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BOSNIA AND HERZEGOVINA

EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

TECHNICAL ANNEX

APRIL 30, 1996

CURRENCY EQUIVALENTS
(as of April 30, 1996)

Currency unit: Bosnia and Herzegovina Dinar (BHD)
100 BHD = US$0.67

WEIGHTS AND MEASURES
(Metric and International Systems)

GJ	:	Gigajoule (0.034 tons of coal equivalent or 10^9 joule)
kW	:	Kilowatt
MWe	:	Megawatt electric (1,000 kilowatts)
MWt	:	Megawatt thermal (0.86 Gcal/h)
MWh	:	Megawatt-hours (3.6 GJ)

ABBREVIATIONS AND ACRONYMS

BH	Bosnia and Herzegovina
DC	Direct Contracting
DH	District Heating
DHE	District Heating Enterprise
EBRD	European Bank for Reconstruction and Development
EPBiH	Elektroprivreda Bosne i Hercegovine
EU	European Union
GBH	Government of Bosnia and Herzegovina
GDP	Gross Domestic Product
GPN	General Procurement Notice
ICB	International Competitive Bidding
IDA	International Development Association
IS	International Shopping
JUGEL	Union of the (former) Yugoslav Electric Power Industry
LIB	Limited International Bidding
NBF	Not Bank Financed
NCB	National Competitive Bidding
NS	National Shopping
PIU	Project Implementation Unit
PSA	Project Start-up Advance
SFRY	Socialist Former Republic of Yugoslavia
TFBH	Trust Fund for Bosnia and Herzegovina
UCPTE	Union for the Coordination of Production and Transmission of Electricity
USAID	US Agency for International Development

FISCAL YEAR
January 1 - December 31

BOSNIA AND HERZEGOVINA

EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

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I. BACKGROUND

A. BANK PRE-WAR INVOLVEMENT IN ENERGY

1. The Bank has been heavily involved in the energy sector in Bosnia and Herzegovina in the past, notably in electric power, petroleum and natural gas. Power sector projects, which benefitted partly or exclusively BH included the Third Power Loan (Loan 386-YU; US$75 million; 1972) and the Fourth Power Loan (Loan 1469-YU; US80 million; 1977), both of which helped finance the development of SFRY's interconnected power system; the Fifth Power Project (Loan 1561-YU; US$73 million; 1978) was for development of the hydro power plants on the middle Neretva River; the Sixth Power Project (Loan 1561-1-YU; US$61 million; 1983) was for construction of the Mostar dam; the Seventh Power Project (Loan 2338-YU; US$120 million; 1984) financed SFRY's energy management system; and the Eighth Power Project was for the Visegrad hydro power plant (Loan 2527-YU; US$125 million; 1985). In the petroleum sector the Bank financed the First Petroleum Project (Loan 2597-YU; US$92.5 million; 1985) for development of indigenous energy resources. In the gas sector the Bank financed the Sarajevo Air Pollution Control Project (Loan 1264-YU; US$38 million; 1975). The Bank did not finance projects in the coal or district heating sectors in BH.

B. ELECTRIC POWER

2. **Background**. In 1990 BH produced 13,090 Gigawatt hours (GWh) of electricity from generating plants located on its territory. Electricity consumption was 11,181 GWh. The system comprised 13 hydro power plants with a total capacity of 2,034 Megawatt (MW) and an average output of 6,922 GWh/year, and 12 thermal power plants with a total capacity of 1,957 Megawatt (MW) and an output of 10,675 GWh in 1990. The thermal power plants were coal and lignite fired, with the fuel coming from mines within BH. Distribution losses amounted to 11% of gross consumption. BH was responsible for operating its own system and meeting local demand. However, being part of the former Yugoslav network, the 400 kV power grid in BH was controlled by JUGEL's dispatching center in Belgrade. Power exchanges with neighboring countries were also controlled by JUGEL.

3. **Current Situation**. At present, 58% of total generating capacity in the Federation area (comparable data are not available for the Republika Srpska) has been damaged. Part of the remaining capacity is out of operation due to destroyed transmission lines or lack of coal. About 60% of the transmission network and control system are seriously damaged, including transmission facilities and interconnection lines to neighboring countries and UCPTE. The distribution network is largely destroyed. Many transformer stations, buildings, telecommunications and maintenance equipment are also either seriously damaged or destroyed.

As in the other energy sectors, human resources are scarce, since many staff were required for the war effort while others have become refugees. Massive technical assistance will be required to implement a recovery program and help with the organization, staffing and training of the entity.

4. **Sector Strategy**. The proposed sector strategy would be to: (i) restore service to acceptable levels; (ii) reconfigure the electric power network to optimize the system, taking into account BH's need for significant independence from the SFRY's network and its security of supply; (iii) restructure the sector and introduce a regulatory framework that would facilitate attracting potential investors; and (iv) improve sector finances by improving billing and collections and revising the tariff structure and levels to reflect supply costs for each category of consumers.

C. COAL

5. **Background.** In the 1980's the coal mines in BH produced annually about 18 million tons of coal, of which 10 million tons of brown coal and 8 million tons of lignite. Their brown coal output accounted for about 80% of total former SFRY production, lignite for only 15%. Production was concentrated in areas near Tuzla and Zenica in both open pit as well as underground mines. In addition, two mines in the Republika Srpska were important: Ugljevik (brown coal) and Gacko (lignite). About half of the production originated from surface mines and the other half from underground mines. BH's proven reserves of coal are about 1.6 billion tons. More than 80% of BH's total production was used for electric power generation and the remaining 20% for industrial and household uses.

6. **Current Situation**. Coal production dropped to 1.5 million tons in 1994, i.e. less than 10% of the pre-war level. The coal mines have been grouped into two principal companies: the Tuzla Coal Mines and the Central Bosnia Coal Mines, which supply thermal power plants. A third group, the Mostar Coal Mines, is of much less economic importance, both in terms of output and product end-use. Much of the mobile mining equipment has been cannibalized beyond repair. Some newer mobile equipment had to be turned over to the army or just disappeared. There is an acute lack of critical materials such as fuel, tires and spare parts.

7. Despite the drastic drop in production, no efforts were made to concentrate production in a few large and economic mines. The number of people employed has decreased from 26,000 to about 7,000. Since production declined much faster, productivity is now among the lowest in the world. Present production costs appear to be at or above the world market level of coal prices adjusted for quality and are higher than sales prices, which are set by the State. To ensure future financial viability, coal mining enterprises need to close uneconomic capacity.

8. **Sector Strategy**. In view of the coal sector's uncertain future in a market economy, all major long-term investment decisions should be avoided at this stage. The proposed sector strategy would be to: (i) determine priority actions to be taken for the lowest cost and most competitive mines; (ii) restore output of the lowest-cost mines to minimum acceptable levels;

and (iii) restructure the coal industry, including closing uneconomic mining capacity and privatizing services whenever feasible.

D. NATURAL GAS

9. **Background.** The gas system in BH was developed starting in 1975 under the Bank's Sarajevo Air Pollution Control Project (Loan 1264-YU). Russian gas is supplied via Hungary and Serbia and enters BH at Zvornik, in the Republika Srpska. As of 1992 the gas supply network consisted of 190 km of transmission mains and offtake pipes, running from Zvornik to the Sarajevo area via Semizovac and from the latter to Zenica. Consumption peaked in 1990 with 610 million cubic meters, constituting 8% of the total energy consumption in BH. Within Sarajevo, there were 15,000 household connections and all major boilers of the city's district heating network had been converted from coal to gas-firing. Gas imports for BH are metered at the Ukraine/Hungarian border (Beregov; the contractual point of delivery of the gas) and from there it is transported through the Hungarian and Serb transmission systems to Zvornik. The cost of transporting the gas from Beregov to BH has been charged in kind by withholding about 35% of the contracted gas volume. The gas was imported under a contract between Energopetrol, a state-owned oil and gas company, and Gazexport, the export branch of Russia's Gazprom. Within BH, gas transmission and distribution was (and is) the responsibility of Sarajevogas.

10. **Current Situation**. At the beginning of the war the Bosnian Serbs reduced the gas supply coming into Sarajevo to such an extent that gas use for industry and much of the district heating system became impossible. Combined with the destruction of part of the district heating system in Sarajevo early on and given a sharp reduction of electricity generation in BH, gas suddenly assumed major importance for the inhabitants of Sarajevo as a means to stay warm and to cook. Many improvised connections and appliances were made, which has often led to explosions and highly inefficient gas use. As of the end of 1995, the total number of household connections in all of Sarajevo was estimated at around 85,000; gas consumption constituted about 70% of all energy consumption and it was the basic heating and cooking fuel for the city's remaining 300,000 inhabitants.

11. **Debt to Gazexport**. During the war, the gas supply from Semizovac to Zenica (the entire western branch of the transmission system, affecting several major industries along that line) was shut off. However, some gas was allowed to come into Sarajevo. In exchange, gas was allowed to go to Belgrade and to the Bosnian Serbs. The total bill for gas supplied by Gazexport was US$105 million as of October 12, 1995. Of this total, GBH claims that only about 30% is owed by it for the supply of gas to the Bosnian part of Sarajevo. A new agreement signed between Gazexport and Energopetrol calls for delivery at Beregov of specified quantities of gas for both the Federation and the Republika Srpska at US$80 per 1,000 m^3. Since then, most supplies have been paid for and efforts are underway to come to a permanent solution for full payment of current gas consumption.

12. **Sector Strategy**. The proposed sector strategy would be to: (i) seek partial donor funding for the next three years' gas consumption; (ii) reconfigure the gas network and restore

safe service; (iii) ensure demand management through disconnection of consumers that can be reconnected to the district heating system, introduction of energy efficient appliances, and gradually increasing cost recovery; (iv) strengthen the sector entity; and (v) settle past debts to Gazexport.

E. DISTRICT HEATING

13. **Background.** In 1991 BH had district heating (DH) systems in most major towns and cities with a population in excess of about 25,000 inhabitants. The systems were generally run by municipally-owned district heating enterprises (DHEs). Cogenerated heat was provided only by the combined heat and power plants in Tuzla and Kakanj as well as by local industries; the remaining heat was generated by local heat-only boilers. Already prior to the war, some efforts had been made to start converting coal-fired boilers to gas or oil firing, notably in Sarajevo. DH systems throughout BH served 120,000 flats, equivalent to 450,000 inhabitants or 10% of the total population. The Sarajevo DH system was the country's largest, serving about 180,000 inhabitants or 45% of the pre-war population of Sarajevo. All DH systems delivered mostly heat only and provided domestic hot water only to a small percentage of consumers. Heat prices were set locally and were not uniform nationwide. Subsidies for heat and domestic hot water consumption were provided based on income levels from local tax proceeds. The average subsidy per consumer was US$100 per annum, compared to an average annual heat bill of about US$370.

