ENVIRONMENTAL AND SOCIAL STRATEGY[1]

I. PROJECT DESCRIPTION AND LOCATION

1.1 The Project will be located approximately 20 km south of Guatemala City in the Amatitlán Geothermal Field **(see Annex I)**, in the municipality of San Vicente Pacaya, adjacent to the village of San Francisco de Sales and the Laguna de Calderas (lagoon), in an environmentally protected area (Pacaya Vulcan National Park). The Amatitlán Geothermal Field has been under exploration for quite a number of years and the first wells have been drilled back in 1993.

1.2 Under a balanced and sustainable development of the resource, geothermal energy is considered a renewable resource, since the volume of geothermal fluid taken out can be re-injected, making it a sustainable energy source. In a typical electricity generating scheme hot geothermal fluid is tapped from deep wells (more than 1000 m deep) and used directly or indirectly to produce steam, or other vapor (in a binary-cycle plant), that will drive a turbine.

1.3 The Amatitlán Power Project will comprise: (i) construction of the geothermal power plant; (ii) construction of additional geothermal production and/or re-injection wells; (iii) construction of additional elements of the gathering system (to deliver the geothermal fluids from the production wells to the generating units and back to the injection well(s)); and (iv) various auxiliary systems and buildings. It is estimated that around 100 new direct employments will be generated by the construction activities of the Project and approximately 20 in the operation phase.

1.4 In the development of the Project two possible site options were analyzed for the power plant, both of them inside the Amatitlán Geothermal Field. Based on technical and environmental criteria the present site option has been retained as the most favorable. The power plant platform may occupy an area of approximately 50 m x 150 m.

1.5 Currently, within the Project area there is a geothermal power plant, with approximate capacity of 5 MW and in operation since 1998, which will be dismantled, and four production and two injection wells. The Project will integrate some of the existing facilities such as the four production and two injection wells, which together with a new additional well will be used for the operation of the Project and to re-inject the entire amount of geothermal fluids

[1] This Environmental and Social Strategy (ESS) is being made available to the public in accordance with the Bank's Policy on Disclosure of Information. The ESS has been prepared based primarily upon information provided by the project sponsors and does not represent either the Bank's approval of the project or verification of the ESS's completeness or accuracy. The Bank, as part of its due diligence on the feasibility of the project, will assess the environmental and social aspects. This assessment will be presented in the project Environmental and Social Management Report, prepared by the Bank, and will be made available to public prior to consideration of the project by the Bank's Board of Executive Directors.

after use (cooled brine and condensates). A transmission line (including associated work in existing road) will be refurbished for the construction and operation of the Project by INDE. The energy will be transmitted by INDE's subsidiary *Empresa de Transporte y Control de Energía Eléctrica* (ETCEE), the owner of the transmission system. Construction is expected to start in the first half of 2004 and the scheduled commercial operation date is 19 months from construction start date subject to the terms of the PPA between INDE and the project company.

1.6 The new Amatitlán power plant will be based on Ormat's proven Organic Rankine Cycle (ORC) technology, where the generating system is comprised of two types of subsystems. Subsystem I contains backpressure steam turbine(s) operating on steam from production wells located in the well field. After expanding the steam in the turbine(s) it enters a binary type unit (Subsystem II). Subsystem II is based on two Ormat® Energy Converter (OEC) units, which converts the heat, unutilized from Subsystem I turbine(s) into additional power, based on the principle of the thermodynamic Organic Rankine Cycle (ORC). In the OEC units the organic motive cycle fluid (or working fluid) is a hydrocarbon selected for optimal utilization of the available heat source. The cooling media for the plant will be air; therefore, no cooling or makeup water will be required. The cooled brine and condensate will be mixed after exiting from the plant and injected in appropriate wells.

1.7 Some areas of the Amatitlán Geothermal Field integrate the area of the Pacaya Vulcan National Park (PVNP), a 2000 ha environmentally protected area created in 1963, based on conservation values associated mainly with the geological, biological, hydrological and social characteristics of the area. Under Guatemalan laws the Park is classified in the Management Category Type II: Natural Monument. The proposed power plant site is located in the Buffer Zone according to a proposed zoning plan for the protected area.

