CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>>

Amatitlan Geothermal Project

Version 7

25/04/2008

A.2. Description of the project activity:

>>

The Amatitlan Geothermal Project (hereafter, the Project) developed by Ortitlan Limitada (hereafter referred to as the Project Developer) is a geothermal power plant in the Department of Escuintla, in Guatemala (hereafter referred to as the "Host Country"). Total installed capacity of the Project will be 25.2 MW, with an actual net capacity of 20.5 MW. The plant will utilize 3 turbines (two with installed capacities of 12 MW each, and one at 1.2 MW) and has a predicted power generation of 162,000 MWh per annum.

The purpose of the project is to utilise the geological resources of the Amatitlan Geothermal Field in a state-of-the-art geothermal power plant to generate renewable energy and dispatch it to the Guatemalan Sistema Nacional Interconnectada (hereafter referred to as the Grid). The electricity currently generated by the grid is relatively carbon intensive, with an operating margin emission factor of 0.778 tCO_2/MWh and a build margin emission factor of 0.514 tCO_2/MWh. The project is therefore expected to reduce emissions of greenhouse gases by an estimated 82,978 t CO_2e per year during the first crediting period.

The project is contributing to sustainable development of the Host Country. Specifically, the project:

- Increases employment opportunities in the surrounding area: The Project will directly generate approximately 500 temporary jobs during the construction phase and 20 permanent jobs during the operation phase. The operation phase will also create indirect service jobs and economic development in the surrounding community;
- Enhances the local investment environment and opportunities through programs specifically targeted to direct local financial assistance towards lasting improvements that the surrounding communities can manage;
- Diversifies the electricity portfolio of Guatemala and provides baseload power to the grid in order to help meet growing electricity demand. Geothermal-derived electricity is relatively free of seasonal or fuel-driven supply fluctuations, therefore the project increases stability of power supply to consumers and to the national economy;
- Implements a program to reduce flooding of the local area through the repair of road infrastructure and reforestation of hillsides with over 5,000 trees;
- Reduces emissions of harmful air pollutants by displacing electricity generated by fossil fuel plants and makes a positive impact on health in the host country; and
- Makes a contribution to global efforts to mitigate climate change by reducing 82,978 tCO2e emissions annually.

A.3. Project participants:

>>

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Guatemala (host)	Ortitlan Limitada	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Carbon I Ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Table A.3 Project Participants

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

>>

Guatemala

A.4.1.2. Region/State/Province etc.:

>>

Departments of Escuintla and Guatemala

A.4.1.3. City/Town/Community etc:

>>

Municipalities of San Vicente Pacaya, Amatitlan and Villa Canales

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

>>

The exact location of the project is defined using GPS coordinates. These GPS coordinates are for the Amatitlan Geothermal Field:

Longitude 14º 23’ 00’’ N - 14º 25’ 00’’N

Latitude 90º 35’ 00’’W - 90º 37’ 00’’ W

The Project is located 28km Southeast of Guatemala City in the Pacaya Volcano National Park region, near the Laguna Calderas, which is part of the larger Michotoya River basin. The Project is situated 2000 meters above sea level. To the North lies the Hoja de Queso Hill and El Pepinal: to the East, San Francisco de Sales, El Cedro and the Municipality of San Vicente Pacaya. The region has vegetated zones with scarce and secondary evergreen forests and coffee plantations. The level of previous and current human intervention in the region is high due to years of human presence and agricultural activity.

The Project site can be reached by taking the National Highway CA-94, which leads towards the Guatemalan Pacific, and then the departmental road No. 3 to San Vicente Pacaya.

A.4.2. Category(ies) of project activity:

>>
According to Annex A of the Kyoto Protocol, this project fits in Sectoral Category 1, Energy Industries (renewable/non renewable).

A.4.3. Technology to be employed by the project activity:

>>
The Project uses proven and environmentally safe geothermal power generation technology for electricity generation and transmission. It has a total installed capacity of 25.2 consisting of 3 turbines (two with capacities of 12 MW and one of 1.2 MW), and an actual net capacity of 20.5 MW (see table A.4.3.2.below).

The main technical parameters of the proposed project are shown below.

Table A.4.3.1. Main technical parameters of the proposed project

Variable		Source
Installed capacity (MW)	25.2 MW	Developer
Net Capacity (MW)	20.5 MW	Developer
Plant Energy Factor (average)	95%	Developer
Capacity Factor	95%	Developer
Expected annual power generation (effective supply to the grid) (MWh)	162,000 MWh	Developer
Transmission Line	13.8 kV	INDE

The availability and capacity factors described above are estimates of expected performance for use in conservative calculations; in reality the plant is intended to operate at a higher energy factor. INDE will control power wheeling over a 13.8 kV transmission line which it will build to connect to the 138 kV substation which is located within the power plant fence. Dedicated power circuit breakers serve the generator and protective devices guard against over-current, over-voltage, loss of field and fluctuation in frequency.

The Project consists of the following main parts:

The Ormat Combined Cycle Unit that will be installed for power generation is comprised of two types of modules. The topping module consists of a 1.2 MW back-pressure steam turbine imported from Kato Engineering of Minnesota, U.S. This turbine uses a portion of the produced steam at an initial inlet with

pressure of approximately 9 bara from the well-field. It converts the mechanical energy of the turbine into 3-phase electrical power. After the steam is expanded in the Module 1 turbines it enters a binary type unit (Module II).
Module II is comprised of two Ormat Energy Converter (OEC) units, which use an Organic Rankine Cycle to convert the heat of the brine, the heat of the steam bypassing module I, and the heat rejected from the topping module into power. This electricity is generated by the synchronous type Brush generator that the two OECs are connected to, imported from the Netherlands. The organic motive cycle fluid used in the OECs is a hydrocarbon selected for optimal utilization of the available heat source. The steam and hot brine flow to the vaporizer and the preheater of the unit where they heat and boil the organic fluid. The geothermal steam is condensed while flowing in the vaporizer and exits the vaporizer as condensate and mixes with the brine. The waste geothermal fluid exits the OEC at a temperature of approximately 75°C, and the entire amount of steam and brine extracted from the production wells is re-injected into the injection wells.

Table A.4.3.2. Details of capacity and turbines

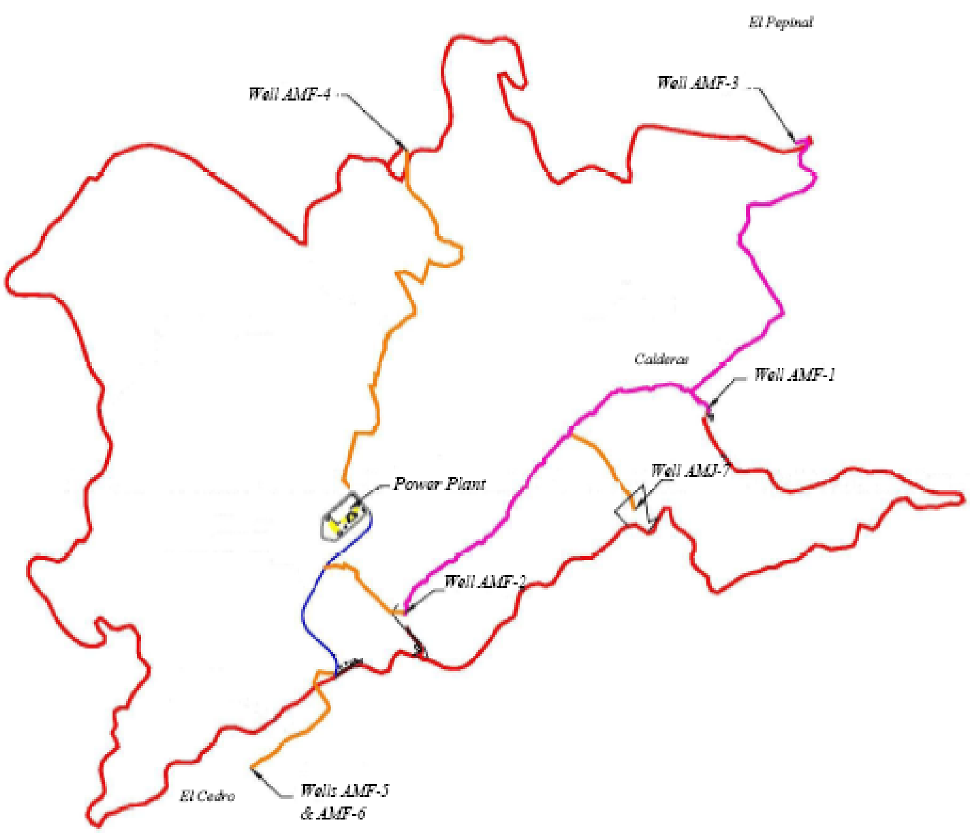
Capacity	**Turbine**			
	OEC 1	OEC 2	Kato Steam Turbine	Total
Installed Capacity *Nameplate capacity of the generating unit installed*	12 MW (15,000 kVA)	12 MW (15,000 kVA)	1.2 MW (1,500 kVA)	25.20 MW
Gross Capacity *Projected performance (in capacity units), of generating unit under "design conditions", or the contractual set of that the unit's performance is optimized for*	11.18 MW	11.18 MW	1.20 MW	23.56 MW
Net Capacity *Gross Capacity less auxiliaries, such as internal unit loads of pumps, electrical losses, fans, etc.*	9.8 MW	9.8 MW	1.19 MW	20.79 MW
Net Capacity of Plant *Net Capacity of the plant is the projected capacity that could be sold to the grid, equal to the net capacities of the generating units less common plant auxiliaries*				**20.50 MW**

The steam and brine are extracted from 5 wells, which feed into two pipelines that carry it to the generation plant. Ortitlan has drilled three steam production wells AMF-5, AMF-6[1], and AMJ-7 from

[1] Please note that wells AMF-5 and AMF-6 are referred to interchangeably in the EIA as AMJ-1 and AMJ-2, respectively.

which steam and brine will be extracted, separated, metered, and piped to the generating station. AMJ-7 is not currently open; it is a contingency well that may one day have to be opened in case of underperformance. Steam and brine from AMF-1 and AMF-2 will be processed similarly and piped in the second pipeline. These two wells differ in that they were drilled and used by INDE in previous early exploration of the resource as part of the Calderas project and have been modified for use in the Project.[2] In addition there are two wells (AMF-3 and AMF-4) which are to be used for steam and brine re-injection.

Figure A.4.3.1. Site layout



Back-up power will be provided by a 100 kW Olympian GEP 110 diesel generator manufactured by Caterpillar with approximate fuel consumption of 120 g/kWh. This genset will be used extremely rarely, because it is only needed in the case that the plant is not generating power and also cannot utilize power from the grid. The plant is almost never fully offline because during maintenance only one OEC is taken off-line at a time.

[2] The Calderas plant was an early, small 5 MW portable back-pressure steam turbine which INDE installed and operated for some years but which has since ceased operations.

The Project will use state of the art but known technology in electricity generation and transmission. The OCCU is manufactured by Ormat Industries Ltd, a subsidiary of the U.S.-based Ormat Technologies Inc. The OCCU is a proven, widely used and environmentally safe technology. There are no geothermal technology distributors in Guatemala; therefore, utilizing ORMAT technology and training local staff in its usage will result in technology transfer and technical capacity-building. Safety will be emphasized and personnel will be trained in safe storage and handling of hazardous materials, accident prevention, control and maintenance of equipment, emergency response, and environmental safety. During training, personnel will be informed of safety regulations and instructed in use of personal protection equipment. Employees receive two weeks of classroom training in operations and maintenance from Ormat staff, supplemented heavily by on the job training.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

>>

Table A.4.4 Estimated amount of emission reductions over the chosen crediting period

Years	**Annual estimation of emissions reductions**
2008	55,319
2009	82,978
2010	82,978
2011	82,978
2012	82,978
2013	82,978
2014	82,978
2015	27,659
Total estimated reductions (tonnes of CO2e)	580,849
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)*	82,978

*Note that this is the annual average per crediting year, rather than per calendar year.

Refer to section B.6.3 for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

>>

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

>>

1. The baseline methodology ACM0002 is used: "Consolidated baseline methodology for grid connected electricity generation from renewable sources" version 06, in effect as of 19 May 2006;
2. The monitoring methodology ACM0002 is used: "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 06 in effect as of 19 May 2006;
3. The tool for demonstration and assessment of additionality used is: the "Tool for demonstration and assessment of additionality" Version 04, in effect as of EB Meeting 29.

More information about the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

>>

The Methodology of ACM0002 (Version 6) is chosen and applicable to the proposed project for the following reasons:

- The Project is a renewable electricity generation plant, in the form of a geothermal power plant which is connected to a national power grid, the Guatemalan National Interconnected System (Sistema Nacional Interconectada), This grid is clearly identified and information on its characteristics is available to the public, and
- The proposed project is not an activity that involves switching from fossil fuels to renewable energy at the site of the project activity.

Based on the reasons above, the applicability criteria of The Methodology stated in ACM0002 (Version 6) are clearly met.

