estimates.

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

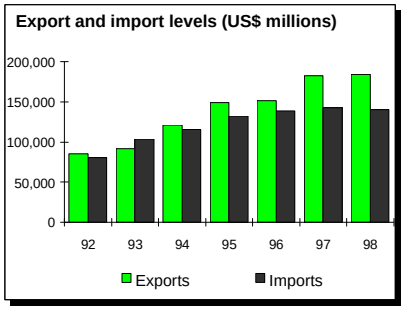
PRICES and GOVERNMENT FINANCE

	1977	1987	1997	1998
Domestic prices				
(% change)				
Consumer prices	..	7.3	2.8	-0.8
Implicit GDP deflator	1.6	5.1	1.2	-1.3
Government finance				
(% of GDP, includes current grants)				
Current revenue	..	21.5	12.0	12.8
Current budget balance	..	4.2	0.6	-2.2
Overall surplus/deficit	..	-2.1	-1.5	-4.0



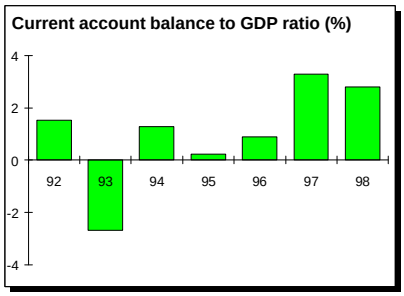
TRADE

	1977	1987	1997	1998
(US$ millions)				
Total exports (fob)	..	39,437	182,792	183,757
Food	..	4,781	11,075	10,619
Fuel	..	4,544	6,987	5,181
Manufactures	..	26,206	158,838	163,157
Total imports (cif)	..	43,216	142,370	140,166
Food	..	3,055	6,308	6,463
Fuel and energy	..	539	10,306	6,773
Capital goods	..	21,110	57,930	61,915
Export price index *(1995=100)*	..	75	95	89
Import price index *(1995=100)*	..	75	92	89
Terms of trade *(1995=100)*	..	99	104	100



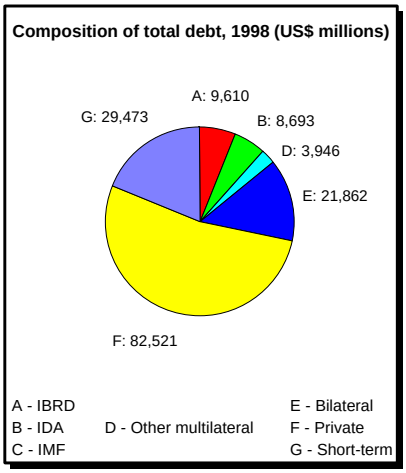
BALANCE of PAYMENTS

	1977	1987	1997	1998
(US$ millions)				
Exports of goods and services	8,550	39,120	207,251	207,589
Imports of goods and services	8,148	38,880	166,754	165,900
Resource balance	402	240	40,497	41,689
Net income	82	-215	-11,097	-13,428
Net current transfers	-70	224	5,144	4,278
Current account balance	414	249	34,544	32,540
Financing items (net)	-320	4,534	1,313	-26,114
Changes in net reserves	-94	-4,783	-35,857	-6,426
Memo:				
Reserves including gold *(US$ millions)*	..	22,500	147,000	..
Conversion rate *(DEC. local/US$)*	1.9	4.5	8.3	8.3



EXTERNAL DEBT and RESOURCE FLOWS

	1977	1987	1997	1998
(US$ millions)				
Total debt outstanding and disbursed	..	35,340	146,697	156,105
IBRD	..	1,427	8,239	9,610
IDA	..	1,330	7,830	8,693
Total debt service	..	3,852	18,445	13,009
IBRD	..	208	858	940
IDA	..	12	81	97
Composition of net resource flows				
Official grants	..	209	228	..
Official creditors	..	626	4,315	2,282
Private creditors	..	5,462	8,134	916
Foreign direct investment	..	2,314	44,236	45,000
Portfolio equity	..	0	8,457	1,153
World Bank program				
Commitments	..	1,306	2,425	2,636
Disbursements	..	702	2,275	2,061
Principal repayments	..	97	377	434
Net flows	..	605	1,898	1,627
Interest payments	..	124	562	602
Net transfers	..	482	1,335	1,024



Additional
Annex No.: 11

INCREMENTAL COST ANALYSIS OF CARBON ABATEMENT

Development Goals and Global Environment Objectives

1. Beijing's air quality has been persistently poor for many years. During the heating season, the ambient concentration of major pollutants, such as sulfur dioxide and particulates, is so high over large areas of the city as to pose long-term, and even acute, health risks (i.e. exceeding Class II and Class III levels). The principal cause of the problem is the extensive use of coal, which supplies about 75% of the city's energy needs. The major environmental damage from coal is caused by the numerous scattered coal-fired heating boilers in use around the city, with their low emission stacks and minimal pollution control equipment. Relatively energy-inefficient coal-fired district heating systems add to the pollution problem.

