CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

A. General description of the small scale project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the proposed small scale project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring Information

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Addition of a power generation microunit at the "5 de Noviembre Power Plant"
Version 3.0 - 05/12/2008

A.2. Description of the small-scale project activity:

The purpose of this project is to incorporate a new electricity generation microunit that will increase the capacity generation of the existing 5 de Noviembre Hydro Power Plant. This project will take advantage of the excess water that flows through this kind of plant (run of river plant) during the rainy season.

The 5 de Noviembre Hydroelectric Power Plant is a run-of-the-river facility which started operations in 1954. It comprises five Francis type turbines rated from 18 to 21 MW each, for a total capacity of 99.4 MW[1]. The station handles base load during the rainy season and intermediate-load in the dry season. Cerrón Grande reservoir, located upstream, provides regulatory storage for the Lempa´s river flows. The 5 de Noviembre power project itself has a small reservoir with limited storage capacity, which is used to control discharges from the Cerron Grande reservoir and additions inflows between both plants.

The station service unit from the plant rated at 625 kVA was taken out of service and dismantled since June 2002 and ever since, the main units have been generating the required power for the station.

The addition of the new unit will allow the plant as a whole to deliver an extra 2,160 MWh per year[2] to the Salvadorean Wholesale Market (SWM), which is the main grid in the country. Since the project does not involve any changes to the station's reservoir, the 5 de Noviembre power plant will remain a run-of-the-river facility even after the project takes place.

The project is expected to contribute to sustainable development of El Salvador mainly through the following benefits arising from the project activity:

- **Electricity production from a renewable energy source:** The increase in the electric supply will improve living conditions of households and reduce business interruptions, therefore stimulating population income and employment. In addition, the project will lower electricity costs, offering one of the cheapest sources of energy in the country. The use of indigenous renewable energy sources will help reduce the consumption of imported fuel oil: thus this will enhance the Salvadorean current account and strengthen the country's economy.

- **No GHG emissions:** the proposed project activity will be generating electricity from a clean source, displacing carbon-intensive technologies in the grid, which is currently dominated by thermal plants (more than 50% of the generation mix).

[1] Plant generation in 2007 was 527.4 GWh (*Source:* SIGET)

[2] The new unit´s auxiliary consumption will be negligible since the latter consists of an asynchronous generator (i.e. it has no exciter).

- **No increase in reservoir volume and no land inundation:** The new unit will enhance plant efficiency without further reservoir or land inundation requirements.

CEL is an institution highly committed with local development. Its Socio-Environmental Programme (in Spanish, "Programa Socio Ambiental- PSA") covers the surrounding areas of the 5 de Noviembre's reservoir ever since the year 2000. Its main activities comprise:

- Socio-economic study of the nearby communities[3]
- Training on solid waste management to the students in the Jacinto Castellanos Palomo School.
- Undertaking the proceedings with the NGO[4] "Plan Internacional" for the development of solid waste management projects in the area.
- Demonstration plots were established in the lands of the agricultural cooperative "Chamalistagua" as part of a training system to illustrate techniques that work well both in terms of sustainability and economic returns.
- Inclusion of local schools (Jacinto Castellanos Palomo and Parroquial San Francisco de Sales) into the "Environmental Keepers programme" (in Spanish: "Programa de Guardianes Ambientales"), by means of an agreement with FONAES[5].
- Provision of 360 schools packages to local schools.
- Training programmes on the national "Fishing and Aquaculture Law" (in Spanish "Ley de Pesca y Acuicultura") were given to the local fishermen in the "Caserío El Dique", and other surrounding areas of the reservoir.
- Development of a "Fishing Code" (in Spanish: "Reglamento de Pesca", which will provide fishing regulations for the reservoir of the 5 de Noviembre Hydroelectric power plant. This was developed in association with local fishermen.
- Fish restocking with an estimate of 50,000 units.

The project activity, together with the additional income provided by the sale of CERs, will contribute to the continuation and further expansion of CEL's Corporate Social Responsibility programmes like the ones described above.

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)
El Salvador (Host Party)	Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL) - (Public Entity)	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.		

[3] The document is entitled "Diagnóstico y Definición de Estrategias de Implementación de la Política Social de CEL"

[4] NGO: Non-Governmental Organization.

[5] Fondo Ambiental de El Salvador (El Salvador Environmental Fund). More information available at www.fonaes.gob.sv.

A.4. Technical description of the small-scale project activity:

The following is the list of equipment that will be part of the competitive bid process[6].

a) Francis turbine with horizontal axis (or equivalent), including its speed control and all auxiliary systems, accessories and instruments. The net nominal fall (Net head) is around 50 meters of water column and the nominal power output on the turbine's axis will be determined by the contractor who wins the public bid and it shall be not less than 500 kW.
b) A three-phase, asynchronous generator, with all auxiliary systems, accessories and instruments that include two energy meters. The generator will be directly attached to the Francis turbine and will have three terminals from the phase side and three on the neutral side. Nominal electric specifications for the generator are:
    - Continuous Power: 625 to 750 kVA
    - Voltage: 480 V
    - Frequency: 60 Hz
    - Protection grade: IP55
    - Service factor: 1
c) A local panel to control the unit, with a PLC[7]-based control system or embedded PC with all the relevant elements for controlling the operation of the generator unit from the control room. (The latter as an optimal supply)
d) A set of current transformers for power measurement and relay protection.
e) Capacitor cubicle

A.4.1. Location of the small-scale project activity:

The location of the project is on the Lempa River, approximately 88 km Northeast from San Salvador (Capital city of El Salvador)

