CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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SECTION A. General description of project activity

A.1 Title of the project activity:

>> Rio Hondo II Hydroelectric Project

A.2. Description of the project activity:

>> The objective of the Rio Hondo II Hydroelectric Project is to provide clean and reliable renewable energy to Guatemala while addressing a variety of high priority local, national and international interests. The Project is a 32 MW hydroelectric generating facility located in the Zacapa region of Guatemala. Guatemala is currently experiencing rapid economic growth with projections that healthy growth in energy consumption will continue over the next several decades. The government of Guatemala has clearly acknowledged the need for reliable power generation and distribution systems to support this economic growth.

The Project is expected to generate an average 130 GWh of energy per year and 32 MW of firm capacity. The Project will provide power to the Guatemalan Wholesale Electricity Market over a Project life of 50+ years. The Project consists of a concrete gravity dam, a small reservoir, a diversion tunnel, penstock, powerhouse, and provisions for downstream flow re-regulation. Auxiliary components include an access road, a step-up sub-station and upgrade of an existing transmission line and substation.

The Project is a rehabilitation and expansion of the Rio Hondo I Project. Rio Hondo I was owned and operated from 1960 to 1998 by the Instituto Nacional de Electrificacion (INDE), Guatemala's national utility. In 1998 Rio Hondo I was damaged beyond repair by Hurricane Mitch. Upon closure of the facility, INDE chose not to rebuild the plant but instead to bid out the rights to own and operate the facility, including water rights and the transmission line right of way. In 2001, the Project Company entered the competitive bidding process and successfully obtained the rights to develop the Project.

The project developers have made a commitment to provide support and cooperation for local programs and projects that are needed by the community of Rio Hondo and the surrounding areas. Programs and facilities that are initially created will be supported with an annual contribution of up to 2% of net income from the Project. The Project expects to create approximately 400 local jobs during construction, and 100 long-term jobs (40 long-term jobs associated with the operation and maintenance of the Project, and 60 long-term jobs associated with reforestation and watershed protection).

A substantial effort has been devoted to understanding the environmental aspects of the Project and assuring that environmental issues have been addressed and programmed to be mitigated as appropriate. All such efforts indicate that the Project is environmentally sound and poses no adverse threat to its surroundings or inhabitants. The Project's Environmental Impact Statement (EIS) has been completed and approval has been received from the National Environmental Commission (CONAMA).

The Project is located in the area of the Sierra de las Minas Biosphere Reserve and Protected Area which was created by legislative decree and is managed by the Fundacion Defensores de la Naturaleza (Defensores). The Project Company has worked closely with the Defensores in all aspects of environmental review and consideration for the Project. Defensores fully supports the Project as a very positive proposal that does not adversely affect the environment and will provide several important environmental benefits. The Project Company and Defensores signed an Agreement committing to cooperation and joint action to develop specific work plans for the conservation of bio-diversity and sustainable development, as well as an Environmental Guarantees Contract with the National Council for Protected Areas (CONAP).

A.3. Project participants:

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A.4. Technical description of the project activity:

>> The Project will develop a gross generating head of 1070 meters. At a rated capacity of 3.95 cms, the Project will have an installed capacity of 32 MW. Average annual energy is estimated at 130 GWh. The Project includes a small reservoir, dam and spillway, power intake, power tunnel, penstock, powerhouse, provisions for re-regulating downstream flow, transmission line, and improvements to INDE's Panaluya substation. The Project will also involve improvements to access roads in the area as needed to support construction activities, long-term operations and maintenance activities.

A concrete gravity dam was selected since it maximizes the use of materials available locally and reduces the complexity of the construction works at the site. The structure will have a spillway crest level at elevation 1328 meters. The height of the dam abutments has been set at elevation 1334 meters. The selected dam levels will allow for the inflow Design Flood of 50% of Probable Maximum Flood (PMF) to be discharged over the free over-flow spillway, with a freeboard of at least 1.0 meters.

The water conveyance system includes the power intake structure, tunnel, and penstock. The water conveyance system will be designed for the rated power station flow of 3.95 cms. The penstock has an approximate length of 3140 meters from the end of the power tunnel to the powerhouse. The conduit diameter will vary from 1.07 meters at the upstream end to 1.00 meters at the downstream end upstream from the bifurcation to the unit inlet piping.

The powerhouse will be located on the right bank of the river in the same general location as the Rio Hondo I powerhouse. The plant will have a rated generating capacity of 32 MW with the reservoir at the low supply level of 1315 m elevation. Two horizontal axis, twin-jet Pelton turbines will be installed. The Project includes 4 km of single circuit 69 kV transmission line from the plant to the Panaluya Substation.

Main Project Characteristics:

Installed Capacity -	32MW
Generation-	130 GWh
Head -	1070 meters
Number of units -	Two horizontal, twin-jet Pelton turbines with rated capacity of HP 21,500 each
Powerline -	69 kV

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>> Guatemala

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

>> Department of Zacapa

A.4.1.3. City/Town/Community etc:

>> Municipality of Rio Hondo

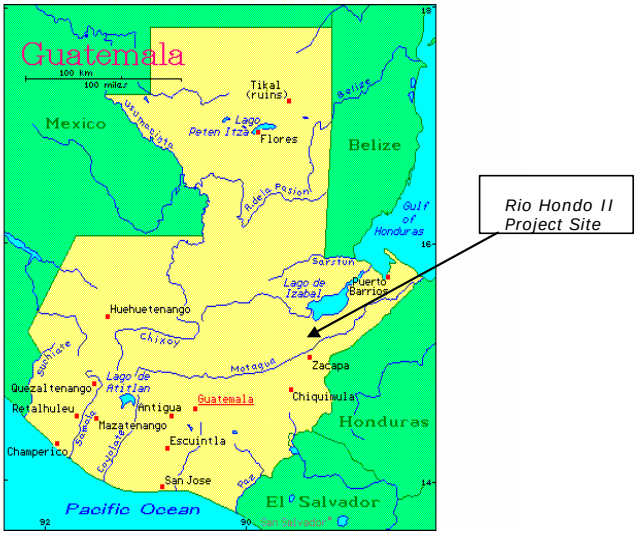
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

>> The Rio Hondo II Project is located approximately 140 km east of Guatemala City in the Zacapa region of Guatemala. The site is located in the Sierra de las Minas mountain range in the sub-basin of the Rio Colorado. The diversion dam for the Project will be located on the Rio Colorado at the confluence of the Quebrada La Virgen and the Rio Colorado at elevation 1295 masl. The powerhouse is located at elevation 260 masl near the confluence of the Rio Colorado and Rio Lima, approximately 2.8 kilometers from the dam. The transmission line extends 4 kilometers from the powerhouse to the Panaluya substation.

Coordinates of the site:

Dam: Longitude 89º 37' 20'' W
Latitude 15º 5' 20'' N

Power House: Longitude 89º 36' 7'' W
Latitude 15º 4' 7'' N



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

>> Grid-connected electricity generation from renewable energy sources

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

>> The turbines required have been specified and quotations have been received. There will be two horizontal axis, twin-jet Pelton turbines. This technology is widely used throughout the world with many manufacturers available and many years of experience in their operation.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

>> The proposed activity will displace existing and future thermal generation facilities in the Guatemalan national electricity grid that use diesel as fuel. Under the business as usual scenario there would be continuing growth in thermal-based electricity generation capacity using various fossil fuels.

Over the past several years, the Government of Guatemala has strived to attract energy investment. While investment in thermal generation has benefited from the 1996 passage of the Guatemalan Energy Law, investment in non-thermal or renewable energy projects such as hydropower has been more difficult. In fact, Guatemala's energy mix has seen a substantial increase in thermal generation, and in the last few years the market has grown from less than 40% to over 55% thermal generation.

Applying the methodology described in section B, the total estimated amount of anticipated reductions over a 21 year crediting period is 2,140,488 tons of CO_2 equivalent. The annual average for full operation is 101,928 CO2e tons per year. This is based on a conservative estimate of 130 GWh of average annual generation. For details, please refer to Section E.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

>> 2,140,488 tons of CO_2 equivalent over 21 year crediting period

A.4.5. Public funding of the project activity:

>> This project has not received and is not seeking public funding.

SECTION B. Application of a baseline methodology

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

>> Approved baseline methodology AM0005 - "Baseline methodology (barrier analysis, baseline scenario development and baseline emission factor, using combined margin) for small grid-connected zero-emissions renewable electricity generation"

The selected approach from paragraph 48 of the CDM modalities and procedures is "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment".

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

>> The chosen methodology sets a series of applicability criteria that the proposed project activity must meet. A description of these eligibility criteria and an explanation of how the proposed project activity meets these criteria follows:

A. There is sufficient publicly available information to document in a transparent and conservative manner the nature of the prohibitive barriers to which the proposed project activity is subject, and the nature of the means by which its registration as a CDM activity would enable the project to overcome those barriers (and thus be successfully undertaken).

There is sufficient publicly available information to document the nature of the prohibitive barriers that the proposed project activity faces. The primary source for this information is the Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)), the Ministry of Energy and Mines, and documents in Rio Hondo's possession. A discussion of the prohibitive barriers to which the proposed project activity faces, and the nature of the means by which its registration as a CDM activity would enable the Project to overcome those barriers is provided in section B.3.

B. There is sufficient publicly available information to document in a transparent and conservative manner that the proposed project is occurring in a sector and investment context that does not feature the proposed activity as a common practice.

The Rio Hondo II Project is the first and currently only merchant financed hydro project in Guatemala. Lenders providing financing to the Rio Hondo II Project face risk above and beyond traditional renewable energy finance risk due to the merchant market. This is because the deregulated electricity market in Guatemala subjects generation assets to a "pool pricing" concept. As a result of this added merchant risk, as well as a lack of standardized contracts, inexperience of lenders in this market, and increase in thermal capacity over the last thirty years, this type of project activity cannot be considered common practice.

C. The project will provide electricity to the electric grid, displacing power that would otherwise be provided by other generating sources through the operation and expansion of the electric sector. The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

Rio Hondo will supply electricity to the grid, which is the national grid for Guatemala. The system boundaries are the national grid, taking electricity exports into account. Source of data on the grid is the Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)).

D. The project is in an electricity sector that is not dominated by generating sources with zero- or low-operating costs such as hydro, geothermal, wind, solar, nuclear and low-cost biomass and this fuel mix is expected to persist for the duration of the crediting period.

The Guatemalan electricity sector consists of a combination of various thermal power plants and various renewable energy sources, and is not dominated by zero- or low operating cost plants. Thermal power plants (bunker oil, diesel and coal) produced 63.85% of the electricity and renewable sources (hydro, geothermal, biomass) produced 36.15% in 2003 (source: AMM, 2003). No significant changes in the energy mix are expected.

