

ENVIRONMENTAL AND SOCIAL IMPACT BRIEF (ESIB)

Project: **Cana Brava Hydroelectric Power Project (ACana Brava@)**
Country: Brazil
Project number: BR-0304
Sponsor: *Tractebel Brasil Limitada*
Project Cost: US\$430 million
Financing Plan:
 A- Loan: US\$75.0 million
 B- Loan: US\$75.5 million
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 Robert Montgomery
Date: February 1, 1999

I. INTRODUCTION

- 1.1 The Inter-American Development Bank (IDB) was approached by *Tractebel Brasil Limitada*. (~~A~~Tractebel@ or the ~~A~~Sponsor@) with regard to the financing of the *Cana Brava* hydroelectric power plant (~~A~~Cana Brava@) located on the *Tocantins* River, between the municipalities of *Minaçu* and *Calvacante* in the State of *Goiás*, approximately 250 kilometers (~~A~~km@) north of *Brasília*. The project resulted from an international competitive tender held on March 19, 1998, by *Agencia Nacional de Energía Eléctrica (ANEEL@)*, the Brazilian electric regulatory agency. The concession (the ~~A~~Concession@) provides for the exploitation of the river resources for a period of 35 years. Tractebel has created a special purpose company, *Companhia Energética Mercosul (CEM@)*, to implement the project in accordance with the terms of the Concession
- 1.2 The project entails the construction and operation of a 450-MW hydroelectric power plant and the construction of a 230 kilo-Volt transmission line, 60 km in length (the ~~A~~Project@). The project will be implemented under a turnkey fixed-price date certain equipment, procurement and construction (~~A~~EPC@) contract by a consortium formed by four Brazilian companies: two civil works construction companies, *Construtora Norberto Odebrecht S.A.* and *Construtora Andrade Gutierrez S.A.*; and two equipment suppliers, *Voith S/A Maquinas e Equipamentos* and *Siemens Ltda.* Construction is expected to take 42.5 months.
- 1.3 Tractebel is a global energy and service business. It has developed gas and electricity projects in 18 countries outside of Belgium. Since 1995, it has invested around US\$1.5 billion in electricity and gas projects throughout the world. Today, Tractebel is ranked the third largest Independent Power Producer (Independent Power Producer or ~~A~~IPP@) in the world.

II. PROJECT DESCRIPTION

A. Location

- 2.1 The Cana Brava plant will be located in the upper reach of the *Tocantins* River Basin, in the State of *Goiás*, approximately 250 km north of *Brasília*, in the center-west region of Brazil (see map in Annex). The *Tocantins* River is a tributary of the *Pará* River, and runs northward, from the Brazilian heartland to the Amazon rainforest. The Cana Brava Project will be located approximately one km downstream from the *Tocantins* River's confluence with the *Carmo* River and 46 km downstream from the *São Felix* River, on the border between the municipalities of *Minaçu* and *Cavalcante*.

B. Technical description

- 2.2 The Project consists of the construction and operation of a 450-MW hydroelectric power plant and the construction of a 230 kilo-Volt transmission line, 60 km in length. It will provide guaranteed average energy equivalent to 273-MW or 2,396 Gwh/year. The water flow conditions of Cana Brava will be regulated by the reservoir of the *Serra da Mesa* dam, located 50 km upstream.
- 2.3 The Project entails the installation of three generating units of 150-MW each, and the construction of a Roller Compacted Concrete dam (RCC) in the central section and two lateral embankments to close the valley. The RCC will be built on the river bed in order to modify the natural course of the *Tocantins* River and will have a maximum height of 66 meters (Am) and a total volume of approximately 325,000 m³. On the left bank of the river, the dam will be built out of earth-fill with a length of 380 m and height of 50 m. All the main structures are located on the right bank, including the spillway, with the incorporated sluice ways for the river diversion, and the generation circuit, which comprises the power intake, the penstocks and the powerhouse. The RCC dam continues to the right of the power intake, until it reaches the earthfill dam, which forms the right abutment.
- 2.4 The construction of the main structures of the Cana Brava facility will have two main phases. In the first phase, the river will continue to flow in its natural bed. A longitudinal cofferdam with crest at elevation 290 m will be built to protect the excavations of the structures of the right bank against floods with recurrence interval up to 1,000 years for the months of June and July. The cofferdam will be heightened to elevation 300 m to protect the construction of the spill way and river diversion sluice ways against floods with recurrence interval up to 75 years for the wet season, the months of December and January. In the second phase, the river will be diverted through the sluice ways built under the spillway during the first phase. There will be five sluice ways, 5.5 m wide by 11 m high, invert at elevation 274 m and with a length of 50 m. The crest of the second phase upstream cofferdam will be at elevation 294 m protecting the construction of the RCC dam on the river bed against floods with recurrence interval up to 1,000 years, for the dry period (until November). The crest of the downstream cofferdam will be at elevation 292 m. The diversion tunnels exit immediately downstream of

the dam.

