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ENVIRONMENTAL AND SOCIAL ISSUES IN GEOTHERMAL DEVELOPMENT IN GUATEMALA

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ABSTRACT

Geothermal development, as well as all potential energy projects must, take into account the environmental legal framework established in Guatemala. Among these requirements the social issues are the ones that could spell the success or the failure of a project. The Environmental Impact Assessment (EIA) is required for each project as well as the community license to build in the area. The entity in charge of the EIA approval is the Ministry of Environment and Natural Resources (Ministerio de Ambiente y Recursos Naturales (MARN). The Assessment should be performed by an authorized consultant or technician and according to the established regulations.

The task of future developers must be to take responsible environmental and social issues considerations, including people and communities. The one that pursuits the economic development must form a communication plan in order to succeed in the project and to promote the renewable energy. This contributes to poverty eradication, in equity with the interested parties. Due to increased price of fossil fuels and its future exhaustion, it will be necessary to improve their status in order to be competitive and to create social development through multiple-utilization of geothermal energy resources for local, small and medium industries. The only way to develop the renewable projects will be with a responsible attitude towards the environment as well as the people.

1. INTRODUCTION

The constant growth of the population, as well as the demand in energy to supply their needs, makes it important to develop the renewable resources to be friendly or benign towards the environment.

The developed countries, as well as the undeveloped, should recognize that the development programs have significant environmental impact. Due to this situation a global concern for the environment began. Environmental impact studies or assessments have as a main goal to protect both the environment (water, air, soil) and human life.

2. ENVIRONMENTAL INSTITUTIONS AND ENVIRONMENTAL COMPONENT STRUCTURE

Based on the Political Constitution Articles 64, 97, 125, 126 and 128, the Law decree 68-86, Law of Environmental Protection and Improvement as well as the acceptance of the Declaration at the United Nations 21st Agenda Development and Environment Conference and International Agreements that the Republic of Guatemala have signed, the country established the political program on the environment, that includes all the sectors and the entity in charge was the National Commission on Environment today Ministry of Environment and Natural Resources which principal function is to assess, coordinate and protect all actions of the law application and to conserve, protect and improve the environment.

Other entities than the Ministry of Environment and Natural Resources are responsible. They are:

The Ministry of Health considers the environment in Health Code.
The Fishing and Aquiculture Office.
The General Forest Office.
The Guatemalan Tourism Institute.
The conservation center studies at the Universidad de San Carlos.
The Naval Pacific Base.
The Sea and Aquiculture Study Center.
The Protected Areas national Commission (CONAP).

3. ENVIRONMENTAL LEGAL FRAMEWORK

The environmental legal framework concerns:
Prohibition: Uses, abuses or disposal.
Prevention: Order the environmental management as the use of the natural resources (decree 68-86).
Corrective: Are those that mitigate the negative effects.
Control: Monitor and control.

Among these laws are:

- Political Constitution of the Republic of Guatemala.
- Law (law decrees).
- Rules (government decrees).
- Special law, general law and international agreements.

THE POLITICAL CONSTITUTION OF THE REPUBLIC OF GUATEMALA

Article 64

Its national interest is to conserve, protect and improve the natural patrimony of the nation. The state will encourage the creation of national parks, reserves and habitats.

Article 97 Environment and ecological equilibrium

The state, municipalities and the inhabitants of the Republic are compelled to promote the social, economic and technological development and to prevent contamination and to sustain the ecological equilibrium. All the regulations must guarantee the fauna, flora; soil and water use to be realized rationally avoiding their depredation.

Article 126

Its national urgent and social interest is forest conservation and reforestation.

Law decree 68-86

General principles:

a. The state, the municipalities and the citizens are required to promote social, economic and scientific development that prevents contamination of the environment.
b. It is required to realize studies on environmental impact assessment.