2. Until now, municipal pollution control measures have comprised a series of small-scale palliatives, such as flue gas treatment, extension of district heating systems, and consolidation of scattered boilers into large boiler houses with taller stacks and improved pollution control equipment. None of these measures have had a significant impact. The recent switch to low sulfur coal will be more effective in decreasing sulfur dioxide emissions, but has only a minor effect on particulates. Now the availability of natural gas from Shanxii Province provides an opportunity to solve the local environmental problem of scattered boilers by converting them from coal to natural gas, which will eliminate low-level releases of sulfur dioxide and particulate matter. The conversion from coal to natural gas would also have significant global benefits, as gas emits roughly half as much carbon dioxide as coal when burnt in heating boilers. This is also a timely opportunity to launch an effective district heating energy efficiency program that would further reduce GHG emissions.

Role of the GEF Alternative in Barrier Removal

3. GEF support is required to remove the barriers to both coal-to-gas conversion and to district heating energy efficiency improvement, as is envisaged under Operational Program 5 for the promotion of energy conservation and efficiency. The incremental cost analysis that follows will show that gas conversion and district heating system energy efficiency improvement involve significant incremental costs for the Beijing government. It is therefore evident that, without GEF support, it will take many years to realize the potential local and global environment benefits of these actions if Beijing has to rely solely on its own limited financial means (Baseline Case). The grim Baseline scenario presented is, if anything, optimistic though, because the numbers of initial gas conversions that are likely to result without GEF support may well be too small for the gas conversion program to maintain any momentum and to justify the high initial costs of gas infrastructure that Beijing has already incurred.

4. **Removing the Barriers to Gas Conversion.** The primary group of boilers targeted for coal-to-gas conversion under the GEF Alternative are scattered residential heating boilers, which are the worst polluters. At least 2,500 conversions must be completed over a short (3-4 year) period to realize potential economies of scale in gas boiler production, installation and service, and thereby sharply drive the cost of conversion down to a level at which gas will be competitive with coal. GEF funds will complement initial Beijing government conversion subsidies by financing the barrier removal initiatives required to achieve this objective. With GEF assistance, a major global benefit can be obtained in the form of reduced carbon dioxide emissions. Over a million tons a year of carbon release will be avoided, due to the lower

carbon content of natural gas (per heat value) and the higher efficiency of modern gas boilers.

5. **Barrier Removal to Energy Efficiency and Energy Conservation.** The second area requiring GEF support is energy efficiency improvement of district heating systems (from boiler houses to the end users) fired by coal fired boilers that are not yet targeted for gas conversion. With support from the GEF, an Energy Conservation Unit (ECU) would be set up under the Residential Boiler Heating Office of the Beijing Municipal Real Estate Bureau for the purpose of promoting and demonstrating heating boiler and system energy efficiency and conservation. This would promote both techniques already selectively used in Beijing and measures that are well established elsewhere, but new to China, such as end user gas instead of heat distribution, use of condensing gas boilers, and end user heat metering and control.

6. Unlike gas conversion, the critical needs are primarily to inform users of these options and their economic benefits, and to promote them through audits, demonstrations and information. GEF funding would be used for such marketing efforts to showcase new or innovative energy conservation measures. This will include direct support for an information center, demonstration projects, and transaction costs for energy audits and feasibility studies.

7. **GEF Strategic Context**. This proposed project complements and does not duplicate the two other Bank/GEF energy efficiency projects in China: Efficient Coal Industrial Boilers and Energy Management Contracting. The former project is designed to overcome technology transfer barriers to the domestic production of efficient coal boilers for industrial use. Such boilers are no longer acceptable in Beijing because of their local pollution impacts. The proposed project will therefore target boiler types that have not benefited from GEF support. The support for Energy Conservation Promotion in the space heating sector would extend GEF support to a neglected energy efficiency market. It would complement and utilize capacity that is being created by the Energy Management project.

Incremental Cost Analysis Method: Gas Boiler Conversion

8. The incremental cost of achieving the global benefits of this component of the GEF Alternative is based on the cost of converting the target of 5,000 scattered coal boilers from coal to gas during a period of 5 to 10 years, compared to a Baseline case. The former is termed the GEF case, or the With Case, while the latter is referred to as the Base case, or the Without case.

9. **Base Case scenario.** Without GEF support, barrier removal is not achieved in the short term and in consequence far fewer than the programmed 5,000 boiler conversions will be achieved. It is assumed that only 20 % of the coal boilers, those of the most financially sound operators, would be converted under the Base Case. The remaining boilers would most likely adopt more conventional pollution control measures. For example, some would be consolidated into district heating systems in order to obtain higher system efficiencies, hence reducing emissions. Other old boilers would be retired and be replaced in kind (i.e., with coal-firing). The newer equipment will likely perform at a higher level of energy efficiency and pollution control. The remaining boilers would simply continue operating as per normal. The most likely scenario is a mixture of all these cases, and the following combination is assumed under the Base Case :

Consolidation into district heating	20 % (1000 boilers)
Continued use of existing boilers	40 % (2000 boilers)
Replacement with new coal boilers	20 % (1000 boilers)
Conversion to gas boilers	20 % (1000 boilers)
Total	**100%**

10. **GEF Case.** With the financial support of GEF grants for barrier removal and Beijing municipal government subsidies, 2,200 boiler conversions will be directly supported. It is anticipated that the cost reduction and capacity-building benefits and demonstration effect of this project will result in a total of 5,000 conversions within 5 to 10 years. This represents about 15,000 tons/hour of hot water and steam demand, fulfilled more efficiently by gas and with lower carbon release.