A.4.1.1. Host Party(ies):

El Salvador

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

The project is located on the border of the departments of Cabañas and Chalatenango

A.4.1.3. City/Town/Community etc:

Cantón San Nicolás, Sensuntepeque (Cabañas) and Cantón Potrerillos, Nombre de Jesús (Chalatenango)

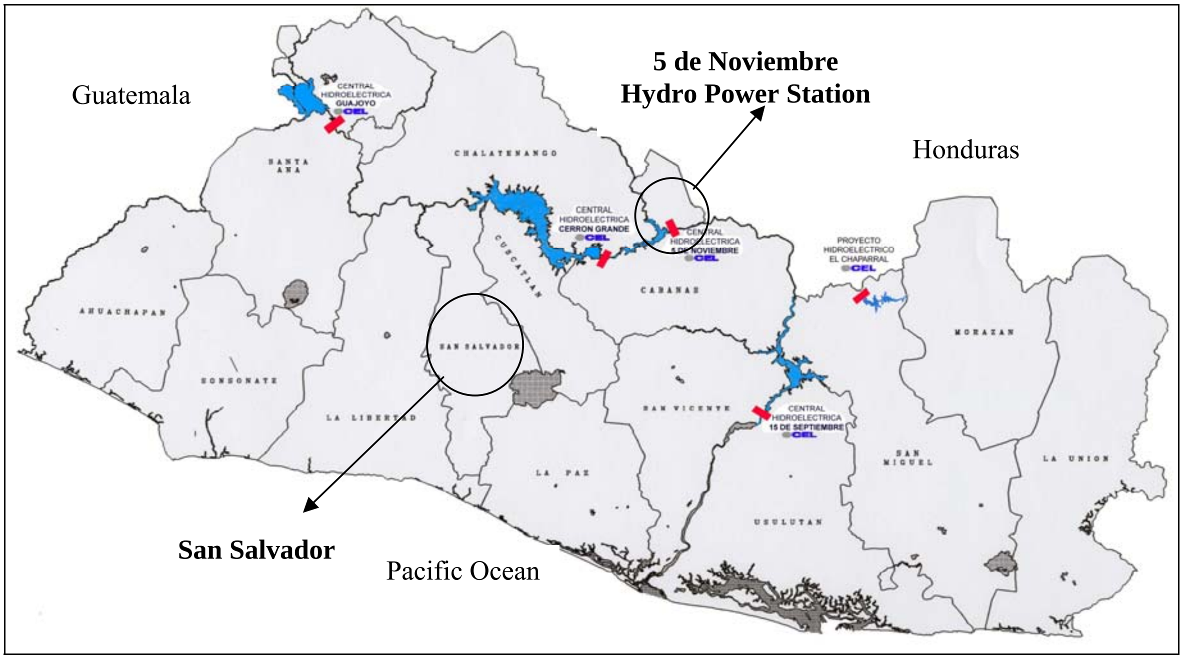
[6] Although this list comprises all the main aspects of the technology to be applied, some specific aspects of the equipment still have to be confirmed and/or specified by the contractor who wins the public bid.

[7] PLC: Programmable Logic Controller.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The project is located in the northeast of San Salvador, at approximately 13º59´ north latitude and 88 º 45´ west longitudes. The project location is illustrated in Figure A.1 below.

Figure A.1 – Project Location in El Salvador



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Type: I – Renewable energy projects
Category: I.D – Grid connected renewable electricity generation

Technology/measure:

In the case of projects activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity due to the incorporation of the new unit should be lower than 15 MW. In the case of this project, the capacity addition will be rated between 0.5 and 0.6 MW[8], notably below the 15 MW thresholds for small scale projects.

Finally, the methodology requires that the units added must be physically distinct from the existing units. Physically distinct units are those that are capable of generating electricity without the operation of *existing* units, and that do not directly affect the mechanical, thermal or electrical characteristics of the latter. This is exactly the case of the microunit which is the core of the proposed project. The microunit will be able to function independently of the rest of the units, providing the station with its own power, without affecting any of their mechanical, thermal or electrical characteristics.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The project of adding a new unit to the 5 de Noviembre Hydro Power Plant will increase the amount of energy generated by the latter as a whole by an annual 2,160 MWh. In a national grid with a combined margin emission factor of 0.717 tCO_2/MWh, this implies that the project is expected to displace around 1,549 tCO_2 per year in relation to those that would occur on the baseline scenario.

Table A.1. Estimated amount of emission reductions during the First Crediting Period.

Years	**Annual estimation of emission reductions in tonnes of CO2 e**
2009	1,549
2010	1,549
2011	1,549
2012	1,549
2013	1,549
2014	1,549
2015	1,549
Total estimated reductions (tonnes of CO_2 e)	**10,843**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**1,549**

[8] Depending on the specific equipment provided by the firm who results winner of the public bid for the contract.

A.4.4. Public funding of the small-scale project activity:

The project is expected to cost US$1,432,500.00 which will be fully funded with equity from CEL. This project does not have public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

There are currently no other small scale projects registered (or applying for registration) as CDM projects by CEL. Therefore, and as stated on the "Appendix C to the simplified modalities and procedures for small scale projects", all the requirements to demonstrate that the proposed project activity is not a debundled component of a large scale project activity are met.

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline and monitoring methodology applied to this project is "AMS I.D. – Grid connected renewable electricity generation". Version 13 (December 2007) of the methodology was followed.