E. *Electricity exports are included in electricity generation data used for calculating and monitoring the baseline emission factor to avoid potential leakage.*

Electricity exports are included, see B.2.

F. *Applies only to small electricity capacity additions, i.e., less than or equal to 60MW and using a 50:50 default weighting of the build and operating margins.*

The Rio Hondo II Project is a 32 MW hydro plant, and therefore it meets this criterion. The 50:50 default weighting is used, see B.2.

B.2. Description of how the methodology is applied in the context of the project activity:

>> AM0005 describes a baseline scenario that captures the proposed project's impacts, which are dispersed throughout the electric sector's ongoing operation and expansion. The first impact is on the operating margin (affecting the operation of power plants on the grid). The second impact is on the build margin (delaying or avoiding the construction of future power plants).

According to the AM0005 methodology, the process for considering these two aspects of the baseline scenario and estimating the emission factor of the displaced electricity is as follows. Firstly, the system operating margin is approximated by the entire electric generation mix, excluding sources with zero or low operating costs on the grounds that the operation of these plants would be essentially unaffected by the additional generation from the proposed project. Such generating sources include hydro, geothermal, wind, solar, nuclear, and low-cost biomass. The impact of the additional generation from the Project is assumed to be shared across the rest of the sector's generation sources in proportion to their generation. Given this assumption regarding the operating margin, the baseline operating margin emission factor (*OM*) is approximated as the generation-weighted average emission factor for the sector (excluding the mentioned sources).

Table 1 presents the generating facilities on the Guatemalan grid that are included in the OM calculation.

Table 1. Plants considered for the Operating Margin

Name	Technology	Fuel Type	GWh
Electrogeneracion	IC Motor	bunker	3.9
Amatex	IC Motor	bunker	14.8
Arizona	IC Motor	bunker	561.4
La Esperanza	IC Motor	bunker	740.0
Genor	IC Motor	bunker	156.3
Las Palmas	IC Motor	bunker	460.9
Lagotex	IC Motor	bunker	102.1
Sidegua	IC Motor	bunker	86.9
Generadora Progresso	IC Motor	bunker	33.7
PQPC	IC Motor	bunker	444.8
GGG Stewart + Stevenson	Gas Turbine	diesel	12.8
GGG Gas 4	Gas Turbine	diesel	16.0
Esc. Gas 5	Gas Turbine	diesel	6.4
GGG Gas 2	Gas Turbine	diesel	22.5
Esc. Vapor 2	steam turbine	bunker	0.1
Esc. Gas 3	Gas Turbine	diesel	9.2
Esc. Gas 4	Gas Turbine	diesel	0.0
Esc. Gas 2	Gas Turbine	diesel	0.0
GGG Gas 1	Gas Turbine	diesel	2.7
Esc. Vapor 4	steam turbine	bunker	0.0
Esc. Vapor 3	steam turbine	bunker	2.8
San Jose	steam turbine	coal	892.1

Source: AMM, 2003

-	Annual Generation	Average Plant Efficiency*	Actual Fuel Consumption	IPCC 1996 Inventory Workbook Carbon Content	Emissions	CEF
	GWh/yr	%	TJ/year	tC/TJ	tCO2/yr	t CO2/MWh
	(GEN)	(PE)	(F)	(COEF)	(TEM)	(EF_OM)
Bunker - Internal Combustion	2,607.68	30%	31,292.15	21.1	2,420,969.18	
Diesel - Gas Turbine	69.74	25%	1,004.28	20.2	74,384.03	
Coal - steam turbine	892.06	35%	9,175.52	25.8	868,003.76	
Total (TGEN)	**3,569.49**				**3,363,356.97**	**0.942**

OM EF = 0.942 t CO2/MWh

The build margin is approximated by a mix of plants that reasonably represents recent trends in electric sector expansion. The methodology specifies two options for the build margin mix: the five power plants most recently commissioned or the most recently built 20% of the system generating sources.

Since the first option leads to a mix of plants that only represents 9.5% of the total generating capacity, the second option of the most recently built 20% is chosen here for the build margin calculation.

The build margin emissions (*BM*) rate is approximated as the weighted average emission factor for the identified mix of recent plants. Table 2 shows the plants included in the build margin for Guatemala.

Table 2. Plants considered for the Build Margin

Name	Technology	Fuel Type	GWh	Cum Gen	% of capacity
El Canada	hydro	RE	13.0	**13.02**	**0.2**
Electrogeneracion	IC Motor	bunker	3.9	**16.91**	**0.3**
Amatex	IC Motor	bunker	14.8	**31.70**	**0.5**
Arizona	IC Motor	bunker	561.4	**593.1**	**9.1**
Calderas	geothermal	RE	32.7	**625.8**	**9.6**
Matanzas	hydro	RE	62.4	**688.2**	**10.5**
San Isidro	hydro	RE	0.7	**688.9**	**10.5**
Las Vacas	hydro	RE	79.9	**768.8**	**11.8**
Pasabien	hydro	RE	42.8	**811.7**	**12.4**
Poza Verde	hydro	RE	36.3	**848.0**	**13.0**
La Esperanza	IC Motor	bunker	740.0	**1588.0**	**24.3**

Source: AMM, 2003

-	Annual Generation GWh/yr (GEN)	Average Efficiency* % (PE)	Actual Fuel Consumption TJ/year (F)	IPCC 1996 Inventory Workbook Carbon Content tC/TJ (COEF)	Emissions tCO2/yr (TEM)	CEF t CO2/MWh (EF_BM)
Bunker - Internal Combustion	1,034.65	30%	12,415.79	21.1	960,568.50	
RE	271.81	N/A	-	0	-	
Total	**1,306.46**				**960,568.50**	**0.735**

BM EF = 0.827 t CO2/MWh

The relative weighting of the operating margin emission factor ($?_{OM}$) and the build margin emission factor ($?_{BM}$) will depend on the characteristics of the electricity sector. The AM005 methodology proposed a default weighting of ½ *EF_OM* and ½ *EF_BM*, and actually requires it in the applicability criteria. The default weighting of 50:50 is used in the calculations here.