14. **Current Situation.** Currently, the DH systems in major cities such as Sarajevo, Banja Luka, Bihac and Mostar are only partly operational. In Sarajevo the system has been damaged due to shelling and freezing of the pipes in the network; building internals in residential dwellings (pipes, radiators and valves) have incurred substantial damage, also due to the corrosion associated with non-usage of the system. In Banja Luka most of the damage is related to non-usage of the system due to lack of fuel, and associated rusting and freezing. In all cities, lack of maintenance due to the absence of spare parts has been significant and further aggravated the problems.

II. BANK RESPONSE AND STRATEGY

15. The conclusion of the Dayton-Paris Peace Agreement in December 1995 ended Europe's most destructive war in the last fifty years. The war has shattered the economy and brought productive activity almost to a standstill. The country's pre-war GDP of about US$9 billion has shrunk to about US$2 billion, and its per-capita GDP declined from about US$1900 to about US$500. Few of the nearly 900,000 workers employed in 1991 are currently employed. The majority of the population lives exclusively or partially on humanitarian assistance. At least 200-

250,000 people are dead or missing, and over 1 million people left the country. In addition, there are about 1.5 million displaced people in the country, many of whom live in temporary shelters. Enormous damage has been inflicted on the country's physical infrastructure, including energy. Direct war damages are huge, probably in the range of US$15-20 billion. Indirect damage due to lack of maintenance and corrosion accounts for many more billions of dollars of losses.

A. SECTOR RECONSTRUCTION PROGRAM

16. A reconstruction and rehabilitation program for the combined energy sectors of BH of about US$900 million has been prepared as part of the US$ 5.1 billion reconstruction program for all sectors, over 3-4 years, which the Bank has helped to develop in a joint effort with the country and the donor community. The energy sector program calls for a major effort to restore destroyed, damaged and forcibly neglected equipment and to bring service back as soon as possible to near pre-war levels. The proposed project will be the first major element in this program, aiming to ensure restoration of district heating to large numbers of households in Sarajevo and preparing the groundwork for similar investments in the future in Banja Luka.

17. Other emergency projects in the energy sector planned for FY96 or early FY97 are the Emergency Electric Power Reconstruction Project (which would also include rehabilitation of the most efficient coal mines serving the cogeneration plants in Tuzla and Kakanj) and the Emergency Gas System Reconstruction Project, which focuses mostly on Sarajevo. Projects with a medium term perspective would deal with further reconstruction and rehabilitation of the various energy sectors and would address broader issues such as the sector's regulatory framework, energy pricing, sector restructuring, and eventual privatization.

B. BANK/IDA ASSISTANCE STRATEGY

18. The Bank has been deeply involved in defining a reconstruction program for Bosnia and Herzegovina, and has offered direct technical assistance to the Government. Initial discussion with the Government began in January 1995. Subsequent meetings culminated in a full review of the reconstruction program by a joint mission of the Bank, IMF, EU, EBRD, and USAID which visited the country from October 22 to November 1, 1995. This was followed by two donors' meetings, co-sponsored by the Bank and the EU, in Brussels on December 20-21, 1995 and on April 12-13, 1996, respectively. These meetings obtained new commitments of about US$1.8 billion for financing a priority reconstruction program during 1996.

19. The reconstruction program envisages funding for priority reconstruction of US$5.1 billion over the next 3-4 years, of which some US$1.8 billion for 1996. The program aims to immediately rehabilitate facilities essential for economic recovery and social well-being, to make maximum use of private initiatives, and to expand new facilities only where there is an exceptionally high economic return. The program covers sectors such as energy, transport, telecommunications, water and waste management, agriculture, industry, education, health, housing, de-mining as well as social expenditures in support of stability.

20. The Bank's own assistance strategy for BH consists of a two-track approach. First, prior to clearance of BH's arrears to the Bank, the Bank supports selected immediate assistance programs through the special World Bank Trust Fund for BH (TFBH) in the amount of US$150 million, approved by the Board of Governors on February 23, 1996. Of these Trust Fund resources, US$125 million is to be extended at concessional terms identical to those offered by IDA and US$25 million is to be provided as grant. Four projects have been approved by the Board so far and three more are to follow, including the proposed project. Second, following the clearance of arrears to the Bank, a program of lending and technical assistance would be initiated to support reconstruction and employment generation, as well as economic transformation. The current pipeline of operations for the remainder of FY96 and for FY97, to be financed from regular World Bank Group resources, comprises about twelve emergency-type projects, including projects in the electric power and gas sectors.

III. THE SARAJEVO DISTRICT HEATING SYSTEM

21. **System Characterics and Status.** The district heating system of Sarajevo started operations in 1968 and is the largest within BH. The system is owned by the City of Sarajevo and supplied, by the end of 1991, approximately 45% of the city's population (about 180,000 inhabitants) and part of the public sector with heat.

22. The Sarajevo DH system consists of 130 individual heat-only boilers with a total installed capacity of 515 MW, a peak load of 387 MW (75% of capacity), and a network with a total length of 62 km. There is no cogeneration of heat and power in Sarajevo. The system is divided into two parts with entirely different technologies: (i) 44 independent area networks, supplied by medium to large-sized individual boilers. These boilers produce heat only; and (ii) 87 separate buildings, supplied by one small rooftop boiler each. About 60% of these rooftop boilers provide both heat and domestic hot water. As a result, only 7% of the flats connected to the district heating system receive domestic hot water from it. The fact that the district heating system produces very limited amounts of domestic hot water defines the annual operating season as essentially the period October 1- May 10.

23. During the war, gas shortages and direct impact damage reduced the system to operation of low-pressure lines only. At present only 16,000 (32%) of the 50,000 flats originally connected to the district heating system can be supplied with heat by Toplane, and regularly served heat demand has dropped from 387 MW to 141 MW (36%). Unsupplied consumers were initially using alternative energy sources such as coal, wood and paper. However, as the war continued and those sources of fuel were depleted, more and more consumers resorted to making improvised connections to the gas network. Neither the household DH nor the household gas consumers paid during the war for their consumption (para 85).

24. **Boilers.** The Sarajevo system has two main types of boilers: (i) medium and large-sized boilers feeding individual, independent networks; and (ii) small roof-top boilers. Their principal characteristics are summarized in Table 1.

Table 1: Boiler Characteristics

Boiler Size	Number	Age (Years)	Fuel	Total Heat Capacity
- large (3-55 MW)	30 14 6 10	 >20 15-20 7-14	 gas/oil gas/oil gas/oil	448 MW
- medium (1-3 MW)	13 6 4 2 1	14-16	 gas/oil gas oil coal	27 MW
- roof-top boilers (<1 MW)	87	7-14	gas	40 MW
Total	**130**			**515 MW**

25. Out of the 130 boilers listed above only about 60 can operate today, representing in total 200 MW or 39% of the total pre-war installed capacity. Although they are capable of heating 25,000 flats at present, damage to buildings and house installations has reduced the number of heated flats to only 16,000.

26. **Distribution Network**. Out of the 44 independent networks 43 belong to Toplane and one to an industrial plant. The overall network pipeline length is 62 km, most of it steel pipes laid in underground concrete channels. There appears to be no major obvious war damage to the underground pipes, but they are heavily corroded. In particular the channel systems in areas with a high groundwater level close to the river are affected by corrosion, freezing and insulation damage. The rate of overall system damage is estimated to be about 15%. Prior to the war about 2 km of pipe (3.2% of the total) were replaced each year. This adds a significant maintenance backlog to the repairs required as a result of war damage. At present, water losses are equivalent to replacing the water in the system about seven times per heating season (para 45).

27. **Substations.** 120 substations with an overall capacity of 210 MW are located in the supply areas of big boilers and are placed in the basement of the apartment buildings they supply. Only a few substations show war damage. Most substations are affected by lack of maintenance due to a lack of spare parts and wear and tear. For those substations that have been out of operation and without water for almost 4 years corrosion, freezing and insulation problems are expected to be pervasive.

28. **Remote Control Center.** Before the war 105 boilers, including all 87 roof-top and 18 of the 44 network boilers, and about 40% of the substations were connected to a remote control

center. Although the networks were not interconnected and capacity management (dispatching) was therefore not possible, the performance of the heat generating units was monitored centrally. The remote control center was entirely destroyed during the war. Only part of the wiring, local interface equipment and parts of the original building are left.

29. **Internal Installations.** Prior to the war there were on average about 4.5 radiators per flat. Thus, in total 225,000 radiators in 50,000 flats were connected to the district heating system. At present, about 5% of all flats in Sarajevo are totally destroyed and 60% are partly destroyed. In part due to the resulting destruction of radiators, valves and internal pipelines only about 30% (65,000) of all radiators can operate today. One major other source of destruction has been the use of internal district heating equipment for individual gas heating, since unsupplied consumers cut internal DH pipes and used them to connect themselves to the gas network.

30. **Metering.** Metering is necessary both at the heat production (supply) side and the heat consumption (demand) side. It is of equal importance for capacity management, demand management, cost allocation and energy conservation. There was little metering of either type in the original district heating system. Production metering is applied to only 6 of the 44 medium and larger size boilers. The remaining 37 boilers are unmetered. Substations were metered to a limited extent only.

31. Heat consumption is fully metered only in flats supplied by roof-top boilers. The meters are located in the stairways at the entrance to each flat. In contrast, only about 15% of the consumers supplied by network boilers are metered. As a result, 38,000 flats connected to the system prior to the war (76% of the total) have no metering at all. For both metered and unmetered consumption billing was carried out on the basis of a fixed price per square meter. Metered consumption was compared to the assumed consumption once a year to adjust the payment.

32. **Maintenance.** Toplane's pre-war maintenance department used to provide mechanical and electrical servicing of all DH components, including internal heating installations. The cost of maintening building internals was financed from a portion of rental revenues. During the war Toplane lost not only a large part of its maintenance staff but also about 50% of all workshops, storage space, and other maintenance facilities, along with most vehicles. Theft of tools and spare parts further impaired its maintenance and repair capability. This gradually reduced maintenance to a minimum and, along with a lack of spare parts, severely hampered reconstruction of damaged facilities.

IV. THE PROJECT

A. PROJECT OBJECTIVES

33. The objectives of the project are to: (a) restore district heating service in Sarajevo as soon as possible by reconstructing both the district heat supply system as well as by reconstructing building internal heating installations; (b) enable BH to potentially reduce its gas consumption through fuel switching by Toplane-Sarajevo from gas to fuel oil, which would enhance the country's strategically important security of energy supply; (c) strengthen Toplane-Sarajevo's institutional capacity; and (d) initiate network improvements. The project would enhance energy efficiency and energy conservation and reduce environmental pollution by enabling disconnection of about 34,000 flats in Sarajevo from self-made gas connections.

34. The importance of the project's second main objective has been abundantly demonstrated during the war. The total dependence of Sarajevo on natural gas imported from Russia and transiting through Serbia means that Sarajevo's energy supply is not secure. The DH system's ability in principle to use dual firing and, hence, the option of using light fuel oil for district heating rather than gas would enhance Bosnia's security of energy supply. The capability to use this dual firing option will be fully rebuilt under the proposed project.