Scope Number 1: Energy industries (renewable - / non-renewable sources)
Type I: Renewable energy project
Category I.D: Grid connected renewable electricity generation

B.2 Justification of the choice of the project category:

The I.D category comprises renewable energy generation units –hydro among others- that supply electricity to and/or displace fossil fuel generation units (or non renewable generation) from a power distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the capacity added by the project should be lower than 15 MW according to the methodology. Since this particular project will add between 500 to 600 KW of nominal capacity to the 5 de Noviembre Hydro Power Station[9], the proposed project complies with the methodology's scale requirements. Likewise, the new unit will be physically distinct from the existing ones (i.e. capable of generating electricity without the operation of the other units). Therefore, the methodology is fully applicable to the proposed project activity.

B.3. Description of the project boundary:

[9] According to the specific equipment provided by the firm that wins the public bid for the project's contract.

The project boundary encompasses the physical and geographical site of the renewable generation source[10]. The proposed project will generate electricity for the operation of the 5 de Noviembre's power station, allowing the latter to deliver an extra 2,160MWh per year to the Salvadorean Wholesale Market (SWM).

The SWM is composed of all the generators, distributors, traders, and major users that are directly connected to the 115kV transmission system. Since the additional capacity provided by the project will be delivered to this system, the SWM is the relevant electric power grid which defines the boundaries to the proposed project. Therefore, and for the purpose of baseline determination, this project will only consider CO_2 emissions from electricity generation in fossil fueled power plants in the SWM.

B.4. Description of baseline and its development:

Institutional structure

The Salvadorean Wholesale Market (SWM)'s dispatch is managed by Unidad de Transacciones - UT ("Transactions Unit"), which acts as the independent system operator. The UT is a private organization, owned exclusively by the SWM participants[11]. Superintendencia General de Electricidad y Telecomunicaciones - SIGET ("General Superintendence of Electricity and Telecommunications") is the government regulatory body in charge with overseeing UT operations. Dirección de Energía Eléctrica ("Department of Electric Energy"), established in 1999 under the Ministry of Economy, oversees generation, transmission, distribution and commercialization activities in the electric power and proposes national policies.

The wholesale market is composed of both a contracts market and a spot market. The contracts market is based on previously agreed contracts between generators and distributors/ brokers/users. Although the UT must be informed of all contracted transactions including the prices agreed to in the contracts market. It is a common practice that the prices in the contracts market are set as a fraction or proportion of the spot market price —e.g. the contracts price would be the spot market price in the relevant one-hour time interval less 5-10%. The spot prices are used as the overall reference price for the energy market[12]. Contract periods vary, and are most typically agreed for a one-year period at a time, with fixed delivery amounts and timing. At the end of the contracting period, the generator and the user may negotiate a contract continuation.

Non-contracted energy is traded in the Mercado Regulador del Sistema (MRS) (System Regulation market)—the spot market— which is based on a system of price and volume bids and offers for energy. Spot market prices are set for one-hour intervals. The UT sets the price one day in advance (*ex-ante pricing*), based on bids and offers received from generators, distributors, and major end users. The market-clearing price —which is the price of the last and most expensive unit called upon to generate in the hour— sets the price received by all generators dispatched during that one-hour interval.

[10] AMS I.D. version 13, page 1.

[11] The UT management is carried on by an Executive Board with representatives from the generators, distributors, transmitters, traders and major end users.

[12] SIGET is currently studying a set of reforms aiming to reduce this dependency on the spot market, thus reducing and stabilizing the price of energy.

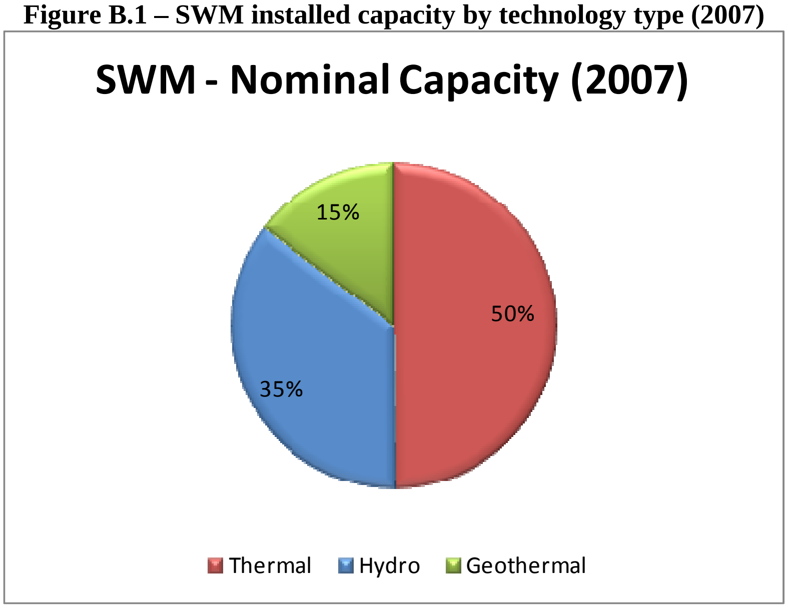
Transmission in El Salvador is undertaken by Empresa Transmisora de El Salvador - ETESAL (in English: "Transmission Company of El Salvador"), an independent transmission company, formerly a part of CEL. The distribution system, in turn, was privatized in January 1998. At the present date, there are five distribution companies, covering five major regions in El Salvador[13].

Baseline composition

As defined by the methodology, the baseline scenario consists of the electricity that, in the absence of the proposed project activity, would have been delivered to the grid by the rest of the existing plants in the system or by new additions to it.