B.3. Description of the sources and gases included in the project boundary

>>

As per the requirements of ACM0002 version 6, the spatial project boundary "includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to", and the gases covered are as follows:

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity	CO_2	Included	According to ACM0002 only CO_2 emissions from electricity generation should be accounted for.

	production	CH_4	Excluded	According to ACM0002
		N_2O	Excluded	According to ACM0002
Project Activity	Non-condensable gas emissions from steam	CO_2	Included	According to ACM0002 CO_2 emissions in non-condensable gases that are released to the atmosphere must be accounted for.
		CH_4	Included	According to ACM0002 CH_4 emissions in non-condensable gases that are released to the atmosphere must be accounted for.
		N_2O	Excluded	According to ACM0002

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

As specified in ACM0002.v6 for projects which do not modify or retrofit existing electricity generation facilities, the baseline scenario is the following:

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations in B.6.1.

Table B.4: Key Information and Data Used to Determine the Baseline Scenario

Variable	Value / Unit	Source
Operating Margin Emissions factor	tCO_2/MWh	General Office of Energy of the Ministry of Mines and Energy (Dirección General de Energia or DGE), and the Power Market Authority (Administrador del Mercado Mayorista or AMM)
Build Margin Emissions Factor	tCO_2/MWh	General Office of Energy of the Ministry of Mines and Energy (Dirección General de Energia or DGE), and the Power Market Authority (Administrador del Mercado Mayorista or AMM)
Combined Margin Emissions Factor	tCO_2/MWh	(see above)
Generation of the project in year y	MWh	Project Developer and PPA

In the absence of the project electricity will continue to be generated by the existing generation mix operating in the grid.

Three alternatives to the project scenario are considered:

Alternative 1: The proposed project activity without CDM: construction of a new renewable generation plant with a net capacity of 20.5MW connected to the local grid, implemented without considering CDM support and revenues.

Alternative 2: Continuation of the current situation. Electricity will continue to be generated by the existing generation mix operating in the grid and future expansions.

Alternative 3: Construction of a thermal (fossil-fuel) power plant with the same installed capacity or the same annual power output.

Assessment of Alternatives:

Alternative 1:

This alternative would face technical, investment, and other barriers outlined in section B.5 below, therefore is not considered viable.

Alternative 2:

Continuation of the current situation would require no investments on the part of the project developer, and would not face any technological or other barriers. Electricity would continue to be generated by the existing mix of (predominantly fossil fuel) power plants in the grid (as discussed in section B.5, step 4, below) and would be expanded along the lines of the build margin.

Alternative 3:

This is not a plausible alternative for this specific project developer, given that Ortitlan Limitada is a company dedicated to operation and management of geothermal power plants and has no experience in thermal (fossil-fuel) power plants.

Of the remaining alternatives, Alternative 1 - construction of a new geothermal energy plant - faces the largest number of barriers, and therefore is unlikely to be implemented in the absence of the CDM (i.e. is not the baseline scenario).

Alternative 2, continuation of the current situation, would face the least barriers, and is therefore identified as the baseline scenario.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The following steps are used to demonstrate the additionality of the project according to the latest version of the “Tool for the demonstration and assessment of additionality” agreed by the Executive Board (for the assessments of alternatives please refer to B.4):

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

After an assessment of alternatives in section B.4., two alternatives to the project scenario are considered:

Alternative 1: The proposed project without being registered as a CDM project activity: construction of geothermal generation plant with installed capacity of 25 MW connected to the local grid, implemented without CDM support.

Alternative 2: No implementation of a geothermal power plant. Electricity would continue to be generated by the existing generation mix operating in the grid and by other future expansions of capacity.

Sub-step 1b. Consistency with mandatory laws and regulations:

The law governing the electricity sector is the "Ley General de Electricidad – Decreto Nº 93-96,". It was enacted in 1996 and mandated the de-bundling and privatization of the Guatemalan electricity sector. The Decreto Nº 93-96 also established the legal and regulatory requirements for electricity generation and transmission to the consumers. There are no laws or government incentives that are compelling the project developer to develop this type of renewable energy plant, thus alternatives 1 and 2 identified are in line with all applicable laws and regulations. Both alternatives are in compliance with all applicable legal and regulatory requirements of Guatemala. Because the Guatemalan power generation sector was privatized in 1996, all growth in this sector is subject to investment decisions by private entities, based on the project return and risk profile.

Therefore the outcome of Sub-step 1b is the list of alternatives 1 and 2 as described above.

Step 3. Barrier Analysis

Sub-step 3a. Identify the barriers that would prevent the implementation of type of the project activity.

Technical Barriers

- **Resource uncertainty:** While Guatemala is acknowledged to have great geothermal potential, the exploration and commercial development of specific geothermal resources is both expensive and risky. Geothermal energy development involves high risks due to the uncertainty inherent in predicting reservoir size and the long-term fluid and heat flow that reservoirs can sustain.[3] Regardless of resource studies, it "can take several years of production from a field before the reservoir performance can be gauged" and exponential reservoir decline is a serious risk.[4] This creates the risk of plant underperformance and failure to meet capacity delivery obligations. According to the project developer, the Project suffers the risk of an unexpected decline in the capacity of respective geothermal wells and is exposed to the risk that its geothermal reservoirs could be insufficient for sustained generation of the desired power capacity over time[5].

---

[3] Lawrence, Stephen. "Geothermal Energy". Leeds School of Business; Boulder, Colorado. 21 February, 2006. <http://leeds-faculty.colorado.edu/lawrence/syst6820/Lectures/Geothermal%20Energy.ppt> Page 48.

[4] *Ibid*

[5] Ormat 2005 Annual Report, page 40. <http://ormat.com/investor-relations/sec-filings/>

In the best cases resource underperformance leads to unexpected costs for additional resource studies and requires capital expenditures on new wells in order to exploit the resource adequately. These represent not only additional costs, but also the risk of delays in project operation and loss of attendant revenues. In the worst cases of resource underperformance, plants might never reach expected levels of generation. Cost outlays necessitated by resource risk were incurred by the Project in the drilling of an extra contingency well, AMJ-7, which required significant additional upfront costs but was done in order to help ensure that the plant would be able to meet its capacity obligations. Developers of geothermal projects walk a fine line when they try to balance the sizing of geothermal field capacity (to extract sufficient steam and/or geothermal brine) against the risk of "overbuilding" the resource, or excessive withdrawal of geothermal fluids, which leads to reservoir decline and reduced energy output.[6] Resource assessment is risky and "can be subject to large errors thus increasing the risk of plant size incompatibility"[7].

- **Operational and Maintenance Requirements:** Exact operation and maintenance requirements of a geothermal power station are difficult to determine in the development stages of the project, which results in uncertainty of future costs and operational consistency[8]. The extent to which corrosion of moving parts and scale deposition, caused by the presence of silica in water, will be a problem is unknown upfront.[9] Consequently the Project must establish and regularly pay into a well maintenance fund to reduce the risk that unexpected costs could cause volatile income. This is one of many costs to geothermal energy projects which are not borne by fossil fuel plants.

- **Technology Barriers:** Guatemala's extensive geothermal reserves are estimated at between 800 and 4,000 MW, and are "most likely about 1,000 MW"[10]. Despite this, only 33 MW[11] of power capacity has ever been installed, and the technology for geothermal power plants is not available locally.[12] Instead, equipment for the Project must be imported from countries outside Central America. In the case of the project activity, the technology is imported from Europe, the United States, and Israel. In INDE's international tender for a developer of the geothermal field, Ormat Industries Ltd. was the only bidder, which indicates limited interest due to the significant challenges and risks associated with such a project in Guatemala. In addition, because the technology is uncommon, the Project development requires engineers from outside the country and laborers with more specialized skills than those required for thermal power plants. Special training in operations and maintenance is

---

[6] *Ibid*

[7] United Nations Environment Programme (UNEP) and GEF. "Assessment of Financial Risk Management Instruments for RE Projects in Developing Countries". April, 2006. <www.uneptie.org/energy/projects/frmi/doc/Background%20study-%20final.pdf>

[8] European Commission, Geothermal Energy: Market Barriers. Available online at <http://ec.europa.eu/energy/atlas/html/geomark.html>

[9] GAO. "Renewable Energy: Increased Geothermal Development Will Depend on Overcoming Many Challenges". Testimony to United States Senate. 11 July 2006. <http://www.gao.gov/new.items/d06930t.pdf>

[10] Lobato, Enrique M. et al. "Geothermal Guatemala," June, 2003. *GRC Bulletin*. Geothermal Resources Council. Available online at <www.geothermal.org/articles/guatemala.pdf>

[11] Manzo, Alfredo René Roldán. "Geothermal Power Development in Guatemala 2000-2005". Proceedings of the World Geothermal Congress 2005. Antalya, Turkey. 25-29/04/2005.

[12] Lobato, Enrique M. et al. "Geothermal Guatemala," June, 2003. *GRC Bulletin*. Geothermal Resources Council. Available online at <www.geothermal.org/articles/guatemala.pdf>

required for Ortitlan employees, which adds to costs[13] and development times. Furthermore, where in-country technical capacity is limited, outside consultants have to be brought in for such crucial services as exploratory studies, chemical sampling, and substation design, adding to Project costs and coordination needs. Geothermal projects characteristically have longer development lead time than fossil-fueled plants,[14] making them less competitive and commercially attractive. In the case of the Project, the lack of local technology supply and local expertise further increases the risk of delay and extends the Project's lead time. The project developer has publicly disclosed to investors that the completion of the Project is subject to the "significant risks" including that of "work shortages, inconsistent qualities of equipment, material, and labor, and failure by key contractors and vendors to timely and properly perform".[15] Any of these could result in delays, cost overruns, termination of the plant construction, or the "loss (total or partial) of interest in the project"[16]. The risks outlined above are primarily a result of the fact that the technology is state-of-the-art, not available locally, and not common practice.

Commercial Barriers

- **Investment barriers:** There is a lack of commercial financing available for geothermal power plants which present a large barrier to project implementation.[17] International and commercial banks are reluctant to finance geothermal projects in large part due to the risks associated with resource uncertainty.[18] This resource uncertainty can lead to sizeable geothermal investments that do not correspond to the appropriate level of return. The investment profile of geothermal projects is inherently riskier than similar thermal plants due to higher upfront capital investment[19]; adding resource risk to this investment profile further increases barriers to financing. Even under the best circumstances of proven steam quantity and quality within a geothermal field, banks and multilaterals usually offer loans that have short maturity terms.[20] These terms can be difficult for a geothermal developer to assume considering the large upfront construction costs of a geothermal facility. Furthermore, even if financing for a geothermal plant is eventually secured with feasible terms, the process itself can be a barrier as it is typically longer, with more due diligence and special covenants than for a thermal power plant. In the case of the Project, the financing process is proving to be long

[13] World Bank. "Geothermal Energy: An Assessment". As cited in Stephen Leeds (Page 53), < http://leeds-faculty.colorado.edu/lawrence/syst6820/Lectures/Geothermal%20Energy.ppt>

[14] Newcombe, Ken. "The Kyoto Protocol: Consequences and Opportunities for Transformation – Increasing the Contribution of the CDM to the post-Kyoto Era". Presentation at Yale University. Oct. 21, 2005. (Page 6).

[15] Ormat 2005 Annual Report, page 41. <http://ormat.com/investor-relations/sec-filings/>

[16] *Ibid*

[17] International Institute for Sustainable Development. "Summary of Proceeding of the International Conference for Renewable Energies #3". Volume 95, Number 03. Thursday, 3 June 2004. Geothermal Power Side Event. <http://www.iisd.ca/download/asc/sd/sdvol95num3e.txt>

[18] Lobato, Enrique M. et al. "Geothermal Guatemala," June, 2003. *GRC Bulletin*. Geothermal Resources Council. Available online at <www.geothermal.org/articles/guatemala.pdf>

[19] Geothermal Energy Association (GEA). "Statement of the GEA to the Committee on Ways and Means, US House of Representatives". Washington DC: May 42, 2005. < http://www.geothermal-biz.com/Docs/Statement%20of%20the%20Geothermal%20Energy%20Association%20Submitted%20May%2024%202005.doc>

Bronicki, Lucien. "Financing Private Geothermal Power Plant Projects, Hurdles and Opportunities". Proceedings of the World Geothermal Congress 2000. Kyushi-Tohoku, Japan: 28 May, 2000. < http://www.geothermie.de/egec-geothernet/prof/0548.PDF

[20] *Ibid*

and unpredictable. Originally it was thought that Inter-American Development Bank (IADB) would provide debt financing but, due to delays, the Project developers have been forced to seek financing elsewhere. They are currently seeking financing from another financial institution but to date[21], more than three years after contact with lenders was first established and the PPA signed, the project has not reached financial closure.

Country risk is another factor which creates barriers to financing and which, if it does not totally negate developer interest in the project, leads to additional time and cost expenditures. These are impediments to project financing and success, and would not be similarly encountered by Alternative 2. Permitting risk and contractual risk are two types of country-specific political risk which have been expressly been considered of concern in relation to the Project[22]. General contractual risk is a concern in the context of the Project because Guatemala has a relatively lower level of legal certainty and rights in connection with contractual relationships[23]; it received a "D" rating in Legal and Regulatory Risk from The Economist in 2006[24]. These concerns and Guatemala's overall political risk rating of "C" present challenges when trying to arrange financing of a geothermal power plant there. Furthermore, investors would not be interested in the Project without political risk insurance (PRI), which the Project has had to secure privately at a significant cost. The developers had originally hoped to secure political risk insurance through the World Bank's Multilateral Investment Guarantee Agency (MIGA). MIGA insurance is known to be a highly effective political risk mitigation instrument due to MIGA's unique ability to find resolutions between parties, and is not as expensive as some private PRI. In the past 17 years, MIGA has resolved all but 3 cases in pre-claim stages[25]. However, project developers found that the intensive MIGA process would not have been completed before they hoped to commence the construction of the plant. Consequently they have obtained private PRI, though they had originally pursued MIGA insurance because of its advantages.