Weighted EF, excluding exports= 0.884 t CO2/MWh

AM0005 specifies that if the grid imports or exports electricity from/to other grids, a correction is needed unless the correction is negligible. The following formula is provided for the correction:

$$EF_y \rightarrow EF_y + (EL^{in}{}_y)/(TGEN_y) * EF^{in}{}_y - (EL^{out}{}_y)/(TGEN_y) * EF^{out}{}_y$$

where EL^{in} and EL^{out} are electricity coming in and going out of the grid (and *EF* their associate emission factors); and $TGEN_y$ is the electricity generated in the grid. The arrow means replacement of the EF_y by the right-hand-side of the above formula.

The electricity imports are insignificant for Guatemala; only 30 GWh was imported in 2003, out of a total production 6545 GWH. The effect on the calculation of the CEF for Guatemala is less than 0.5%.

Grid exports are larger; 427 GWh were exported in 2003. This leakage factor is taken into account according to the formula provided, and the CEF is reduced to:

Input data:		
CEF	0.839	t CO2/MWh
EL (in)	30	GWh
TGEN	6549	GWh
EF (in)	unknown	t CO2/MWh
EL (out)	427	GWH
EF (out)	0.839	t CO2/MWh

Adjustments:		
Using a low EF (in) (0,001)	0.784	t CO2/MWh
Using a high EF (in) (0,999)	0.789	t CO2/MWh
Max range of impact on CEF	0.005	t CO2/MWh
In %	**0.55%**	
Import is therefore negligible.		

Output:		
Combined Margin CEF corrected for export:	**0.784**	**= 0,588-(427/6545)*0,588**

B.3. 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:

>> Approved baseline methodology AM0005 seeks to establish that barriers would have prevented the project from being undertaken or completed (Step 1-A), and to demonstrate that by registering the project as a CDM activity these barriers would be alleviated and the project enabled (Step 1-B). Being a registered CDM project has both financial and institutional benefits that affect the viability of the Project.

This methodology ensures additionality and identifies the baseline scenario by using the following steps:

Step 1. Analyse prohibitive barriers to the proposed project

Step 1-a. Identify the relevant barriers to the proposed project activity.

The primary barrier to the implementation of hydro projects such as Rio Hondo II is the difficulty in procuring financing. Several factors relevant to the Rio Hondo II Project contribute to this difficulty.

- *Access to financing in Guatemala*: The domestic financial market in Guatemala has been characterized by high interest rates[1] and short loan terms over the course of the time that the Rio Hondo II Project has been under development. This has forced the project developers to look to international financial markets, which offer more attractive rates and longer terms, but are correspondingly more difficult to access. For example, the project developers have worked to secure financing through the Overseas Private Investment Corporation (OPIC). Carbon credits were considered when OPIC made its decision to invest in the Project. One reason that it is difficult to access financing is that prospective financiers look for reliable, creditworthy, and firm sources of revenue for the Project. The Rio Hondo II Project relies on selling electricity through the wholesale energy market and does not have a negotiated power purchase agreement with a creditworthy off-taker.

- *Perceived technology risk in hydro*: The Rio Hondo II Project is not based on conventional fossil technology, which immediately raises the level of perceived risk by prospective financers and consumers. The Guatemalan electric sector does not have a large amount of hydro (approximately 30% of the capacity of the Guatemalan electric sector). Moreover, the fact that the last dam was wiped out by Hurricane Mitch increases project risk. In fact, there was only one other company that bid for the Rio Hondo II project. Finally, the Rio Hondo II Project is the first and only merchant financed hydro project in Guatemala and the first to not have a long-term power purchase agreement (PPA). Since the 1996 reform of the Guatemalan electricity law, it is no longer possible for projects to get a long-term PPA. Without such a PPA it is much more difficult to obtain project financing.

- *Transaction costs for small projects:* As a relatively small facility with a maximum output of 32 MW, Rio Hondo II faces the barrier of project development costs and transaction costs for financing that are disproportionately high, as is often the case for low-capacity renewables opportunities. Furthermore, since hydro projects are typically new to municipalities and local governments, the permitting process is often unclear which can lead to increased transaction costs.

Securing financing has been an ongoing obstacle throughout the development of the Rio Hondo II Project. The project developers began to advance this project concept in 1995, and have shown a commitment to its completion and full confidence in its viability; however, the difficulty in securing project financing remains a significant barrier and the Project still has not reached financial closure. The path to secure financing has been long and complex, with several intermediate decision points where the Project could have been deemed unbankable and terminated.

[1] World Trade Organization: *Trade Policy Review*, 2002

It is now expected that the registration of the Rio Hondo II Project as a CDM activity and final negotiation of an emissions reduction purchase agreement will make it possible for the developer to secure financing and allow the Project to proceed. The project developer began exploring marketing of the Project's CO_2e reductions early in the development cycle, and has determined that this is an essential component of the Project's financial package (see Step 1-b). The World Bank and other buyers have expressed interest in purchasing the emissions reductions generated from the Rio Hondo II Project.