Environmental and protection law decree 68-86, reformed by decree 1-93 and modified by decree 90-2000
Article 8
It is established that for all projects, industry or any other activities that could cause environmental damage to the natural renewable resources or non-renewable resources, the environment, or that could introduce novice or noticeable modifications to the landscape, to the cultural resources or the national heritage, must undergo, prior to their launch, an environmental impact assessment, realized by technicians and approved by the Environmental commission or MARN. The omission of this assessment according to this Article, the developers will be personally responsible for not fulfilling their duties and will be sanctioned with penalties from Q5,000 to Q100,000. In case this requirement is not fulfilled after six months from the penalty date, the activities related to the project will be closed until this requirement has been fulfilled.

Decree 33-96 reforms to penal code
Article 347 "A" Contamination
One or two year imprisonment or a Q 300 to Q5,000 fine will be a sanctioned to a person that causes air, soil or water contamination through toxic emanations, excessive noises, dangerous products or substances disposals that could damage human health, animal, forest or crops. If the contaminant is proven a Q200 to Q1000 penalty will be sanctioned to the director, manager or owner of the industrial activity that allow their activities to cause such air, soil or water contamination. If the contamination is realized in a community or its surroundings or it affects crops or drinking water, the penalty will be double the minimum or one third of the maximum of imprisonment.

4. THE ENVIRONMENTAL PLANNING PROCESS

There are defined several technical documents with procedures in order to: a) identify and evaluate the environmental impacts, and to b) formulate mitigation measurements. They are:

- Initial environmental evaluation
- Environmental impact assessment
- Environmental risk evaluation
- Social impact evaluation
- Accumulative effects evaluation
- Environmental diagnostic

The initial environmental evaluation is done in order to categorize the project impact. MARN has classified the projects in order to the uniform industrial international standard code CIIU that determines the potential environmental impact on the industrial projects as:

A High environmental impact.
B Moderate environmental impact.
- B1 High moderate environmental impact.
- B2 Low moderate environmental impact.

C Low level environmental impact.

The environmental impact assessment is required for any project to be developed according to MARN review and its classification.

ENVIRONMENTAL IMPACT ASSESSMENT

BASIC CONTENT

1. General information:
1.2. Name (applicant).
1.3. Legal representative.
1.4. Person's principal activity.
1.5. Address, telephone, fax, e-mail.
1.6. Commercial identification.

2. Introduction:
2.1. Executive summary.
2.2 Table of contents or index.
2.3 Personnel that prepared the research.
2.4 Project location.

3. Project description:
3.1. Project objectives and objectives of EIA.
3.2. Technical description. Each phase or project planning stage should describe:
- Working plan and schedule.
- General technology description to be used.
- Origin, sources and energy and fossil fuels demands.
- Roads and transportation for equipment and labor, as well as the impact on the influenced area.
- Labor number and type required.
- Origin and quantity of raw material.
- Other natural resources.
- Infrastructure design.
- Products, waste, emissions, liquid, solid disposals and noise, vibrations.
- Identify other actions to be implemented.

4. Identifying the project area:
Technical and objective definition.
4.1. Environmental status. Description of all the environmental factors in the influenced area, illustrated by maps, graphs, environmental quality prior to the project development, taking into account:
- The development programs, the local legal framework.
- The political and administrative boundaries in the area.
- The biotic, abiotic and social economic environment.
- The protected areas.
- The water resources.
- Other ecosystems.
- Soil use and other natural resources.

- The productive processes.
- Other aspects with ecological value, historical, archeological, heritage, or physiographical that could be affected, and
- the human communities and their characteristics.

5. Identifying factors that could impact the environment and which part is affected:
5.1. Environmental impact analysis, principal characteristics:
Positive/negative; primary/significative, local/regional;
temporal/permanent/periodic or irregular.
5.2. Impact magnitude
5.3. Impact importance.