- 2.5 The plant will operate at the maximum upstream water level at elevation 333 meters. A maximum depletion of 3 m may occur for daily regularization purposes, and hence the minimum water level of the reservoir will be at elevation 330 meters. During the discharge of the PMF (17,802 m³/s) through the spillway the water level in the reservoir will reach elevation 334 m.
- 2.6 The total volume at the maximum normal reservoir water level, at elevation 333 m, correspond to an area of 139 km². The reservoir average water depths of the reservoir under operational conditions will be 16.5 m with a maximum depth of 55 m. The residence time of the reservoir is approximately 60 days.
- 2.7 A bridge built downstream of the dam will be used during the construction, and later used as an access for the town of *Minaçu*.
- 2.8 The 60 km transmission line will be installed between the switchyard of the power plant and the switchyard of the *Serra da Mesa* hydroelectric facility, located in the center-west region of Brazil. It will connect the plant to the Brazilian south/southeast/center-west interconnected system.

C. Schedule and Cost

- 2.9 Cana Brava began construction in June 1999 and is expected to begin operations in 2002. Specifically, construction of the three units is scheduled to begin in March of this year. All works are expected to be completed 42.5 months after the commencement of the works (39.5 months for the first generating unit, 40.5 months for the second and 42.5 for the third) The *Tocantins* river will be diverted 25 months after the start of construction. The assembly of electrical and mechanical equipment for the first unit will last 21 months.
- 2.10 The project cost is estimated at US\$430 million, including a specific environmental and social budget (see section VI.C for details).

D Project Basis/Alternatives

- 2.11 In conjunction with the regulatory reforms being implemented by the Government of Brazil, the *Grupo Coordenador de Planejamento do Sistema (AGCPS®)* which is coordinated by ELETROBRAS and integrated by all the Brazilian state utilities, was established to be responsible for all of the activities in connection with sector planning, mainly future investments in the sector. In this regard, a Ten-Year Expansion Plan 1998/2007 was prepared and approved by the GCPS, the Planning and Engineering Directorate of ELETROBRAS, 34 electric power utilities and the Ministry of Mines and Energy on April 30, 1998. The Plan is updated annually. The sequence of plants and transmission works is established according

to criteria which will guarantee the supply of electric power, the physical and economic viability of their implementation and an evaluation of their social and environmental impact.

- 2.12 The Cana Brava hydroelectric facility is included in this plan and is considered a fundamental component of the North/South (sub-system South/Southeast/Center West) interconnected system and thus is part of the overall strategic energy generation plans for Brazil. These plans include the development of various hydroelectric power plant projects on the Tocantins River, as well as other regional rivers. Hydroelectric power is the most desired electricity generation alternative for the specific regional area, in terms of overall benefits (e.g., efficiency, costs, environmental, etc.), especially since there are no other existing sufficient, economically viable, and environmentally advantageous fuel sources.
- 2.13 The development of the Cana Brava facility and project site alternatives were originally explored in 1979 by *Furnas Centrais Elétricas S.A. (AFURNAS®)* who was granted permission to study the hydroelectric opportunities on the *Tocantins* River between the confluence of the *Almas* and *Maranhão* Rivers and the point 10 kilometers from the *Ribeirão São Felix* falls. The proposed hydroelectric facility was originally to be called *São Felix* and incorporated both *Serra da Mesa* and Cana Brava. Due to financial as well as environmental considerations, it was subsequently decided to create two separate hydroelectric facilities, *Serra da Mesa* with 1275 MW capacity and Cana Brava with 450 MW capacity. Construction of the *Serra da Mesa* facility began in 1986 and it began operations in 1998.

III. LEGAL AND REGULATORY FRAMEWORK

A. Environmental Institutions

- 3.1 The National Environment Policy (*Política Nacional do Meio Ambiente* or *PNMA®*) created by Law No.6,938, 1981 established the basis for environmental protection in Brazil with the purpose to preserve, improve and restore the life-giving environmental quality, to ensure conditions for socioeconomic development, to protect national security interests and to safeguard the dignity of human life. This policy made provisions for the creation of the Brazilian Institute for the Environment and Renewable Natural Resources (*Instituto do Meio Ambiente e dos Recursos Naturais Renováveis* or *IBAMA®*), the National Environment System (*ASISNAMA®*), and the National Environment Council (*ACONAMA®*). The Ministry of Environment (*AME®*) and the subordinate SISNAMA have their own planning, performance and control structures for implementing the National Environment Policy.
- 3.2 CONAMA is the entity responsible for formulation and establishment of basic criteria and general guidelines for the use and implementation of the Environmental Impact Assessment (*AEIA®*) (CONAMA's Resolution No.001/86).