Furthermore, the projected CDM revenue will allow the project developers to implement environmental and other regional sustainable development activities, which are necessary to receive the permits and final approvals. As part of the socioeconomic and environmental aspects of the Project, programs must be developed to support general education needs, infrastructure, and environmental education in the local area. Additionally, the project company has developed a reforestation program that will recuperate large extensions in the sustainable buffer zone areas. These activities are integral to the project's success, however would be very difficult to support and implement without CDM revenue as traditional banks will not support these programs. Therefore, the Project would not go forward without this projected CDM revenue.

Step 1-b. Explain how only the approval and registration of the proposed project as a CDM activity would enable the project to overcome the identified barriers and thus be undertaken.

The revenues from the sale of carbon credits from the CDM have been considered as an integral part of the financial package of the Rio Hondo II Project from the conception of the project. Indeed, all business plans include revenues from CERs in the projected cash flows.

The Rio Hondo II Project is the first merchant financed project in Guatemala, and the Project can thus only be implemented if sufficient dividends can be paid to investors. The fact that the revenues from the Rio Hondo II Project are not based on a PPA but on market prices implies that risks exist related to the revenues. An Emission Reduction Purchase Agreement for the sales of the emission reductions from the Project will mitigate this revenue risk. Based on the estimate of emission reductions generated by the Project, the carbon credits can contribute up to 4-5% of gross revenues. The carbon revenues can thus serve as longer term revenue and will help convince lenders to finance the Project.

The development of this project as a CDM project will enable the project company to sell emission reduction credits and generate revenue that would increase the returns to a level that is acceptable to investors. The sale of CERs increases the estimated project Internal Rate of Return (IRR) from 9.3% to 11.2%.

Moreover, the prospect of registering the Rio Hondo II Project as a CDM activity has helped to mitigate risk and establish the credibility and creditworthiness of the developer in the view of prospective financers. A wide range of prospective financers have been approached, many of whom were immediately deterred by the perceived level of risk. Perceived risks primarily include the technological risk of hydro, financial risk of a merchant financed project in Guatemala without a power purchase agreement, and sovereign risk associated with investments in Guatemala. The inclusion of revenue from emissions reductions from the registration of the project as a CDM project activity is anticipated to make the risk and financial barriers surmountable.

Step 2. Analyse other activities similar to the proposed project

In order to test whether a credible claim can be made that there are real prohibitive barriers to private development of a project such as Rio Hondo II, it is necessary to investigate the current state of private sector hydroelectric activity in Guatemala. Despite the barriers for hydropower in Guatemala, several hydropower plants have been developed in the past few years or are under development, including: the Pasabien, Poza Verde, Matanzas, San Isidro, (with long term PPAs received prior to 1996 or short-term PPAs with penalties) and El Canada and Las Vacas (with PPAs with COMECSA, the country's largest distribution company) plants (see table 3). There are, however large differences in the barriers that these projects faced and the barriers that Rio Hondo II faces.

Table 3. Hydropower plants recently developed or currently under development

Name	Technology	Fuel Type	GWh	MW Installed	Effective MW	Year Online
El Canada	hydro	RE	13.0	41.6	40	Nov-03
Matanzas	hydro	RE	62.4	12	12	Jul-02
San Isidro	hydro	RE	0.7	3.5	3.4	Jul-02
Las Vacas	hydro	RE	79.9	40	38	May-02
Pasabien	hydro	RE	42.8	12	12	Jun-00
Poza Verde	hydro	RE	36.3	8.1	8	May-00

The barriers Rio Hondo faces that these other projects did not face can be primarily grouped into two categories:

First, The Rio Hondo II Project is the first merchant financed hydro project in Guatemala and the first project not to have a Power Purchase Agreement (PPA). A PPA with distribution companies can only be based on open bids and since the implementation of the Electric Power Act of 1996 there have been no open bids for PPAs. The fact that Rio Hondo II cannot obtain a long term PPA poses difficulties in obtaining financing that are specific to the Rio Hondo II Project. Financial institutions would require guarantees on revenues and Rio Hondo II cannot give the same guarantees as a project with a long term PPA.

Second, the Rio Hondo II Project is the only hydro project in Guatemala that will not be completely built on land that is owned by the developer. The land where the powerhouse will be built was obtained through a public concession and maintained by paying a yearly lease to INDE. This means the project faces barriers and risks in obtaining the necessary permits for construction, operation and financing of the project that the other recently developed hydro projects did not face. The land cannot be purchased at this time.

In summary, these barriers further support the claim that there are significant barriers facing this project that were not faced by other similar projects that were recently developed or currently under development in Guatemala.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>> The project boundary is defined as the notional margin around a project within which the project's impact (in terms of carbon emission reductions) will be assessed. As referred to in the AM0005 methodology for "small grid-connected zero-emissions renewable electricity generation" project activities, the baseline boundaries have to be assessed from three points of view: geographic boundary, system boundary and time boundary.