The construction of the project is financed by short term temporary loans, however, the project still needs long term external financing that will optimize its financial structure by replacing such short terms loans. The CDM revenues are needed to provide potential lenders the customary debt coverage ratios. Furthermore, CDM revenues will provide resources to construct two additional wells that are needed to achieve project's contractual obligations for 20.50 MW under the PPA. In order to sustain the flow of fluids to the plant, it is projected that a new well (or major overhaul to existing wells) will have to be carried out every 3-4 years. Failure to make these investments may lead to deterioration of the plant's performance and compromising the contractual obligations to INDE. Besides, it is agreed that the CDM revenues shall belong to the project therefore lower tariffs could be offered to INDE.

- **Institutional and infrastructure barriers**: There are institutional barriers to the development of a geothermal power plant in Guatemala which result primarily from sectoral policy and reorganization of the power sector. First, the privatization of the electricity sector in 1996 has resulted in a distinctly less attractive investment environment for geothermal and renewables in general. In the pre-1996 structure INDE had a public mandate and responsibility to undertake investment in power generation

---

[21] As of writing on March 13, 2007.

[22] Ormat 2005 Annual Report, page 42. <http://ormat.com/investor-relations/sec-filings/>

[23] *Ibid*

[24] The Economist Intelligence Unit. "Guatemala Political Risk Briefing". Fourth Quarter 2006, accessed 23 February, 2007. <http://www.viewswire.com/index.asp?layout=RKcountryVW3&country_id=560000056>.

[25] "MIGA Frequently Asked Questions". World Bank Group. 2006. <http://www.miga.org/sitelevel2/level2.cfm?id=1172>

capacity and focused on renewables, new generation is now to be built by the private sector.[26] Because the private sector is more risk averse and seeks short-term profit in its investments, the Guatemalan power sector restructuring has had a notable effect on renewables in the electricity portfolio in Guatemala. The grid has seen a substantial increase in thermal generation. Between 1990 and 2004 thermal power increased from 7% to 53% of total generation.[27] In 2005, geothermal electricity was 1.9% of total grid production, and the implementation of the project will bring it to approximately 3.7%.[28]

Independent power producers still rely on INDE for such crucial project components as Power Purchase Agreements and the installation of grid interconnections, both of which are under its mandate in the current power sector structure. However, this institutional arrangement makes generators dependent on INDE and vulnerable to any delays within its operations as well as their own. Since INDE no longer develops resource potential, meaning that the Project developers assume responsibility for any and all damages or reductions in geothermal capacity that the field suffers. Development of the other geothermal plant in Guatemala did not face this barrier because INDE was responsible for the production of the heat source, thereby taking on resource risk. [29]

- **Regulatory Risk:** The Project developer is one of many independent generators in Guatemala who has publicly expressed concern about the risk of further policy changes that would worsen the investment environment for renewables. Changes in electricity sector regulation, renewable support policies, and local regulation can all affect financial performance of the Project and are outside of its control. Geothermal technology is becoming more mature, but still requires governmental support for commercial success; if this support is not dependable it presents a barrier to success and decreases attractiveness to investors.

  One example of regulatory uncertainty facing the Project is that it has not been clear throughout development whether the electricity sector, which was partially privatized in 1996, would be further privatized and whether this would “result in changes to the prevailing tariff regime or in the identity and creditworthiness of the power purchasers.[30] This remains to be seen, but it seems that other regulatory changes may be made very soon. The regulatory agencies which oversee the power market, the National Commission on Electrical Energy (Comisión Nacional de Energía Eléctrica, or CNEE) and the Administrador del Mercado Mayorista agencies have recently announced plans to change the tariff structure for electricity in such a way which will decrease some capacity payments and increase transaction costs for independent generators. The changes have been protested loudly by the Association of Renewable Energy Generators (Asociación de Generadores con Energía Renovable, or AGER) and the National Association of Generators (Asociación Nacional de Generadores), both for their negative effects on the profitability of investments which have already

---

[26] World Energy Resources Council. “Survey of Energy Resources: Geothermal Energy”. 2001. <http://www.worldenergy.org/wec-geis/publications/reports/ser/geo/geo.asp>

[27] The Economist Intelligence Unit. “Guatemala Infrastructure Risk Briefing”. 15/12/2006. <http://www.tmcnet.com/usubmit/2006/12/15/2173592.htm>

[28] General Office of Energy (Dirrección General de Energía) of Guatemala. Statistics 2005. Available by communication with the DGE or data in the baseline calculations in Annex XX.

[29] Zunil Power Purchase Agreement (PPA). INDE, 1993.

[30] Ormat 2005 Annual Report, page 47. http://ormat.com/investor-relations/sec-filings/

been made, and for the perceived lack of public consultation in the rule-making[31]. They will not affect the project to a large degree because of its payment structure, however these events still demonstrate the regulatory risk of commercializing projects in this sector under reform.

The Project has also encountered permitting complications in Guatemala due to disagreement between the national and local regulation on exactly what type of permitting is required for the Project. The municipal government claimed that the project required a construction license, while local legal council advised developers that, according to national law, it did not. The developers simultaneously have proceeded to challenge the claim of the local municipal authorities and to obtain the construction license. This lack of governmental coordination led to uncertainty as to the status of the Project[32], and shows how novel types of power technology can be complicated by a lack of institutional coordination. Regulatory institutions often take time to gain capacity for regulating new technologies, and geothermal power is quite rare in Guatemala; hence the project faces bureaucratic barriers.

During the development of the project, Guatemala's policy environment changed dramatically due to the replacement of the old renewables subsidy law (Decreto 20-86) with the Law for Incentives for Development of Renewable Energy Projects (Decreto 52-2003). Whereas the old law allowed for 100% recovery of investment via, among other things, investment tax credits for an unlimited time period, the new Decreto 52-2003 decreased the level of support for renewables by limiting tax credits to a ten-year period.[33] This change disadvantages the Project and exemplifies the policy risks faced, given that geothermal energy still depends on institutional support in order to compete commercially with thermal fossil fuel plants.

Sub-step 3b: The barriers detailed above are specific to the development of a geothermal power plant in Guatemala without CDM support (Alternative 1). They do not apply to or in any way prevent Alternative 2 and therefore it is demonstrated that the baseline scenario is not the project activity.

STEP 4. COMMON PRACTICE ANALYSIS

Sub-step 4a. Analyse other activities similar to the proposed activity

Existing commercial geothermal power plants in Guatemala are listed in the following table:

Geothermal Power Stations Operating in Guatemala[34]

---

[31] "Reformas al sector eléctrico provocan un corto circuito", El Periodico. 03 Feb, 2007. <http://elperiodico.com.gt/es/20070203/actualidad/36376>

[32] Ormat 2005 Annual Report, page 41. http://ormat.com/investor-relations/sec-filings/

[33] Decreto 52-2003. Government of Guatemala, 2003. <http://www.oj.gob.gt/es/QueEsOJ/EstructuraOJ/UnidadesAdministrativas/CentroAnalisisDocumentacionJudicial/cds/2003/Leyes%20en%20PDF/Decretos%202003/Decreto%2052-2003.pdf#search=%22guatemala%20decreto%2020-86%22>

[34] Manzo, Alfredo René Roldán. "Geothermal Power Development in Guatemala 1995-2000". Proceedings of the World Geothermal Congress 2000. Kyushu - Tohoku, Japan. 28/5/2000 – 10/6/2000.

Manzo, Alfredo René Roldán. "Geothermal Power Development in Guatemala 2000-2005". Proceedings of the World Geothermal Congress 2005. Antalya, Turkey. 25-29/04/2005.

Name & Location	Installed capacity	Comments
Orzunil Power Plant (Quetzaltenango)	28 MW	Installed 1999

Even by the most conservative estimates, Guatemala has a capacity of 800 MW in geothermal resources. However, Orzunil is the only large-scale power plant operating to date, indicating large barriers to geothermal resource development.[35] The 5 MW portable back-pressure turbine which INDE operated and has since removed from Calderas is not counted in the common practice analysis because it is no longer operating and because the technology is significantly different to and less advanced than the than the Ormat Combined Cycle unit.

The small amount of capacity installed relative to what exists indicates that the development of this type of project is not common practice.

Sub-step 4b Discuss any similar options that are occurring

The only other large commercial geothermal power plant in Guatemala is located at the Zunil geothermal field near the town of Zunil in Quetzaltenango. There are, however, essential distinctions between the proposed CDM Project and the already operating Orzunil project. Most significantly, the Orzunil project was planned in 1993, before the privatisation of the electricity sector. Although Orzunil is not state-owned, INDE provides an enormous amount of risk mitigation support in its PPA with Orzunil, which it does not in the PPA for Amatitlan. These measures include INDE taking full responsibility for the resource risk. Although INDE did not have geothermal experience, it took on this “high risk” and even offered Orzunil a take-or-pay PPA.[36] For Orzunil, INDE guaranteed the production of hot water and steam supply, well-field operations, and adequate injection capacity, all of which removes all resource risk to the developer.[37] Furthermore, the Orzunil project was able to source both equity and debt funding from the IFC, which wanted to fund it as a demonstration project.[38] The third important distinction between Orzunil and Amatitlan is that Orzunil was financed before the renewable support law was changed, and so enjoys a locked-in tax structure which allows for 100% tax credits for capital expenditures.

The common practice analysis therefore reveals that there are essential differences in the regulatory and investment environment under which similar activities were implemented, and that the project activity is not common practice.

Conclusion:

This Project faces significant barriers to implementation, as described above. It implements a technology which is not available in the region and involves higher operative and resource risk than fossil fuel power

[35] Lobato, Enrique M. et al. “Geothermal Guatemala,” June, 2003. *GRC Bulletin*. Geothermal Resources Council. Available online <www.geothermal.org/articles/guatemala.pdf>

[36] Government of Guatemala. “Plan de Acción Económica 2002-2004. (Plan of Economic Action 2002-2004)”. Guatemala, 27 May 2002. <www.geocities.com/samperez7/PlanAccionEconomica27mayo.doc>

[37] Zunil Power Purchase Agreement (PPA). INDE, 1993.

[38] IFC Press Release. “IFC Finances Geothermal Power Plant in Guatemala”. 12/05/1998. < http://www.ifc.org/ifcext/LAC.nsf/Content/SelectedPR?OpenDocument&UNID=DA5174958338EFE88525697B004DF661>

generation in Guatemala. This, as well as host-country political and regulatory risks, creates clear and evident barriers to the financing and implementation of the Project. These barriers are confirmed by the common practice analysis, which shows a very small amount of geothermal capacity already installed in Guatemala under more advantageous commercial and regulatory conditions. The institutional barriers of Guatemala's power sector to geothermal energy (and renewable energy more generally) are evidenced by the dramatic growth in fossil fuel power generation in the period shortly after the sector's privatization. *These barriers do not in any way prevent Alternative 2, therefore it is the baseline scenario.*

Carbon finance was considered key early on to increasing the attractiveness of the Project as an investment by providing an additional annual revenue stream and increasing stable financial returns of the project. CDM revenues has been considered in the project viability analysis, and accounted into the proposal presented to INDE (20th February 2002) before the Project Activity starting date, defined as the date of the first binding action for the project developer, which is the signature of the contract with INDE (25th April 2003). In addition, EcoSecurities was contracted to analyze and commercialise the project's carbon mitigation potential[39]. CDM revenues will help the Project recover investment sooner and alleviate the burden of high upfront capital expenditures that the Project incurs due to the cost of technology. The CDM revenue stream will also provide a financial buffer to stabilize the income of the project and lessens the potential revenue impact of the numerous risks associated with its development. This will help the project avoid financial distress in the event that it experiences additional unforeseen costs associated with operations and maintenance of this unique technology, a need for further drilling to combat resource underperformance, the need to procure expensive services from specialized foreign contractors, or further reduction in government support for renewable energy technologies. There are significant barriers to the Project; however, they will be alleviated with the crucial support of the CDM and thus, the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the latest version of ACM0002, the Sistema Nacional Interconectada (the Guatemalan National grid system) is selected as the project boundary. This choice is justified because:

- It is the default grid definition in countries which do not have layered dispatch systems, which Guatemala does not;
- It is the grid to which the electricity generated by the Project will be sold; and
- It is the grid which serves the whole country, with the exception of a small area in the rural northern region of Petén.

The Sistema Nacional Interconectada Grid is therefore determined as the project boundary.

The baseline emissions factor (EFy) is calculated as the average of the operating margin emissions factor and the build margin emissions factor. The data used to calculate the grid emissions factor comes from General Office of Energy, a division of the Ministry of Mines and Energy (Dirección General de Energia, or DGE) and the grid administration authority (Aministrador del Mercado Mayorista, or AMM).