The SWM generation mix is dominated by thermal technology: around 50% of the grid's total capacity comes from this kind of plants. In addition, renewable sources are also present with a 35% share for hydro power plants and 15% for geothermal technologies[14]. The proposed project activity will increase the share of renewable sources by displacing the energy generated by plants which rely on highly pollutant fossil fuels like diesel and residual fuel oil.

Figure B.1 – SWM installed capacity by technology type (2007)



Source: SIGET, 2007

In a similar way, a project providing electricity from a cheap renewable resource is likely to reduce the average price of energy and therefore new investments may be deterred due to the reduction of the price signals that motivate the latter.

[13] Namely: AES-CLESA, CAESS, DELSUR, EEO and DEUSEM.

[14] Source: UT (2007). http://www.siget.gob.sv/documentos/electricidad/estadisticas/boletin20072024.pdf

Table B.1 presents a list of the six most recent power plants that entered the system, showing that around 84% of the capacity added by these plants has been based on thermal technologies and that renewable energy projects, on the other hand, have been scarce (only 16% of the capacity added is powered by this type of source). Although there has been a major rise in oil prices in recent years, this thermal-dominated trend is likely to continue in El Salvador since private investors are still considering non-renewable alternatives like coal[15]. Small-scale capacity additions -like the one proposed by this project- are one of the few exceptions to this trend.

Table B.1 – Six most recent power plants to enter the SWM (Excluding capacity additions at existing facilities)

Plant name	Capacity		Technology	Starting Year
	MW	%		
Borealis	13.6	7%	Thermal	2007
GECSA	11.6	6%	Thermal	2007
Talnique	51.2	28%	Thermal	2006
CASSA	29	16%	Biomass	2003
CESSA	32.6	18%	Thermal	2001
Textufil	44.1	24%	Thermal	2000
Total	**182,10**	**100%**		

Source: SIGET - 2007

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 small-scale CDM project activity:

A project is said to be *additional* to its corresponding baseline scenario when it can be shown that the former would not take place in a hypothetical situation where no carbon credits existed to support clean projects, i.e. when the additional cash flow provided by the sale of carbon offsets is critical for the decision of undertaking the proposed project.

The purpose of this section is to demonstrate that the proposed project activity is additional to the baseline scenario described above. This will be accomplished by means of the general guidelines established in the Attachment A to the Appendix B of the simplified modalities and procedures for small-scale CDM project activities[16].

The most important barrier to the incorporation of the new microunit to the 5 de Noviembre Hydro Power Station is economical. An investment/economical barrier exists when "*a financially more viable*

[15] See for example, the AES FONSECA 250 MW coal power project, which is expected to start operations in 2011. For more on this topic, see http://www.fonsecaenergia.com. And the addition of 50 MW by the private firm INE with thermal technology which will be ready on March, 2009.

[16] This section also follows the "Non-binding best practice examples to demonstrate additionality for SSC project activities" (Annex 34, EB 35) as well as the "Guidance on the Assessment of Investment Analysis" (version 02 – Annex 45, EB 41).

alternative to the project activity would have led to higher emissions[17]". In the next paragraphs we will demonstrate that without carbon credits the project would not take place due to the effect of these barriers, specifically, we will show that in the absence of CERs, the project participants would choose the alternative of the continuation of the current baseline scenario (i.e. that no project activity would be undertaken neither by the project participants nor comparable developers).

Next, a brief summary of the project's economics is presented. The following are the main assumptions underlying the estimation of the project's expected return:

Table B.2 – Assumptions for the project's financial model

Variable	Value	Unit/comments
Overall project cost (capital expenditures)	1,432,501	US$
Additional generation provided by the microunit	2,160	MWh/year
Average price	76.0	US$/MWh
Price growth rate	2.69%	Annual rate
O&M Costs[18]		
Increase in operation and administrative costs	No increase due to the project	
Maintenance (starting from the fourth year)*	15,000	US$/year
SIGET	0.42	US$/MWh
UT	0.33214	US$/MWh
CUST	4.709970	US$/MWh
Insurance (US$3.5 per thousand capital exp.)	5,013.75	US$/year
Fiscal Retribution	25%	Of annual net income
Reference capital cost	12%	
Project Lifetime (2009-2033)	25	Years
Construction period	12	Months
Annual depreciation	57,300.02	US$/year

*The initial investment includes maintenance works and supplies for the project's first four years

The international public bid[19] process for the contract of the project was held on November 21st, 2007, with a maximum authorized budget of US$ 809,540. However, the best offer presented at the process was significantly above this figure[20] and the bid was declared void. The higher capital expenditures required to carry on with the project, together with the administrative costs required to undertake a new public bid process, discouraged the project participants and further raised the project's dependence on CDM registration. A second bid[21] was held on July 2008, and this time the total budget allowed was 1.432 million dollars. This is the amount used in the project's financial model for the calculation of the latter's

[17] *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB 35, Annex 34), page 1.

[18] O&M Costs: Operation and Maintenance Cost.

[19] International Public Bid No. CEL-2309.

[20] A copy of the official document from the first bid process can be presented upon request.

[21] Public Bid No. CEL-LP 04/08.

Internal Rate of Return (IRR), as presented below. The fact that CEL decided to pursue CDM validation and registration even before awarding the contract of the project by means of a public bid shows that CDM revenues are essential to the project independently of the firm which is awarded the construction bid. It is also evidence of early consideration of the said incentives (i.e. that CDM was considered from the very beginning stages of the project).