- *Geographic boundary*: This refers to the geographical site where power expansion facilities could be located and would compete with the proposed project. The geographic boundaries for the calculation are the national borders of Guatemala, imports and exports are considered in a separate step.
- *System boundary*: Guatemala has an interconnected power system, which covers most of the country. Guatemala is also small enough so that the Project may have an effect on power generated anywhere else in Guatemala. The system boundaries are therefore the Guatemalan NIS.
- *Time boundary*: The planning and construction of new power plants involves multi-year projections. With appropriate provisions for monitoring of relevant developments and updating of the baseline scenario in connection with the renewal of the crediting period – as provided for in the Monitoring Plan for this Project – the time boundary, and thus the validity of the baseline scenario, extends to the end of the 21 year crediting period.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity(ies) determining the baseline:

>> The baseline study was completed on the 15th of November, 2004, and was prepared by:

EcoSecurities Ltd., 15 West 26th Street, 12th Floor, New York, NY 10010. Tel: +1-646-202-9899 (contact: Annika Lundgren Colston, annika@ecosecurities.com, or Eron Bloomgarden, eron@ecosecurities.com).

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:

>> 01/02/05 (mm/dd/yy)

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

>> 50y – 0m

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

C.2.1. Renewable crediting period

The project activity will use a renewable crediting period of seven years.

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

>> 01/02/08 (mm/dd/yy)

C.2.1.2. Length of the first crediting period:

>> 7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> not applicable

C.2.2.2. Length:

>> not applicable

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>> The AM0005 approved monitoring methodology is applied.

Title: "Methodology for ex post monitoring of electricity generation from the project and its impacts on emissions from the operation and expansion of the electric sector".

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

>> The AM0005 is appropriate for the proposed Rio Hondo II Project. This monitoring methodology is used in conjunction with the AM0005 baseline methodology "(barrier analysis, baseline scenario development and baseline emission rate, using combined margin) for small grid-connected zero emissions renewable electricity generation", which has also been applied to the proposed Rio Hondo II Project (see also section B above). Moreover, the grid to which the Rio Hondo II Project will be connected can be clearly identified, the grid is not dominated by zero or low-operating cost generating sources (less than 50% in Guatemala) and the Rio Hondo II Project is small compared to the total additions to the grid in the Build Margin (less than 10% of the Build Margin and 2% of the total grid).

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

>> Being a hydropower project, no emissions from the project activity were identified. Therefore, the table below does not have to be filled out.

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> As hydro power does not result in any emissions, this is not applicable. See also Section E. 3.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1. RH_y	Electricity supplied to the grid by the Rio Hondo II Project	Project participants	MWh	M	Yearly	100%	Electronic and paper	Electricity supplied by the Rio Hondo II Project to the grid. Double check by receipts of sales. Data will be kept during the total of the Crediting period plus 2 years
2. EF_y	GHG Emission Factor of the Grid	AMM, default values from IPCC for Carbon Content and plant efficiency factors from AMM from validated PDD for Candelaria	T CO_2/ MWh	C	Yearly	100%	electronic	Calculated as the weighted sum of emission factors of OM and BM
3. EF_OM_y	GHG Emission Factor of the Grid (Operating Margin)	AMM, default values from IPCC for Carbon Content and plant efficiency factors from AMM from validated PDD for Candelaria	T CO_2/ MWh	C	Yearly	100%	electronic	Calculated as TEM_y divided by $TGEN_y$

4. EF_BM_y	GHG Emission Factor of the Grid (Build Margin)	AMM, default values from IPCC for Carbon Content and plant efficiency factors from AMM from validated PDD for Candelaria	T CO_2/ MWh	C	Yearly	100%	electronic	Calculated as ? $F_{i,j}$ *$COEF_i$ / $GEN_{j,i}$ for plants included in the BM defined in baseline methodology.
5. TGENy	Total electricity generation of the grid excluding zero- or low-operating cost sources	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM))	MWh/yr	C	Yearly	100%	Electronic and paper	Data will be kept during the total of the Crediting period plus 2 years. Calculated as the sum of electricity generated of the grid excluding zero- or low-operating cost sources
6. TEMy	Total GHG emissions of the grid.	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM))	T CO_2/yr	C	Yearly	100%	Electronic and paper	Data will be kept during the total of the Crediting period plus 2 years. Calculated as ? F_i * CC_i * (44/12)

7. $F_{i,y}$	Fuel Consumption	AMM and plant efficiency factors from AMM from validated PDD for Candelaria	TJ/year	C	Yearly	100%	Electronic	If possible, obtained from local statistics otherwise calculated as ($TGEN_{i,y}$ *TJ_{conv}) / PE_y where i is the amount per fuel type (diesel, bunker, coal).
8. $COEF_i$	GHG Emission coefficient of each fuel i	IPCC Default Values	T CO_2/ physical unit of Fuel (F_i)	C	Yearly	100%	Electronic	If possible, obtained from local statistics otherwise default IPCC values multiplied by (44/12) to convert from TC to TCO2 where i is the amount per fuel type (diesel, bunker, coal).
9. $GEN_{j,y}$	Electricity generation of Plant J in BM	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	MWh/yr	M	Yearly	100%	Electronic and paper	Obtained from latest local statistics. Data will be kept during the total of the Crediting period plus 2 years.
10.	Plant identification for OM	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	-	M	Yearly	100%	Electronic	OM does not include low cost / no cost plants

11.	Plant identification for BM	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	-	M	Yearly	100%	Electronic	BM is the most recent 20% of existing plants
12. w_{OM} and w_{BM}	Weight factor of (OM) BM	Methodology	-	M	Yearly or fixed	100%	Electronic	Default weight factor is 0.50 each.
13.	Documented Evidences				Once at the renewal of the crediting period	100%		Documented information related to the alternatives to the project. Especially diffusion data.
14.	Documented Evidences				Once at the renewal of the crediting period	100%		Documented information related to the alternatives to the project. Especially diffusion data.