11. **Incremental Cost Assumptions.** The economic and financial analysis was completed for a period of twenty years, assuming the two alternative scenarios have equivalent economic lives. The analysis examined capital, operating and fuel costs for each of the two cases. It was assumed that the same heat energy was delivered each year, and that the operating revenue would be the same in both cases. The analysis is done on a pre-tax basis, with tax consequences disregarded based on the assumption that cash-flows are equivalent. A discount rate of 12% was used.

Gas boiler efficiency is about 75-80% compared to 68% for consolidated district heating boilers. Moreover, additional losses of 13% associated with the district heating system lowers the net efficiency to about 53%. For the other Base cases, the efficiency of existing coal boilers is about 45% and new coal boilers is 53%.

Capital costs vary with each option and include boiler and associated infrastructure for coal or gas. Boilers are assumed to be of an average size of 3 ton/hour capacity. In the Base Case, land acquisition was included for the case of district heating consolidation, since a significant amount of land is required to construct the district heating plant and associated facilities. Land acquisition is not considered in all other cases as this was insignificant, but an annual land rental cost was imputed by estimating the area requirements for 3 ton/hr boilers.

Operating costs consist of fixed variable, annual variable and fuel. Costs, with the exception of depreciation and fuel, are escalated at an annual rate of 6% for new and existing coal boilers in the Base Case. Fuel costs are escalated according to the World Bank Commodity price forecast of the annual percentage change in the price of crude oil.

For the financial analysis, depreciation and SO2 taxes were included. For coal, economic and financial prices were used from 2001-2005, after which it was assumed that financial and economic prices would be similar. Assets, excluding land, were depreciated using 12 year fixed depreciation.

The following emission factors were used to estimate carbon emission rates:

Coal: 26 kg/GJ or 546 kg/ton of coal
Gas: 15 kg/GJ or 585 kg/1000 m^3 of gas

Incremental Cost Analysis Method: Energy Efficiency

12. Without GEF support, additional district heating energy conservation initiatives would not be pursued. The Baseline is therefore operation and maintenance of coal-fired district heating boilers that are not targeted for conversion to gas in a "business as usual" mode. The GEF Alternative would upgrade and improve the efficiency of these same boilers. It is estimated that the GEF alternative would reduce coal use from its present average of 35 kg/m^2 to about 25 kg/m^2 of heating area, and result in energy savings of about 30% over existing energy consumption levels. An estimated 14,000 tph of boiler capacity would be targeted over a 20 year period, which is the duration of the incremental cost analysis.

Economic And Financial Incremental Cost Analysis

13. **Economic Incremental Cost.** The total economic net present value (NPV) for the Base Case is Y38,143 M, compared to Y39,420 M for the GEF Alternative Case. The incremental cost of the gas conversion and energy efficiency components combined is therefore Y1,277 M, or about US$154 M. The breakdown of these costs between the two components is shown in the Incremental Cost Matrix. China is seeking GEF grant support of $25 M (about 15%) of the incremental cost.

14. Results of the financial analysis is shown principally to illustrate the impact of asset deprecation on the abatement cost calculation. Under the financial method, the higher capital cost outlay for the Base Case generates greater depreciation (e.g. for expenses), and thus a lower incremental cost for the GEF Case and a lower abatement cost per ton of carbon.

Table 2: Summary of the Economic and Financial Analysis

	NPV Base Case (Y million)	**NPV GEF Case** (Y million)	**NPV Incremental Cost** (Y million)	**Abatement Cost** (US$/ton C)
Economic Analysis	38,143	39,420	1,277	5.73
Financial Analysis	39,750	40,383	633	2.84

Emissions Analysis

15. **Carbon abatement.** For the gas conversion component, the annual carbon released in the Base Case is 2.5 million tons in year 2001, falling to 2.1 million tons in year 2020. In the GEF Case, it is 2.2 million tons a year in year 2001, down to 1.4 million in 2020. For the conservation component, total carbon abated from 2001 to 2010 is about 4.5 million tons. Over twenty years, a cumulative reduction of about 26.9 million tons of carbon is realized in the GEF Case compared to the Base Case. The project's estimated abatement cost, calculated per GEF guidelines, is therefore US$5.73/ton of carbon. The unit abatement cost to the GEF for its proposed share of the incremental cost is $0.93 per ton carbon.

16. **Local Environmental Benefits.** The project will produce considerable local environmental benefits with decreased SO2 and particulate emissions due primarily to the reduced combustion of coal with some additional savings from coal handling as well. It is estimated that some 784,000 tons of sulfur dioxide and 546,000 tons of total suspended particulates will be reduced over the project lifetime. Although the benefit of this reduction is difficult to quantify, an estimation of medical costs associated with these pollutants was made for a 1990 study of coal boilers. By updating the data for price and population increases, the above reduction in the pollutant emissions is estimated to save about $49 million in present value terms.