The next critical assumptions are the output that the plant will be able to deliver to the grid once the new unit is installed at the 5 de Noviembre power plant and the price of the energy sold. The former value is estimated to be of 2,160 MWh per year, while the price was set at US$/76 MWh[22]. A 2.69% growth rate was assumed for the price based on a time series analysis with over 50 thousand hourly observations from the UT[23].

The rest of the assumptions involve different kinds of costs associated with the operational phase of the project. The plant should not have any increase on its regular operation expenditures after the implementation of the project and thus no additional costs were considered for this variable. Maintenance and spare parts during the new unit's first four years of operation are included within the initial consignment and therefore should be provided by the private firm that wins the bid process. After this period, maintenance should be afforded by CEL at an estimated US$ 15,000 per year. The SIGET, UT and CUST rates correspond to the regular rates charged for energy commercialization, administration of the wholesale market and use of the transmission lines, correspondingly. The insurance rate for the equipment was set to US$ 3.5 per thousand dollars of the overall capital budget, as determined by CEL's Risk Administration Department.

The 25% fiscal retribution is the income tax rate paid by autonomous state-owned companies[24]. The next two assumptions refer to the project's critical dates, namely, its expected lifetime and construction period. Another premise needed is the annual depreciation of the capital goods, estimated as a constant amount for each year of the project's lifetime[25]. Finally, the discount rate is set to 12%, which is the value established by SIGET to be the reference return for energetic projects[26].

Under this set of assumptions, the project's IRR is 9.42%. The results of the financial model are presented below:

Table B.3 – Model Results[27]

[22] 76 U$S/MWh was assumed for the price by CEL´s commercial department; the same value was used in our analysis since the latter is a reasonable assumption considering historic energy prices. The average price for 2007 was 70 U$S/MWh (evidence provided to the DOE – file: "average energy price - 2007 - UT.xls"); the 76 U$S/MWh price was not modified since this value is more conservative.

[23] The results from this analysis are available on Annex 6.

[24] This is as stated by Decree number 146 (1994), available upon request.

[25] This is used in order to estimate the income tax expenditures for the project.

[26] This was established in the SIGET Agreement Number 29-E-2007. A copy of this document is available upon request.

[27] The project cash flow is presented on Annex 5.

Project Summary	
NPV (US$, without CERs) @ 12%	-277,305
IRR without CERs	9.42%
IRR considering CERs @ US$ 16 /tCO_2	11.20%
Reference return for energetic projects	12.00%

As it can be readily seen in Table B.3, the net present value (NPV) of the proposed project is negative since its Internal Rate of Return (IRR) falls *below* the reference return. On the other hand, when considering the additional income provided by the sale of CERs, the project's IRR increases by almost two points to 11.20%. While still below the reference return, the results are significantly better than in the no-credits scenario. This way, the revenue from the sale of carbon credits proves to be critical for the desirability of the project, i.e. that the proposed project is *additional*.

In order to test the robustness of these results, a sensibility analysis was performed. The key variables in the model are the capital expenditure; the additional generation provided by the new unit; the average energy price and the annual maintenance fee. For each case, +/- 10% variations were considered reasonable assumptions. The results are provided in Table B.4 below.

Table B.4 – Sensitivity Analysis Results

Variable	Base Value	Variation	IRR
Capital Expenditures	1,432,501	10%	8.45%
		-10%	10.55%
Additional Generation	2,160	10%	10.50%
		-10%	8.29%
Energy Price	76	10%	10.56%
		-10%	8.22%
Maintenance	15,000	10%	9.36%
		-10%	9.47%

In all the depicted scenarios, the project's IRR falls below the 12% threshold. The minimum of the values obtained is as low as 8.22%, while the highest reaches 10.56%, 144 basis points below the reference return. This way, the proposed small scale project proves to be additional not only under the basic case, but also under a wide variety of reasonable scenarios as well.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the simplified methodology for small scale projects, the emission coefficient may be calculated in either of two ways:

a) A *combined margin* (CM), consisting of the combination of an operating margin (OM) and a build margin (BM) according to the procedures prescribed in the latest version of the "Tool to calculate the emission factor for an electricity system".

b) The weighted average emissions of the current generation mix

Option (a) will be followed since it comprises the most representative approach to the Salvadorean Baseline.

The "Tool to calculate de emission factor for an electricity system" states that the baseline emission factor must be estimated as the weighted average between an operating margin emission rate (EFOM) and a build margin emission rate (EFBM). The first of these rates captures the project's effect on the operation of the power plants that are already part of the grid, while the latter accounts for the project's effect on the construction of new power plants. The weighted average of these two effects is known as the combined margin emission factor (EFCM).

For El Salvador, the OM and the BM estimates are computed using the relevant time series from SIGET[28] (Superintendencia General de Electricidad y Telecomunicaciones – Electricity and Telecommunications Agency), the Unidad de Transacciones–UT (Transactions Unit) and the Salvadorean DNA (MARN – Ministerio de Medio Ambiente y Recursos Naturales) for the 2005-2007 periods. *IPCC's Guidelines* (2006) and the "*Annual Energy Outlook*[29]" (2007) were used since national estimates for critical parameters are currently unavailable. In all cases, *net* electricity generation is considered[30] and, as stated in the methodological tool, "*for imports from connected electricity systems located in another host country(ies), the emission factor is 0 tons CO2 per MWh*[31]".