1.8 Some of the land on which the Project will be built belongs to INDE (*Instituto Nacional de Electrificación*) and no expropriation or resettlement issues are anticipated. This region is sparsely populated and eminently rural, agriculture being the main economical activity. The municipality of San Vicente Pacaya extends to an area close to 236 km^2, and holds a population of about 8960 inhabitants (approximately 38 hab./km^2, national average is around 122 hab./km^2), around 3% of the local population is considered to integrate the indigenous group of the Mayas (of the Pokoman linguistic group).

1.9 Some small villages are located in the area of the Amatitlán Geothermal Field. The Project involves areas that are part of the following communities of the municipality of San Vicente Pacaya: Calderas, El Bejucal, El Cedro and San Francisco de Sales. The closest village to the plant site will be at a minimum distance of about 500 m.

1.10 According to contractual documents of the Project, there is a possibility, under certain conditions, to expand in the future the plant up to a capacity of 50 MW. The technical conditions are mainly: (i) initial evaluation of field development costs; (ii) evaluation of the geothermal resource; and (iii) monitoring of the existing and new wells. A decision on expansion will be made after assessment procedures indicate that expansion potential actually exists. The necessary environmental studies will be performed accordingly to get environmental approval.

II. ENVIRONMENTAL AND SOCIAL COMPLIANCE STATUS

2.1 According to Guatemalan laws an Environmental Impact Assessment Study (EIA) has to be prepared, presented and approved previously to the implementation of a project of the type of the Amatitlán Geothermal Project. The Ministry of the Environment and Natural Resources (*Ministerio del Ambiente y Recursos Naturales* - MARN) is the competent authority for review and approval of the EIA. MARN usually seeks the opinion of other authorities, such as the (CONAP - *Consejo Nacional de Áreas Protegidas*) in the case a protected area is involved, prior to a decision on the EIA.

2.2 An Environmental Impact Assessment Study (EIA) for the Project has been prepared by a consulting firm (*Asesoria en Geologia, Petroleo y Medio Ambiente*) for the Project Company. During elaboration of the EIA the nearby communities were informed of the proposed Project and associated impacts, and specific individual surveys were conducted through these communities involving the general population and local authorities.

2.3 The EIA has been submitted to the Guatemalan Ministry of the Environment and Natural Resources (*Ministerio del Ambiente y Recursos Naturales* - MARN) and made available to the local public in July 2003. No public hearing has been requested by the Government or the local public during the 20-workday period of public consultation. The Project EIA has been approved by MARN in November 2003.

2.4 The Decree-Law 4-89 created the Guatemalan System of Protected Areas (SIGAP – *Sistema Guatemalteco de Áreas Protegidas*) and the CONAP, responding directly to the Presidency of the Republic of Guatemala, as the top institution in the coordination and management of the SIGAP. This law also allows the possibility that commercial, industrial, tourist, fishery, forestry, agriculture, experimental, and transport activities may be developed in protected areas under certain circumstances and upon agreement of CONAP.

2.5 In the case of the Pacaya Vulcan National Park, a special agreement has been established with the municipality, so CONAP, the National Institute of Forestry (INAB - *Instituto Nacional de Bosques*), and the Municipality of San Vicente Pacaya all have shared responsibilities toward administration of the PVNP.

III. POTENTIAL IMPACTS, RISKS AND CONTROL MEASURES

3.1 As the region is sparsely populated and the Project area, which partly belongs to INDE, has been in use for geothermal development purposes for a number of years, no expropriation or resettlement issues are anticipated. Bibliographic and field studies performed during EIA preparation indicate that this area is not considered an archaeological sensitive area. The indigenous population is not prevalent in the area and specific management procedures will be adopted that will contribute to attenuate impacts on this particular group.