- 3.3 Law No. 7735, 1989 created IBAMA, the entity responsible for the execution and enforcement of the national environmental policies and for conservation and control of the use of the renewable natural resources.
- 3.4 The Brazilian Secretariat for Water Resources (**ASERH@**) regulates the diversion and use of federal public waters for industrial or hygiene use, and reviews and approves water diversion projects.
- 3.5 The 1988 Federal Constitution granted authority to the states and local governments to legislate on nearly all environmental matters. The federal agency establishes general requirements of broad applicability, while specific standards of enforcement are left to the state agency, either by regulation or by administrative orders. The states and municipalities may issue standards of equal or more stringent requirements than the federal ones.
- 3.6 The State of *Goiás* Environmental Foundation (**AFEMAGO@**) is the entity responsible for the execution, monitoring and control of the environmental issues in the State of *Goiás*.

B. Power Sector Regulations

- 3.7 Regulation of the public provision of electricity is centered principally around articles 175 and 21 of the Federal Constitution, Laws 8.987/95, 9.074/95, 9.427 (creating the *Agência Nacional de Energia Elétrica* (**AANEEL@**), the regulatory body for the sector) and Law 9.648, of May, 1998, as complemented by Decree 1.717/95 and Decree 2.003/96.
- 3.8 A Constitutional Amendment (No.06 of August, 1995) of the Article 176 of the Federal Constitution opened up the possibility for participation of foreign capital in the sector, through bidding processes. All electricity concessionaires are subordinated to the regulations of ANEEL.
- 3.9 Two more organizations are involved in the operation of the sector: (i) the *Grupo Coordenador de Planejamento do Sistema* (**AGCPS@**), coordinated by ELETROBRAS and integrated by all the Brazilian state utilities, is responsible for all of the activities in connection with sector planning, mainly future investments in the sector; and (ii) the recent created Independent System Operator (**ANSO@**) is responsible for the sector's operations planning and programming and the activities of coordination and control of the generation and transmission system.
- 3.10 Following the constitutional and regulatory amendments introduced during 1993 and 1995, the reform of the electricity sector was taken one step further by the Ministry of Mines and Energy (**AMME@**) in 1996. Among the main objectives of the reform was the introduction of greater competition and transparency into the generation and supply of electricity. To implement the reform, Law 9.648 was passed in May 1998. It establishes that the ANEEL, according to article 12, paragraph 1, of law 9.648, will define the rules for participation in a

Wholesale Electricity Market (AWEM®), which will merge all the energy trading not covered under bilateral contracts. The coordination and operational control of the generation and transmission systems will be the responsibility of the ISO.

C. Environmental Regulation

3.11 The principal environmental, social and health and safety legislation potentially applicable to the Project are:

a. Federal Laws:

C Laws 8,171/91 and 8,987/95 establishes that electricity utilities are responsible for: environmental damages caused by their plants; forest clearing and disinfecting of the reservoir area; institutional arrangements with environmental agencies to promote the pollution control in the reservoir water sheds; and monitoring and control of activities in the reservoir and protected areas.

C Law 3,824/60 establishes the requirements for deforestation and clearing of the areas to be flooded.

C Law 4,771/65 defines as permanent preservation areas those forests and other forms of natural vegetation located along rivers and around lakes and natural or artificial reservoirs. It also permits the possibility of the elimination of these protected forests if previously authorized or when it is absolutely necessary for the execution of public interest projects.

C Law 6,938/81 determines the need and basis of the Environmental Impact Assessment (EIA).

C Law 7,990/89 and 8,001/90 establishes compensatory payments to States, Federal District and Municipalities of areas to be flooded by hydroelectric reservoirs.

C Law 9,433/97 establishes the Hydraulic Resources National Policy and creates the National System of Hydraulic Resources Management.

C Law 9,605/98 establishes punishments for environmental crimes.

b. CONAMA Resolutions:

C Resolution 001/86 - regarding the EIA

C Resolution 006/87 - establishes definitions, responsibilities, basic criteria and general guidelines for the use and implementation of the EIA as an instrument of the National Environmental Policy; and definition of required permits (see below).

C Resolution 002/96 - establishes a minimal of 0.5% of total project cost to be applied for protected areas

C Resolution 237/97 - reviews the criteria and procedures for on the environmental licensing process

c. Federal Agreement between the Ministry of Environment, the Hydraulic Resources,

the Legal Amazon, IBAMA, Government of the State of *Goias*, the Environmental and Hydric Resources Secretariat of the State of *Goias* and FEMAGO to protect the environment and the natural renewable resources

d. Environmental Legislation of the State of *Goias*:

- C Law 8,577/78 determines the prevention and control of environmental pollution
- C State forestry and fish policies

3.12 CONAMA Resolution 006 regulates the environmental licensing process for hydroelectric power plants. According to this regulation, three licenses must be obtained: Preliminary License, Installation License, and Operation License. The Preliminary License (*Licença Previa* or **ALP**) must be requested at the beginning of the feasibility study for hydroelectric power plants. The granting of the LP depends on the approval of the Environmental Impact Assessment and the *Relatorio de Impacto Ambiental* (**ARIMA**, summary of the ENVIRONMENTAL IMPACT ASSESSMENT (EIA)). The Installation License (*Licença de Instalação* or **ALI**) must be obtained for the construction of the plant to begin. The granting of the LI is subject to the presentation and approval of the *Projeto Basico Ambiental* (**APBA**, analogous to the Environmental Management Plan). The Operation License (*Licença de Operação* or **ALO**) is granted before the closing of the dam (i.e., beginning of the flooding) and after required environmental actions have been fulfilled or implemented.