B. PROJECT DESCRIPTION

35. The proposed emergency project consists of the following major components: (a) in *Sarajevo*: (i) technical assistance for project management, including an engineering survey and assessment, and for staff training, master plan and tariff studies; and (ii) critically needed investments for the reconstruction of all parts of the district heating network, including building internals; and (b) in *Banja Luka,* technical assistance for project preparation (engineering survey and assessment) only. Details of the project are described below.

1. Technical Assistance Component

36. A major technical assistance program will be required, both in order to assist Toplane in implementing this large-scale emergency reconstruction project over a very short period of time, as well as in order to improve its institutional capabilities for the longer term. Critical areas in which such technical assistance will be needed are: (i) project management; (ii) engineering; (iii) financial and commercial management; and (iv) system planning. Each of these tasks would include a significant staff training component.

37. **Project Management.** The magnitude of, and time constraints faced by, the project require strong and specific expertise in coordination and organization of large projects. To provide the management capability that is necessary to successfully direct and control implementation of the project, Toplane will be assisted by experienced professionals from a leading engineering company within a project implementation unit (PIU; para 60). The PIU

would manage work scheduling, procurement, coordination and supervision of the construction process, monitoring, approval of reconstructed components and all financial and administrative operations associated with the implementation of the project.

38. **Engineering.** The core of the project implementation team would be constituted by qualified district heating specialists who would provide the necessary engineering assistance to Toplane. This assistance will cover both the technical aspects of project implementation as well as on-the-job training of Toplane staff. The engineering tasks of the project require extensive experience in planning, systems analysis, etc., and would cover both the engineering assessment and the development of the reconstruction strategy (para 40). The engineers would also prepare the bidding documents and assist in bid evaluation. Continuous involvement and on-the-job training of qualified Toplane engineers as the project progresses and new technologies get implemented will be the most efficient way of strengthening the operational capacities of Toplane.

39. A complete and thorough engineering survey will be required to determine the technical details of the damage to the DH system and the specifications for reconstruction. This will be carried out by Toplane, engineers from Sarajevo's technical university and local engineering enterprises. This work has already been started, which will help to shorten the time that it will take to move from preparation to implementation. The survey of boilers, networks and substations includes, inter alia, reconstitution of missing technical specifications; visual and acoustic inspection; pressure testing; cold starting and warm operational checking; sample testing of network pipes; and testing of electrical equipment.

40. The emergency character of the project requires that solutions be implemented within a limited time frame. Nevertheless, reconstruction and rehabilitation should be in line with optimal longer-term solutions. The extent to which the most essential elements of system improvement (such as interconnection of some independent networks and connection to the network of separate buildings currently heated by roof-top boilerhouses), can be incorporated now has to be evaluated as soon as possible. A brief engineering assessment during the early stage of project implementation will define the optimal strategy in this regard and determine, together with the engineering survey, final project scope and design. As part of the engineering assessment, options to enhance the oil firing capability of the DH system would also be examined.

41. The results of the engineering assessment will determine which option to follow for each sub-component: (i) reconstruction to pre-war state; or (ii) reconfiguration of part of the system to achieve higher efficiency and, correspondingly, retirement of inefficient and/or severely damaged facilities. It is expected that in most cases the cost of laying additional pipes would be offset by the savings to be achieved by not rehabilitating inefficient or damaged and destroyed facilities.

42. **Financial and Commercial Management.** Toplane has an obvious lack of specialized knowledge in the financial and commercial areas. This partly reflects attitudes carried over from the previous centrally planned system and the fact that Toplane, by order of the Government, had to keep supplying heat during the war to consumers that were unable to pay. To enable full

rehabilitation and satisfactory operation of the system, Toplane has to achieve financial viability as soon as possible (para 86). To help achieve this, the project includes technical assistance in accounting and in restoring, upgrading and reintroducing an efficient billing and collection system to achieve an acceptable degree of cost recovery.

43. **Planning.** A district heating master plan would be developed and would include a forecast of future load growth, economically justified system expansion for the next twenty years, and the measures necessary to improve the system and make it more economical, such as expanding domestic hot water supply, increasing network interconnection and using cogeneration as a source of heat. Fundamental system improvement options to be evaluated are: (i) interconnection of independent networks; (ii) connection to the network of separate buildings currently heated by roof-top boilers; (iii) capacity adjustment, management and optimization; and (iv) cogeneration of heat and power.

2. Reconstruction Component

44. **Boilers.** Both boilers and the boilerhouse-buildings themselves require reconstruction and rehabilitation. Most of this is expected to consist of the replacement of smaller components such as pipes, pumps, valves, regulators, insulation, wiring, electronic equipment and building repair. Three larger boilers (with a total capacity of 16 MW), 1 medium-sized boiler (2.6 MW) and 10 roof-top boilers (altogether 5 MW) have to be replaced entirely. However, this may underestimate the actual reconstruction requirements significantly: although most boilers with minor external damage may appear in good condition, the impact of internal corrosion and freezing could be severe and must be examined carefully. The estimated damage to the boilers is summarized in Table 2.

Table 2: Damage to Boilers

Boiler Size		Number	Installed Capacity (MW)	Damage			Available capacity (Jan. 96) [%]
				completey destroyed [number]	partly damaged [number]	worn [number]	
A) large	(3 - 55 MW)	30	448	3	15	12	39%
B) medium	(1 - 3MW)	13	27	1	2	9	38%
C) roof-top boilers	(< 1 MW)	87	40	10	36	41	38%
Total		**130**	**515**				

45. **Distribution Network.** In order to get a quick but representative impression of the state of the entire 62 km of distribution network and start the reconstruction effort on time, sample testing of the pipeline network is recommended as a first approach. The city is located in a valley formed by the Miljacka river. Therefore, the greatest damage to the pipelines is expected

to be close to the river, where the ground water level is high. Pipeline engineers and experienced personnel of Toplane will have to determine to what extent a reduction of time consuming full survey requirements through sampling or other means is feasible and cost-effective. The current estimate of overall damage is that a total pipeline length of 10 km in various diameters will need to be replaced by new preinsulated pipes. As a minimum, this would reduce the present annual water losses, equivalent to replacing the water in the system 7 times per heating season, to the pre-war level of 4 times.

46. **Substations.** 120 substations, located in the basements of buildings connected to the network, have to be rehabilitated. Due to their relatively protected location, the rehabilitation of the substations will consist mostly of replacement of parts that suffered from being out of operation for several years. Affected parts are heat exchangers (shell and tube type), pumps, valves, and electrical and control equipment. The initial estimate is that 50 pumps, 30 heat exchangers, 350 valves and 120 heat meters need to be replaced or installed.

47. **Remote Control Center**. Since the networks are not interconnected and dispatching is therefore impossible, the old control center was mainly used to monitor the operation of various subsystems (para 28). This function can be carried out by staff until, at a later stage, system optimization will require the installation of a fully functional dispatching center. The results of the engineering assessment will define the time frame for the rehabilitation and expansion of the remote control center.

48. **Internal Building Installations.** In order to organize the enormous logistical task of reconstructing damaged internal installations in up to 50,000 flats, precise information about location and requirements in material and labour must be collected. This task is not complicated but it is extremely time consuming. As part of the project, the Mechanical Faculty of the University of Sarajevo has already started to record the state of the internal installations, using teams of students under supervision of engineers. Under the project, an average of 2.5 radiators would be repaired or installed per flat, including thermostatic valves, meters and pipe connections.

49. **Metering.** Since heat energy has been free for the last four years, major efforts will need to be made to redevelop an awareness of the need for energy conservation, both on the demand side as well as on the supply side. To achieve tangible and rapid progress in this area, individual heat consumption metering is essential. Under the project, such meters would be installed at the lowest cost, i.e., through the installation of evaporation meters on all radiators where evaporation metering is possible, and the replacement of destroyed metering installations. Similarly, heat production metering would be installed on all network boilers and substations.

C. PROJECT COST

50. The total estimated cost of the project equals US$40 million equivalent, of which US$25 million in foreign costs. The project cost includes physical contingencies of 20 percent. No price contingencies have been included, given the expected short disbursement period of this

emergency project. The project cost also excludes duties and taxes. The Bank is working with the Government on schemes to either significantly defer payment of such taxes under Bank-financed projects or to otherwise ensure that the Beneficiaries will not have to pay these taxes during the transition period. Estimated project costs are summarized in Table 3.

Table 3: Project Cost Summary
(US$ million)

PROJECT COMPONENT	FOREIGN	LOCAL	TOTAL [1]
A. SARAJEVO			
I. BOILERS	6.3	3.2	**9.5**
II. DISTRIBUTION NETWORKS	4.2	3.3	**7.5**
III. SUBSTATIONS	2.5	0.5	**3.0**
IV. INTERNAL INSTALLATIONS	3.0	3.7	**6.7**
V. METERS	1.2	0.1	**1.3**
VI. OTHER EQUIPMENT	0.5	0.9	**1.4**
VII. CONSTRUCTION SITE PREPARATION	0.1	0.3	**0.4**
VIII. TECHNICAL ASSISTANCE	3.0	0.1	**3.1**
B. BANJA LUKA			
I. PROJECT PREPARATION	0.3	0.2	**0.5**
BASE COST	***21.1***	***12.3***	***33.4***
PHYSICAL CONTINGENCIES[2] (20%)	*4.2*	*2.4*	*6.6*
TOTAL	**25.3**	**14.7**	**40.0**

[1] Costs include labour and spare parts. Taxes and duties are not included.

[2] Physical Contingencies exclude Banja Luka.

D. FINANCING PLAN

51. The State of BH would be the recipient of the funds to be provided by various donors, with the DHEs being the Beneficiaries. Of the total project cost, the Bank would finance US$20 million equivalent on IDA terms out of the special World Bank Trust Fund for the Reconstruction of BH. Various donors, such as Belgium, Denmark, Finland, Italy, the Netherlands, Sweden and the European Union, have expressed interest in cofinancing the project. In the event such additional financing cannot be mobilized by the time of effectiveness of the Bank credit, the project scope would be adjusted through a reduction in the number of flats to be connected. Priority would be given to those areas where the largest number of consumers can be

reconnected at the least cost. In addition to seeking funding for the project costs, the donors have been requested to fund a portion of the annual fuel costs of Toplane-Sarajevo in an estimated amount of US$18 million equivalent during 1996-1998. The financing plan is shown in Annex 1.

E. ENVIRONMENTAL ASPECTS

52. The project is rated Category B, in accordance with the Bank's Operational Manual Statement 4.01 of October 1992. This category is reserved for projects which may have relatively minor adverse environmental impacts, despite the fact that the project would result in a net reduction in air pollution. The chief requirement under a "B" project would be for Toplane-Sarajevo to prepare and implement an environmental monitoring and mitigation plan satisfactory to the Bank. Environmental issues associated with rehabilitation of the dual-fired boilers fall into three broad areas: (i) air quality impact; (ii) storage and transport of fuel; and (iii) condition of the equipment. Specific issues, and the manner in which they will be mitigated, are discussed below.