[39] EcoSecurities. "Developing the Carbon Mitigation Potential of the Amatitlan Geothermal Project". Contract enacted 15 February, 2005.

The methodology will be applied using Option (a) of the Consolidated Methodology for Grid Connected Projects (Simple Operating Margin). This is because low-cost must run resources constitute less than 50% of total grid generation, detailed data to apply option (b) is not available, and detailed data to apply option (c) is also unavailable. In addition, Option C (Dispatch Data Analysis) will not be used because even if data was available, the costs of processing the data would be beyond the amount affordable by the project developer. For evidence that low-cost/must-run sources are less than 50% of total generation, see Annex 3.

a) *Simple OM emission factor.*

The simple Operating Margin (OM) emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. A three-year average, based on the most recent fuel consumption statistics available at the time of PDD submission, is used.

$$EF_{OM,y} = \frac{\sum F_{i,j,y} \cdot COEF_{i,j}}{\sum GEN_{j,y}} \qquad \textbf{(1)}$$

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in years y,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid,
$COEF_{i,j}$ is the CO_2 emissions coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in years y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad \textbf{(2)}$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel I, IPCC default;
$OXID_i$ is the oxidation factor of the fuel, IPCC default value;
$EF_{CO2,\,i}$ is the CO_2 emission factor per unit of energy of the fuel i, IPCC default value.

$EF_{OM,y}$= 0.778 tCO2e/MWh

For the detailed information, please see the Annex 3.

b) *BM emission factor.*

To calculate the Build Margin (BM), the formulae should be the following according to the methodology:
Where:

EF_BM: Build Margin emission factor (tCO_2e / MWh) and
Where:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad \textbf{(3)}$$

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{j,m}$ are analogous to the variables described from the simple OM method above for plants *m*.

The Build Margin emission factor $EF_{BM,}y$ is calculated ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. According to ACM0002, Project participants should use from these two options that sample group that comprises the larger annual generation. In this case, the 20% of most recent plants have been chosen. Details of the plants included in the BM calculation are given in Annex 3.

$EF_{BM,y}$= 0.514 tCO2e/MWh
For the detailed information, please see the Annex 3.

Wherever possible, plant specific fuel consumption data was used where supplied by the DGE or AMM. However, for the few plants without such data available, fuel consumption was calculated using conservative default fuel efficiencies for the relevant technologies, as specified in EB Guidance[40].

c) *Combined margin emission factor.*
To calculate EF_y with the combined margin (CM), the following equation is used:

$$EF_y = \omega_{OM} \cdot EF_{OM,y} + \omega_{BM} \cdot EF\_BM_{BM,y}$$

=(0.5*0.778) +(0.5*0.514) = 0.646 tCO2e/MWh **(9)**

Where:
EF: baseline emission factor (tCO_2e / MWh)
ω_{OM}: Operation Margin weight, which is 0.5 by default
$EF_{OM,y}$: Operational Margin emission factor (tCO_2e / MWh)
ω_{BM}: Build Margin weight, which is 0.5 by default
$EF_{BM,y}$: Build Margin emission factor (tCO_2e / MWh)
y: a given year

Then baseline emissions *(BE_y)* are obtained as:

$$BE_y = GEN_y * EF_y \qquad \textbf{(10)}$$

Where:
BE: Baseline emissions (t CO_2e)
GEN: Electricity supplied by the project to the grid (MWh)

[40] EB Response to the Request for guidance on the Application of AM0015 (and AMS-I.D) in Brazil, dated October 7, 2005.

EF: baseline emission factor (tCO_2e / MWh)
y: a given year

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/MWh
Description:	Operating Margin emission factor of the Sistema Nacional Interconectada
Source of data used:	Grid Calculation
Value applied:	0.778
Justification of the choice of data or description of measurement methods and procedures actually applied :	EF_{OM} was calculated using the simple operating margin as specified in ACM0002 version 6. Data on fuel consumption was provided by the Dirección General de Energia (DGE); data on annual generation was supplied by the DGE, with supplementary data from the Adminstrador Mercado Mayorista (AMM).
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO2/MWh
Description:	Build Margin emission factor of Sistema Nacional Interconectada
Source of data used:	Grid Calculation
Value applied:	0.514
Justification of the choice of data or description of measurement methods and procedures actually applied :	EF_{BM} was calculated as specified in ACM0002 version 6 using the most recent plants that represent 20% of the grid's generation in the year of the BM (2005). Data on fuel consumption was provided by the Dirección General de Energia (DGE); data on annual generation was supplied by the DGE, with supplementary data from the Adminstrador Mercado Mayorista (AMM).
Any comment:	

Data / Parameter:	Installed Capacity
Data unit:	MW
Description:	Installed capacity
Source of data used:	Project Developer
Value applied:	25.2 MW
Justification of the choice of data or description of measurement methods and procedures actually applied :	Installed capacity denotes the sum of the nameplate capacities.
Any comment:	The Net Capacity of the plant (considering expected operating at design conditions, and parasitic load) is 20.5 MW.

Data / Parameter:	NCV_i

Data unit:	TJ/t
Description:	Net calorific value (TJ/t of fuel)
Source of data used:	IPCC 2006 Guidelines for national greenhouse gas inventories
Value applied:	Fuel Oil = 0.0404 Diesel = 0.0430 Coal = 0.0267 Orimulsion = 0.0275
Justification of the choice of data or description of measurement methods and procedures actually applied :	All defaults are from the latest version of the IPCC national inventory guidelines and correspond specifically to the types of fuels used in Guatemala. Latest version of Good practice guidelines did not have country-specific values for Guatemala.
Any comment:	

Data / Parameter:	$EF_{CO2,i}$
Data unit:	kgC/GJ
Description:	CO_2 emission factor of fuel
Source of data used:	IPCC 2006 Guidelines for national greenhouse gas inventories
Value applied:	Fuel Oil = 77.36 Diesel = 74.06 Coal = 98.26 Orimulsion = 77
Justification of the choice of data or description of measurement methods and procedures actually applied :	All defaults are from the latest version of the IPCC national inventory guidelines and correspond specifically to the types of fuels used in Guatemala.
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of fuel
Source of data used:	IPCC 2006 Guidelines for national greenhouse gas inventories
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	All defaults are from the latest version of the IPCC national inventory guidelines and correspond specifically to the types of fuels used in Guatemala.
Any comment:	

Data / Parameter:	FE_j
Data unit:	%
Description:	Default power plant fuel efficienc(ies) used to calculate fuel consumption at

	plants where no specific consumption data was available from DGE or AMM
Source of data used:	EB Response to the Request for guidance on the Application of AM0015 (and AMS-I.D) in Brazil, dated October 7, 2005.
Value applied:	Open cycle gas turbines: 32% Oil based power plant sub-critical oil boiler: 33%
Justification of the choice of data or description of measurement methods and procedures actually applied :	These defaults were suggested by the EB as a conservative proxy for plant efficiencies.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions:

Refer to Section B.6.1. for methodological choices and equations used to estimate baseline emissions.

$$BE_y = GEN_y * EF_y$$

Where:
BE: Baseline emissions (t CO_2e)
GEN: Electricity supplied by the project to the grid (MWh)
EF: baseline emission factor (tCO_2e / MWh)
y: refers to a given year

$$BE_y = \omega_{OM} * EF\_OM_y + \omega_{BM} * EF\_BM_y$$

Where:
EF: baseline emission factor (tCO_2e / MWh)
ω_{OM}: Operation Margin weight, which is 0.5 by default
EF_OM: Operational Margin emission factor (tCO_2e / MWh)
ω_{BM}: Build Margin weight, which is 0.5 by default
EF_BM: Build Margin emission factor (tCO_2e / MWh)
y: refers to a given year

Electricity supplied annually by the project to the grid (*GEN*) = 162,000 MWh. Baseline emission factor with combined margin (*EF*) = 0.646 tCO_2e / MWh

Therefore using the approach above, and the data shown in Annex 3, the baseline emissions will be 104,649 tCO2e/year annually for the 7-year crediting period.

Project Emissions:

According to ACM0002, the expected project emissions relate to emissions of non-condensable gases from produced steam and to any fossil fuels consumed for operation of the power plant.

Thus for geothermal projects:

$$PE_y = PES_y + PEFF_y + PECG_y$$

Where:

PES_y (Fugitive CO_2 emissions due to release of non-condensable gases from the produced steam) are estimated here based on operational projections from the project developer but will be calculated based on monitored data as described in section B.7.

PEFFy (Carbon dioxide emissions from fossil fuel combustion) are estimated here based on operational projections from the project developer but will be calculated based on monitored data as described in section B.7

PECGy (Carbon dioxide emissions from grid power consumption) are estimated here based on operational projections from the project developer but will be calculated based on monitored data as described in section B.7

Fugitive CO_2 emissions due to release of non-condensable gases from the produced steam (PES_y):

$$PES_y = (\omega_{Main,CO2} + \omega_{Main,CH4} \cdot GWP_{CH4}) \cdot M_{S,y}$$

Where:

PES_y: project emissions due to release of CO_2 and methane from the produced steam during the year y

$\omega_{Main,CO2}$: average mass fractions of CO_2 in the produced steam

$\omega_{Main,CH4}$: average mass fractions of methane in the produced steam

GWP_{CH4} : global warming potential of methane

$M_{S,y}$ is the quantity of steam produced during the year y.

$PES_{1\text{-}7}$ = (1.69 % + (0.001098 % * 21)) * 1,250,000 tons/yr = 21,508 tCO_2e per year

Non-condensable gas emissions occurring during well testing are excluded from project emissions, as they are negligible, as clearly stated in the methodology: “Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered as they are negligible”. Steam production and composition from well testing will be monitored as required going forward but this data will not be used.

Carbon dioxide emissions from fossil fuel combustion ($PEFF_y$):

$$PEFF_y = \sum_i F_{i,y} \cdot COEF_i$$

Where:

PEFFy :project emissions from combustion of fossil fuels related to the operation of the geothermal power plant (tCO_2e)

$F_{i,y}$: fuel consumption of fuel type i during the year y

$COEF_i$: CO_2 emission factor coefficient of the fuel type i.

Carbon dioxide emissions from fossil fuel combustion (*$PEFF_y$*) are expected to be extremely low, given that the back-up diesel generator will only be run approximately 15 hours per year, but are duly accounted for in project emissions with a predicted calculation of fuel consumption. Ex-post project emissions will be based on actual monitored fuel consumption.

$$PEFF_{1\text{-}7} = 180 \text{ kg} * 1/1000 * 3.185 \text{ tCO}_2\text{e/ton fuel}^{41} = 0.57 \text{ tCO}_2\text{e/year}$$

PECGy (Carbon dioxide emissions from grid power consumption) is calculated based on the plant's annual grid consumption multiplied by the combined emissions factor of the grid.

$$PECG_y = ECG_y * EF$$

Where:
PECGy: Carbon dioxide emissions from grid power consumption
ECG_y : Annual power consumption of the plant from grid
EF: baseline emission factor (tCO_2e / MWh)

$$PECGy = 250 \text{ MWh} * 0.646 \text{ tCO2/Mwh} = 161.8 \text{ tCO2e/year}$$

For the Amatitlan project, total project emissions have been calculated as follows:

$PE_{1\text{-}7}$ = 21,508 tCO_2e/yr + 0.6 tCO_2e/yr + 161.8 tCO2e = 21,670 tCO_2e per year

Leakage:

According to ACM0002, the leakage of the proposed project is not considered. No leakage is expected. Therefore, $L_y = 0$.

Annual Emission Reductions:

The ex-ante emission reductions calculations are as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:
ER: Emission reduction (t CO_2e)
BE: Baseline emissions (t CO_2e)
PE: Project Emissions (t CO_2e)
L: Leakage emissions (t CO_2e)
y: a given year

[41] Calculated based on IPCC defaults.

Leakage is zero, therefore:

$$ER_y = BE_y - PE_y$$

This results in net emission reductions of 82,978 tCO2e annually:

$$ER_y = 104,649 – 21,670 = 82,978 \text{ tCO2e}$$

Please see the table below for a summary of the values used and the results of the calculation.

	Per year (average)	**7 years**
Operating Margin Emissions Factor (EF_OM_y in tCO_2/MWh)	0.778	0.778
Build Margin Emissions Factor (EF_BM_y in tCO_2/MWh)	0.514	0.514
Baseline Emissions Factor (EF_y in tCO_2/MWh)	0.646	0.646
Electricity generated by Project (*EG* MWh)	162,000	1,134,000
Baseline Emissions (*BE* tCO_2)	104,649	732,541
Quantity steam produced in year y (Ms,y)	1,250,000	8,750,000
Avg. mass fractions of CO2 in steam (Wmain,CO2)	1.69%	1.69%
Avg. mass fractions of CH4 in steam (Wmain,CH4)	0.0011%	0.0011%
Fuel consumption *(Fi,y in kg/year)*	180	1260
Fuel coefficient *(COEFi in tCO2e/t fuel)*	3.185	3.185
Plant power consumption (ECGy)	250	1,753
Project Emissions (tCO2e)	21,670	151,692

Emission Reductions (tCO2e)	82,978	580,849

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
2008	14,447	69,766	0	55,319
2009	21,670	104,649	0	82,978
2010	21,670	104,649	0	82,978
2011	21,670	104,649	0	82,978
2012	21,670	104,649	0	82,978
2013	21,670	104,649	0	82,978
2014	21,670	104,649	0	82,978
2015	7,223	34,883	0	27,659
Total (tonnes of CO2e)	144,469	697,659	0	580,849

B.7 Application of the monitoring methodology and description of the monitoring plan:

The project uses the approved monitoring methodology ACM0002 "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 6, 19 May 2006.