6. Alternative analysis:
Alternatives should be presented to the proposed action, taking into account:
6.1. Considering the evaluation of a reasonable alternative as well as the elimination of others.
6.2. Details of every evaluated alternative.
6.3. In case government proposals include other alternatives from other entities according to the development region.
6.4. Include the alternative of no project or no action.
6.5. Identify the selected alternative.
6.6. Include the adverse mitigation measurements not discussed in the proposed alternatives.

7. Mitigation measurements:

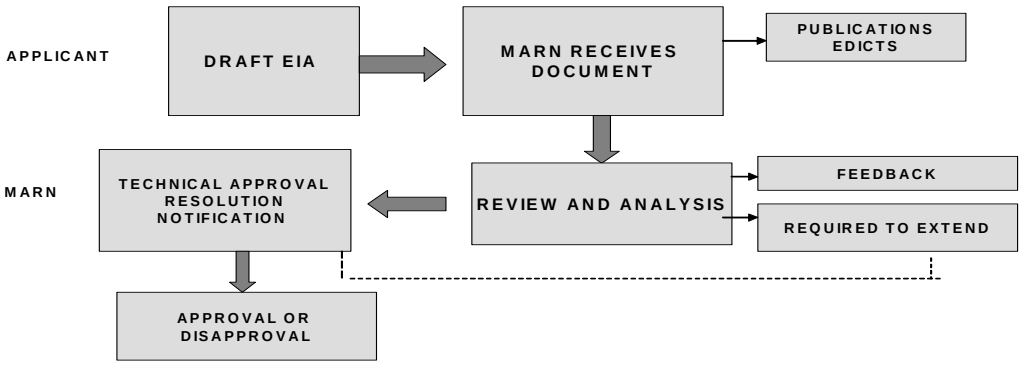
7.1 Avoid completely the impact or the impacts.
7.2 Minimize the effect or the magnitude of an action.
7.3 Management recommendations.
7.4 Replace the quality or the affected resources. According to the project characteristics a contingency plan must be prepared for environmental security and human health.
7.5. Contingent plan.
This plan should include all the measurements in case of emergency (floods, earthquakes, fire, explosions, etc.).
7.6. Human health safety plan.
This plan should include all the preventive measurements taken to conserve human health during the project development or activity as well as the population around the project.
7.8 Environmental safety plan.
This plan should describe all the measurements taken to prevent or restore the integrity of the environment.
7.9 Waste disposal system.
In order to avoid contamination the disposal all waste should be described.

8. Environmental monitoring program:
It includes all the list of mitigating measures, controls, measurements frequency, and laboratory analysis, appropriate action to correct deficiency, mitigation verification plan, and annual environmental monitoring report.

9. **Bibliography**

10. Name and signature of the team who prepared the report

ACTUAL PROCESS



5. GUATEMALAN CHARACTERISTICS

The state jurisdiction requires Environmental impact assessment to cover both physical effects of development and social and economic impacts.

TABLE No. 1 Country demographics

Demographics	
Population	12,293,545 (July 2006 est.)
Age structure	*0-14 years:* 41.1% (male 2,573,359/female 2,479,098)
	15-64 years: 55.5% (male 3,353,630/female 3,468,184)
	65 years and over: 3.4% (male 194,784/female 224,490) (2006 est.)
Median age	*total:* 18.9 years
	male: 18.5 years
	female: 19.4 years (2006 est.)
Population growth rate	2.27% (2006 est.)
Birth rate	29.88 births/1,000 population (2006 est.)
Death rate	5.2 deaths/1,000 population (2006 est.)
Net migration rate	-1.94 migrant(s)/1,000 population (2006 est.)
Sex ratio	*at birth:* 1.05 male(s)/female
	under 15 years: 1.04 male(s)/female
	15-64 years: 0.97 male(s)/female
	65 years and over: 0.87 male(s)/female
	total population: 0.99 male(s)/female (2006 est.)
Infant mortality rate	*total:* 30.94 deaths/1,000 live births
	male: 33.55 deaths/1,000 live births
	female: 28.2 deaths/1,000 live births (2006 est.)
Life expectancy at birth	*total population:* 69.38 years
	male: 67.65 years
	female: 71.18 years (2006 est.)
Total fertility rate	3.82 children born/woman (2006 est.)
Ethnic groups	Mestizo (mixed Amerindian-Spanish - in local Spanish called Ladino) and European 59.4%, K'iche 9.1%, Kaqchikel 8.4%, Mam 7.9%, Q'eqchi 6.3%, other Mayan 8.6%, indigenous non-Mayan 0.2%, other 0.1% (2001 census)