53. **Air Quality Impact**. If gas is the fuel, nitrogen oxides are the only significant potential pollutants. Since the air quality in Sarajevo was improved in the past by switching to gas, it is reasonable to assume that nitrogen oxides will not cause air pollution problems if the boilers are fired on gas, as was the case before the war. Mitigation measures will include an examination of the condition of the boilers (particularly the burners) to make sure they can operate with minimal emissions of NO_x.

54. If the gas supply is threatened, the Government has the option to utilize fuel oil for the district heating boilers. Should fuel switching actually occur, then (depending on fuel quality) air quality issues such as nitrogen oxides, sulfur dioxide; and, to some extent, dust would be taken into account. Mitigation measures would include: (i) examination and testing of burners to ensure that they are physically capable of firing the selected fuel oil optimally; and (ii) evaluation of existing air quality data and an air quality impact analysis (increases in ambient dust, NO_x, and SO_2 levels) using appropriate modeling techniques. Based upon the results of this analysis, maximum allowable sulfur levels in the fuel oil would be established.

55. Substituting distillate and residual fuel oil for natural gas could result in a deterioration of the ambient air quality on a limited number of winter days when heat demand is very high and, simulateously, persistent stagnation of the air occurs. Emissions of SO_2, particulates and possibly nitrogen oxides will increase due to oil firing. The general contribution of sulfur dioxide loading to the Sarajevo air shed may be noticeable, and the ambient air quality in the immediate vicinity of individual boiler units will vary to a greater or lesser extent depending on the individual source characteristics and location relative to nearby structures.

56. **Fuel Transport and Storage**. If rehabilitation or reconstruction of the existing storage system is required, this would be done in accordance with international standards. Fuel oil storage tanks will be inspected to ensure they are mechanically sound and not leaking into the groundwater. In the vicinity of the storage area, groundwater will be monitored regularly to insure against contamination. Above-ground tanks will be surrounded by berms to assure oil containment should a rupture occur.

57. **Equipment Condition**. Boilers and burners will be inspected to ensure satisfactory environmental performance. Burners will be tested to make sure they can fire both gas and fuel oil in the manner prescribed in their design.

V. PROJECT IMPLEMENTATION

A. THE PRINCIPAL BENEFICIARY

58. The municipal district heating enterprise of Sarajevo, Toplane, was founded in 1968 and has since been responsible for running the city's entire DH system, including the 87 rooftop boilers. The staff situation of Toplane has been heavily affected by the war. However, immediately after the end of the war former staff began to return to Toplane and within the first two months of the year the number of personnel almost doubled to 166 (Table 4). Although the staffing level is still well below where it should be, the available staff is generally well qualified and able to implement the proposed project if significant support in project management and engineering is provided (para 60).

Table 4: Toplane Staff

	Dec. 1991	Jan. 1996
TOTAL	385	166
- Management	10	8
- Technical	20	18
- Commercial/financial	45	9
- Operation	150	44
- Maintenance	140	68
- Other	20	19

59. Large numbers of local labor would be required to implement the proposed project. However, once the project is completed total manpower requirements would diminish significantly. Toplane would ensure that such labor would be provided by local contractors. If absolutely necessary it would hire such labor itself, but on a temporary basis only in order to avoid excessive permanent staffing levels.

B. PROJECT IMPLEMENTATION

60. The emergency character of the reconstruction project poses an implementation task of extreme complexity and magnitude. In order to execute the reconstruction process efficiently and complete it on time, a strong project implementation unit (PIU) will be established by Toplane. This PIU will be headed by a senior Toplane manager, assisted by experts of an internationally experienced engineering company and local Toplane staff. The combination of the local system knowledge of Toplane staff with foreign management expertise will facilitate rapid parallel implementation of all project components. The Toplane project manager, assisted by a foreign deputy project manager with strong international experience in directing large scale (re)construction projects will coordinate the operations of the PIU. These managers will have the authority and responsibility to take all decisions necessary to facilitate project implementation.

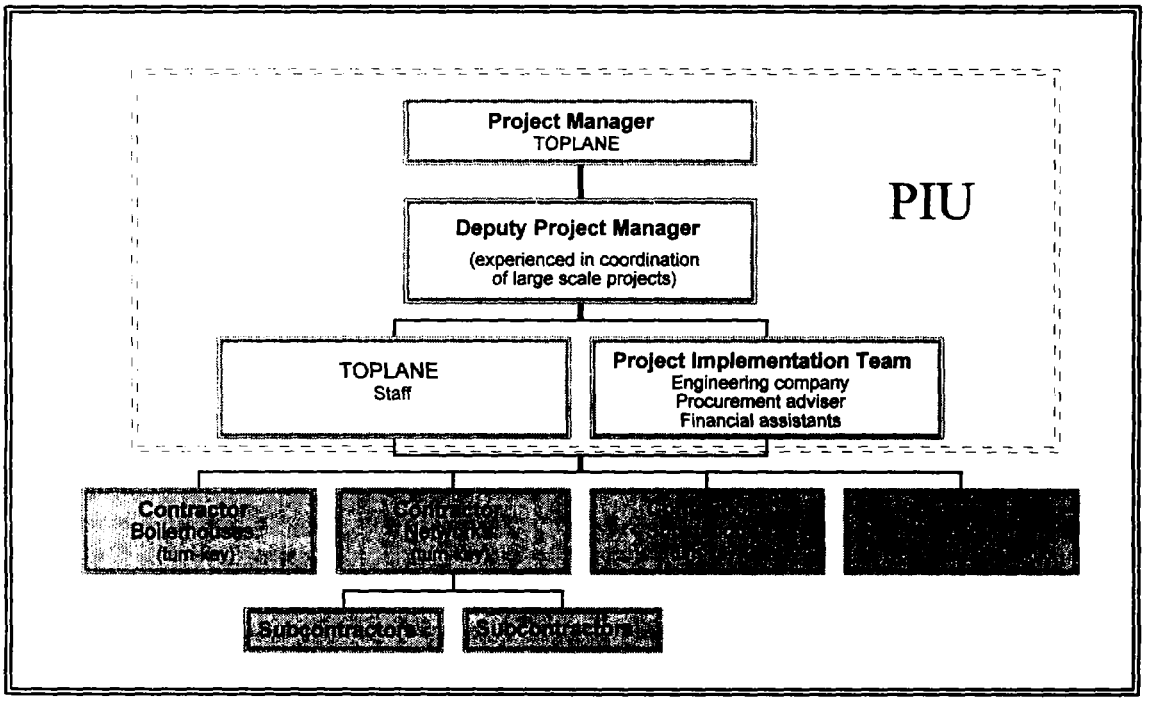
61. The PIU will manage scheduling, procurement, contracting, construction supervision and coordination, monitoring and final commissioning and will be responsible for all financial and administrative tasks associated with the project. The nature of the project, being physical reconstruction of war-damaged facilities, strongly emphasizes the engineering component in each of the tasks. To meet this challenge, the PIU would be supported by a group of about eight foreign district heating experts, one procurement advisor and three financial assistants. Close cooperation with Toplane staff will provide the required detailed technical knowledge of the system, extend the operational capability of the team and will prepare Toplane for its responsibilities after project completion.

62. The PIU's local district heating engineers will be assisted by experts from a leading engineering company. Their international experience in large-scale construction of district heating systems will enable them to manage the technical and operational aspects of implementation. This would cover: assessment of system improvement, development of the detailed reconstruction strategy, preparation of bidding documents, evaluation of bids, negotiation and award of contracts, scheduling, supervision and monitoring of the reconstruction work and final approval after commissioning.

63. Procurement and financial operations associated with project implementation will be handled by the procurement advisor and the financial assistants, respectively. Procurement of project components will be initiated at the earliest possible time. A procurement advisor with extensive experience in Bank-financed district heating projects is in the process of being recruited. The procurement advisor would work closely with the engineering group and the PIU management. The financial assistants will coordinate the financial aspects of the project with the

international donors in accordance with their respective procurement rules and financing conditions. The proposed project management scheme is shown in Chart 1.

Chart 1: Project Management Scheme



64. **Implementation Schedule.** The four main project implementation phases, to be scheduled as tightly as possible, are project preparation, engineering survey and assessment, procurement and construction. A detailed Project Implementation Schedule is shown in Annex 2. The schedule requires rapid mobilization of major financial and manpower resources, as well as implementation of local housing reconstruction programs. Given the practical difficulties of meeting these requirements virtually simultaneously, the project is expected to be completed by the end of September 1997.

65. **Project preparation** has to be carried out mainly by Toplane itself and has started already. Recruitment and training of local project staff, preparation of terrain and repair facilities, a basic survey and appointment of the core staff of the PIU is in process and expected to be finalized by end-May. The full **engineering** survey of the district heating system and an engineering assessment of possible system improvement options will be started by Toplane to the maximum extent possible and completed by the expert engineering group with the help of subcontractors for highly specialized tasks. The outcome of this phase will determine the detailed project design required for reconstruction. The **procurement** phase is highly dependent on the conditions on which donor funds will be made available. The PIU has an important task in this regard in coordinating and seeking to simplify the requirements of different donors. An early pre-bid and orientation conference will save time and be mutually beneficial by giving potential contractors a project overview and an opportunity to provide useful practical inputs

while bidding documents are being prepared. The **reconstruction** phase would start with the award of contracts for each of the main construction components of the project. Local subcontracting for manpower, civil works, construction and other services will be under the primary contractors' responsibility. Supervised by the PIU, this phase requires delivery of equipment, installation, repair, on-site training of Toplane staff and start-up of operations of all major components virtually simultaneously. Each project component will be completed after acceptance testing and take-over by the PIU.

C. PROCUREMENT

66. In the absence of firm data on which donors will finance what packages and how (joint or parallel financing), it has been assumed that all packages will be procured based on the Bank's procurement guidelines. When donors indicate their actual preferences the procurement arrangements will undoubtedly change. The Bank's procurement rules will be applicable only to Bank-financed packages and to those packages for which donors have agreed to follow the Bank procurement rules. Procurement for all other packages will follow the rules defined by the individual donors.

67. The scope of procurement is based on preliminary inspection of the district heating system and is subject to change when the detailed engineering survey and assessment have been completed. The bulk of the work to be performed under the project is expected to be carried out under three major turnkey contracts as follows: (i) boilers; (ii) distribution networks; and (iii) district heating substations. The detailed project procurement plan is attached in Annex 3. The tentative procurement arrangements are summarized in Table 5.