Table 3. Emissions Scenario Matrix

	Baseline	Alternative	Net Reduction
Scenarios	Several modes: coal district heating, scattered boilers, some gas	Mainly gas boilers, with a some coal district heating	Fuel switch reduces emissions and health costs
Global Carbon Emissions, tons			
5,000 Boilers	46,182,095	23,885,136	22,296,960
Energy Conservation Measures	11,384,100	15,937,740	4,553,640
8,200 Boilers	75,809,514	39,171,623	36,637,891
Incremental Heating Capacity	61,862,265	38,594,406	23,268,244
TOTAL	**195,238,359**	**117,591,904**	**86,756,735**
Local Emissions (5000 boiler conversion)			
Particulates (tons)	686,229	140,352	545,877
SO2 (tons)	985,244	201,509	783,735

Table 4. Incremental Cost Matrix

Component 1: Gas Boiler Technology and Market Development			
	Baseline	Alternative	Increment
Features	***Business as usual:*** Consolidation of scattered coal boilers into coal-fired district heating, with a small number converting to natural gas	***Proposed situation*** Barriers to introduction of gas boilers are removed to allow conversion of at least 5,000 coal boilers.	***New features*** Wide-scale introduction of gas boilers has a carry-on effect supporting additional conversion
Domestic benefits	Substantial reduction in coal consumption and emissions.	Major reduction in pollution	Improved air quality in targeted areas and a lower incidence of health problems
Global benefits	Energy efficiency improves and GHG emissions increase more slowly.	Major reduction in the carbon emissions due to substitution of clean, energy efficient fuel	Significant additional reduction in carbon emission
cost	***$4.59 billion***	***$4.73 billion***	*$138.1 million* ***GEF Program Costs****:* $33. 1 million, Grant: $16.5 million
Component 2: Heating Energy Conservation			
	Baseline	Alternative	Increment
Features	***Business as usual*** Continued use of inefficient coal boilers	***Proposed situation*** Improved heating efficiency due to retrofit and better management of heating boilers.	***New features*** Development of best practices and promotion of investments in energy conservation
Domestic benefits	Pollution and energy consumption increase rapidly with economy	Reduced fuel consumption and SO2 emission	Reduced fuel costs and health costs
Global benefits	Carbon emission increases with increasing energy consumption	Reduced carbon emission	Reduced consumption of fossil fuels and risk to global climate
cost		***$120 million***	***$120 million*** ***GEF Program Costs: $13.6 million, Grant: $8.5 million***

Additional
Annex No.: 12

Environmental Assessment Summary

CHINA: Second Beijing Environment Project

Broad Environmental Objectives

Beijing, as China's capital has enjoyed unprecedented growth over the last decade but has also suffered from new (autos) as well as traditional (coal and wastewater) sources of air and water pollution. A number of environmental projects have sought to deal with these issues. From the Bank side, the first Beijing Urban Environmental Project provided for institution building, wastewater treatment and collection, and solid waste management. The present project will build on the success of these earlier efforts in addressing the continuing environmental problems through:

(a) conversion of small coal-fired boilers to natural gas;
(b) measures to promote energy conservation in district heating systems;
(c) building wastewater collection networks and associated treatment facilities in the Liangshui and Qing River Basins; and
(d) strengthening Beijing Municipality's environmental management policies and institutions.

Table 1. Project Components

Component	Description	Scale
Liangshui River wastewater collection and treatment system	Sewerage network	Length: 48 km
	Sewage treatment plants	Area: 82 ha (total) Capacity: 88*104 m^3/day (total)
Qing River Drainage Area	Sewerage network	Length 26 km
Boiler rehabilitation	Fuel switching from coal to cleaner fuel, gas	Total number: 2,555 Total capacity: 6,792MW Coal replacement of 93 million tons per year Gas consumption: 750 million m^3
Decision supporting system for air quality management in Beijing	Air pollution control policy, development of an air quality management system, and training	System for the whole Municipality

4. Regulatory and Policy Framework

An environmental assessment (EA) was prepared by the Beijing Municipal Research Institute of the Environmental Protection Bureau. It was reviewed by the Bank and found to be in compliance with Bank's guidelines and standards for such projects. The EA was also reviewed and cleared by the State Environmental Protection Agency prior to its review by the Bank. The project is subject to the following

Chinese environmental and health and safety requirements:

(a) The design and implementation of the project should be consistent with the Master Plan and General Environmental Plan of Beijing;
(b) The environmental discharges should meet applicable Chinese and Beijing Municipal regulations and standards;
(c) Prohibitions of intentional spills in Liangshui River and Qing River drainage areas;
(d) Surface water quality of Liangshui and Qing Rivers;
(e) Odor prevention at the banks of Liangshui and Qing River banks; and
(f) Accidents prevention related to rehabilitation of boilers and air emissions and noise from their operations.

The most significant guidelines relating to sewage treatment pertains to fecal coliform which specifies a level of less than 1,000 MPN (most probable number) per 100 ml. Ambient air quality guidelines (1987 WHO Air Quality Guidelines for Europe) specify 24-hour average levels for fine particulates (PM10) and nitrogen oxides (NOx) of less than 150 ug/m^3.

Baseline Information

Natural Conditions: Mountainous areas comprise about 62 percent of Beijing Municipality. The area is also very dry with annual average temperatures of about 12 degree C; annual average precipitation at about 630 mm; the dominant wind directions are south and northwest; the annual average wind speed is 2 to 3 meters per second; and the maximum depth of snow cover is 0.85 meters.