D. Expropriation and Resettlement

3.13 The expropriation process, regulated by the Law-Decree No. 3.365, of June 21, 1941, occurs in two stages. In the declaratory stage, ANEEL, the organization responsible for the regulation of the electricity concessionaires, publishes a Resolution determining the area to be expropriated for public utility. In the expropriation stage, the concessionaire is allowed to acquire and compensate the affected properties in the areas to be expropriated. ANEEL signed such resolution, after the publication of the Concession Agreement, declaring public utility for the required land and properties. This resolution is the legal basis of the expropriation.

E. Compliance Status

3.14 The Cana Brava Project was originally to be undertaken by *Furnas Centrais Elétricas S.A.* (**FURNAS**) who is the primary wholesale generator in the area, including the Southeast, the State of *Goias* and the Federal District. FURNAS developed the preliminary studies associated with its implementation which included, among others, the site selection and an Environmental Impact Assessment (see below). FURNAS began miscellaneous minor construction works. In accordance with the Concession, CEM reimbursed FURNAS approximately R\$12 million for the development and environmental costs previously incurred.

- 3.15 The Environmental Impact Assessment and the RIMA were prepared by FURNAS in 1987 and submitted to FEMAGO in 1987. The RIMA was finalized in 1989. In 1990, the LP was issued by FEMAGO to FURNAS and was subsequently renewed in 1995 and 1997.
- 3.16 In conjunction with the renewal of the LP in 1997, a governmentally sponsored Public Audience was held on April 23, 1997 and the project RIMA was made available to the public at various locations (see section VII for details). No major objections or concerns to the project were presented.
- 3.17 The Project Company (*Companhia Energética Mercosul*)(ACEM@) submitted an application to FEMAGO for the project Installation License (LI). The information submitted by the Project Sponsors to obtain the LI included the *Projeto Básico Ambiental* (PBA) or the Environmental Management Plan (see section VI for details on the project PBA). FEMAGO issued the LI for the project on September 29, 1998..
- 3.18 The Concession Agreement signed between ANEEL and CEM on August 7, 1998 determined that the condition to develop the hydroelectric plant should include the expropriation of the land and properties, and resettlement or indemnification of the families existent in the area. A previously performed survey estimated approximately 80 families would have to be resettled associated with the development of the project. Presently, a new survey of the potentially directly affected population in *Minaçu*, *Cavalcante* and *Colinas do Sul* is being performed and should be completed by April 1999. The project PBA has a specific program related to resettlement (see section VI) and the project will comply the IDB policy on involuntary resettlement.
- 3.19 An environmental assessment for the transmission line was not originally included as part of the hydroelectric power plant EIA. Presently, associated with the design of the transmission line, potential environmental impacts will be identified and the necessary mitigation measures. In case that an existing right of way is used for the transmission line, only a limited environmental review would be needed.

IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

- 4.1 The Cana Brava plant will be located in the upper reach of the *Tocantins* River Basin, in the State of *Goiás*, approximately 250 km north of *Brasília*, in the center-west region of Brazil (see map in Annex). The *Tocantins* River is a tributary of the *Pará* River, and runs northward, from the Brazilian heartland to the Amazon rainforest. The Cana Brava Project will be located approximately one km downstream from the *Tocantins* River's confluence with the *Carmo* River and 46 km downstream from the *São Felix* River, on the border between the municipalities of *Minaçu* and *Cavalcante*. The area of direct influence associated with the project consists of the area to be flooded and the areas where surface drainage will enter directly into the reservoir. The area of indirect influence consists of the Municipality of *Minacu* and Municipality of *Cavalcante*.