Table 5: Proposed Procurement Arrangements
(US$ million)

COMPONENTS	ICB	NCB	OTHER 2/	NBF 3/	TOTAL
A. SARAJEVO					
Network Equipment	8.9 (8.9)	0.0	3.1 (3.1)	12.0	24.0 (12.0)
Site preparation	0.0	0.2 (0.2)	0.1 (0.1)	0.2	0.5 (0.3)
Internal Equipment	0.0	0.0	5.6 (5.6)	5.7	11.3 (5.6)
Technical Assistance	0.0	0.0	1.6 (1.6)	2.1	3.7 (1.6)
B. BANJA LUKA					
Project Preparation	0.0	0.0	0.5 (0.5)	0.0	0.5 (0.5)
Total	**8.9** (8.9)	**0.2** (0.2)	**10.9** (10.9)	**20.0** (0.0)	**40.0** (20.0)

ICB = International Competitive Bidding

NBF = Not Bank Financed

NCB = National Competitive Bidding

1/ Assuming that all goods and works are Bank financed or that the financing is Bank administered

2/ Includes Limited International Bidding, International Shopping for goods and Competition for Technical Assistance

3/ Not applicable until after cofinancing arrangements are determined

68. For procurement packages estimated to cost more than US$5 million each, **simplified International Competitive Bidding (ICB)** will be used. A General Procurement Notice (GPN) was published in Development Business in April 1996. This notice includes information about the nature of goods and services to be procured and invites interested and eligible suppliers to send their expression of interest to the PIU. The GPN will also be published in the local press and will be followed by specific advertisements for individual contracts in the local press. The period allowed for submission of bids may be reduced to four weeks. Bid and payment currency may be limited to one currency widely used in international trade.

69. **Limited International Bidding (LIB),** tendering by invitation, will be used for procurement packages estimated to cost over US$2 million and up to US$5 million each. Exceptions to this threshold will be applied in cases where there are only a limited number of suppliers. The *List of LIB bidders* will be based on the expression of interest received in

response to the GPN as well as other sources, such as Toplane's and the PIU's experience, etc. The list should broad enough to encourage competition.

70. **International Shopping (IS)** will be used for procuring equipment and materials or standard specification commodities, estimated to cost between US$200,000 and US$2 million per contract, with the aggregate amount not exceeding US$1.8 million. IS procedures are based on comparison of price quotations obtained from at least three suppliers in two countries.

71. **National Competitive Bidding (NCB)** procedures will be used for site preparation contracts. **National Shopping (NS)** will be used for goods available within BH, such as office furniture, equipment and supplies, up to an estimated cost of US$200,000 per contract with at least three quotations from national suppliers.

72. **Consultants Services** will be procured in accordance with Bank guidelines which shall include both competition and sole sourcing. Sole sourcing of services should be justified in each case. Such justification may be the time constraint, continuity, unique expertise, and lack of candidates given the situation in BH. Any sole sourcing during implementation will be subject to the Bank's approval. Follow-up assignments will be permissible to the extent that this will be indicated in the initial Terms of Reference for assignments. Incremental operating costs, such as office rent, utilities, and incremental local staff costs, would be procured in accordance with local practices. These costs will be disbursed on the basis of annual budgets to be approved by the Bank.

73. **Prior and ex post Bank review of procurement documents**. The Bank's standard bidding documents will be used for ICB and LIB procurement packages. The Bank has also prepared the invitation to quote and contract document for IS. These documents will be used for procurement under the project. For IS, the documents and awards would not require any further prior reviews by the Bank. All ICB, LIB and NCB bidding documents, individual consultants contracts above US$50,000 and contracts with consulting firms in excess of US$2 million, will require prior review by the Bank. For consultants contracts, the Bank's standard form would be used. Procurement documentation for consultants contracts procured competitively and exceeding US$2 million each will be subject to the Bank's prior review. Follow-up assignments will be permissible to the extent that this will be indicated in the initial terms of reference.

74. Ex post reviews of procurement actions will be carried out on quarterly basis by Bank supervision missions. Furthermore, ex post review monitoring of procurement will be facilitated through quarterly reporting, which will be part of the regular quarterly progress reports. These reports would include, inter alia, the type items and value of procurement packages, the kind of procurement method followed, the numbers and values of bids received, the name of the winning supplier, as well as the key dates of the bidding, award and contract completion process.

75. **Procurement Implementation Capacity**. Since the Beneficiary currently lacks the capacity to carry out procurement of goods, works and services in the timely manner required, a procurement advisor is being engaged to assist the PIU in this task. The procurement advisor would be responsible for carrying out all procurement of goods and services in accordance with the agreed procedures and for day-to-day coordination of procurement work. The advisor would

also be responsible for contract management and supervision. Procurement training of PIU staff is included under the project.

D. DISBURSEMENTS

76. The estimated disbursements schedule is summarized in Schedule B of the Memorandum of the President. Disbursements are expected to be completed within about 15 months from the date of effectiveness. To facilitate timely project implementation, the Borrower would establish, maintain and operate, under conditions acceptable to the Bank, a Special Account in U.S. dollars in a commercial bank. The authorized allocation of the Special Account would be limited to US$2.0 million, representing almost four months (average) of the Bank's share of estimated expenditures expected to be paid from the Special Account. Replenishment applications would be forwarded to the Bank on a monthly basis, and must include reconciled bank statements as well as other appropriate documents. For payments over US$400,000 the Bank would make direct payments to suppliers.

77. The Bank Credit would be disbursed against: (a) 100 percent of the expenditures for directly imported equipment, materials and services quoted on CIF basis; (b) 100 percent of local expenditures of goods (ex-factory cost) net of taxes and 85 percent of local expenditures for other goods procured locally; (c) 100 percent of civil works net of taxes; and (d) 100 percent of expenditures for consulting services, including commercial services. Disbursements would be made against Statements of Expenditures for contracts for goods and works up to US$5.0 million equivalent, for consulting services (including commercial services) for firms and individuals of up to US$2.0 million and up to US$100,000 respectively. For these detailed documents evidencing expenditures will be reviewed by the PIU and made available for the required audit as well as Bank supervision missions. Disbursements for contracts requiring the Bank's prior review, would be made against presentation to the Bank of full contract documentation. The project completion date would be September 30, 1997 and the closing date would be March 31, 1998.

78. A US$5.3 million Project Start-up Advance (PSA) for this project as well as a PSA for the proposed Emergency Electric Power Reconstruction Project (US$3.8 million) and for the proposed Emergency Gas System Reconstruction Project (US$6.0 million) were approved by the Board of Executive Directors on March 27, 1996. The PSA would be applied to project preparation and start-up activities as well as land-mine and unexploded ordnance clearing. PSAs for this and the other two projects were necessary because no other funds were available to launch reconstruction operations. The PSAs are advanced against the proposed project's US$20 million Credit from the TFBH. To ensure that the full US$20 million will be available for district heating, the proposed Emergency Electric Power Reconstruction Project and the Emergency Gas System Reconstruction Project will contain components for the Emergency District Heating Reconstruction Project and, after Board approval and effectiveness, these components will be financed from the Credits for these projects.

E. ACCOUNTS, AUDITING AND REPORTING

79. Separate and auditable project accounts would be established by the PIU. These accounts would include: (i) a record of withdrawals on the Bank Credit with copies of all disbursement requests and underlying documentation; and (ii) a record of transactions on the Special Account and the copies of the bank statements on this account. Technical assistance has been included under the project to establish proper accounts and financial controlling procedures.

80. The financial statements of the Beneficiaries and the project accounts would be audited annually by independent auditors and under terms of reference acceptable to the Bank. Separate audit statements would be prepared for the Special Account and for the Statement of Expenditures. All audit reports would be made available to the Bank at the latest six months after the end of the fiscal year. Project accounts would be maintained for one year after they have been audited. The PIU will prepare and furnish to the Bank quarterly progress reports showing the status of implementation of the project as well as a financial report in a format acceptable to the Bank.

F. SUPERVISION PLAN

81. Project implementation will require intensive Bank staff involvement, especially during the first 4-5 months of implementation, and will require a high degree of flexibility in view of the need to adapt to rapidly changing circumstances. Implementation progress would be formally evaluated approximately 5 months after effectiveness, when project implementation should be in full swing. In addition, the Bank's Resident Mission in Sarajevo would assist in supervising initial project implementation and would assist closely on matters requiring advice and rapid decisions by the Bank, such as procurement and disbursements.

VI. FINANCIAL AND ECONOMIC ASPECTS

A. FINANCIAL ASPECTS

1. Past and Current Financial Situation

82. Toplane's financial statements for 1990 and 1994 (the only years for which --unaudited-- financial statements are available) and financial forecasts for 1996-1998, are presented in Annex 4. Prior to the outbreak of the war Toplane was allowed to set tariffs at levels which covered its operating expenses plus a modest profit margin, but funding for major investments was provided by the Central Government. Toplane's operations were severely affected during the war, because direct impact damage and the inadequate and uncertain supply of gas led to the shutdown of a

large part of the district heating system. At the same time, Toplane had to continue to operate its remaining facilities without receiving adequate income and consequently incurred substantial deficits during the war (around US$3-4 million per annum in 1994 and 1995). These deficits were financed through non-payment of bills due to Sarajevogas as well as through subsidies in the amount of about US$2 million per annum from the municipality.

83. Energy purchases account for 55% of Toplane's **cost structure**, mostly natural gas (48%). Toplane purchases its gas at a cost equal to the base price of the gas plus a share of the operating costs of Sarajevogas. Toplane's prewar staffing level appears high in relation to best practice European standards. Labor costs are currently lower than under normal circumstances, due to the depressed wage and salary levels. However, as staff return to resume employment and as wage and salary levels start increasing, management would need to pay special attention to measures that enhance productivity.

84. The current **tariff structure** (1995) is graduated by class of consumers: households, schools and kindergartens pay the least (about US$0.70 per m^2 of space), followed by hospitals and clinics (US$1.10), cultural and social facilities (US$1.40), and commercial/industrial enterprises (US$2.10). In principle, these tariffs cover operating expenses, including normal repair and maintenance and a small (1-2%) profit margin, but they do not allow for substantial financing of investments.

85. Prior to the war, **billing and collection** was done on a monthly basis. The central billing and collection system was computerized. However, during the war, Toplane's offices, including its computer system, were badly damaged. Furthermore, with the disruptions in Toplane's operations and the financial difficulties faced by consumers, billing and collection was suspended for household consumers. The billing system must now be restored, upgraded and reintroduced. In addition, Toplane lost several of its experienced commercial and financial staff who left to serve in the army or went abroad. While some of them are expected to return, substantial staff training would be required to enable effective usage of current hardware and software required for revitalization of the commercial system.

2. Future Financial Performance

86. Given the continuing financial difficulties faced by households in the post-war period, Toplane can expect to achieve only gradually full cost recovery through user charges. Cost recovery (in terms of the percentage of total annual operating expenses recovered) has been assumed at 15%, 50% and 75% in 1996, 1997 and 1998, respectively, consistent with the targets agreed with the Bank. In addition, starting in 1997, Toplane would begin to recover from building owners the investment in building internals (US$8.0 million) provided for under the project through a special surcharge for five years. This assumes grant financing for the radiators. In case the radiators would be financed with soft loans, Toplane would charge the appropriate interest rate to consumers as well. The financing plan for the period 1996-1998 is shown in Table 6.