3.2 The principal environmental impacts that may be associated with the construction of the Project will be those related to drilling and testing of new wells, construction of power plant platform and buildings, and installation of equipment. Some of the potential impacts are those typically associated with construction of a moderate size civil works such as: (i) vegetation loss and soil erosion; (ii) dust and noise emissions; (iii) contamination of water by suspended solids and oil from worksites; and (iv) indirect impacts on nearby communities and indigenous populations, such as health and safety problems and other social impacts related to the influx of non-local workers. These impacts usually occur on a limited scale, are temporary and can be mitigated with standard construction environmental management procedures.

3.3 Other potential environmental impacts associated with the construction activities will be more specific to geothermal development (geothermal fluids present high temperature, and salt and heavy metal content), such as: (i) contamination of soil, and surface and groundwater bodies by drilling and geothermal fluids during well drilling and testing; (ii) impacts on other water uses related to usage of water in the construction activities; (iii) impacts related to disposal of sludge and solid wastes generated during drilling and other construction activities; (iv) impacts associated with noise and vibrations generated during drilling; and (v) effects of drilling on groundwater aquifers, nearby hot springs, natural thermal features, and on sensitive geological formations and ecosystems located in the proximities.

3.4 The most relevant potential environmental impacts associated with the operation of the Project will be: (i) contamination of water bodies due to spills and accidental discharges of geothermal fluid; (ii) effects of geothermal fluid removal and re-injection on groundwater aquifers, nearby hot springs and natural thermal features; (iii) implications of geothermal development on land subsidence, microseismic activity and volcanic risk; (iv) impacts of gaseous emissions (H_2S, etc.) on ambient air and plant workers; (v) impacts of noise generated at the air-cooled system; (vi) impacts associated with the binary system working fluid (a hydrocarbon), including likelihood of occurrence of accidents such as spills, fires and release of working fluid to the atmosphere; and (vii) induced land use changes.

3.5 Some measures have already been adopted in the development of the Project to avoid environmental impacts or attenuate their magnitude, including the following: (i) selection of plant site taking into account environmental factors; (ii) re-injection of spent geothermal fluid, brine and condensates in the geothermal reservoir through deep wells; (iii) use of air-cooled system reducing significantly the use of water during plant operation and avoiding fumes typically billowing above cooling towers; and (iv) use of silencers in some plant equipment to reduce noise emissions. Other standard environmental management procedures are foreseen in the EIA to mitigate construction and operation impacts, as well as the preparation of adequate Environmental Management Plan and Health and Safety Management Plan.

IV. OTHER ISSUES

4.1 Development of geothermal energy has a large net positive impact on the environment compared with development of conventional energy sources, major factors being: (i) it is renewable; (ii) energy can be extracted without burning a fossil fuel such as coal, gas, or oil; (iii) geothermal developments produce only about one-sixth of the carbon dioxide that a natural-gas-fueled power plant produces; (iv) geothermal power plants have sulfur emissions rates that average only a few percent of those from fossil-fuel alternatives, and nitrogen oxide emissions are much lower in geothermal power plants than in fossil power plants; (v) discharges of geothermal fluid to the environment are practically eliminated by returning the geothermal fluids for injection back into the reservoir; (vi) geothermal power plants require very little land, taking up only a fraction of that needed by other energy sources; (vii) other land uses can mingle with geothermal developments with little interference or accidents; and (viii) can contribute to reduce import and transport of oil and other fuels; thus improving energy independence (Guatemala is a net energy importer and oil is the primary import) and diminishing the risks of accidents that can have deleterious consequences to the environment.

4.2 The specific survey conducted during preparation of the EIA through personal interviews with local population and authorities indicated that the majority of the communities tend to have a favorable expectation toward the Project (creation of jobs, dinamization of local economy, etc.). However, some complains were identified regarding nuisance and other problems in relation to smoke and liquid discharges from the existing plant, and concerns were raised also on the possibility of air and water contamination by the new development.