A. Environmental

- 4.2 At the Cana Brava site, the river has been characterized by high erosion with many rapids upstream *Porto dos Paulistas* that transport sediments, and in the dry season hinder the movement of aquatic organisms. However, with the construction of the *Serra da Mesa* reservoir located 87 km upstream of the Cana Brava dam, a large portion of these sediments will be removed (i.e., deposited in *Serra da Mesa* reservoir). The limnological conditions of the upper reach of the *Tocantins* River are directly affected by the regional hydrological and meteorological regime, varying considerably according to the rainfall distribution. In-stream water quality meets the specifications defined by Brazilian legislation regarding waters intended for domestic supply after conventional treatment, protecting aquatic communities, primary contact recreation, irrigation of vegetables and fruit-bearing plants and natural or intensive breeding of species intended for human food.
- 4.3 The minimum registered river stream flow in the *Tocantins* River is 84 m³/s (02/20/1980), the maximum is 13,368 m³/s (10/12/1967), and the average minimum per month is 102 m³/s. The Project drainage area is 57,777 km².
- 4.4 The region's tectonic conditions consist of the presence of significant and complex structural features, including normal and reverse faults, limestone rocks, and the occurrence of natural seismic events with a maximum magnitude of 3.7 (Richter Scale). A significant portion of the area to be flooded by UHE Cana Brava exhibits soils with low agricultural potential, with physical impediments, low depths, over 5 months with water deficiency, and difficulties for irrigation.
- 4.5 The prevailing climate in the region is classified as sub-humid. The wet months are December and January, and the dry June and July. The annual average precipitation is 1,262 mm, the relative humidity is 74 percent and the maximum and minimum temperature are 33°C and 20°C, respectively.
- 4.6 The Project area is part of the Brazilian savannah region. The principal types of vegetation around the area of the reservoir are dense and open savannah, grasslands and riverside woodlands. From the site of *Porto do Garimpo* to the *Serra da Mesa* dam, the vegetation of the flooded area is more preserved, covered by riverside woodlands, and downstream *Porto do Garimpo* until the Cana Brava site the landscape includes areas used for farming, *Babaçu* palm groves and secondary vegetation.
- 4.7 The savannah region contains a relatively abundant number of animal species, although few endemic species. Endangered species were not identified during the surveys. There are few migratory species of birds. There are no conspicuous migratory movements, which suggests that there is a persistently stable structure. There are a wide variety of insects present, including species of phyto-sanitary interest and species which transmit diseases to man. A

wide variety of reptiles and amphibians are present in the region.

- 4.8 The largest variety of regional fish species are found in the *Tocantins* River. However, the upper reach of the *Tocantins* has the natural characteristic of oligotrophic conditions, making the system less productive when compared with the middle and lower reaches. Endangered species were not identified during the surveys.

B. Socio-Economic

- 4.9 Cana Brava is located in the municipalities of *Minaçu* and *Cavalcante*. The nearest city to the project is *Minaçu*, which is linked to the Federal road BR-153 by the State road GO-241 from the city of *Santa Teresa de Goias*. BR-153 links *Goiania* (the capital city of *Goias*) to the State of *Tocantins*. The city of *Goiania* has a major airport, and is linked by road to the main Brazilian cities.
- 4.10 The municipality of *Minaçu* represents an area of 2,909 km² with a population of just over 32,000 people. Over 80 percent live in the city of *Minaçu* which is located 15 km away from the *Tocantins* River. The proposed reservoir area consists only of scattered rural populations (previously estimated to be approximately 110 families) and there are no villages or cities. There is a high level of population migration to large cities, due mainly to the low demand for labor and to the low wages of workers in the rural area.
- 4.11 The municipality of *Cavalcante* is the sixth largest municipality in *Goiás* in relation to land with close to 7,000 km². However, the municipality of *Cavalcante* is sparsely populated with a little over 8,000 people, 75 percent of which reside in the rural areas. The seat of the Municipality of *Cavalcante* is located approximately 80 km from the area to be flooded and has no direct access to that area. The most viable access is through *Minaçu*.
- 4.12 A recent survey from the *Prefeitura Municipal of Minaçu*, regarding the evolution of population from 1985 to 1998, shows a decrease in the rural population of approximately 30 percent. A similar survey was developed by IBGE for the State of *Goiás*, and it also showed a decrease in the rural population of approximately 47 percent from 1980 to 1991. Both surveys presented an increase in the urban population of 47 percent and 35 percent, respectively.
- 4.13 *Minaçu* has already some infrastructure such as hospital, schools, airport, business activities, water treatment station, workers village, etc. The majority of this infrastructure was built to support the construction of the *Serra da Mesa* facility.
- 4.14 There are two operating ferry services. The majority of transportation is by road on State Road GO-241 to BR-153 that links the city to *Goiania*, the capital of *Goiás*. The education system is insufficient. The majority of the residents do not have sanitary or sewerage facilities. The lack of a basic municipal sanitation systems has a direct effect on the

population's health resulting in the occurrence of endemic diseases in the region.