Table 6: Toplane-Sarajevo Financing Plan, 1996-1998
(US$ million)

	US$	%		US$	%
Sources of Funds			**Uses of Funds**		
Net Income	-25	*-49*	Emergency Project	40	*78*
Depreciation	10	*20*	Other Investments	0	*0*
Internal Sources	-15	*-29*	**Total Investments**	40	*78*
Bank Credit and Other Loans	40	*78*	Changes in Working Capital	3	*6*
Government Equity	8	*16*	Settlement of Arrears	8	*16*
Financing Gap	18	*35*			
Total Sources	51	*100*	**Total Uses**	51	*100*

87. With the assumed cost recovery levels, which are judged to be the maximum socially sustainable under the post-war circumstances, Toplane would incur cash flow deficits during 1996-1998 for a cumulative total of about US$18 million. This assumes that the US$8 million in accumulated accounts payable to Sarajevogas for gas consumption during 1992-1995 will be taken care of by the Government as an equity contribution. The cash deficits could be covered entirely if donors would cover an appropriate portion of the fuel bills of Toplane during the period 1996-1998. To that end donors have been requested to fund Toplane's fuel bills in the following approximate proportions: 100% (1996); 60% (1997) and 25% (1998). The estimated fuel bill for 1996 is about US$7.3 million, which is less than in subsequent years (US$12.8 million per annum) because of the limited gas consumption during the first half of that year. Any remaining cash deficits appear manageable and could be financed by the Government and/or the City of Sarajevo.

B. ECONOMIC JUSTIFICATION

1. The District Heating Project in the Overall Reconstruction Program

88. During the war, coal and oil (and gradually wood as well) were not available for space heating. Electricity supplies were sharply reduced and only sporadically available for short periods of time. Hence, space heating with electricity--widespread before the war--also was no longer an option. Part of the gas-fired district heating system was damaged early in the war, while other district heating boilers ceased operating at full capacity because gas shortages led to such pressure drops that normal operation was no longer feasible. As a result, the DH system could supply only one-third of its service area. The availability of natural gas, although in restricted quantities, led more than 60,000 households and some commercial entities to make their own connections to the gas network using, among other materials, district heat pipes, hoses, etc. Households have also been using improvised equipment. These installations are very unsafe: during the war about 70 explosions and 100 fires relating to gas use resulted in 40

fatalities and 200 injuries. In addition, these make-shift installations last for only one to two years and use up to three times as much gas to achieve the same useful heat as would be obtainable with proper connections. This improvised heat supply option was adopted under the severest of emergency conditions and obviously should be replaced as soon as possible.

89. Under the project, about 34,000 improvised gas connections in flats previously served by district heating would be replaced by reconstructed district heat facilities. As an integral part of the overall emergency reconstruction program, the district heating project would provide an essential level of heating in the flats reconnected to the system. Due to Sarajevo's cold winters, lack of heat poses a serious health risk, resulting in the spreading of communicable diseases. Since the war started, the number of people affected by epidemics and communicable diseases increased five-fold. A high rate of absenteism reduces both worker productivity and economic growth. The district heating project would provide heat to homes, hospitals, schools, hotels and commercial and industrial enterprises, thereby also enhancing economic recovery and growth. The optional firing of either gas or fuel oil in the Sarajevo district heating system would stabilize the heat supply and its beneficial effects by providing partial independence from gas supply interruptions. Reconstructing the district heating system, simultaneously with rehabilitation projects for water, gas, electric power, telecommunications and roads would yield cost savings by avoiding the repetition of civil works on roads and bridges in the same areas. Additional cost savings would come from implementing the project as soon as possible, because the later the project will be started the higher the rehabilitation costs will be, because of ongoing corrosion, weather related damage and possibly unauthorized dismantling of equipment.

2. Comparison of Heating Options

90. The experience during the war demonstrates that heat is an essential need that people will try to meet by any means necessary. The reconstruction of the electric power system, which has also a high priority due to its impact on industry and commerce, could lead to an abuse of electric power for space heating if the heat demand is not served by the restoration of both the district heating system and the gas system. Diverting electric power from more productive uses for the purpose of space heating should be avoided, since it is the most inefficient and expensive means of heating and might also overload the capacity of the electric power network. The competition in efficient heat supply between district heating and individual gas heating is generally in favor of district heating in high population density areas, while individual gas heating is the lower cost option in areas of low housing density. Furthermore, the comparison of reconstruction time and costs proves the restoration of existing connections to be the least-cost option, rather than dismantling and replacement of one system by another.

3. Economic Rate of Return Calculation

91. An economic rate of return is normally not calculated for emergency rehabilitation projects since the need for the investments is usually evident. Nevertheless, an attempt was made for the proposed project in order to provide confirmation of its economic justification. Details are provided in Annex 5.

92. The physical components of the proposed project would provide the following benefits: (i) restored district heat service to customers cut off during the war; (ii) repaired or replaced building internal heating installations (radiators, valves and pipes) permitting district heat to be supplied to the rooms where the radiators are located; and (iii) heat savings which consumers are expected to achieve by controlling their heat consumption individually.

93. Quantitative estimates were made of these three benefits. The benefits of repaired or new district heating building internals were estimated based on the fact that the investment cost would be recovered from consumers through five equal annual payments, excluding interest (para 86). Prior to the war, building internals belonged to the flat owners, and their costs were recuperated through flat rents. Under the proposed project, Toplane will install the building internals, and the costs of the repaired or replaced radiators will be covered by a separate surcharge. The estimates reflect willingness to pay, since consumers are expected to make these payments rather than do without heating. The benefits of restored district heat service were estimated using the prewar district heat price plus consumers' surplus. The consumers' surplus was limited to one-third of the pre-war price because of low household income during the economic recovery. Since this implies a demand elasticity of -4, it is a conservative assumption given that the demand for heat would normally be expected to be inelastic. However, for the period 1996-1998, the Government and donors are assumed to pay part of the heating costs because of the temporarily low incomes of consumers. Consumers' surplus was not included for those years. The heat savings benefit was projected to be 10% of the cost of district heat used in the absence of thermostatic valves. This estimate is based on actual savings achieved by similar projects in Germany and Poland.

94. The costs include: the project investment costs, natural gas and other energy purchases, as well as other operating and maintenance costs. Natural gas consumption was taken to be 785 cubic meters per flat (on the basis of historical data supplied by Toplane) multiplied by the 34,000 flats to be resupplied with district heat. Natural gas was valued at the purchase price at the Ukraine-Hungarian border of US$80/thousand cubic meters prevailing at the beginning of 1996, plus transit charges through Hungary and former Yugoslavia of US$28/thousand cubic meters, plus the marginal cost of distribution by Sarajevogas. The latter cost was estimated as the sum of operating and maintenance costs (excluding debt service and depreciation) and a capital charge that would amortize needed transmission and distribution transport investments by Sarajevogas (to be financed under a proposed Emergency Gas System Reconstruction Project). Other energy, operation, and maintenance costs were estimated using historical data by Toplane.

95. The internal economic rate of return was estimated to be 23%, which is satisfactory. Sensitivity tests were carried out with respect to changes in key parameters in order to determine the switching values. The changes needed to reduce the rate of return to the opportunity cost of capital of 12% would be: (i) a 17% reduction in district heat revenue; or (ii) a 58% increase in investment costs; or (iii) a 90% increase in the natural gas cost; or (iv) a four-year delay in benefits after the investments have been made. Eliminating the consumer surplus would reduce the economic rate of return to 14%.

C. RISKS

96. There are significant risks associated with this project, other than a renewed outbreak of hostilities. A general failure of economic growth to resume would have wide-ranging implications, inter alia on the consumers' ability to pay. The resulting operating deficits would either have to be funded by the Government budget and donors, or services would have to be drastically cut back. The risk of Toplane-Sarajevo having inadequate cash flow is being addressed by the project's emphasis on speedy reintroduction of billing and collection systems and by agreeing on specific minimum annual targets for collections. Furthermore, donors have been requested to finance part of the fuel costs of Toplane-Sarajevo. Although any remaining cash deficits might affect operation and maintenance of the system, repairing it now would still cost significantly less than repairing it later, assuming that minimal maintenance will be provided. Project cost overruns are, despite the inclusion of a 20% physical contingency, possible given that much of the damage may be in the underground distribution network. Implementation delays might occur because of unexpected technical complications, the difficulty of coordinating many civil works projects that need to be undertaken at the same time in different sectors, and because of a possible multiplicity of procurement procedures, depending on the number of donors and international financial institutions involved. However, the latter risk is manageable given the appointment of an experienced procurement advisor and the use of an experienced project management team. There is a risk that the project component for Toplana-Banja Luka will be implemented with a delay, depending on when Republika Srpska is willing to execute the necessary subsidiary loan agreement. The risk of the project's financing plan remaining incomplete (financing gap) has been mitigated by the design of the project, with the lowest priority investments to be deleted first as required to meet the level of financial resources. Finally the risk of interruption of gas supplies would be mitigated by ensuring that the dual firing capability of the system is fully operational to allow for fuel oil firing as well.

VII. THE BANJA LUKA DISTRICT HEATING SYSTEM

97. Banja Luka's district heating system consists of one heat-only boiler house, a primary distribution network, 195 sub-stations, and an equal number of secondary distribution networks. The principal function of the system is to supply heat. Only 17% of 18,800 flats connected to the system are also supplied with domestic hot water, and those flats were rebuilt following the 1969 earthquake. The district heating system is operated by Toplana-Banja Luka.

98. **Demand**. Before the war, Toplana supplied heat to 18,800 flats with a surface area of 983,770 m^2, plus communal and commercial/industrial consumers. The connected heat load was 265 MW, of which 176 MW for heating, 14 MW for domestic hot water, and 75 MW for

industrial consumption. Total annual heat demand was 929,000 MWh. Because of the economic embargo on the region during the war, virtually no oil or spare parts could be obtained. Hence, only about 6% of the connected load (schools and hospitals) was supplied with district heat during the winter of 1995/96. Household consumers used wood for individual space heating.

99. **Generation**. Apart from a small 1970-era 7 MW boiler, virtually all district heat in Banja Luka is generated by one boiler house with four heat-only boilers with a capacity of 58 MW each. The four boilers--installed between 1972 and 1984--range in age from 12 to 24 years, are oil fired and should, under normal circumstances, operate safely. Prior to the war, annual fuel consumption was 30,000 tons of standard fuel oil with a maximum sulfur content of 1%; and heat energy produced was 292,000 MWh per year. This shows an annual efficiency rate of 88%, which is within the normal range. All boilers (type VKLM-50) were manufactured in Croatia. There are no heat exchangers in the boilers house, and the heating water from the network flows directly through the boilers. Water is circulated by five pumps with a total capacity of 6,300 m^3/hour. The supply temperature is 130°C. The boiler plant has been damaged mainly by corrosion caused by non-usage of the facilities resulting from the lack of fuel and spare parts.

100. **Heat Distribution**. The distribution system consists of one primary network and 195 secondary networks. The transition between the two sub-systems is the heat transfer station (substation). The lengths of the primary and secondary networks are 45 km and 110 km, respectively, giving a total distribution system length of 155 km. The pipes are made of steel, insulated with mineral wool, and are laid in concrete underground channels. They were empty during the war, and are most probably heavily corroded. A significant percentage of the pipes may therefore need to be replaced.