The sewage treatment project of the Liangshui River water system lies in the middle to upstream area of the alluvial plain of the Yongding River. Groundwater is 40 meters below the surface in the porous structure of quarternary unconsolidated sediments with good permeability and storage capacity.

Air Quality: In 1998, the annual daily average concentration of total suspended particles (TSP), sulfur dioxide (SO2), and nitrogen oxide was 78, 120, and 150 ìg/m^3, respectively, which are 89%, 100% and 204% higher than the standard for the airshed. During the winter heating season, air pollution is worse due to by poor dispersion associated with the unfavorable weather conditions. As a result, based on statistics by the Beijing Environmental Protection Monitoring Center, the ambient air quality level met the environmental standard only in 8 out of 52 weeks in 1998.

Water Quality: Of some 82 rivers in the Municipality, 59 do not meet the water quality standard. Some 28% are above Class V, 43% are above Class IV, 92% are above Class III, and 100% are no better than Class II. Only nine (9) out of 17 reservoirs are in compliance with water quality standards required for drinking water supplies. An example is the Liangshui River which is heavily polluted with high levels of CODcr, BOD5, NH3, phenol and petroleum. The main problems of groundwater quality are hardness and nitrate-nitrogen. Groundwater near the suburban area is heavily polluted as well, whereas the groundwater quality further away from the city is better.

Environmental Impacts

The EA outlines both positive and negative impacts on the physical, biological, and human environment which may result from the implementation of the Project. The construction of collection networks and treatment plants will result in minor impacts associated with those activities consisting primarily of traffic congestion and fugitive dust and vehicular emissions. The overall impact of the Project

will be positive as a result of improved sanitary conditions throughout Beijing.

An effective public awareness plan will provide residents with information needed to improve personal hygiene and improve sanitary conditions. It is important that sewage discharges near the banks of rivers are completely eliminated and all the sewage is diverted to the sewerage networks. In general, odors near the banks will be reduced and a reduction achieved in the incidence of water related diseases. The project will collect and treat about 880,000 cubic meters of wastewater per day.

Fuel switching in boilers will reduce the atmospheric loading of particulate matter, sulfur oxides, and nitrogen oxides compared to the baseline, thereby, resulting in improvement of ambient air quality and a reduction in visible smoke. Reduction in SO2 will be some 200,000 tpy and in TSP, 100,000 tpy. Although the coal-to-gas component of Beijing Environment II will greatly reduce the air pollution of Beijing city, the gas boilers will emit nitrogen oxides (1,300 tons per year) and carbon monoxide (260 tons per year). The hot water boilers for the newly-built sewage treatment plants will release small quantities of air pollutants (1 ton per year of PM; 6 tons per year of sulfur dioxide; 3 tons per year of nitrogen oxides, and 2 tons per year of carbon monoxide).

Noise pollution mainly comes from the fans in gas boiler houses and from blowers and pumps at the sewage treatment plants.

Sludge Management: A key area of importance is the safe handling and disposal of sludge generated in the treatment processes. To date, the safest approach which has been used in China is to dispose of it in a landfill and or to make it available to farmers for soil conditioner after a period of stabilization. Both these approaches will be used in conjunction with this project.

Environmental Management Plan: The EMP includes measures to mitigate adverse environmental impacts, monitoring and evaluation system for assessing the implementation program, and institutional framework for ensuring effective implementation. The following summarizes the proposed monitoring activities.

Construction Period

1. Dust: TSP will be monitored at all sensitive work areas. Twelve (12) monitoring points have been established. Five (5) measurement points are set along the strand of Liangshui River, five (5) along the strand of Qing River, 1 each at of the three sewage treatment plants. At each point, 24-hour average TSP will be measured every 15 days and the wind direction and velocity recorded at the same time. One monitoring (1) point will be established for small boilers and 2 to 3 points for larger boilers. Measurements will be taken once every month. Corrective action will be taken when needed.

2. Noise: Noise will be monitored at eight (8) measurement points around the construction spots in Liangshui River drainage area, five (5) along the Qing River, measured once every week (if construction activities are proceeding at night, then monitoring will be performed at night). If deviations are noted, the monitoring frequency will be increased to thrice a week. Four (4) measurement points have been set at construction spots near boiler houses, measurements taken once every week. The acceptable daytime noise level is 75 dB(a) and if it exceeds 85 dB(a), then ear plugs will be worn. The World Bank Environmental Guidelines specify a noise level of 70 dB(a) in commercial areas at receptor points.

3. Solid Waste: Solid waste will be loaded in enclosed vehicles. Pollution of water bodies will be avoided and monitoring performed to ensure that there is no solid waste near water bodies.

4. Sludge and Dredging Spoils: Sludge and clean sediments will be loaded separately during dredging and transport vehicles covered to avoid spillage. The sludge disposal site will be such so as not to contaminate groundwater and will have a ditch to collect surface run-on. Leachate will only be discharged after treatment. The sludge will be covered the with clean top soil (with a cover of at least 0.5m thickness) to reduce dust emissions and release of foul odor.