Step 2 and 3 of the "Tool to calculate de emission factor for an electricity system" consists of the calculation of the OM emission factor. Project participants have to choose among four different options to estimate the $EF_{OM,}$ depending on local data availability and grid characteristics. For this project, the OM emission factor is determined according to option "b" (simple adjusted OM). This choice is justified since in El Salvador, low-cost/must run resources[32] constitute more than 50% of the total grid generation. Likewise, since the project participants will use an *ex-ante* estimation of the emission factor, option "c" (dispatch data analysis) of the methodological tool is not applicable.

---

[28] Energy generation data is publicly available at www.siget.gob.sv.

[29] Energy Information Administration (EIA) – Official Energy Statistics from the US government.

[30] As stated on page 1 of the "Tool to calculate the emission factor for an electricity system", net electricity generation is defined as the difference between the total quantity of electricity generated by the power plant / unit and the auxiliary electricity consumption of the power plant / unit (e.g. for pumps, vans, controlling, etc)

[31] Tool to calculate the emission factor for an electricity system, page 4.

[32] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Coal is another fuel commonly used as must-run.

Information on the 3 most recent years for which data is available was collected to perform calculations. The OM emission factor for each year *y* is obtained as follows:

(1) $$EF_{OM,y} = (1-\lambda_y)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot NCV_i \cdot EF_i}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum_{i,k} F_{i,k,y}\cdot NCV_i \cdot EF_i}{\sum_k GEN_{k,y}}$$

$F_{i,j,y}$ is the amount of fuel *i* (in thousand gals) consumed by power source *j* in year *y*; *"j"* refers to the power sources delivering electricity to the grid (not including low-operating cost and must-run power plants); "*k"* is to the set of low-operating cost and must-run power plants delivering electricity to the grid; *NCVi* is the net calorific value (energy content) per volume unit of fuel *i* (MMBtu[33]/10^3 gals); EF_i is fuel *i´*s carbon dioxide content (tCO_2/MMBtu), and $GEN_{j,y}$ ($GEN_{k,y}$) is the electricity (in MWh) delivered to the grid by source *j (k)*.

The λ_y factor is calculated as follows[34]:

(2) $$\lambda_y = \frac{\textit{number of hours per year for which low-cost/must-run sources are on margin}}{\textit{8760 hours per year}}$$

Since the *k* group of plants includes hydro, biomass, and geothermal stations, its fossil fuel consumption equals zero and therefore the entire second term in expression (1) one is null. Thus we may write:

(1´) $$EF_{OM,y} = (1-\lambda_y)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot NCV_i \cdot EF_i}{\sum_j GEN_{j,y}}$$

As indicated on Step 4 of the "Tool to calculate de emission factor for an electricity system", the BM emission factor is estimated using the sample group of the "*m*" most recent additions to the grid. This group "m" is obtained from table B5, which presents the latest additions to the grid.

[33] MMBtu: millions British Thermal Units.

[34] Load duration curves needed to obtain the Lambda factor are presented on Annex 3.

Table B.5 – Most recent units to enter the SWM (sample "*m*")

	Units	Technology	Starting Year	Net Generation (MWh)	Accumulated Generation (MWh)	% accumulated over total generation
1	Borealis	Thermal	2007	73,523	73,523	1.3%
2	Gecsa	Thermal	2007	4,323	77,846	1.4%
3	Acajutla Unit 4	Thermal	2007	9,714	87,560	1.6%
4	Talnique	Thermal	2006	351,011	438,571	7.9%
5	Soyapango	Thermal	2003	49,167	487,738	8.7%
6	CESSA	Thermal	2001	153,433	641,171	11.5%
7	Acajutla Gas	Thermal	2001	44,866	686,037	12.3%
8	Acajutla Motors	Thermal	2001	724,585	1,410,622	25.3%
			Total	**1,410,622**		

Source: SIGET

The group "*m*" consists of either the five most recently built power units, or the capacity additions to the electricity system that comprises 20% of the system generation and that have been built most recently[35]. The alternative which comprises the largest annual generation[36] was chosen. The formula used for the EF_{BM} is presented below:

(3) $$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot NCV_i \cdot EF_i}{\sum_{m} GEN_{m,y}}$$

Once the OM and BM emission rates are obtained, the *combined margin* (CM) is calculated according to:

(4) $$EF_{CM,y} = \omega_{OM} EF_{OM} + \omega_{BM} EF_{BM} \quad , \qquad \text{where } \omega_{OM} + \omega_{BM} = 1$$

The default $\omega_{OM} = \omega_{BM} = 0.5$ was assumed for the weights[37].

Project emission reductions (ER_y) are given by the following equation:

(5) $$ER_y = BE_y - PE_y - L_y$$

The baseline emission reductions (BE_y) equals the $EF_{CM,y}$ times the *additional* electricity that the plant will be able to deliver when the new unit is operational[38] (EG_y). Since leakage (L_y) and project emissions (PE_y) for this type of projects are zero, expression (5) becomes:

---

[35] Total net generation in 2007 was 5,577,426 MWh.

[36] As established in the methodological tool ("Tool to calculate the emission factor for an electricity system", version 01, page 13).

[37] Established by the "Tool to calculate the emission factor for an electricity system" for this type of projects.

[38] The ex-ante estimation of the additional electricity that the plant will be able to deliver when the new unit becomes operational is $EG_y = 2,160$ MWh per year. However, this parameter will be monitored according to the procedures and guidelines provided in the methodology (refer to the monitoring section for further details).

(5) $$ER_y = EF_{CM,y} \cdot EG_y$$

This formula gives the annual amount of emission reductions due to the proposed small-scale project activity.