101. **Substations**. The heat produced is transferred through the primary network to 195 substations. Some substations are located in separate buildings, but most are located in the basement of apartment buildings. All heat exchangers were manufactured in Ljubljana, Slovenia, by the IMP Company. About 90% of the heat exchangers are of the compact plate type, while the remainder are traditional counter flow shell-and-tube heat exchangers. The secondary water in the system is circulated by 940 pumps.

102. **System Evaluation**. The connected load of 265 MW and the 155 km network length results in a linear heat density of 1.7 MW/km, which is low. Most district heating systems in Europe, including in countries like Poland and Hungary, have linear heat densities of 2-4 MW/km. The implication is that the large distribution network in Banja Luka is not being used economically. The heat consumption of 292,000 MWh/per annum and the 265 MW connected load result in a load duration of 1,100 hours/per annum, compared to an average of more than 1,700 hours/per annum in other European countries. To increase the economics of the Banja Luka district heating system, one could connect more consumers to the heat network and/or take over the supply of domestic hot water to all flats. Both options should be examined under a future master plan study.

BOSNIA AND HERZEGOVINA
EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Project Financing Plan
(US$ million)

COMPONENT	Potential Donors				
	Finland	Netherlands	Other	TFBH	TOTAL[1]
BOILERS	-	-	0.4	11.0	**11.4**
DISTRIBUTION NETWORKS	9.0	-	-	-	**9.0**
SUBSTATIONS	-	3.6	-	-	**3.6**
INTERNAL INSTALLATIONS	-	-	-	8.0	**8.0**
METERS	-	1.6	-	-	**1.6**
OTHER EQUIPMENT	-	0.2	1.5	-	**1.7**
SITE PREPARATION	-	0.2	-	0.3	**0.5**
TECHNICAL ASSISTANCE	3.0	0.2	0.3	0.2	**3.7**
BANJA LUKA[2]	-	-	-	0.5	**0.5**
SUBTOTAL PROJECT	*12.0*	*5.8*	*2.2*	*20.0*	*40.0*
FUEL DONATIONS	-	-	18.0	-	**18.0**
TOTAL	12.0	5.8	20.2	20.0	58.0

[1] Costs include labour, spare parts and 20% contingencies. Taxes and duties are not included.

[2] Physical Contingencies exclude Banja Luka.

BOSNIA AND HERZEGOVINA
EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Implementation Schedule (Sarajevo)

Financing Period :			PSA	Loan Effectiveness																	
				1. Month	2. Month	3. Month	4. Month	5. Month	6. Month	7. Month	8. Month	9. Month	10. Month	11. Month	12. Month	13. Month	14. Month	15. Month	16. Month	17. Month	18. Month
Activities:																					
1	Preparation for project implementation																				
1.1	TP*	Establishing the PIU																			
1.2	PIU/TP	Project implementation plan																			
1.3	TP	Preparation of terrain and facilities																			
1.4	TP	Survey																			
1.5	TP	Survey evaluation, handover to engineering company																			
1.6	EC*	Assessment, specifications for bidding documents																			
1.7	TP	Draft specifications																			
1.8	PIU	Pre-bid and orientation conference																			
1.9	C	Preparation of bids																			
1.10	PIU	Evaluation of bids																			
1.1	PIU	Award																			
2	Project realisation and construction																				
2.1	C	Delivery of equipment and mobilization																			
2.2	C	Repair and construction																			
2.3	C	Setting into operation																			
2.4	C	Training of operational staff																			
2.5	C	Testing and correction of equipment																			
2.6	C	Handover of facilities to TOPLANE																			
3	Supervision of implementation (EC)																				
4	Training																				
4.1	TP	Technical (manpower for reconstruction)																			
4.2	C	Commercial (TOPLANE staff)																			
4.3	EC	Maintenance (TOPLANE staff)																			
5	Final documentation (PIU,TP)																				

* ***lead responsibility*** :

- ***TP*** *TOPLANE*
- ***PIU*** *Project Implementation Unit*
- ***EC*** *Engineering Company (part of the PIU)*
- ***C*** *Contractor, Consultant*

Annex 2

BOSNIA AND HERZEGOVINA
EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Detailed Procurement Plan

	PROCUREMENT PACKAGE	Size	Units	Unit Cost US$'000	Total Cost US$'000	Proc.[2] Method	Invit.[3] to Bid	Bid[3] Submis.	Contr.[3] Signing	Pckg.[3] Complt.
I.	**BOILERS**									
A.	**LARGE AND MEDIUM-SIZE BOILERS**									
	Building Renovation		5	-	450					
	Boilers (gas/fuel oil)	3-7MW	4	330	1,320					
	Burners (gas/oil)	1-7 MW	26	45	1,170					
	Pumps									
	Small Pumps	5-20 m³	45	4	180					
	Large Pumps	20-100 m³	30	7	210					
	Pipes and Steel construction									
	Small Pipes (km)	15-80 mm	3	45	135					
	Large Pipes (km)	100-300 mm	2.5	140	350					
	Steel Construction		-	-	100					
	Flue Gas Ducts		-	-	170					
	Valves									
	Small Valves	15-80 mm	350	0.2	70					
	Large Valves	100-300 mm	270	2.5	675					
	Insulation	m²	1800	0.1	180					
	Water Treatment		10	13	130					
	Sensors, Regulators, etc.		8	40	320					
	Metering		37	10	370					
	Electr. Equipment (switching, motors)		-	-	1,100					
	Retrofitting Oil System (tanks, pumps, pipes)		10	50	500					
	Monitoring, Dispatching devices		-	-	1,000					
	Miscellaneous Material		-	-	300					
	Subtotal:	-	-	-	**8,730**	**ICB**	**11**	**17**	**21**	**77**
B.	**ROOF-TOP BOILERS**									
	Building Renovation		10	-	50					
	Boilers									
	Roof-Top Boilers (gas only)	150-300 kW	20	80	1,600					
	Pumps									
	Small Pumps	5-20 m³	15	4	60					
	Large Pumps	20-100 m³	10	7	70					
	Pipes and steel construction									
	Small Pipes (km)	15-80 mm	1	45	45					
	Large Pipes (km)	100-300 mm	0.5	140	70					
	Steel Construction		-	-	100					
	Flue Gas Ducts		-	-	30					
	Valves									
	Small Valves	15-80 mm	100	0.2	20					
	Large Valves	100-300 mm	30	2.5	75					
	Insulation	m²	200	0.1	20					
	Water Treatment		10	5	50					
	Sensors, Regulators, etc.		10	8	80					
	Metering		0	10	0					
	Electr. Equipment (switching, motors)		-	-	200					
	Retrofitting Oil system (tanks, pumps, pipes)		-	-	-					
	Monitoring, Dispatching Devices		-	-	100					
	Miscellaneous Material		-	-	50					
	Subtotal:	-	-	-	**2,620**	**LIB**	**11**	**17**	**19**	**77**

BOSNIA AND HERZEGOVINA
EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Detailed Procurement Plan

	PROCUREMENT PACKAGE	Size	Units	Unit Cost US$'000	Total Cost US$'000	Proc.[2] Method	Invit.[3] to Bid	Bid[3] Submis.	Contr.[3] Signing	Pckg.[3] Complt.
II.	**DISTRIBUTION NETWORKS**									
	Structures (channels, segments)		100	1	100					
	Preinsulated									
	Small Pipes (km)	32-80 mm	1	480	480					
	Large Pipes (km)	100-300 mm	10	790	7,900					
	Ball valves									
	Small Valves	32-80 mm	30	0.6	18					
	Large Valves	100-300 mm	20	2.5	50					
	Shut-off valves									
	Small Valves	32-80 mm	50	0.2	8					
	Large Valves	100-300 mm	40	0.4	16					
	Compensators	100-300 mm	10	18	180					
	Insulation (renovation) (km)	m²	2000	0.1	100					
	Miscellaneous Material		-	-	100					
	Subtotal:	-	-	-	**8,952**	**ICB**	**11**	**17**	**21**	**77**
III.	**SUBSTATIONS**									
	Renovation of buildings		20	3	60					
	Heat exchangers		15	10	150					
	Pumps									
	Smaller Pumps	5-20 m³	30	4	120					
	Larger Pumps	20-100 m³	20	8	160					
	Pipelines									
	Smaller Pipes (km)	15-80 mm	2	45	80					
	Larger Pipes (km)	100-300 mm	0.5	140	70					
	Steel Construction									
	Shut-off valves									
	Small Valves	15-80 mm	300	0.2	60					
	Large Valves	100-300 mm	130	3	390					
	Insulation	m²	1000	0.1	100					
	Electr. Equipment (Regulators,		-	-	-					
	Monitoring, Dispatching)		120	10	1,200					
	Metering		120	10	1,200					
	Miscellaneous Material		-	-	60					
	Subtotal:	-	-	-	**3,650**	**LIB**	**11**	**17**	**19**	**77**
IV.	**INTERNAL HEATING EQUIPMENT**[4] **(4 Lots)**									
	Radiators									
	Whole Radiators	2.5 kW	7545	0.2	1,132					
	Damaged Radiators		36215	0.03	1,086					
	Thermostatic Valves		43760	0.04	1,532					
	Pipes (km)	20-80 mm	42	45	1,890					
	Valves	20-80 mm	12000	0.2	1,800					
	Insulation		-	-	200					
	Miscellaneous Material		43760	0.01	360					
	Subtotal:	-	-	-	**8,000**	**LIB**	**11**	**17**	**19**	**77**

BOSNIA AND HERZEGOVINA
EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Detailed Procurement Plan

	PROCUREMENT PACKAGE	Size	Units	Unit Cost US$'000	Total Cost US$'000	Proc.[2] Method	Invit.[3] to Bid	Bid[3] Submis.	Contr.[3] Signing	Pckg.[3] Complt.
V.	METERING IN FLATS	-	-	-	1,600	LIB	11	17	19	73
VI.	SITE PREPARATION	-	-	-	400	NCB	1	5	10	20
	MINE CLEARING				120	LIB	1	2	2	5
VII.	TECHNICAL ASSISTANCE									
1	Project Management and Engineering		-	-	3,240	C	1	2	2	77
2	Studies						12	20	22	77
	Masterplan for District Heating		-	-	240	C				
3	Training									
	3.1 Technical		-	-	144	DC	1	2	2	71
	3.2 Commercial, Financial		-	-	108	DC	12	15	17	36
	Subtotal:	-	-	-	3,732					
VIII.	OTHER EQUIPMENT									
1	Software		-	-	30					
2	Office Facilities and Equipment		-	-	120					
3	Office Supplies		-	-	20					
4	Cars and Trucks		8	60	480					
5	Workshop and Inventory Building		-	-	480					
6	Inventory Facilities and Tools		-	-	500					
7	Measuring Instruments		-	-	100					
	Subtotal:	-	-	-	1,730	IS	1			10
IX.	BANJA LUKA									
	Project Preparation[5]		-	-	500	C	1	4	5	16
	Subtotal:	-	-	-	500	C	1			16
	TOTAL:				40,034					