Operational Period

Rivers, wastewater collection systems and operations of the treatment plants will be monitored during the life of the project. The drainage areas of the Liangshui and Qing Rivers will be monitored for unlawful discharges, industrial discharges and for general indicators such as BOD5, COD, TSS, pH, oil and grease, NH3-N, total N and total P on a monthly basis. The treatment plants will be monitored for influent and effluent water quality and quantity, noise, odor and sludge management.

The gas-fueled boilers will be monitored for relevant parameters (NOx and CO). All accidents and spills are to be reported to the appropriate environmental authorities promptly and the surrounding area monitored for any impacts. Sample points are set at every stack of gas boilers. Monitoring parameters include: sulfur dioxide & dust (for diesel only), nitrogen oxides, and carbon monoxide, once during start-up and once a day during operations. Noise will be monitored as per the applicable regulations.

Public Participation

Ten specialists from different fields, representing the Standing Committee of the City or District People's Congress, participated in public hearings associated with the environmental assessment. The specialists concurred that implementation of this project will greatly improve ambient air quality and surface water quality of the Liangshui and Qing Rivers. Construction of the sewerage network (including interceptors) and sewage treatment plants will reduce the pollution load on the rivers. The specialists agree with the recommendations of the Environmental Assessment report. They agreed with the feasibility study for the Qing River on proper management of water resources in the rivers, and planting of trees along the banks. They agreed that regulating discharges into the rivers and planting trees along the banks is necessary and will improve environmental quality of Qing and Liangshui Rivers.

The public is perceived to be strongly dissatisfied with existing ambient air quality and surface water quality. The investigations show that the present environment in Beijing is detrimental to human health and to long term, sustainable development. They also point out that government should improve its enforcement capabilities. The public considers in general that it is urgent to ameliorate the environmental quality and that gas as alternate fuel for boilers and sewage management (including sewage collection in sewerage network followed by proper treatment) are the most important environmental projects for Beijing. The public has high expectations from this project. The public considers that proper environmental management, training of staff, and establishment of a scientific monitoring system will ensure social, economic, and environmental benefits from the project.

Details of consultations and disclosures during EA and RAP preparation are provided below:

Table 2 Public Consultation

Item	Participants	Date of Consultation	Location	Relevant Bank Policy
EA, TOR & RAP outline review	- EA team, PMO, BDC. - 10 experts from different sectors	September 21, 1999	Beijing Academy of Environmental Sciences	OP 4.01: Consultation prior to the finalization of the EA TOR
Questionnaire distribution & project information (including main point of EA work & RAP) distribution	- EA team, PMOs, BDC. - district governments, district People's Congress, neighborhood committees, and individuals	September 26-28, 1999	Haidian District (Qinghe River Basin); Fengtai District (Liangshuihe River Basin)	OP 4.01& BP 17.50
Draft report review	- EA team, BDC, SJET - 10 experts from different sectors	December 13, 1999	Beijing Academy of Environmental Sciences	OP 4.01: Consultation prior to the finalization of the draft report
Public hearing for the EA & RAP draft reports	- EA team, PMOs, BDC, SJET. - deputies of districts' People Congress, representatives of neighborhood committees and project affected people	October 14, 1999 October 22, 1999	Haidian district Fengtai district	OP 4.01: consultation prior to the finalization of the draft report
Field social ecomonic survey for RAP	- Sociologists from Beijing University. - Consultation & interviewed with PAPs	January 19-23, 2000 March 20 - April 5, 2000	Haidian & Fengtai Districts	OD 4.30

Table 3 Information Disclosure

Document	Date of Disclosure	Location	Relevant Bank Policy
EA, TOR & RAP outline	September 21, 1999	Beijing Academy of Environmental Sciences	OP 4.01, 0D 4.30, BP 17.50
Project information with main points in EA & RAP	September 26-28, 1999	Haidian & Fengtai Districts	
Draft EA & RAP reports	October 14, 1999 October 22, 1999	Displayed for reading & reference in the public hearing meetings in Haidian & Fengtai Districts	
"Notice for Availability of EA & RAP reports"	April 26, 2000	Local newspaper "Beijing Economics Daily"	
Final EA & RAP report	April 2000	PMO, BDC, SJET	
Resettlement information booklet	April 2000	PMO, BDC	

Additional
Annex No.: 13

Financial Mangement System Assessment Summary

CHINA: Second Beijing Environment Rroject

I. Background

This report is the result of a financial management review and analysis of the Project as conducted by Yuahua Yu, Senior Disbursement Officer, EACCF, and Nancy Chen, Financial Management Specialist, EASFS, on October 25th to 29th and in November 11th, 1999, to determine whether the Project has in place an adequate financial management system as required by the Bank OP/BP 10.02. The review was performed in accordance with the following:

- § Guide for Review and Design of Accounting and Reporting System for World Bank Projects (Prepared by Central Operational Services Unit, East Asia and Pacific Region, December 1997);
- § Review of Financial Management System as stipulated in Annex II of LACI Implementation Handbook; and
- § Project Financial Management Manual issued by the Loan Department, February 1999.

The review consequently included procedures as were considered necessary and appropriate to Project's circumstances, including site visit, discussion and observation. As a result, the task team has discussed and reviewed with the Municipal Finance Bureau (FB), Beijing Environment Project Management Office (BEPO), and the implementing agencies: Beijing Drainage Corporation (BDC) and Shihuan Jietien Energy Technology Co (SJET) about plans, procedures and guidelines for establishing a sound project financial management system, *inter alia*, accounting system, staffing and training, internal controls, project reporting, auditing and budgeting.