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

Data / Parameter:	**NCV_i**
Data unit:	MMBtu/10^3 gal (millions British Thermal Units per thousand gal)
Description:	Net calorific value (energy content) per volume unit of fuel i
Source of data used:	Energy Information Administration (EIA) – "Annual Energy Outlook 2007", Appendix G (available at: www.eia.doe.gov/oiaf/archive/aeo07/index.html) Appendix G with the data used is available by the project participants.
Value applied:	Fuel Oil: 149.690 Diesel: 138.071
Justification of the choice of data or description of measurement methods and procedures actually applied :	No local or regional data is publicly available. EIA values have been used since they do not require previous conversion from volume to mass units.
Any comment:	

Data / Parameter:	***EF_i***
Data unit:	tCO_2/MMBtu
Description:	CO_2 emission factor
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National Greenhouse Gas Inventories.
Value applied:	Fuel Oil: 0.079652273 Original value: 75.5 tCO_2/TJ (TJ = 947.87 MMBtu) Diesel: 0.076592782 Original value: 72.6 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	No other data is publicly available. IPCC guidelines have been used in a conservative manner.
Any comment:	Conversion from TJ to MMBtu was made considering 947.87 MMBtu/TJ (from unit-converter.org).

Data / Parameter:	***$F_{i,j,y}$ ($F_{i,m,y}$)***
Data unit:	10^3 gals
Description:	Amount of each fossil fuel consumed by each power plant
Source of data used:	MARN (Ministerio del Medio Ambiente y Recursos Naturales, in English: "Ministry of Environment and Natural Resources"), El Salvador.

Value applied:	Data for the 2005-2007 period is available in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	All data presented is from official sources.
Any comment:	

Data / Parameter:	***$GEN_{i,y}$ ($GEN_{m,y}$)***
Data unit:	MWh
Description:	Annual electricity generation of each power plant in the SWM.
Source of data used:	SIGET
Value applied:	Data for the 2005-2007 period is available in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	All data presented is from official sources.
Any comment:	A summary of this data is publicly available at www.siget.gob.sv (see “Electricidad” at the “Estadísticas” menu on the website – Spanish only).

Data / Parameter:	***$EF_{grid,OM\text{-}adj,2005\text{-}2007}$***
Data unit:	tCO_2/MWh
Description:	Operating margin emission factor (Simple adjusted OM)
Source of data used:	Calculated using data from MARN, SIGET and IPCC according to the equations presented in ACM0002
Value applied:	0.7156
Justification of the choice of data or description of measurement methods and procedures actually applied :	All input data is from official sources.
Any comment:	

Data / Parameter:	$EF_{grid,BM,\ 2007}$
Data unit:	tCO_2/MWh
Description:	Build margin emission factor
Source of data used:	Calculated using data from MARN, SIGET and IPCC according to the equations presented in ACM0002
Value applied:	0.7175
Justification of the choice of data or description of measurement methods and procedures actually applied :	All input data is from official sources.
Any comment:	

Data / Parameter:	$EF_{grid,CM,2005-2007}$
Data unit:	tCO_2/MWh
Description:	Combined margin emission factor
Source of data used:	Calculated using data from MARN, SIGET and IPCC according to the equations presented in ACM0002
Value applied:	0.717
Justification of the choice of data or description of measurement methods and procedures actually applied :	All input data is from official sources.
Any comment:	Default weights were used (0.5 for each EF)

B.6.3 Ex-ante calculation of emission reductions:

Expressions (1) to (6) are used to estimate the number of emissions displaced by addition of the new unit to the 5 de Noviembre hydro power plant. Tables B.6 and B.7 are based on data available in Annex 3; they provide a summary of the information required for the OM calculations. The result for this rate is $EF_{OM} = 0.7182(1-\lambda) = 0.7156\ tCO_2/MWh$.

Table B.6 – Fuel consumption and CO_2 emissions by fuel type (plants in set *"j"*)

Fuel Type	Volume (000 gals)			COEF[39]	tCO_2		
	2005	2006	2007	(tCO_2/000 gal)	2005	2006	2007
Fuel Oil No. 6	134,858	141,656	154,453	11.923187	1,607,937	1,688,991	1,841,572
Diesel	2,362	7,850	2,513	10.575275	24,979	83,016	26,576
				Total	**1,632,916**	**1,772,007**	**1,868,148**

Source: MARN

Table B.7 – Net Generation (plants in set *"j"*, including imports)

Origin	Generation (MWh)		
	2005	2006	2007
Domestic	2,137,030	2,266,398	2,457,796
Imports	322,100	11,100	147,600
Total	**2,459,130**	**2,277,498**	**2,605,396**

Source: SIGET

Similarly, the BM is obtained applying formula (3) in the previous section to the set "*m*" (recent unit additions to the grid). The following tables summarise the results and estimations (both are based on information available on Annex 3):

Table B.8 – Fuel consumption and CO_2 emissions by fuel type (units in set *"m"*) – Year 2007

Fuel Type	Volume (000 gals)	COEF (tCO_2/000 gal)	tCO_2
Fuel Oil No. 6	82,696	11.923187	986,000
Diesel	2,467	10.575275	26,089
		Total	**1,012,089**

Source: MARN

Table B.9 – Net Generation by plant and fuel type (units in set *"m"*) – Year 2007

Units	Technology	Starting Year	Net Generation (MWh)
Borealis	Thermal	2007	73,523
Gecsa	Thermal	2007	4,323
Acajutla Unit 4	Thermal	2007	9,714
Talnique	Thermal	2006	351,011
Soyapango Unit 1	Thermal	2003	49,167
CESSA ICE 1	Thermal	2001	153,433
Acajutla Gas	Thermal	2001	44,866
Acajutla Motors	Thermal	2001	724,585
		Total	**1,410,622**

Source: SIGET

[39] COEF = NCV multiplied by EF.