[1]Costs include equipment, installation, commissioning, spare parts and 20 % contingencies.
[2]Valid for direct IBRD financing or IBRD-administered financing
[3]Expressed in number of weeks from project start
[4]To be split by district into four packages; each package containing roughly one quarter of the total quantity of goods and works
[5]No contingencies included

BOSNIA AND HERZEGOVINA - EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Toplane - Sarajevo: Income Statements

(US$ Million)

	Actual		Forecast			
	1990 *	1994 *	1995	1996	1997	1998
REVENUES						
Heat Sales	25.12	0.70	0.88	14.59	23.16	23.67
Surcharge for Building Internals	0.00	0.00	0.00	0.00	1.60	1.60
Other Income	0.37	1.97	1.48	0.00	0.00	0.00
Total Revenues	25.49	2.67	2.36	14.59	24.76	25.27
EXPENDITURES						
Gas Purchases	11.73	0.43	0.23	5.57	11.14	11.14
Other Energy	1.39	0.92	1.06	1.61	1.69	1.77
Materials	1.42	0.33	0.53	1.64	1.73	1.81
Services	1.42	0.34	0.53	1.64	1.73	1.81
Wages and Salaries	4.38	0.80	1.01	1.65	2.55	2.81
Depreciation	1.60	1.74	2.00	2.03	4.03	4.03
Interest and Financial Charges	0.43	0.05	1.06	0.45	0.30	0.30
Total Operating Expenses	22.38	4.61	6.40	14.59	23.16	23.67
Revaluation, Exchange Losses, etc.	2.81	0.64	0.27	0.00	0.00	0.00
Write-Offs for Uncollectibles	0.00	0.00	0.00	10.94	11.58	5.92
Total Expenditures	25.19	5.25	6.67	25.53	34.74	29.59
NET INCOME	0.31	-2.58	-4.32	-10.94	-9.98	-4.32
Operating Ratio	0.89	6.59	7.27	3.99	1.76	1.22

* Based on unaudited financial statements.

BOSNIA AND HERZEGOVINA - EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Toplane-Sarajevo:Sources and Applications of Funds

(US$ Million)

	Forecast			Total
	1996	**1997**	**1998**	**1996 - 98**
SOURCES				
Net Income	-10.94	-9.98	-4.32	-25.24
Depreciation	2.03	4.03	4.03	10.09
Internal Funds Generation	-8.92	-5.95	-0.29	-15.16
Bank Credit and Other Loans	40.00	0.00	0.00	40.00
Government Equity*	8.16	0.00	0.00	8.16
Financing Gap	8.33	7.29	2.78	18.40
Total Sources	47.57	1.34	2.49	51.40
APPLICATIONS				
Emergency Project	40.00	0.00	0.00	40.00
Changes in Working Capital	-0.59	1.34	2.49	3.24
Settlement of Arrears*	8.16	0.00	0.00	8.16
Total Applications	47.57	1.34	2.49	51.40

* Payment to SARAJEVOGAS for gas supplied to Toplane during 1992-95.

BOSNIA AND HERZEGOVINA - EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Toplane - Sarajevo: Balance Sheets

(US$ Million)

	Actual		Forecast		
	1994*	**1995***	**1996**	**1997**	**1998**
ASSETS					
Cash and Banks	0.00	0.00	0.28	0.47	0.48
Inventories	0.01	0.07	0.07	0.86	0.91
Accounts Receivable	0.01	0.21	1.20	2.11	3.10
Other Current Assets	0.01	0.01	0.01	0.01	0.01
Total Current Assets	0.03	0.30	1.56	3.45	4.50
Gross Fixed Assets	32.28	36.83	76.83	76.83	76.83
Less: Accumulated Depreciation	11.77	13.51	15.54	19.57	23.60
Net Fixed Assets	20.51	23.32	61.29	57.26	53.23
Total Assets	20.54	23.61	62.85	60.71	57.73
LIABILITIES AND EQUITY					
Accounts Payable	7.38	9.90	3.60	4.15	2.70
Total Current Liabilities	7.38	9.90	3.60	4.15	2.70
Medium & Long Term Loans	0.00	0.00	40.00	40.00	40.00
Founders' Equity	20.09	24.95	24.95	24.95	24.95
Government Equity*	0.00	0.00	8.16	8.16	8.16
Equity Contributions	0.00	0.00	8.33	15.62	18.40
Retained Earnings	-6.93	-11.24	-22.19	-32.17	-36.48
Total Equity	13.16	13.71	19.25	16.56	15.03
Total Liabilities & Equity	20.54	23.61	62.85	60.71	57.73
Current Ratio			0.43	0.83	1.67
Debt:Equity Ratio			67:33	71:29	73:27

* Based on unaudited financial statements.

BOSNIA AND HERZEGOVINA - EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

Economic Rate of Return Calculation

(US$ Million)

	Project Cost	Costs Natural Gas	Other Energy	Other O&M	District Heat Rev.	Consume Surplus	Benefits Heat Savings	Radiator Revenue	Net Benefits
1996	40	1.6	0.4	1.2	5		0.32	1.6	-36.3
1997		3.7	0.9	2.8	11.9		0.74	1.6	6.8
1998		3.7	0.9	2.8	11.9		0.74	1.6	6.8
1999		3.7	0.9	2.8	11.9	4.0	0.74	1.6	10.8
2000		3.7	0.9	2.8	11.9	4.0	0.74	1.6	10.9
2001		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2002		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2003		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2004		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2005		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2006		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2007		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2008		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2009		3.7	0.9	2.8	11.9	4.0	0.74		9.3
2010		3.7	0.9	2.8	11.9	4.0	0.74		9.3
							IRR =		22.9%

Project cost includes physical contingency of 20%.

Gas cost: 34,000 flats x 785 m3/flat x US$0.14/m3 (the estimated economic cost). The estimate for 1996 is for the last three months only.

Other energy: assumes total annual Toplane expenditure of US$1.1 million for electricity and $0.4 million for oil ; assumes the 34,000 flats account for 60% of annual Toplane expenditure.The estimate for 1996 is for the last three months only.

O&M: US$0.106 per scm of gas consumed. The estimate for 1996 is for the last three months only.

District heat revenue: pre-war price of DM12/m2 x 51 m2 per flat x 34,000 flatsx 80%(since only 2.5 radiators/flat).

Prior to 1999, Government and donors are assumed to share part of the heating costs because of temporarily low incomes of consumers.

Consumer's surplus: assumes a price elasticity of demand of -4; it starts in 1999 because of inability of consumers to pay before then.

District heat savings from valve control: estimated at 10% of the quantity of district heat consumed in the absence of valves, valued at the costs of gas plus other energy plus O&M.

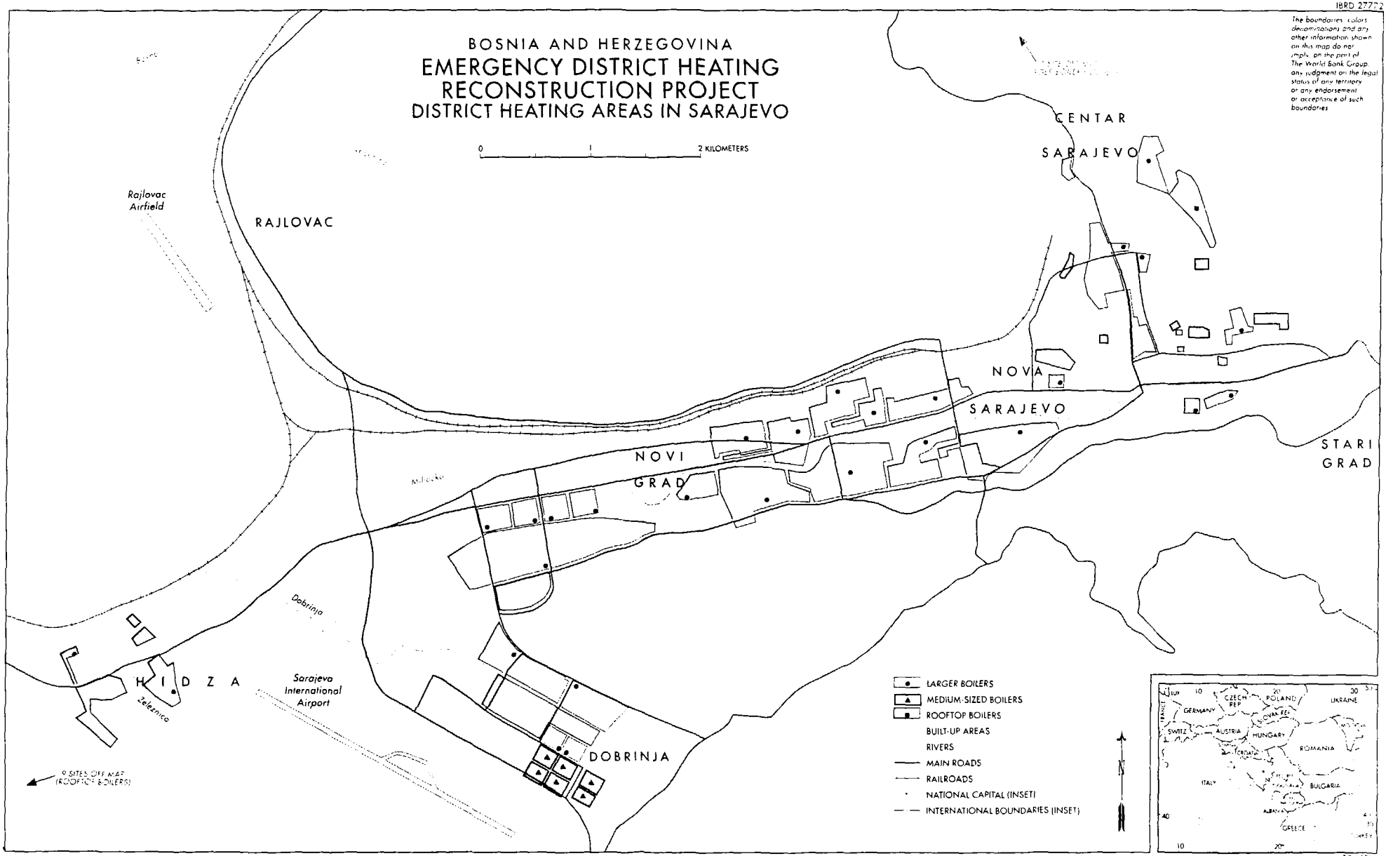
Radiator revenue: assumes the US$8 million cost of internals is recovered over 5 years without interest.

IBRD 27772

BOSNIA AND HERZEGOVINA

EMERGENCY DISTRICT HEATING RECONSTRUCTION PROJECT

DISTRICT HEATING AREAS IN SARAJEVO



MARCH 1996

IMAGING

Report No: T- 6806 BIH
Type: MOP