15. EL^{in}_{y}	Electricity imported to the grid	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	kWh	C	Yearly	100%	Electronic	Obtained from latest local statistics. Data will be kept during the total of the Crediting period plus 2 years.
16. EL^{out}_{y}	Electricity exported from the grid	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	kWh	C	Yearly	100%	Electronic	Obtained from latest local statistics. Data will be kept during the total of the Crediting period plus 2 years.
17. EF^{in}_{y}	GHG emission factor of the imported electricity	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	kWh	C	Yearly	100%	Electronic	Data will be kept during the total of the Crediting period plus 2 years.

18. EF^{out}_y	GHG emission factor of the exported electricity	Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)	kWh	C	Yearly	100%	Electronic	Obtained from latest local statistics. Data will be kept during the total of the Crediting period plus 2 years.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The emission factor *EFy* of the grid is represented as a combination of the Operating Margin and the Build Margin. If we set the emission factor of associated method as *EF_OMy* and *EF_BMy*, the *EFy* is given by

$$EF_y = w_{OM} * EF\_OM_y + w_{BM} * EF\_BM_y$$

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

The Operating Margin emission factor *EF_OMy* is defined as the generation-weighted average emissions per electricity unit (tCO2 / MWh) of all generating sources serving the system, excluding zero- or low-operating cost power plants (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation), based on the latest year statistics data and are derived from the following equation:

$$EF\_OM_y = TEM_y / TGEN_y = [\sum_i F_{i,y} * COEF_i] / [\sum_j GEN_{j,y}]$$

Where *TEMy* and *TGENy* is the total GHG emissions and electricity generation supplied to the grid by the power plants connected to the grid excluding zero- or low-operating cost sources. *Fi,y* and *COEFi* are the fuel consumption and associated carbon coefficient of the fossil fuel *I* consumed in the grid. *GENj,y* is the electricity generation at the plant *j* connected to the grid excluding zero- or low-operating cost sources.

The Build Margin emission factor *EF_BMy* is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most recent 20% of the generating units built (summation is over such plants specified by *k*):

$$EF\_BM_y = [\sum_i F_{i,y} * COEF_i] / [\sum_k GEN_{k,y}]$$

as the default method. The summation over *i* and *k* is for the fuels and electricity generation of the plants mentioned above.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

>>
Not applicable, see D.2.1 above

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

As indicated in section B.4 the project boundary is defined as the project site and the electricity grid system to which the project is connected. The emissions associated with the import and export of electricity are included but calculated as part of the baseline emission reductions and variables for monitoring it are included in Section D.2.1.3. Also indirect emissions that potentially give rise to leakage, like emissions that result from project construction, transportation of materials and fuel and other up-stream activities have been excluded. This is because in the case of the proposed Rio Hondo II Project, the emissions related to construction and transportation of materials are thought to be comparable to the life cycle emissions that would result from the eventual construction and operation of alternative fossil fuel plants. This is also in line with the instructions for monitoring as presented in the approved monitoring methodology (AM0005).

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> Not applicable

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> The project targets only CO_2 emissions and will not claim any emission reductions from any of the other GHGs as identified in Annex A of the Kyoto Protocol. Therefore, in the formula below, only the CO_2 emissions are being calculated.

The Emission Reductions during a given year (ER_y) are calculated using the following formula:

$$ER_y = RH_y * EF_y$$

Where RH_y is the electricity supplied to the grid by the Project, EF_y is the GHG emission factor of the grid.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data (*Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D2.2.1.1	*Low*	*The electricity generated by the Project will be supplied to the grid. To ensure accuracy, a metering instrument will be installed. The metering system will comply with technical specifications for commercial metering. The metering requirements are defined by the Guatemalan Wholesale Market Administrator (Administrador del Mercado Mayorista (AMM)).*
D2.2.1.2	*Low*	*The GHG emission factor of the grid is based on data provided by AMM.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>> The operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects generated by the project activity is included in the detailed Monitoring Plan included as Annex 4.

D.5 Name of person/entity determining the monitoring methodology:

>> The monitoring methodology was completed on the 15th of November, 2004, and was prepared by:

EcoSecurities Ltd., 15 West 26th Street, 12th Floor, New York, NY 10010. Tel: +1-646-202-9899 (contact: Annika Lundgren Colston, annika@ecosecurities.com, or Eron Bloomgarden, eron@ecosecurities.com).

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>> The Project is a hydropower project; it does not give rise to direct GHG emissions. Therefore, no formulae for calculation of direct emissions are provided here.

E.2. Estimated leakage:

>> The Project gives rise to emissions only from the initial construction. There are no emissions arising from fuel handling (extraction, processing, and transport). Indirect emissions that potentially give rise to leakage, like emissions that result from project construction, transportation of materials and fuel and other up-stream activities have been excluded. As stated in Section D.2.3, the emissions related to construction and transportation of materials of the Rio Hondo II Project are thought to be comparable to the life cycle emissions that would result from the eventual construction and operation of alternative fossil fuel plants.

It is possible that the Project can generate methane emissions from construction and operation of a water reservoir if biomass is permanently submerged. The Project uses an existing dam and will not submerge biomass as part of the construction process. Therefore, emissions from methane are not considered.