II. Organization of Project Financial Management

BEPO has been established under the Municipal Planning Commission to oversee project implementation and provide coordination between the Bank and the implementing agencies. The project implementation will be undertaken by: BDC for the sewerage component and SJET for the boiler component. BEPO would be responsible for overall project management and would include participation of the Finance Bureau. In addition, a leading group headed by the Vice Mayor was established in May 1999 to strengthen the institutional leadership of the project.

Both BEPO and BDC have prior experience with implementing World Bank-financed projects (Beijing Environment Project) and have accumulated extensive experience with both the Bank and MOF's requirements in preparation and processing of withdrawal application and financial management of Bank-financed projects. However, SJET is a newly established limited liability joint venture, composed of Beijing Comprehensive Investment Company (60%), Beijing Gas Group Corporation (30%) and Beijing Yuanshan Energy Conservative Technology Corporation (10%). Therefore, a comprehensive training will need to be provided to SJET project staff.

III. Loan Disbursement Arrangements

The Project will be disbursing on the traditional disbursement techniques and will not be using PMR-based disbursements, in accordance with the agreement between the Bank and Ministry of Finance (MOF).

Two Special Accounts (SAs) will be set up with the BEPO, who will reconcile the SAs, check and monitor withdrawal applications and to verify payment requests meet Bank requirements. Applications for withdrawal of the proceeds of the loan and for replenishment of SA will be prepared and submitted to the Bank by the BEPO. MOF will on-lend the loan to BMG, who will in turn on-lend, via the Beijing Finance Bureau, to BDC and SJET at the same terms and conditions. Both BDC and SJET will verify the accuracy and validity of its respective expenses submitted, progress reported and prepare requests for payment. The requests for payment will be further reviewed and approved by BEPO before submitting to the Bank.

Original invoices and backup documents will be retained at point of initiation. BEPO will retain copies of withdrawal applications and copies of supporting documents.

IV: Financial and Accounting System

In line with other Bank-financed projects in the People's Republic of China, the Project will follow the Construction Accounting Standards issued by MOF as a basis for bookkeeping and preparation of financial statements and project reports. These standards dictate the format of financial statements, Chart of Accounts and related instructions which would therefore affect project accounting and reporting requirements. Accrual accounting and double entry basis will be adopted.

Project accounts will be maintained by the BDC and SJET, respectively, and further consolidated and submitted by BEPO on a semi-annual basis to the Bank, by October 1 and April 1, covering the first and second half of the year, respectively.

V. Internal Controls

A well designed internal control system is one of the key elements critical to the success of a project. A draft Financial Management Manual (the Manual) has been prepared by the BEPO and reviewed by the Bank. The Manual is supplemented by detailed financial management procedures developed by BDC and SJET, respectively. The objective of the Manual is to document the operational procedures and guidelines for project financial management, encompassing all levels of project management. The scope of the Manual encompasses the following key elements:

- § Project financial management structure and staffing;
- § Identification of the accounting standards to be used by the Project and all the participating agencies (e.g. tailored Chart of Accounts to project specifics and sample accounting treatments);
- § Key internal control features such as a system of authorization, verification, reconciliation and project reporting to provide adequate control over project costs, cash and asset management and segregation of incompatible duties;
- § Reporting formats tailored to project specifics;
- § Fixed assets management;
- § Procedures for procurement, disbursement, counterpart fund management and loan repayment management;

- § Budgetary procedures; and
- § Auditing arrangements

To strengthen project management and provide guidance in financial information preparation and reporting, well-defined roles, job description and detailed operational procedures in the aforementioned aspects have been documented in the Manual under the recommendation by the task team. The draft Manual is expected to be finalized by the end of the project appraisal.

SJET, the financial intermediary and implementing agency of the boiler conversion component, will be a revenue earning entity. An assessment of the financial performance of SJET will be conducted by the task team going forward, as SJET was recently established. To minimize the operating risks with respect to converting non government owned boilers, SJET will conduct a comprehensive appraisal of users. This appraisal includes review of operating records and financial status of boiler owners, and availability of counterpart funds. A draft appraisal manual will be reviewed by the Bank. The task team should also ensure the financial viability SJET; operating losses, if any, will be covered by the shareholders or guaranteed by the municipal government.

Regarding the audit findings of the previous project, the auditors noted no material internal control weaknesses during the audit of Beijing Environment Project Office (BEPO). However, the auditors noted negative signs such as delay in counterpart funding and repayment capacities of some of the industrial subprojects. With respect to the audit of Beijing Drainage Company (BDC), the auditors noted that BDC did not comply with the Loan Agreement to operate on a commercial basis. Instead, fees were collected based on rates prescribed by relevant authorities. These issues will be followed up by the task team during the next supervision mission.

VI. Staffing and Training

The Finance and Accounting Department has been established at the BEPO, BDC and SJET, respectively. In order to have a sound financial management of the project, it was agreed that each agency mentioned above will be staffed with one chief accountant, one project accountant who has overall responsibility for maintaining the project accounts and preparing financial statements and one cashier who processes cash receipts and expenditures. The Bank has received a staffing list and noted that the accountants at BEPO, SJET and BDC have six to twenty five years of experiences. See Attachment II: Staff List for details.