- 4.15 The population is predominantly young; 57 percent is less than 19 years old. There is low average education and health assistance. The average income is also low.
- 4.16 Economic activities in the municipalities are based on agriculture (mainly rice and corn), large-scale and extensive cattle, mining (gold and sand), industrial mining amianthus, and trade and services in *Minacu*.
- 4.17 After closure of the works at UHE Serra da Mesa, there was a significant rise in unemployment in the city of Minacu above the national average.
- 4.18 The region's archeological sites include the bones of pre-historical animals, and the ruins of historical value of *São Felix* and *Carmo* that will be flooded. An agreement was established between the sponsor and the Universidade Federal de Goiás (UFG) for the archaeological rescue of the area. In accordance with item 2.2 of the Installation License the sponsor will conduct studies of the *Caverna do Tamanduá Bandeira*, despite it being located outside the reservoir area.
- 4.19 There are no major indigenous populations present in the area of direct influence.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

- 5.1 The project EIA and RIMA identified and evaluated the environmental and social impacts associated with the Cana Brava Project. In addition, additional information regarding potential project impacts has been developed associated with the requests (submittal) for renewal of the project LP and subsequently the request for the project LI. The area of direct influence associated with the project consists of the area to be flooded and the areas where surface drainage will enter directly into the reservoir. The area of indirect influence consists of the Municipality of Minacu and Municipality of Cavalcante.

A. Construction

- 5.2 The principal environmental and social impacts associated with the construction of the Cana Brava project are those typical or large-scale hydroelectric works, and include the following principal impacts which are basically temporary and mitigable: temporary land use changes, soil erosion, dust generation, air emissions from vehicle traffic and cement plant, management of petroleum products and associated wastes, storm water runoff, temporary changes in river flows due to diversions and hence impacts on aquatic flora and fauna, control of sanitary wastes, noise emissions from construction and blasting activities, spills of petroleum and other chemicals, disposal of sanitary wastes, waste rock disposal, social issues associated with construction camps, increased local traffic, increased demand on local infrastructure and

services (including social services), worker accidents, and disturbances to flora and fauna.

B. Operation

5.3 The principal environmental impacts associated with the operation of the Cana Brava project are briefly summarized below.

C The project will flood an area of 139 km² resulting in loss of land use. The present land use is primarily savannah and marginal forest.

C The reservoir will result in a change in the characteristics of the *Tocantins* River, from a riverine environment to reservoir system. The Cana Brava reservoir water quality has been estimated to be good since the Serra da Mesa hydroelectric project, located immediately upstream, will control the sediment and water quality inputs (i.e., act as a filter system in some respects). The reservoir will result in changes to the hydraulic characteristics and biological resources of the river, primarily in area of the reservoir (i.e., area to be flooded). The reservoir releases may affect the downstream river conditions, including hydraulics, water quality, and biological resources. not downstream), although these changes should be minimal since minimum stream flows (reservoir releases) will be maintained.

C The soil and vegetation along the reservoir shoreline will be impacted associated mainly due to the small fluctuations in water levels, and may result in increased erosion and unstable slopes.

C The reservoir will results in a loss of terrestrial flora and fauna and their associated habitats.

C The reservoir may result in a slight increase in humidity.

C The reservoir may result in changes in the ground water regime, primarily shallow or freatic ground water table.

C The project will result in a change of visual aesthetics (resources).

5.4 The principal social-economic impacts associated with the operation of the Cana Brava project are briefly summarized below.

C Impact on the directly affected local rural population and their economic activities. The reservoir will require the resettlement of this population; previous estimates identified approximately 110 families would required resettlement, however presently a new complete survey of affected populations is being performed to update this estimated (note: based upon visual observations the number of directly families is not expected to be significantly different). The affected families are all rural based and rely primarily on agriculture/livestock for their economic basis. There are no villages or cities within the area to be flooded.

C The reservoir will impact the local infrastructure by flooding portions of the local gravel road system and some public utilities (electricity, telephone).

C The creation of the reservoir may impact public health due to the possible increase

- disease carrying vectors.
- C The development and operation of the project will impact the urban structure of the city of *Minaçu*, due to increased growth and demands.
- C The reservoir may cause the loss of any present archaeological or historical sites.

C. Positive Benefits/Impacts

5.5 The principal directly related project positive benefits or impacts are:

- C development of the road system,
- C increase environmental education in the region,
- C improve sanitary conditions in the city of *Minaçu*,
- C investment in preservation of natural resources,
- C employment during construction,
- C employment during operations, and
- C additional energy resources in an area of expected increased demand.

VI. ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES AND MONITORING PROGRAMS

6.1 The proposed project environmental and social mitigation measures and monitoring programs are presented in the Project Environmental Management Plan (*Projeto Básico Ambiental*) which were developed based upon various project documents, including the EIA, the RIMA, information submitted for the LP renewal and LI authorization. In addition, the Cana Brava mitigation and monitoring measures are also based upon the PBA for the Serra da Mesa hydroelectric project, which is located upstream of the Cana Brava site and has recently completed construction, and the results from the implementation of some PBA programs. A listing of these mitigation and monitoring activities is presented below; additional details are presented in the Annex.