All data required for verification and issuance will be kept for at least two years after the end of the crediting period or the last issuance of CERs of this project.

B.7.1 Data and parameters monitored:

Data / Parameter:	Electricity quantity (EG_y)
Data unit:	MWh
Description:	Electricity delivered to the grid
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected	162,000

emission reductions in section B.6.3	
Description of measurement methods and procedures to be applied:	Hourly measured and monthly monitoring record
QA/QC procedures to be applied:	According to national standards, meters will be verified and calibrated periodically according to manufacturer specifications, and in compliance with the procedures and degree of precision required by the grid administrator. The meter(s) will be read frequently and jointly by the project developer and the grid company. The project developer's reading will be recorded in the monitoring manual and cross-checked with sales receipts.
Any comment:	The meter is a Power Measurement revenue meter which is located at the generation station, and has been approved by inspection of the Adminstrador de Mercado Mayorista (AMM). The same meter is read by the project developer and the AMM over an automatic SCADA system. Data measured by meters will be cross checked by electricity sales receipt; in the case that they do not agree, the lower value will be taken until the disparity is reconciled.

Data / Parameter:	Electricity consumption from grid quantity (ECGy)
Data unit:	MWh
Description:	Electricity consumed from the grid per year
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	250 MWh
Description of measurement methods and procedures to be applied:	Hourly measured and monthly monitoring record. The power meter is bidirectional so the same meter will be read for EGy and ECGy.
QA/QC procedures to be applied:	According to national standards, meters will be verified and calibrated periodically according to manufacturer specifications, and in compliance with the procedures and degree of precision required by the grid administrator. The meter(s) will be read frequently and jointly by the project developer and the grid company. The project developer's reading will be recorded in the monitoring manual and cross-checked with sales receipts.
Any comment:	The meter is a Power Measurement revenue meter which is located at the

	generation station, and has been approved by inspection of the Adminstrador de Mercado Mayorista (AMM). The same meter is read by the project developer and the AMM over an automatic SCADA system. Data measured by meters will be cross checked by electricity sales receipt; in the case that they do not agree, the lower value will be taken until the disparity is reconciled.

Data / Parameter:	Mass quantity of steam ($M_{s,y}$)
Data unit:	T (tonne)
Description:	Quantity of steam produced during the year y
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	1,250,000 T
Description of measurement methods and procedures to be applied:	Measured continuously and recorded daily
QA/QC procedures to be applied:	Data is read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be re-calibrated within the schedule recommended by the manufacturer.
Any comment:	There will be two differential-pressure (also known as “venturi”) steam flow meters installed on site, supplied and calibrated by Rosemount Inc. One will be installed on each pipeline leading to the generation station. Results from each will be monitored and recorded daily, and will be summed to reach the total mass quantity.

Data / Parameter:	Mass fraction of carbon dioxide in steam ($\omega_{Main,CO2}$)
Data unit:	tCO_2/t steam
Description:	Mass fraction of CO_2 in produced steam
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	1.69%
Description of measurement methods and procedures to be	The analysis will be carried out every 4 months by the Thermochem laboratory of Santa Rosa, California, and more frequently if necessary. Sampling will be performed according to the ASTM E1675-95a standard

applied:	sampling procedure. Thermochem will perform the gas analysis using Flow Injection Analysis, acid evolution, and infared analysis, methods which are exactly in-line with the specifications in Note 2. of ACM0002.v6.
QA/QC procedures to be applied:	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Any comment:	The NCG sampling point is located after the two steam pipelines have joined together, thus the reading will be of the total steam.

Data / Parameter:	Mass fraction of methane in steam ($\omega_{Main,CH4}$)
Data unit:	tCH_4/t steam
Description:	Mass fraction of CH_4 in produced steam
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	0.001098%
Description of measurement methods and procedures to be applied:	The analysis will be carried out every 4 months by the Thermochem laboratory of Santa Rosa, California, and more frequently if necessary. Sampling will be performed according to the ASTM E1675-95a standard sampling procedure. Thermochem will perform the gas analysis using Gas Chromatography and Flame Ionization Detection, methods which are exactly in-line with the specifications in Note 2. of ACM0002.v6.
QA/QC procedures to be applied:	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Any comment:	The NCG sampling point is located after the two steam pipelines have joined together, thus the reading will be of the total steam.

Data / Parameter:	Mass quantity of steam ($M_{t,y}$) generated during well testing
Data unit:	T (tonne)
Description:	Quantity of steam produced during well testing
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	N/A
Description of measurement methods and procedures to be applied:	Recorded daily as required during well tests by venturi (also known as “differential pressure”) steam flow meter(s) installed on site prior to future well tests.

QA/QC procedures to be applied:	Data will be recorded as required should there be well testing going forward. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications; they will be re-calibrated if the verification shows that they are not reading within their specified accuracy.
Any comment:	Please note that this variable is not utilized in any part of the methodology or its calculations. Going forward, it will be monitored per the monitoring methodology, but ACM0002.v6 makes clear that this does not constitute project emissions in footnote 10 of page 12.

Data / Parameter:	Mass fraction of carbon dioxide in steam ($\omega_{t,CO2}$) generated during well testing
Data unit:	T (tonne)
Description:	Fraction of CO_2 in steam produced during well testing
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	N/A
Description of measurement methods and procedures to be applied:	The analysis will be carried out as required by the Thermochem laboratory of Santa Rosa, California during future well testing. Sampling will be performed according to the ASTM E1675-95a standard sampling procedure. Thermochem will perform the gas analysis using Gas Chromatography and Flame Ionization Detection, methods which are exactly in-line with the specifications in Note 2. of ACM0002.v6.
QA/QC procedures to be applied:	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal.
Any comment:	Please note that this variable is not utilized in any part of the methodology or its calculations. Going forward, it will be monitored per the monitoring methodology, but ACM0002.v6 makes clear that this does not constitute project emissions in footnote 10 of page 12.

Data / Parameter:	Mass fraction of methane in steam ($\omega_{t,CH4}$) generated during well testing
Data unit:	T (tonne)
Description:	Fraction of CH_4 in steam produced during well testing
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	N/A

Description of measurement methods and procedures to be applied:	The analysis will be carried out as required by the Thermochem laboratory of Santa Rosa, California (or another qualified lab) during future well testing. Sampling will be performed according to the ASTM E1675-95a standard sampling procedure. Thermochem will perform the gas analysis using Gas Chromatography and Flame Ionization Detection, methods which are exactly in-line with the specifications in Note 2. of ACM0002.v6.
QA/QC procedures to be applied:	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal.
Any comment:	Please note that this variable is not utilized in any part of the methodology or its calculations. Going forward, it will be monitored per the monitoring methodology, but ACM0002.v6 makes clear that this does not constitute project emissions in footnote 10 of page 12.

Data / Parameter:	Fuel quantities (F_{iy})
Data unit:	gallons
Description:	Amount of fossil fuels used for the operation of the geothermal plant
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6.3	56.6 gallons (180 kg)/year
Description of measurement methods and procedures to be applied:	Fuel consumption will be measured in gallons and recorded monthly, specifically for each fuel (currently only diesel consumption is expected). Measurement will be made in gallons and converted to tonnes using fuel-specific density or scientifically proven fuel densities.
QA/QC procedures to be applied:	The record will be checked for accuracy before being recorded in the monitoring manual. If necessary, it can be also be checked using the records in the monitoring record of planned or unplanned downtime, given that the consumption of the engine is known.
Any comment:	Fuel consumption will only occur in emergencies when the plant is not operational and the grid is also not available, a confluence of events which is expected to be very rare; at other times the plant will run on grid electricity.

Data / Parameter:	Emission factors coefficient ($COEF_i$)
Data unit:	tCO_2e/t fuel
Description:	CO_2 emission coefficients of fossil fuels types i used for the operation of the geothermal plant
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected	3.185 tCO_2/t fuel (specific to diesel)

emission reductions in section B.6.3	
Description of measurement methods and procedures to be applied:	Plant or country specific values to calculate COEF will be used with preference to IPCC default values. Fuel consumption will always be recorded with fuel type, and wherever possible, with specifications of the fuel including NCV and density for use in calculations.
QA/QC procedures to be applied:	Records of the fuel purchased can be referred to.
Any comment:	

Please refer to Annex 4 for further background documentation.

B.7.2 Description of the monitoring plan:

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Amatitlan Geothermal Project in Guatemala.

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

1. Monitoring organisation

Prior to the start of the crediting period, the organisation of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project and the Plant Manager will coordinate and be responsible for all CDM monitoring. The Plant Manager will have the overall responsibility for the CDM monitoring system on this project. Emission reductions will be calculated and reported to the Plant Manager. Any errors or corrective actions to the data will also be reported to the plant manager.

A formal set of monitoring procedures will be established prior to the start of the project. These procedures will detail the organisation, control and steps required for certain key monitoring system features, including:

a) CDM staff training
b) CDM data and record keeping arrangements
c) Data collection
d) CDM data quality control and quality assurance *
e) Equipment maintenance
f) Equipment calibration
g) Equipment failure

See Annex 4 for a description and the scope of these procedures
* These procedures will be based on the agreements specified in the Power Purchase Agreement signed with the AMM.

The procedures will be agreed and signed off by Ortitlan Limitada and EcoSecurities. Any changes to procedures will need to be agreed by both parties. The Plant Manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.

All staff involved in the CDM project will receive some relevant training from the project consulting company laid down in training procedures agreed on by the project developer and EcoSecurities Group Plc. (further details of the training procedure is provided in Annex 4). Records of trained CDM staff will be retained by the Project Developer. The Plant Manager will ensure that only trained staff are involved in the operation of the monitoring system.

2. Monitoring equipment and installation

<u>Metering of Electricity Supplied to the Grid</u>

The main electricity meter for establishing the electricity delivered to the grid (detailed in B.7.1) will be installed at the input end of the transmission line. This electricity meter will be the revenue meter that measures the quantity of electricity that the project will be paid for and is monitored simultaneously by Ortitlan and by the AMM. As this meter provides the main CDM measurement, it will be the key part of the verification process. This meter is located at the generation site at the Project. Therefore there will be no need to account for transmission losses.

Electricity meters will meet the relevant local standards at the time of installation. Before the installation of the meters, it will be factory calibrated by the manufacturer. The meters will be installed by project developer with installation verified and approved of by the AMM according to the national standard as specified in the PPA. Records of the meter (type, make, model and calibration documentation) are available and will be retained in the quality control system.

<u>QA</u>

The project developer with the AMM to specify the QA procedure for measurement and calibration to ensure the measurement accuracy of the main meter. Periodic checks should be conducted according to AMM Commercial and Operating Coordination Norms. For further details on the CDM data quality control and quality assurance see the CDM Monitoring System Procedures in Annex 4.

3. Data recording procedure

The process for collecting the electricity meter data will be detailed in a procedure. A summary of this procedure is provided below.

1. Data is read continuously and logged automatically by the revenue meter and downloaded daily to a digital file,
2. Data (in KWh or MWh) will be entered into CDM monitoring workbook bi-monthly and will be checked for consistency when entered,
3. Electricity generation data will also be taken off of the AMM bill monthly, and recorded in a separate column,
4. In the case that there is a discrepancy between the two figures, the lower of the two will be used in CER calculations unless the disagreement is resolved,
5. Abnormal events, shut-downs, and maintenance should be noted in a separate column,
6. Data and back-up data will be stored as described in procedure.

4. Data and records management

At the end of each month the monitoring data needs to be filed electronically. The electronic files need to have CD back-up and/or print-out. The project developer needs to keep electricity sale and purchase invoices. A copy of all monitored data will be kept in paper and digital form for the duration of the project activity and two years after.

All written documentation such as maps, drawings, the EIA and the PPA, should be stored and should be available to the verifier so that the reliability of the information may be checked.

In order to make it easy for the verifier to retrieve the documentation and information in relation to the project emission reduction verification, the project developer should provide a document register. The document management system will be developed to ensure adequate document control for CDM purposes. The monitoring manual designates an Ortitlan Limitada employee who is responsible for checking the data (according to a formal procedure) and the Company Secretary will be responsible for managing the collection, storage and archive of all data and records. A procedure will be developed to manage the CDM record keeping arrangements. All the data shall be kept until two years after the end of credit period.

For details of the operational and management structure used for the monitoring of the project activity, please see Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The application of the baseline study was concluded on December 16, 2006 and the monitoring methodology was concluded on December 6, 2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group PLC, listed in Annex 1 of this document as a project participant.
Contact: Jenna@ecosecurities.com

Detailed baseline information is attached in Annex 3.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
25/04/2003 (signing of the contract of PP with INDE)

C.1.2. Expected operational lifetime of the project activity:

>>
25y – 0m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
01/11/2008

C.2.1.2. Length of the first crediting period:

>>
Seven (7) years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

Adhering to Guatemalan law, the proposal for the Project included a detailed environmental impact assessment (EIA), which is the result of an extensive environmental impact study performed in the Amatitlan Geothermal field as well as the region surrounding it. The Project's Environmental Impact Statement (EIS) has been completed and approved by the Ministry of the Environment and Natural Resources (MARN) and the National Council of Protected Areas (CONAP).