The task team recommended that a well designed and focused training be provided by the BEPO during the Project Launch Workshop, to ensure that staff understand financial management requirements. The Bank plans to readdress in details the major aspects of project financial management and reporting requirements during the Project Launch Workshop. It is suggested that this training should include such features as:

- § Bank procedures and the project financial management requirements on the withdrawal of Bank funds;
- § Overview of the project financial statement formats;
- § Review of project Financial Management Systems Manual;
- § Procurement procedures;
- § Project audit requirements.; and
- § Accounting software and its applications

VII. Project Reporting Requirements

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. The project financial statements will be submitted to the Bank on a semi-annual basis and include the following 4 statements:

- § Balance Sheet;
- § Summary of Sources and Uses of Funds by Project Component;
- § Statement of Implementation of Loan Agreement; and
- § Statement of Special Account

VIII. Audit Arrangements

The Bank requires the Project financial statements audited in accordance with standards acceptable to the Bank. In line with other Bank financed projects in China, the Project will be audited in accordance with Government Auditing Standards of the People's Republic of China (1997 edition). The Beijing Audit Bureau has been identified as the auditors for the Project. The audit including opinions on financial statements, Special Account, Statement of Expenditures and Internal Control Memorandum will be scheduled for submission to the Bank within 6 months after the end of each calendar year.

IX. Budgeting

Project budget will be prepared annually by the BEPO based on submissions prepared by the BDC and SJET. BEPO will consolidate budgets approved and submit for the Bank review and approval by November 30 of each year. For BDC the counterpart funds will be provided by the Beijing Finance Bureau. For SJET the counterpart funds will be provided by the boiler end-users; the availability of counterpart funds is one of the evaluation standards used by SJET. (See Section V: Internal Controls for more information.) Details of budget preparation, approval and counterpart funds management have been documented in the draft Manual.

X. Conclusion

Pending addressing the issues outlined in the action plan, on Attachment I, the task team has determined that the Project will satisfy the Bank's financial management requirements as required by OP/BP 10.02. In the team's opinion, the Project will have in place an adequate project financial management system that can provide, with reasonable assurance, accurate and timely information on the status of the Project in the reporting format agreed with the project management office and as required by the Bank.

Attachment I

PROPOSED ACTION PLAN

Description	Responsibility	Target Date
A. Project Financial Management Systems Manual/Controls		
1. BEPO Manual finalized and reviewed by Bank	BDC, Bank	Negotiations
2. BDC and SJET Manuals finalized and reviewed by Bank	BDC, SJET, Bank	Negotiations
B. Staffing		
1. CVs of accountants to be hired by BDC provided to the Bank for review.	BDC, Bank	Received
2. Accountants of BEPO commence work.	BEPO, Bank	Effectiveness
3. Draft boiler user Appraisal Manual finalized	SJET, Bank	Revisions and finalization as condition of effectiveness
C. Training		
1. Project Launch workshop to all relevant staff on: a. Bank and the project financial management requirements including withdrawal of Bank funds. b. Project financial statements formats. c. Project Financial Management Systems Manual. d. Project audit requirements. e. Procurement procedures. 2. Project accounting software	BEPO, Bank	Effectiveness
D. Special Accounts		
1. Obtain domestic clearances for opening of SAs.	BEPO	Effectiveness
2. Authorized signatures sent to MOF and Bank.	BEPO, Bank	Effectiveness
3. First withdrawal application sent to the Bank for initial deposit.	BEPO	After Effectiveness
E. Finalize the On-lending Terms and Conditions	BEPO, BDC, SJET, Bank	Negotiations
F. Provide close supervision of SJET operations to ensure that early warning signals are properly monitored and appropriate actions are taken, to prevent deteriorating operating conditions**.**	Bank, SJET	On-going

Attachment II

STAFF LIST

Department of Financial Management of Beijing Environmental Project Office

Name	Position	Education Background	Professional Title	Work Experience
Mr. Zhang Guoqing	Chief	Bachelor, economic	Accountant	8 years WB project financial management
Ms. Ming Dengli	Accountant	Bachelor of literature and diploma in financial management	Assistant accountant	5 years WB and ADB project financial management
Ms. Jin Jianhong	Cashier	Bachelor of computer science	Junior accountant	4 years ADB project financial management

SJET Financial Department

Name	Position	Education Background	Professional Title	Work Experience
Ms.Fang Xiujun	Chief	Bachelor, economic	Accountant	8 years accounting
Ms. Yin Jianhua	Accountant	Bachelor, economic	Accountant	6 years accounting
Ms. Liu Jianwen	Cashier	Professional training school	Accountant	25 years accounting

Beijing Drainage Company Financial Department

Name	Position	Education Background	Professional Title	Work Experience
Mr. Xie Hongdong	Chief	College graduate	Accountant	25 years accounting
Ms. Zhag Jingming	Accountant	College graduate	Accountant	19 years accounting
Ms. Tian Yanling	Accountant	College graduate	Accountant	24 years accounting
Ms. Li Caixia	Cashier	Professional training school	Junior accountant	16 years accounting