A. Mitigation Measures

6.2 The principal proposed environmental mitigation measures are:

- C removal of vegetation in part of the area to be flooded immediately prior to reservoir flooding;
- C control of soil usage around the reservoir to minimize erosion and stability problems;
- C re-vegetation along parts of the reservoir shoreline and implementation of protection measures to ensure long-term vegetation stability and viability;
- C reforestation of critical areas along the Rivers *Preto* and *São Felix* and around the urban nuclei of *Minaçu*;
- C environmental protection of the island created by the flooding of the reservoir;

- C rescue of the fish during the river diversion and placement downstream of dam;
- C re-population or introduction of native biological aquatic communities during the reservoir operation (if ecologically feasible and permissible by IBAMA);
- C control of the urban and rural land use in watershed areas which immediately affect (e.g., drain) the reservoir, including deforestation activities;
- C rescue and conservation of the terrestrial fauna;
- C control the potential sources of reservoir contamination (e.g., waste water discharges, etc.);
- C establish basic sanitary conditions for the area and city of Minaçu;
- C controls to prevent vector and diseases associated with the reservoir;
- C worker health and safety program;
- C standard mitigation measures for the project construction environmental impacts (see paragraph 5.2), such as dust controls, soil erosion controls, storm water runoff controls, proper waste management, routine maintenance of equipment.

6.3 The principal social mitigation measures are:

- C Indemnification and/or resettlement to owners and workers directly affected by the flooded area, including the resettlement of the limited number of affected population (previously estimated to be approximately 80 families) in compliance with the IDB policy on resettlement.
- C Relocation of the road infrastructure and adapting of the ferry services
- C Establishment of proper infrastructure and sanitary services in the city of *Minaçu* (water supply, sewerage, solid wastes)
- C Technical and financing support to local producers and to assist the regional economy.
- C Support to the *Minaçu* service sectors, including specifically the educational and hospital sectors.
- C Identify and preserve the cultural, historical and archaeological resources.
- C Promote reservoir multiple uses (including fishing, recreation and leisure), including the implementation of a recreation and leisure center

B. Monitoring Programs

6.4 The environmental and social monitoring programs proposed for the project are:

- C seismic,
- C climatological and meteorological,
- C limnological and water quality monitoring of the reservoir and rivers (in flowing rivers and downstream of dam),
- C monitoring of the success of the programs for introduction of aquatic species in the reservoir, and those rescued faunal species,
- C reservoir margins and soil erosion,
- C ground water,
- C terrestrial flora and fauna,
- C social communication (including public consultation and education),
- C directly affected population (e.g., resettled),
- C social-economic conditions of indirectly affected area,
- C cultural, historical and archaeological survey,
- C mineral exploration.

6.5 Associated with each monitoring program, the RIMA and PBA define the monitoring objectives and justification, environmental characteristics/conditions, methodology and procedures, implementation schedule, and responsibility.

C. Cost

6.6 Tractebel has estimated construction phase budget for environmental and social mitigation and monitoring of approximately R\$9.6 million. Approximately R\$13.3 million is budgeted to actions related to the development of the reservoir and approximately R\$14.0 million to reimburse FURNAS (including in part for the development of the ENVIRONMENTAL IMPACT ASSESSMENT (EIA)). During the first three years of operation, approximately R\$1.1 million is budgeted for environmental and social programs and R\$0.1 million for subsequent years.

VII. PUBLIC CONSULTATION

7.1 Prior to issuance of the LP of the project, FEMAGO, FURNAS and DNAEE (the predecessor to ANEEL), promoted and held a Public Audience in *Minaçu* on April 23, 1997. The public hearing included representatives from IBAMA, Federal and State Public Ministry, National Department of Mineral Production, representatives of the municipalities of *Minaçu* and *Cavalcante*, representatives of different entities, communities, students, and university professors. The meeting included a description of the project and environmental and social

aspects. No major problems with the proposed project were identified.

- 7.2 The RIMA was made available prior to the Public Audience to the affected population and public in many different places including the offices of IBAMA, FEMAGO, the municipalities of *Minaçu* and *Cavalcante*, and the Public Ministry.