Religions	Roman Catholic, Protestant, indigenous Mayan beliefs
Languages	Spanish 60%, Amerindian languages 40% (23 officially recognized Amerindian languages, including Quiche, Cakchiquel, Kekchi, Mam, Garifuna, and Xinca)
Literacy	*definition:* age 15 and over can read and write
	total population: 70.6%
	male: 78%
	female: 63.3% (2003 est.)

TABLE No. 2 Country characteristics

Climate	tropical; hot, humid in lowlands; cooler in highlands
Terrain	mostly mountains with narrow coastal plains and rolling limestone plateau
Elevation extremes	*lowest point:* Pacific Ocean 0 m
	highest point: Volcano Tajumulco 4,211 m
Natural resources	petroleum, nickel, rare woods, fish, chicle, hydropower
Land use	*arable land:* 13.22%
	permanent crops: 5.6%
	other: 81.18% (2005)
Irrigated land	1,250 sq km (1998 est.)
Natural hazards	numerous volcanoes in mountains, with occasional violent earthquakes; Caribbean coast extremely susceptible to hurricanes and other tropical storms
Environment - current issues	Deforestation in the Peten rainforest; soil erosion; water pollution
Environment - international agreements	*party to:* Antarctic Treaty, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Wetlands
	signed, but not ratified: none of the selected agreements
Geography – note	no natural harbors on west coast

6. DISCUSSION

With these characteristics Guatemala is a country of diversity, and any project that utilizes the natural resources, will encounter a wide range of interested parties, each with different issues, requirements and motivations. These can be grouped as follows:

- The project developer.
- The general community.
- Directly affected people.

The project will be a success if the project develops an environmental impact assessment, balanced between the groups, and makes equilibrium between the environmental effects (positive or negative) and the social and economic issues involved, encouraging and promoting the public participation.

In the past the environmental impact assessment has been done by law requirement, the public participation has not been well managed and in some cases ignored. It has been a difficult task ensuring the local people their demands and arrangements have been made to secure project investments as the project develops.

Different environmental impacts can be expected at each step in geothermal development for power production: a) initial exploration, b) deep exploration drilling, and c) production.

Two geothermal fields have been developed in Guatemala Zunil and Amatitlán, they started operation after several years of exploration and by now they are on production stage. On their way to be productive, they encountered several problems; at present they are solved and represent lessons learned in the geothermal development. A catastrophic event occurs in Zunil on January 5th 1991, a landslide where 23 people were killed due to natural terrain features. These are potential hazards that may affect the geothermal development, although the project was finished and it started operating as the Orzunil I geothermal power plant in the year 1999.

Amatitlán geothermal field started operation with a 5 MW backpressure turbine, and the field will expand its production by the end 2007 to 20-25 MW operated by Ortitlan (Ormat Industries Ltd.). Their main concern has been to comply with the demands of the surrounding communities.

In the future strategies should be developed to determine ways to attain community acceptance of the project. Social acceptability depends on the political, economic and social circumstances of the community. Communities trust that they will be respected, that they will be heard, that they will hopefully reap benefits and that their participation will produce desirable changes in the way the project proceeds. Being prepared with a detailed environmental monitoring and management plan as well as a communication plan used for public education and provide information on the specific project, are key parameters that enables project development.

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