This is also in line with the instructions for monitoring as presented in the approved monitoring methodology (AM0005). Therefore, no significant leakage from the above activities can be identified.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>> The sum is zero.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>> Baseline emissions are calculated by the following formula:

"The annual generation: (the project's annual electricity dispatched to the grid)
times (the CO_2 emissions rate of the estimated baseline)"

The outline of the method to calculate the ERs is as follows:

Determination of baseline emission rate
(tCO_2e /MWh)

⇩

Monitoring generation output from the Project
(MWh)

⇩

Calculation of ERs generated by the Project using the formula:
periodic annual electricity dispatched to the grid x baseline emission rate for this period
(tCO_2e)

The net annual generation is: 130,000 MWh

The baseline emission rate is: 0.827 tCO_2e /MWh

The net annual reductions are estimated to be: 107,448 tCO_2e

The net reductions over the 21 year crediting lifetime are estimated to be: 2,256,417 tCO_2e

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>> Since the Project emissions and leakage are zero, the emission reductions are those calculated in E.4

E.6. Table providing values obtained when applying formulae above:

>> See Annex 3

SECTION F. Environmental impacts

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

>> In accordance with Guatemalan law, proposals for electricity generation must include an environmental impact assessment, based on an environmental impact study. The Project's Environmental Impact Statement (EIS) has been completed and approved from the National Environmental Commission (CONAMA), for the original EIS as well as for an Addendum provided one year later. As required by law, each of CONAMA's technical advisory board members has approved the EIS. The advisory board was made up of 13 members representing government offices and Non-government Organizations (NGOs).
A substantial effort has been devoted to understanding the environmental aspects of the Project and assuring that environmental issues have been addressed and programmed to be mitigated as appropriate. All such efforts indicate that the Project is environmentally sound and poses no adverse threat to its surroundings or inhabitants.

An analysis of the environmental impacts of the Rio Hondo II Project is attached as Annex 5.

F.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:

>> As the Project Company has progressed through permitting and environmental review over the past three years, there have been revisions to the Project design to reduce and mitigate the identified environmental impacts. All Project revisions, as presented in an update report to the EIS, represent positive changes in design or operations procedures in response to specific environmental needs and concerns. Revisions include such measures as lowering the dam height in order to assure that the reservoir does not encroach on Protected Area lands, and consideration of a new re-regulating dam downstream of the powerhouse to provide adequate control of river flow for safety and environmental purposes. The updated information provided in the update report does not require any further approvals. In order to assure quality and continuity throughout the permitting and review process, the Project Company has utilized the same environmental consultant for studies and EIS development.

As all issues raised in the EIS have been addressed through design/planning and will be addressed satisfactorily upon initiation of construction, there is significant support for the Project by Defensores, the Ministry, and El Consejo Nacional de Areas Protegidas (CONAP). The Project Developer is working in conjunction with the Defensores to develop work plans proposed in the EIS report.

SECTION G. Stakeholders' comments

>>

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

>> The Ministry of Energy and Mines (MEM) coordinated a series of presentations to stakeholders in the region of the project, especially in the Department of Zacapa and the Municipality of Rio Hondo. Invitations and presentations were issued by the MEM, and were always accompanied by a team from the project developer. The meetings were filmed as an archive of the comments received. Stakeholder meetings conducted as of October 2004 include:

1. A meeting with all the Mayors in the Zacapa Department, August 17th, 2004.
2. A meeting with the Departmental Development Council of Zacapa, September 29th 2004.
3. Meeting with local teachers and school directors. October 2nd, 2004,

MEM programmed meetings include:

1. Representatives from Ministries of Health and Agriculture
2. Community and Municipal Development Councils (Consejos Comunitarios de Desarrollo, (COCODES), and Consejos Municipales de Desarrollo (COMODES))
3. Local Universities
4. Private Sector
5. Regional meeting of parents and teaches

G.2. Summary of the comments received:

>> The majority of comments received from the stakeholder meetings were positive. Moreover, there has been broad support for the social responsibility proposal of the project developer. Comments and issues discussed during the stakeholder meetings were focused on the following areas:

1. Questions on water security, human consumption and irrigation, as well as keeping a seasonal flow in the river. The project developer provided technical explanations on how the Project will work in regards to the mechanics of the re-regulating pond, and that there will always be water in the river with the same flow that comes into the main dam.

2. A presentation and discussion of the project developer's social responsibility proposal, including a review of the direct and indirect jobs produced by the Project, and an annual contribution for projects to be developed with the communities in the area of influence of the Project.

3. Concerns were expressed that the Rio Hondo II Project may develop similar issues as an exiting hydro plant that had problems in the past. It was determined that the developers of the previous plant had not put in writing all the commitments that the community claimed they had been offered. MEM formed a multi-sectoral committee to analyze the problems of the existing hydro plant. The committee was formed by the MEM, Ministry of Environment, the Rio Hondo Municipality, local communities in the plants' area of influence, CONAP, and other government organizations. This committee was to present a report on the compliance of the plant's responsibilities, and if there was a problem, the Government of Guatemala was making sure that is was solved.

4. All meetings have suggested that continuing education about the Project is needed for the Rio Hondo community.

5. The social responsibility component of the Project has been commended, especially the willingness of the project developer to make written commitments and provide guarantees.

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

>> As a result of the comments received the company continues to make presentations and explain to the surrounding communities the main points that have caused a negative perception, including:

a) Responsible water use, security for irrigation and human use of water
b) Continuous flow in the river bed
c) Dam security
d) Protection of the environment and the watershed
e) Social responsibility of the company

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable.

Annex 3

BASELINE INFORMATION

Excel document entitled “Baseline Information for Rio Hondo”

Annex 4

MONITORING PLAN

Word document entitled “Monitoring Plan for Rio Hondo”