VIII. RECOMMENDATIONS

- 8.1 The project team will require that the Project comply with all applicable environmental, social, health and safety Brazilian regulatory requirements and the Project comply with all applicable Bank environmental and social requirements, including specifically the Bank's policy on resettlement. The Bank will also require the project to have a complete Environmental Management Plan.
- 8.2 The project team will, as part of the Environmental and Social Due-Diligence (ESDD), assess the environmental and social aspects of the project and prepare a project Environmental and Social Impact Report (ESIR) for review by the Bank's Committee on Environmental and Social Impact (Technical Review Group). The ESDD will specifically include the following components (see Table 1 for list of project-specific issues to be analyzed associated with the ESDD components):
- C Evaluation of the project EIA, RIMA and supporting information in order to ensure that all project related environmental and social impacts have been identified and their magnitude properly estimated.
 - C Evaluation of the proposed project environmental and social mitigation measures and monitoring programs as to their completeness, level of detail, implementation, definition of responsibility, cost, schedule, and quality control.
 - C Assessment of project compliance with the applicable government environmental, social, and health and safety regulatory requirements and also applicable Bank environmental and social policies.
 - C Evaluation of the disclosure of information to the public and the public consultation process involved with the project, including potential future actions that will be implemented to continue the process and disseminate project information to the local public.
 - C Evaluation and development, if necessary, of project supervision and evaluation procedures to ensure complete and proper implementation of environmental and social mitigation measures and monitoring programs.
 - C Evaluation of the proposed contingency actions/plan, including confirmation that all relevant risks have been identified, proper contingency or emergency action procedures have been developed, and sufficient resources will be made available to ensure adequate implementation of the plan.
 - C Evaluation of potential existing environmental financial/credit risks and liabilities

associated with the project.

- 8.3 The project ESIR will include a summary of proposed project, in terms of environmental and social aspects, and present the project team's recommendations related to environmental and social requirements for the project and the loan agreement.

TABLE 1
PROJECT-SPECIFIC ENVIRONMENTAL AND SOCIAL DUE-DILIGENCE ISSUES
Cana Brava Hydroelectric Power Project

1. Confirmation that the project-related environmental and social impacts, including both direct and indirect, have been adequately identified and assessed based upon the present day conditions, for the total project area of influence, for the cumulative impacts due to multiple reservoirs, potential effects on the regional economy (impacts and opportunities for local participation in economic activities), potential induced changes in land use and occupation patterns, and impacts on indigenous populations to the extent they are present in the project area of influence. Confirmation of the adequacy of identification and characterization of indigenous groups in the project area.
2. Confirmation that both in-reservoir and downstream riverine impacts have been fully considered, including specifically the impact of releases from Serra da Mesa reservoir and impacts due to temporary river diversions, and adequately estimated (e.g., via mathematical models), in terms of water quantity and quality and potential changes in hydrology and hydraulics. In addition, confirmation of impacts associated with planned river diversion actions, including minimum flows, and potential reservoir operating conditions, including specifically minimum flow releases, maximum fluctuation in reservoir water level, coordination with Serra da Mesa reservoir releases.
3. Confirmation that the environmental and social impacts associated with the project transmission line have been adequately assessed (especially related to fragile environmental areas, protected areas, and right-of-way issues) and that sufficient mitigation measures and monitoring programs have been established, and that the site selection included environmental and social factors.
4. Assessment of the new survey of directly affected population in order to ensure an accurate estimate and complete survey of the people and properties affected by the reservoir flooding.
5. Assessment of the proposed resettlement program to ensure compliance with the IDB policy on resettlement, including specifically the adequacy of the institutional framework to ensure proper implementation and public consultation, and also compliance with any applicable Brazilian regulatory requirements.
6. Sufficiency of the proposed mitigation measures for the construction phase, including the specific environmental, health and safety requirements stated in the EPC contract, supervision activities to be implemented by the Project Sponsors, and social-related measures associated with the workers (e.g., code of conduct for construction camps).
7. Sufficiency of the proposed mitigation measures to control the urban and rural land use in watershed areas which immediately affect (e.g., drain) the reservoir, including deforestation activities, and to control the potential sources of reservoir contamination (e.g., waste water discharges, etc.)

8. Sufficiency of the proposed mitigation measures to prevent the growth of vectors and diseases associated with the reservoir.
9. Assess the use of public consultation in the preparation of the proposed approach to reservoir master planning.
10. Sufficiency of the proposed environmental monitoring programs, especially water quality monitoring during construction, water quality and biological monitoring during operation, and potential vectors and diseases associated with the reservoir.
11. Identification of the estimated costs and time schedule associated with the individual components (programs) of the proposed environmental and social mitigation measures and monitoring programs.
12. Confirmation of an adequate and sufficient Environmental, Health and Safety Management System within the Project Company in order to ensure that all necessary actions (e.g., mitigation, monitoring, controls, supervision, training, etc.) are successfully implemented.
13. If the implementation of any proposed project mitigation measure and monitoring program is not the responsibility of the Project Sponsor, then the identification of the specific responsible party (e.g., governmental entity), and confirmation their knowledge and acceptance of their responsibility and confirmation of their ability to proper implement/perform the measure/program.
14. Assessment of the institutional capacity of FEMAGO and any other directly applicable governmental agencies associated with project related activities.
15. Assessment of the need to have additional public disclosure and consultation associated with the project Environmental Management Plan, Resettlement Plan, or information generated since the initial public meeting. Assessment of inclusion of community views and participation in the decision-making process for the salvage of archaeological sites and conservation areas.

ENVIRONMENTAL AND SOCIAL IMPACT BRIEF

Canabava Hydroelectric Power Project (BR-0304)

ANNEX