V. ENVIRONMENTAL AND SOCIAL STRATEGY

5.1 The Project team, with the assistance of an independent environmental and social consultant will perform an environmental and social due diligence in order to confirm that all Project impacts have been, or will be properly and adequately mitigated. The environmental and social due diligence will specifically assess the following aspects:

(a) An assessment of Project and Company existing operations and facilities compliance status with national, Department of Escuintla, and municipal environmental, social, health, safety and labor regulatory requirements (e.g., laws, regulations, standards, permits, authorizations, applicable international treaties/conventions, etc.), project specific legal requirements, and any applicable IDB's environmental and social policy or guideline.

(b) An evaluation of the EIA to assess the adequacy of the pre-development baseline information, appropriateness of the evaluation of relevant direct and indirect environmental and social impacts, and adequacy of the definition of mitigation and monitoring measures, in terms of their completeness, sufficiency of detail, implementation, cost, definition of responsibility, schedule, and quality control.

(c) An evaluation of Project-related information disclosure and public consultation activities that have been performed, and the proposed future actions, to provide adequate ongoing information disclosure and public consultation with the local population.

(d) An evaluation to assess if the proposed Project direct and indirect environmental, social, health and safety potential impacts and risks have been properly identified and evaluated, including those indicated in Section III of this annex, and adequate control measures have been introduced.

(e) An evaluation of the Company's environmental, health and safety management systems, including plans (Environmental and Social Management Plan, Health and Safety Plan, Contingency Plan, Spill Prevention and Counter Control Plan, etc.) and procedures, to assess their adequacy including in terms of responsibilities, training, auditing, reporting, and resources to be made available to ensure adequate implementation, and specifically all the system components necessary to ensure that projects and works which will be implemented will not generate significant negative impacts.

(f) An assessment of the compatibility of the Project's activities and land use with the guidelines and control measures foreseen by the National Council on Protected Areas (CONAP - *Consejo Nacional de Áreas Protegidas*) and/or other competent authorities, such as the National Institute of Forestry (INAB -

Instituto Nacional de Bosques), Municipality of San Vicente Pacaya, etc., given the Project location in the Pacaya Vulcan National Park area.

(g) An evaluation of the environmental, social, health, safety and labor impacts and risks related to other projects associated with the Amatitlán Power Project (*e.g.*, transmission line).

(h) An evaluation of potential existing and future environmental, social, health, safety and labor risks and liabilities associated with the Project, the Project area, and the Project Company, in particular soil and surface and groundwater contamination generated during the drilling and exploitation of the existing facilities (production and injection wells, pads, gathering system and the 5 MW plant).

(i) An evaluation to confirm that an acceptable Action Plan is in place, as necessary, in order to correct or mitigate the existing environmental, social, health and safety non-compliances and/or liabilities associated with the Project Company's existing facilities and operations.

(j) An evaluation, and further development of the Project monitoring/supervision procedures to ensure proper implementation of environmental, social, and health and safety actions and requirements during construction and operation, and specifically geothermal reservoir management procedures that will allow a balance to be maintained, where possible, between field recharge and heat and fluid withdrawal.

5.2 Furthermore, the Bank, as part of the due diligence process, will analyze the environmental and social aspects of the Project and establish the appropriate environmental, social, health and safety, and labor requirements in the Loan Proposal for review and approval by the Bank's Committee on Environment and Social Impacts (CESI).

GUATEMALA

ANNEX I

Amatitlan Geothermal Power Plant

DEPARTMENTS

1. RETALHULEU
2. SUCHITEPÉQUEZ
3. ESCUINTLA
4. SANTA ROSA
5. JUTIAPA
6. QUETZALTENANGO
7. SOLOLÁ
8. CHIMALTENANGO
9. SACATEPÉQUEZ
10. GUATEMALA
11. JALAPA
12. CHIQUIMULA
13. SAN MARCOS
14. TOTONICAPÁN
15. QUICHÉ
16. BAJA VERAPAZ
17. EL PROGRESO
18. ZACAPA
19. HUEHUETENANGO
20. ALTA VERAPAZ
21. IZABAL
22. PETÉN

This map, prepared by the Inter-American Development Bank, has not been approved by any competent authority and its inclusion in the document has the exclusive objective of showing the political division of the country.

(ITD/DSV/Design Unit, 30.11.03)