A substantial effort has been devoted to understanding the environmental aspects of the Project and assuring that environmental issues have been addressed adequately and that potentially adverse environmental effects will be mitigated through the implementation of the Environmental Management plan. By adopting the Environmental Management Plan as laid out in the EIA, including environmental monitoring, preventative measures, and mitigation, Ortitlan Limitada ensures that the Project is environmentally sound.

In response to the Environmental Impact Assessment (EIA) and the permitting process, the project developer has made adjustments to the Project design and adopted an Environmental Management Plan to insure the environmentally safe operation of the plant. The MARN and CONAP approvals confirm the EIA conclusion that the Project's potential environmental impacts can be prevented, controlled, mitigated or rehabilitated as appropriate by implementing plan. The plan outlines measures that address Project activities during the Pre-Operation (construction), Operation and Abandonment phases. In some cases these measures include monitoring the environmental impacts of the Project; environmental training for employees and subcontractors; sensitive handling of waste; and rehabilitation of the site post-Project operation. In addition, the project developer will install silencers inside the plant in order to mitigate noise pollution of the area.

Phase of Project	**Strategy for Addressing Concerns outlined in the Environmental Management Plan in Phase**
Mobilization and Pre-Operation Phase	Appropriately manage Project associated traffic Do not construct structures in critical zones Preserve land surrounding construction to the greatest extent possible Dispose of solid and water waste in an environmentally sensitive manner Obey all World Bank Requirements regarding the use and disposal of industrial chemicals and by-products Implement noise reduction technologies Implement an education campaign about the Project for local communities Train employees and subcontractors in environmental and Health safety

Exploration and Production	Erect and dismantle equipment without interfering in an environmentally responsible manner Disperse waste and earthy materials appropriately Restore the area that has been drilled Maintain the equipment in good condition
Operation Phase	Comply with the international industrial safety procedures Comply with environmental monitoring plan to verify project design standards Do not use dielectric oils with PCB and dispose of fluids appropriately
Abandonment Phase	Dismantle the equipment in compliance with industrial safety and environmental standards Rehabilitate the environment by planting native plant species and removing all waste appropriately

According to the EIA, the Project is not expected to have adverse impacts on the local environment beyond the current level of human intervention. The surroundings of Laguna de Calderas has experienced many years of agricultural use, and more recently, industrial use as well. The dismantling of the Calderas plant as well as the rehabilitation of the area was incorporated into the larger Abandonment Plan adopted by the project developer.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

With mitigation controls planned as part of the project construction and EIA process, and the contribution made by the project to sustainable development for the local and national area, the project will have an overall positive impact on the local and global environment. All negative environmental impacts are subject to mitigation measures as described in the MARN approval of the project EIA, which the developer is legally bound to follow. Environmental monitoring and mitigation has already commenced and will continue over the life of the project.

SECTION E. Stakeholders’ comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

Stakeholders have been consulted in four distinct ways during the development of this project, including: a formal survey of opinions in surrounding communities, an open commenting period held in conjunction with the MARN, periodic presentations to the local communities, and quarterly meetings with the Community Councils on Sustainable Development (COCODEs, by the Spanish acronym) of the nearby villages. The stakeholders’ comments and opinions were obtained early on during the EIA phase, using a poll which surveyed stakeholders in the surrounding communities of San Vicente Pacaya, El Cedro, El Bejucal, San Francisco de Sales, and Calderas, and covered demographic, social, economic and environmental aspects of the Project. The project developers also facilitated a public commenting period through a 20-day public discussion administered by the Ministry of Environment and Natural Resources. The public discussion was made open to all and publicized through a broadly circulated newspaper (See Annex 5).

E.2. Summary of the comments received:

>>

The majority of comments received during the stakeholder poll were positive. Stakeholders cited employment, community aid, school and ecotourism as benefits of the project's construction. Some 74% of respondents thought that the project would have benefits for the region. Several concerns were also raised by stakeholders, mainly about the project's environmental safety: 30% were worried that there would be hot water discharge to the local lake, 30% were concerned that there would be toxic fumes from the plant, 22% were worried about noise pollution and odors, and 25% said that the project would create employment only for a few.

These concerns in the pre-construction phase showed a need for continuing education throughout subsequent project development phases to ensure that the community understands the environmental protection measures of the Project. Economic benefits to the local communities are being directed through a consultative process including the village COCODEs and Ortitlan Ltda.

Three further presentations have been made to the communities to present the Project in various phases of development. Responses to the Project have been increasingly positive as community members have had more opportunities to understand the environmental precautions taken and the development benefits that it includes. In addition, quarterly meetings with the leaders of the local Councils on Community Development have been held to consult on the best means of creating community benefits, and confirm this trend in the opinions of village residents. Comments in these meetings show that much of the early negative response was due to prior experiences with the former Calderas pilot plant in the area run by INDE.

E.3. Report on how due account was taken of any comments received:

>>

As a result of the comments received, the company has continued to make presentations to the surrounding communities on topics of their concern.

1. **Concerns about safety of the steam that will be generated by the geothermal plant:** Ortitlan has made further presentations to the community and has explained the composition and nature of steam byproducts of the geothermal. The plant will comply with all national and sectoral regulations regarding air safety, will operate as approved in the EIA, and will comply with the guidelines of the World Bank for Health and Safety Limits for Geothermal Plants and air Threshold Limit Values.

2. **Questions about sulfurized water from the project overflowing into the lake where the local populations draw their water from:** Additional questions were raised regarding the safety of nearby water, the quantity of water that the plant will consume, and the population's need for basic water use as well as irrigation uses. It is most important to note sulfurized water will not be discharged and that the lake and neighbors are not in danger at all. This is because the geothermal fluid produced by the wells is re-injected entirely into the injection well and no fluid is discharged to the surface. The project developer has reassured the local communities of its

responsible water use and water security for irrigation and human use. The project's extensive environmental management and monitoring plan includes measures to maintain water quality and availability to the local communities. Furthermore, Ortitlan is helping to drill new wells to reach new potable water sources for the communities.

3. **Concerns regarding the level of noise pollution that the plant would produce were also voiced:** The population expressed noise concerns related to their past experience with the Calderas plant formerly operating in the area. Although the technology at Amatitlan is different than Calderas, the project developers have installed silencers inside the plant and constructed noise insulating barriers around the plant.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project developer:

Organization:	Ortitlan Limitada
Street/P.O.Box:	Avenida reforma 7-62, Zona 9.
Building:	Edif. Aristos Reforma, Oficina 310
City:	Guatemala City
State/Region:	Guatemala
Postfix/ZIP:	
Country:	Guatemala
Telephone:	502 362 8001
FAX:	502 362 4701
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	Ing.
Last Name:	Choresh
Last Name:	Aaron
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Project Annex 1 participants:

Organization:	EcoSecurities Group Plc.
Street/P.O.Box:	40 Dawson Street
Building:	
City:	Dublin
State/Region:	
Postfix/ZIP:	02
Country:	Ireland
Telephone:	+353 1613 9814
FAX:	+353 1672 4716
E-Mail:	info@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	

Title:	COO & President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	
First Name:	Pedro
Mobile:	
Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	cdm@ecosecurities.com

Organization:	EcoSecurities Carbon I Ltd
Street/P.O.Box:	11/12 Warrington Place
Building:	
City:	Dublin 02
State/Region:	
Postfix/ZIP:	
Country:	Ireland
Telephone:	+353 1 613 9814
FAX:	+353 1 672 4716
E-Mail:	ecosecuritiescarbon1@ecosecurities.com
URL:	
Represented by:	
Title:	Mr
Salutation:	
Last Name:	Brier
Middle Name:	
First Name:	Dean
Mobile:	
Direct FAX:	+1 212-951-8823
Direct tel:	+1 212 325 8648
Personal E-Mail:	list.ecosecuritiescarbon1ops@credit-suisse.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

ANNEX 3 - BASELINE INFORMATION

Table 1. Annual generation and fuel consumption of sources "j" in Operating Margin 2003-2005

Plant	2003				2004			2005			
	GENj,y (GWh)	Fi,j,y (Fuel Cons)			GENj,y (GWh)	Fi,j,y (Fuel Cons)		GENj,y (GWh)	Fi,j,y (Fuel Cons)		
INTERNAL COMBUSTION		Fuel Oil (gal)	Diesel (gal)			Fuel Oil (gal)	Orimulsion (gal)		Fuel Oil (gal)	Diesel (gal)	Orimulsion (gal)
PQPC	1,191.52	72,839,501	781,000		788.77	47,797,342		684.50	41,806,283	931,000	
Genor	157.34	9,545,903			82.32	5,036,254		134.97	8,115,237		
Sidegua	86.94	6,139,368			78.79	5,554,376		94.52	6,669,195		
Arizona	561.70	28,710,700			1,146.36	14,240,311	63,404,301	1,009.15	6,073,000		68,041,725
Las Palmas	463.73	27,429,815			307.17	17,970,787	70,905	289.83	15,104,752		2,746,821
Amatex	227.19	13,556,450			245.14	14,375,367		257.53	15,119,793	283,719	
Electro Generación	-				21.11	1,228,814		68.07	4,483,922		
Progreso	70.51	4,343,614			46.28	2,835,672		52.99	3,204,516		
Lagotex	-				87.77	6,324,696		71.76	5,171,235		
La Esperanza	739.98	53,324,136			606.49	43,705,057		523.27	37,707,568		
GAS & STEAM TURBINES		Fuel Oil (gal)	Diesel (gal)	Coal (mt)		Diesel (gal)	Coal (mt)		Diesel (gal)	Coal (mt)	
Escuintla Gas 3	9.21		983,131		0.95	105,372		3.21	337,309		
Escuintla Gas 5	6.41		703,935		0.52	58,673		1.85	206,165		
Tampa	15.25		1,224,019		1.87	153,444		3.35	271,600		
Stewart & Stevenson	12.85		1,057,262		2.11	173,496		6.86	337,309		
Lagunas Vapor No. 3	2.81		231,306								
Lag. Gas No. 1	2.72		223,498		1.58	130,134		3.90	206,165		
Lag. Gas No. 2	22.52		1,853,428								
Lag. Gas No. 4	16.03		1,319,274								
Escuintla Vapor 2	0.08	10,067	5,210								
San José	892.39		138,841	365,968	1,029.67	115,531	425,437	979.03	145,735	408,878	
COGEN (Non-Harvest)		Fuel Oil (gal)				Fuel Oil (gal)			Fuel Oil (gal)		
Madre Tierra	5.13	592,991			-	-		4.78	565,437		
Tululá	0.02	90,000			0.00	90,000		0.47	90,000		
La Unión	17.77	1,628,309			7.93	242,245		19.07	767,848		
Concepción	20.95	-			13.35	-		20.92	2,976,132		
Pantaléon	22.61	-			3.63	-		20.54	809,158		
Magdalena	9.76	1,038,386			3.60	182,814		12.75	609,517		
Santa Ana	19.15	1,102,840			10.25	798,928		19.06	1,220,718		
San Diego	-				-			-			
Darsa	2.18	-			1.24			1.49			
Trinidad	-				-			-			

Table 2. Calculation of EF_OM

2003	Actual Fuel Consumption unit/year (F)	Actual Fuel Consumption mt/year (F)	IPCC 2006 Inventory Guidelines Net Calorific Value in Fuel TJ/mt (NCV)	IPCC 2006 Inventory Workbook Carbon Content kgC/GJ (COEF)	IPCC 2006 Inventory Guidelines Oxidation Factor %	Fuel CEF tCO2/mt (CEF)	Annual Emissions tCO2/yr (TEM)	Generation of BM Power Sources MWh GENj,y	CEF t CO2/MWh (EF_OM)
Fuel Oil - Internal Combustion (l)	834,123,365	825,782	0.0404	21.1	100%	3.126	2,581,395		
Diesel - Gas Turbine (l)	32,255,135	27,094	0.0430	20.2	100%	3.185	86,295		
Coal - Steam turbine (mt)	365,968	365,968	0.0267	26.8	100%	2.624	960,198		
Orimulsion - Internal Combustion (l)	-	-	0.0275	21.0	100%	2.118	-		
Total							**3,627,888**	**4,576,770**	**0.793**

2004	Actual Fuel Consumption unit/year (F)	Actual Fuel Consumption mt/year (F)	IPCC 2006 Inventory Guidelines Net Calorific Value in Fuel TJ/mt (NCV)	IPCC 2006 Inventory Workbook Carbon Content kgC/GJ (COEF)	IPCC 2006 Inventory Guidelines Oxidation Factor %	Fuel CEF tCO2/mt (CEF)	Annual Emissions tCO2/yr (TEM)	Generation of BM Power Sources MWh GENj,y	CEF t CO2/MWh (EF_OM)
Fuel Oil - Internal Combustion (l)	607,114,421	601,043	0.0404	21.1	100%	3.126	1,878,861		
Diesel - Gas Turbine (l)	5,954,526	5,002	0.0430	20.2	100%	3.185	15,931		
Coal - Steam turbine (mt)	425,437	425,437	0.0267	26.8	100%	2.624	1,116,228		
Orimulsion - Internal Combustion (l)	240,279,794	242,683	0.0275	21.0	100%	2.118	514,002		
Total							**3,525,021**	**4,486,872**	**0.786**

2005	Actual Fuel Consumption unit/year (F)	Actual Fuel Consumption mt/year (F)	IPCC 2006 Inventory Guidelines Net Calorific Value in Fuel TJ/mt (NCV)	IPCC 2006 Inventory Workbook Carbon Content kgC/GJ (COEF)	IPCC 2006 Inventory Guidelines Oxidation Factor %	Fuel CEF tCO2/mt (CEF)	Annual Emissions tCO2/yr (TEM)	Generation of BM Power Sources MWh GENj,y	CEF t CO2/MWh (EF_OM)
Fuel Oil - Internal Combustion (l)	569,682,938	563,986	0.0404	21.1	100%	3.126	1,763,021		
Diesel - Gas Turbine (l)	11,587,860	9,734	0.0430	20.2	100%	3.185	31,002		
Coal - Steam turbine (mt)	408,878	408,878	0.0267	26.8	100%	2.624	866,004		
Orimulsion - Internal Combustion (l)	267,963,797	270,643	0.0275	21.0	100%	2.118	573,223		
Total							**3,233,249**	**4,283,873**	**0.755**

Year	CEFy
2003	0.793
2004	0.786
2005	0.755
AVG	0.778

Table 3. Percentage of low-cost/must run resources of total grid generation

Below is data showing that low-cost/must-run generation has been less than 50% of total grid generation on average over the last 5 years, which confirms the appropriateness of the simple OM calculation method.

Year	2001	2002	2003	2004	2005	
Hydro	2,264	2,089	2021	2,377	2,615	
Geothermal	194	130	195	194	147	
Cogen (Harvest)	536	514	510	555	590	
Total GWh	5,961	6,387	7,302	7,643	7,643	**AVG**
Total % LC/MR	50%	43%	37%	41%	44%	43%
Source	(1)	(1)	(2)	(2)	(2)	

Sources: (1) Adminstrador del Mercado Mayorista, (2) Dirreccion General de Energia and AMM (same sources as for yearly generation and fuel consumption).

Table 4. Generation (GWh) and delineation of Build Margin in 2005 - Note Cumulative Generation (in GWh) and as a % of total year's generation.

Name	Technology	Fuel Type	GWh	Cum Gen	Cum % Gen	Year Online
Palin II	hydro	RE	5.95	5.95	0.08%	Aug-06
Trinidad	Cogen	biomass/thermal	0.08	6.03	0.08%	Dec-05
San Diego	Cogen	biomass/thermal	5.33	11.36	0.15%	2005
Magdalena II	Cogen	biomass/thermal	23.66	35.02	0.45%	2004
Pantaleon II	Cogen	biomass/thermal	34.98	70.00	0.90%	2004
Renace	hydro	RE	279.06	349.06	4.48%	Mar-04
Electro Generación	IC Motor	thermal	68.07	417.14	5.36%	Oct-03
Amatex	IC Motor	thermal	257.53	674.67	8.67%	Jun-03
Darsa	Cogen	biomass/thermal	3.07	677.73	8.71%	May-03
Arizona	IC Motor	thermal	1009.15	1686.88	21.67%	May-03
Calderas	geothermal	RE	25.86	1712.74	22.00%	Dec-02
Cerro Vivo	hydro	RE	6.27	1719.01	22.08%	Mar-02
Pasabien	hydro	RE	56.27	1775.28	22.81%	Jun-00
Poza Verde	hydro	RE	38.88	1814.16	23.31%	May-00
La Esperanza	IC Motor	bunker	523.27	2337.43	30.03%	May-00
San Jose	steam turbine	coal	979.03	3316.46	42.61%	Jan-00
San Jeronimo	hydro	RE	1.01	3317.47	42.62%	2002
Zunil	geothermal	RE	121.05	3438.52	44.17%	1999
Secacao	hydro	RE	105.78	3544.29	45.53%	1998
Genor	IC Motor	bunker	134.97	3679.26	47.27%	1998
Las Palmas	IC Motor	bunker	289.83	3969.09	50.99%	1998
El Salto	hydro	RE	6.78	3975.87	51.08%	1998
La Union	Cogen	biomass/thermal	131.44	4107.31	52.77%	1996
Madre Tierra	Cogen	biomass/thermal	66.48	4173.80	53.62%	1996
Magdalena	Cogen	biomass/thermal	94.24	4268.04	54.83%	1996
Pantaleon	Cogen	biomass/thermal	165.95	4433.99	56.96%	1996
Santa Ana	Cogen	biomass/thermal	103.26	4537.25	58.29%	1996

Name	Technology	Fuel Type	GWh	Cum Gen	Cum % Gen	Year Online
Santa Ana	Cogen	biomass/thermal	103.26	4537.25	58.29%	1996
Concepcion	Cogen	biomass/thermal	108.68	4645.93	59.69%	1996
Tulula	Cogen	biomass/thermal	22.10	4668.03	59.97%	1996
Lagotex	IC Motor	bunker	71.76	4739.79	60.89%	1996
Tampa	Gas Turbine	diesel	3.35	4743.14	60.93%	1995
Rio Bobos	hydro	RE	37.27	4780.42	61.41%	1995
Sidegua	RE	bunker	94.52	4874.94	62.63%	1995
Progreso	IC Motor	bunker	134.97	5009.91	64.36%	1993
PQPC	IC Motor	bunker	684.50	5694.41	73.15%	1993
Stewart & Stevenson	Gas Turbine	diesel	6.86	5701.27	73.24%	1992
ESC.GAS No.5	Gas Turbine	diesel	1.85	5703.12	73.27%	1985
Chixoy	hydro	RE	1487.18	7190.30	92.37%	1983
Aguacapa	hydro	RE	265.47	7455.76	95.78%	1982
Chichaic	hydro	RE	2.87	7458.63	95.82%	1979
ESC.GAS 3	Gas Turbine	diesel	3.21	7461.84	95.86%	1976
Jurun	hydro	RE	233.53	7695.37	98.86%	1970
El Porvenir	hydro	RE	14.90	7710.27	99.05%	1968
Los Esclavos	hydro	RE	50.28	7760.55	99.70%	1966
Santa María	hydro	RE	23.53	7784.08	100.00%	1966
Total				7784.08		

Table 5. Calculation of EF_BM (2005)

	Annual Generation	Fuel Consumption	IPCC 2006 Net Calorific Value	IPCC 2006 CEF	IPCC 2006 Fuel Oxidation	Fuel CEF	Emissions	CEF
	GWh/yr	tonnes	TJ/t fuel	kg/GJ		tCO2/tFuel	tCO2	t CO2/MWh
	(GEN)	(F)			%OX			(EF_BM)
Thermal Generation Total	1,334.75							
HFO Consumption		100,372.16	0.0404	21.10	100%	3.13	313,724.56	
Orimulsion Consumption		260,141.61	0.0275	21.00	100%	2.12	550,849.86	
Diesel Consumption		902.15	0.043	20.20	100%	3.18	2,873.24	
RE (Bagasse & Hydro)	352.13	-	-	-		-	0.00	
Total	**1,686.88**						**867,447.65**	**0.514**

Table 6. Calculation of NCG Project Emissions

NCG composition of the wells on-site was studied by the National Electricity Commission of Mexico in earlier feasibility studies. Studies were made of wells AMF-1 and AMF-2 to determine the percentage of NCG's in the produced steam and the composition of those NCGs. The average readings of the two wells is used to estimate project emissions, but monitored data of the steam coming from all producing wells will be used ex-post.

The calculations are as follows:

Determination of Wmain,CO2 and Wmain,CH4		
Fraction of NCG's in the produced steam=		1.80%
source: Amatitlan Geothermal Project EIA		
Fraction of CO2 in gas compostion of NCG:		
source: Comision Federal de Electricidad test		
AMF 1:	95.50%	
AMF 2:	93.12%	
Avg.	94.31%	
Wmain,CO2=	1.698%	
Fraction of CH4 in gas composition of produced steam:		
source: Comision Federal de Electricidad test		
AMF 1:	0.017%	
AMF 2:	0.105%	
Avg.	0.061%	
Wmain,CH4=	0.001098 %	

Annual quantity of steam produced (MS,y in t/year) =		1,250,000
Fraction of CO2 in produced steam (Wmain,co2) =		1.698%
Fraction of CH4 in produced steam (Wmain,ch4) =		0.001098%
Emissions of CO2 (tons)		21,219.75
Emissions of CH4 (tons)		13.725
GWP of CH4		21
Emissions from CH4 (tCO2e)		288.225
PESy=	21,507.98	t/year

Relevant excerpt from CFE Analysis Report:

Tabla 13. Composición química promedio de gases de pozos.

Pozo	Cg	CO_2	H_2S	NH_3	H_2	He	Ar % peso	O_2	N_2	CH_4
AMF-1	1.7	95.5	3.97	0.04	0.0111	0.003	0.0088	0.000	0.68	0.017
AMF-2	1.8	93.12	5.14	0.03	0.0216	0.000	0.0219	0.000	1.5729	0.105

Annex 4

FURTHER DETAILS OF THE MONITORING PLAN

Table 1: CDM Monitoring System Procedures

Procedure name	Description	Scope
CDM Staff training	This procedure outlines the steps to ensure that staff receives adequate training to collect and archive complete and accurate data necessary for CDM monitoring.	Staff should be trained according to this procedure prior to performing any monitoring duties for the CDM project.
CDM data and record keeping arrangements	This procedure provides details of the site' data and record keeping arrangements. The arrangements ensure that complete and accurate records are retained within the quality control system. Data and records will be stored and archived according to this procedure.	All data and records should be managed following this procedure. Staff are responsible for ensuring that any data or records are dealt with according to this procedure.
Data collection	This procedure describes how to collect data for all of the monitored variables in the PDD.	This procedure will outline the steps to collect the data from the electricity meter, steam flow meters, and sample steam for NCG analysis.
CDM data quality control and quality assurance	Data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions. All records will be checked for completeness.	This procedure covers all measured and/or calculated variables.
Equipment maintenance	This procedure outlines the steps to provide regular maintenance to the electricity meters and steam flows meters.	This procedure should be followed by all staff involved in checking and maintaining the on site meters.
Equipment calibration	This procedure details the process of organising and managing the calibration process.	The calibration of the electricity meters will be conducted by a suitable company according to the AMM standards. The CDM Manager is responsible for organising the calibration and ensuring that records

		are retained.
Corrective Actions	Details how corrective actions of errors will be taken care of if necessary.	Any corrections in the source data are marked, and the type of correction is documented in the spreadsheet. The original source data are stored next to the corrected data.

Table 2: Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity
(E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed)

Task	On-site Operator	Secretary	Plant manager	Project developer's head office	Steam Analysis Lab	EcoSecurities
Collect Data	E	N/A	R	N/A	E	N/A
Enter data into Spreadsheet	N/A	E	R	N/A	N/A	N/A
Make monthly and annual reports	N/A	N/A	E	E/R	N/A	I
Archive data & reports	N/A	E	R	N/A	N/A	N/A
Calibration/ Maintenance	I/E	I	R	I	E	I

Annex 5

Sample Questionnaire for the CDM Stakeholder Consultation and Newspaper Announcement

BOLETA DE ENCUESTA

Nombre de la Comunidad: ____________________
Fecha y lugar de Nacimiento del encuestado:
____
____
Tiempo de residir en la comunidad (si no es del lugar): ____________________
Antes de donde vino: ____________________
Razones por las que vino a la zona: ____________________
Cuanto tiempo piensa quedarse: ____________________
Tiene familiares en el área: ____________________
Tipo de Parentesco: ____________________
Habla otro idioma, aparte del castellano: SI NO CUAL: ____________________
Etnia: ____________________ SEXO: MASCULINO FEMENINO
Sabe leer y escribir: SI NO
Grado de escolaridad: ____________________

1) ¿Tiene trabajo actualmente? SI NO
2) Lugar de su trabajo: ____________________
3) ¿Que trabajo realiza?
   Agricultor Comerciante Jornalero Trabajador Asalariado Otro
4) ¿Está usted de acuerdo en que se abran más fuentes de trabajo en el área?
   SI NO
5) ¿Cree usted que las actividades no agrícolas dan un mayor desarrollo en la zona?
   SI___ ¿Por qué? ____________________
   NO__ ¿Por qué? ____________________

   5.1) ¿Para usted las actividades de la planta geotérmica son beneficiosas para su comunidad? SI NO
   5.2) ¿En caso afirmativo en qué como los puede beneficiar?
   Más trabajo Mayor seguridad Mejores vías de acceso mayores Ingresos económicos Otro
   5.3) ¿En caso negativo, cómo lo puede afectar?:
   Malos olores Ruidos Basura Contaminación del agua
   Otro____________________
   5.4) ¿Cuales cree que sean las ventajas de contar con actividades no agrícolas en la zona?
   ____
   5.5) ¿Qué opina usted con relación a las desventajas de contar con actividades no

agrícolas en la zona?

5.6) ¿Qué opinión tiene de la construcción de una nueva planta de energía eléctrica, para sustituir a la actual?
EXPLIQUE

5.7) ¿Considera que la instalación de una nueva planta de generación eléctrica tendrá beneficios para la zona? SI NO ¿especifique?

5.8) ¿Ha trabajado para las actividades relacionadas con la generación de energía geotérmica? SI NO que actividad ha realizado

5.9) ¿Cree que la empresa operadora de la planta geotérmica ha dado oportunidades de trabajo a los residentes en la zona?: SI NO PORQUE

6) Mencione acciones o actividades en que les ha prestado ayuda la empresa

7) ¿Algún comentario que quisiera agregar?

CLASIFICADOS

EDICTO DE REMATE

Este Juzgado señala la audiencia el día 27 de Agosto del 2,003, a las nueve horas en punto, para el Remate en pública subasta de la finca urbana número: 43,979, folio: 70, Libro: 232, de San Marcos, ubicada en este municipio. El remate tiene lugar en virtud de Ejecución en la Vía de Apremio que contra el propietario del mismo sigue OLIMPIA CONCEPCION MALDONADO SCHAAD DE FUENTES y OLIMPIA CONCEPCION MALDONADO SCHAAD, a través de su mandatario MARIO EGBERTO FUENTES MALDONADO, aceptando posturas que cubran el monto de la deuda que es de: Q. 74,200.00, más intereses y costas judiciales. Cítanse a personas interesadas en el remate. Secretario Juzgado de Primera Instancia, Ramo Civil, Malacatán, San Marcos, 4 de Julio del 2,003.- Augusto Orozco Velásquez. Secretario instancia.

85337 — 14-21-28 Jul./2003

EDICTO DE REMATE

Ejecutivo 02-01. of.I. Srio. El treinta de julio año en curso a las nueve horas se rematará finca rústica 254408, folio 198; del libro 568 de Quetzaltenango, terreno ubicado en lugar llamado Choquí, jurisdicción de este municipio y departamento de Quetzaltenango, consta de 119.60 metros cuadrados., y linda: Norte: 11.50 metros Clara luz Chajchalac Vicente, Sur: 11.50 metros con Rafael Tistoj camino de por medio, Oriente: 10.40 metros con David Chajchalac Vicente y camino, y, Poniente: 10.40 metros con Alejandro Chajchalac García. Juicio ejecutivo que promueve José Carmen Ixtacuy Coyoy contra el propietario respectivo. El inmueble tiene un gravamen más que el que activa la presente ejecución. BASE: Q.1,600.00. más intereses y costas procesales. Secretaría Juzgado Segundo de Paz Ramo Civil, Quetzaltenango, veinticuatro de junio del dos mil tres. LUIS FERNANDO DE LEON RODAS. Srio.

85343 — 15-22-28 Jul./2003

EDICTO DE REMATE

E.V.A. NUMERO 04-2003. SECRETARIO. ESTE JUZGADO DE PAZ DEL RAMO CIVIL DEL MUNICIPIO DE SAN SEBASTIAN, DEPARTAMENTO DE RETALHULEU, SEÑALO AUDIENCIA A LAS NUEVE HORAS DEL DIA CINCO DE AGOSTO DEL AÑO DOS MIL TRES, PARA EL REMATE DEL BIEN INMUEBLE DADO EN GARANTIA HIPOTECARIA, QUE SE ENCUENTRA INSCRITA EN EL REGISTRO DE LA PROPIEDAD COMO TERCERA INSCRIPCION HIPOTECARIA SOBRE LA FINCA URBANA que pesa Hipoteca A FAVOR DE LA EJECUTANTE ALICIA VILLELA GONZALEZ (UNICO NOMBRE), NUMERO CUARENTA MIL SETECIENTOS TREINTIOCHO (40,738) FOLIO DOSCIENTOS TREINTICUATRO (234) DEL LIBRO CIENTO CINCO (105) DE RETALHULEU, con una área de trescientos dieciséis punto treinta y cinco metros cuadrados (316.35 Mts.2.) ubicada en la sexta avenida número tres guión veintitrés zona tres de esta cabecera Municipal, Cantón Pooj del municipio de San Sebastián del departamento de Retalhuleu, por CUATRO MIL QUINIENTOS QUETZALES (Q.4,500.00) MAS INTERESES Y COSTAS PROCESALES, además en cuanto a la Hipoteca en referencia, existen dos más a favor de la ejecutante, TIENE LUGAR VIRTUD EJECUCION PROMUEVE CONTRA RESPECTIVO PROPIETARIO, ACREEDORA HIPOTECA. EFECTO LEGALES HACE PRESENTE PUBLICACION. San Sebastián, Retalhuleu, catorce de Julio del dos mil tres. EDGAR ENRIQUE BARRIOS OCHOA, SECRETARIO.

85396 — 21-28 Jul. 04 Ago./2003

EDICTO DE REMATE

Este Juzgado señaló audiencia de remate para el día TREINTA DE JULIO DEL AÑO DOS MIL TRES A LAS DIEZ HORAS, para la venta en pública subasta del bien inmueble hipotecado identificado con el número dieciséis mil seiscientos treinta y tres folio doscientos treinta y cinco del libro trescientos siete de Chimaltenango, consistente en Terreno llamado Granjas del Trigal, ubicado en la aldea Xenimajuyú, del municipio de Tecpán Guatemala, Departamento Chimaltenango que mide mil setecientos cuarenta metros cuadrados y linda: Nor-poniente con granja quince, calle de por medio; Nor-oriente con Granja uno; Sur-poniente con granja nueve; y Sur-oriente con granja dos. ANOTACIONES: Letra "A" por el Juez Tercero de Paz del Ramo Civil dentro del juicio Ejecutivo en la Vía de Apremio número trescientos veintisiete guión noventa y siete a cargo del oficial y notificador segundo. GRAVAMENES HIPOTECARIOS: Unicamente el que motiva la presente ejecución promovido por AUGUSTO SALVADOR TORIELLO SARAVIA Y LUIS FELIPE MARTINEZ MARROQUIN para obtener la cantidad de CUATRO MIL VEINTITRES QUETZALES CON SESENTA Y UN CENTAVOS más intereses y costas procesales, aceptándose posturas que cubran el capital reclamado más intereses y costas procesales. Para los efectos legales se hace la presente publicación en la ciudad de Guatemala, cuatro de julio del año dos mil tres. E.V.A 327-97 Not.2o. LICENCIADA: BRENDA MARIBEL MONROY LOYO DE ALVIZUREZ. SECRETARIA DEL JUZGADO TERCERO DE PAZ DEL RAMO CIVIL.

85399 — 15-22-28 Jul./2003

EDICTO DE REMATE

EJECUCION NUMERO: C2-2003-66. OFICIAL 1º. Este juzgado señaló la AUDIENCIA del día SEIS DE AGOSTO DEL AÑO DOS MIL TRES A LAS DIEZ HORAS, para la VENTA EN PUBLICA SUBASTA del bien inmueble inscrito en el Registro de la Propiedad bajo el número: SEIS MIL OCHOCIENTOS CUARENTA Y SIETE. Folio: TRESCIENTOS CUARENTA Y SIETE del Libro SETENTA Y CUATRO "E" DE GUATEMALA, que consiste en finca urbana, lote uno, sector veintitrés Lotificación Villas del Amanecer Dos, ubicada en el Municipio de Villa Nueva departamento de Guatemala de noventa punto cero cero metros cuadrados, Medidas y Colindancias NORTE: Seis punto cero cero metros con lote catorce, Sector veintidós; SUR: Seis punto cero cero metros con doce calle; ESTE: Quince punto cero cero metros con Lote Dos; OESTE: Quince punto cero cero metros con finca matriz. Inscripción Número Tres: Relativa a la modificación de la inscripción número uno de dominio de esta finca, en el sentido siguiente que el lindero norte de seis punto cero cero metros colinda con doce calle, el lindero sur de seis punto cero cero metros colinda con finca matriz, el lindero este de quince punto cero cero metros colinda con lote diez y el lindero oeste de quince punto cero cero metros colinda con finca matriz. Número Cuatro: La ejecutada es dueña de esta finca. HIPOTECA VIGENTE: Número Uno: la ejecutada constituye hipoteca cedularia sobre esta finca, actúa como administradora de dicha cédula la entidad ejecutante. Al bien inmueble antes descrito no le aparecen más anotaciones, gravámenes ni limitaciones que los descritos y la hipoteca que motiva la presente ejecución de conformidad con la certificación registral acompañada al presente proceso promovido por PRIMER BANCO DE AHORRO Y PRESTAMO PARA LA VIVIENDA FAMILIAR -VIVIBANCO-, SOCIEDAD ANONIMA a través de su representante legal respectivo, para lograr el pago de CINCUENTA Y CINCO MIL OCHOCIENTOS VEINTE QUETZALES CON SEIS CENTAVOS más intereses y costas procesales. Para los efectos de ley se hace la presente publicación. Ciudad de Guatemala, el día once de julio del año dos mil tres. CARLOS FERNANDO DE LA CRUZ RODRIGUEZ. SECRETARIO del Juzgado Tercero de Primera Instancia del Ramo Civil.

85413 — 21-28 Jul. 04 Ago./2003

EDICTO DE REMATE

Este Juzgado señaló audiencia, día 26 Agosto del 2003, nueve horas para la venta en pública subasta de la finca rústica número 56.949, folio 149 del libro 155 del Departamento de Retalhuleu, terreno ubicado Municipio de Retalhuleu, consta de ciento cincuenta punto metros cuadrados, se desmembró de la finca No. 46,105, folio 205 libro 119 del mismo departamento y linda: al Norte: 8 metros Lote 6-P. al Sur: 8 metros lote 7.0. al Oriente: 18.75 metros lote 18.0. al Poniente 18.75 lote 16-0. Ejecución Vía de Apremio promueve contra su propietario Alicia Villela González. Gravámenes cinco más a favor de la ejecutante. Tome como base capital mutuado de SEIS MIL QUETZALES, más intereses y costas procesales.- Se cita a personas interesadas en la subasta. Secretaría del Juzgado de Paz. Retalhuleu. Retalhuleu, 21 de Julio del 2003. Gustavo Adolfo Maldonado de León. Secretario.-

85590 — 28 Jul. 04-11 Agos./2003

EDICTO DE REMATE

Juicio v. Apremio No. 66-03. Contra JUAN BOCEL BOCEL. REMATE ESTE JUZGADO SEÑALO AUDIENCIA REMATE EN PUBLICA SUBASTA, DIECIOCHO AGOSTO DOS MIL TRES, NUEVE HORAS PARA VENTA INMUEBLE: UBICADO BARRIO SAN ANTONIO ESTA CIUDAD SOLOLA, AREA TRES CUARTAS PARTES DE UNA CUERDA TREINTA Y DOS VARAS POR LADO SIN CONSTRUCCION, MIDE Y COLINDA: *NORTE: TREINTA Y SEIS VARAS CON MARIA CECILIA BEN; AL SUR: CUARENTA Y SIETE VARAS, TRES PULGADAS CON DOMINGA Y CELSO POZ; AL ORIENTE: VEINTIOCHO VARAS CON GRANJA CARMELITAS, CERCO POR MEDIO, LINEA RECTA; AL PONIENTE: DIECISIETE VARAS CON DIECIOCHO PULGADAS CON AQUILINO POZ; MOJONES MATAS DE IZOTE. BASE PARA EL REMATE CAPITAL OCHO MIL SETECIENTOS QUETZALES EXACTOS, INTERESES Y COSTAS PROCESALES. NO CONSTA EN AUTOS QUE DICHO BIEN TENGA OTROS GRAVAMENES. Secretaría del Juzgado de Paz de Sololá, NUEVE DE JULIO DE DOS MIL TRES.- RAYMUNDO MANOLO ORDOÑEZ CABRERA.- SECRETARIO.*

85626 — 28 Jul. 04-11 Agos./2003

AVISO PUBLICO

ORTITLAN LIMITADA
Y
EL MINISTERIO DE AMBIENTE Y RECURSOS NATURALES, -MARN-

Por este medio hacen el conocimiento que el Informe del Estudio de Evaluación de Impacto Ambiental del proyecto de: **"INSTALACION Y OPERACION DE LA PLANTA GEOTERMICA ORTITLAN, UBICADA EN EL CAMPO GEOTERMICO AMATITLAN, MUNICIPIO DE SAN VICENTE PACAYA, DEPARTAMENTO ESCUINTLA, GUATEMALA"** se encuentra a disposición del público en general para consultas durante veinte días hábiles, después de esta publicación, en horario de 9:30 a 12:30 horas, en:

MINISTERIO DE AMBIENTE Y RECURSOS HUMANOS NATURALES
DIRECCION DE GESTION AMBIENTAL Y RECURSOS NATURALES

10a. Calle 6-81zona 1
Edificio 7 y 10, 6to. Nivel
Teléfonos 222 0301 al 7 y 220 4456

Los comentarios sobre el Estudio deberán ser entregados en forma escrita a la Dirección de Gestión Ambiental y Recursos Naturales a más tardar una semana después de los veinte días hábiles indicados en esta publicación..

Guatemala, 28 de julio de 2003

85715

- - - - -