The ratio between the total in tables B.8 and the generation provided to the grid by the set "*m*" results in $EF_{BM} = 0.7175\ tCO_2/MWh$. Thus, the combined margin is estimated as the average between the OM and the BM rate, resulting in $EF_{CM} = 0.717\ tCO_2/MWh$.

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

Table B.10.1 – Summary of the results

Parameter	Value	Unit
EF_{BM}	0.7175	tCO2/MWh
EF_{OM} (1- λ)	0.7156	tCO2/MWh
ω_{BM}	0.5	-
ω_{OM}	0.5	-
EF_{CM}	0.717	tCO2/MWh
EG_y	2,160	MWh
BE_y	1,549	tCO2
PE_y	0	tCO2
$\mathbf{ER_y}$	**1,549**	**tCO2/year**

Table B.10.2 – Summary of the results

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)
2009	0	1,549	0	1,549
2010	0	1,549	0	1,549
2011	0	1,549	0	1,549
2012	0	1,549	0	1,549
2013	0	1,549	0	1,549
2014	0	1,549	0	1,549
2015	0	1,549	0	1,549

The capacity addition provided by the new unit will allow the 5 de Noviembre Hydro Station to deliver an extra 2,160 MWh per year, which in turn will allow to annually displace 1,549 tCO_2 below those that would occur in the baseline scenario.

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

For small scale project activities under the I.D category, monitoring consists of metering the electricity generated by the renewable technology.

According to the methodology, for project activities that involve the addition of new generation units at an existing facility, the increase in electricity production associated with the project (EGy in MWh/year) should be calculated as follows:

(6) $EG_y = TE_y – WTE_y$

Where:
TE_y = the total electricity produced in year y by all units, existing and new project units;
WTE_y = the estimated electricity that would have been produced by existing units (installed before the project activity) in year y in the absence of the project activity, estimated as

(7) $WTE_y = MAX\ (WTE_{actual,y}\ ,WTE_{estimated,y})$

Where:
$WTE_{actual,y}$ = the actual, measured electricity production of the existing units in year y;
$WTE_{estimated,y}$ = the estimated electricity that would have been produced by the existing units under the observed availability of the renewable resource (e.g. hydrological conditions) for year y.

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Increase in electricity production associated with the project.
Source of data to be used:	On-site metering system (same data submitted to UT) and an estimation of the electricity that would have been produced by the existing units under the observed hydrological conditions (taken from official sources) for year y.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,160 MWh
Description of measurement methods and procedures to be applied:	Data will be measured on site on a regular basis (minimum 1 minute, maximum 1 hr). Meters keep records for 60 days minimum; additional records will be kept. The hydrological conditions will be obtained from official sources. Expressions (6) and (7) will be used to estimate the additional generation provided by the project.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid. Double check by receipt of sales. Meter should have a maximum error of 0.2% and be calibrated periodically according to the UT standards (every 2 years) for electricity transactions in the SWM.
Any comment:	

B.7.2 Description of the monitoring plan:

The generation of the 5 de Noviembre Power Plant is been measured according to the Transaction Unit's (UT) standards and regulations for the wholesale market participants ("Reglamento de Operación del Sistema de transmission y del Mercado Mayorista"). Each metering system contains two three phase, read-only meters of equal characteristics (including non-volatile memory modules in compliance with ANSI C12.16 norms), one of them acting as a backup unit. Both units are connected at the interconnection point where they inject energy to the transmission system.

The meters include built-in registers, and generation data ready to download, both remotely and/or locally by the UT and the project developer. The information is acquired on programmable intervals ranging from a minimum of one minute to a maximum of an hour. The register has a capacity of at least 60 days.

In case of failure of any of the meters, CEL will proceed according to section 14.2: SISTEMA DE MEDICIÓN COMERCIAL (SIMEC) from the UT's regulations.

The two meters provided within the new micro unit will allow the measurement of the energy provided by the latter and will be used to corroborate the extra energy produced by the whole plant.

All measurement records, instrument calibrations and maintenance of the latter will be managed according to the procedures established in CEL's "Integrated Management System" (in Spanish: Sistema de Gestión Integrada) (ISO 9001:2000; ISO 14001:2004; OHSAS 18001:1999) and for the Commercial Metering lecture and report, the procedure PRO 41-06[40] will be used.

All current procedures will be adapted to include the carbon component and the adequate accounting of the emission reductions.

The firm that is assigned with the contract after the public bid process will comply with all this specifications, providing and preparing the equipment accordingly.

The project developer will implement a management structure where monitoring responsibilities shall be perfectly delimited. This structure will be as depicted on figure B.2. The Operation Department's chief will be responsible for monitoring and keeping record of the project generation, as well as the implementation of proper QA procedures in the meter. All the information from this department will be consistent and easily verifiable with all the relevant data from other departments in case an external audit should require it. The information gathered by the Operations Department will be sent to CEL´s *Project Management and Control Unit*, specifically, to the *Project Financial Management Department* within the latter.

The person in charge of the carbon credits monitoring, will receive training in accordance with CEL's Personal Training Procedures (PRA 22-01[41]: Procedimiento para la elaboración del plan general de capacitación) and other applicable procedures from the Human Resources Unit (in Spanish: Unidad de Desarrollo Humano).

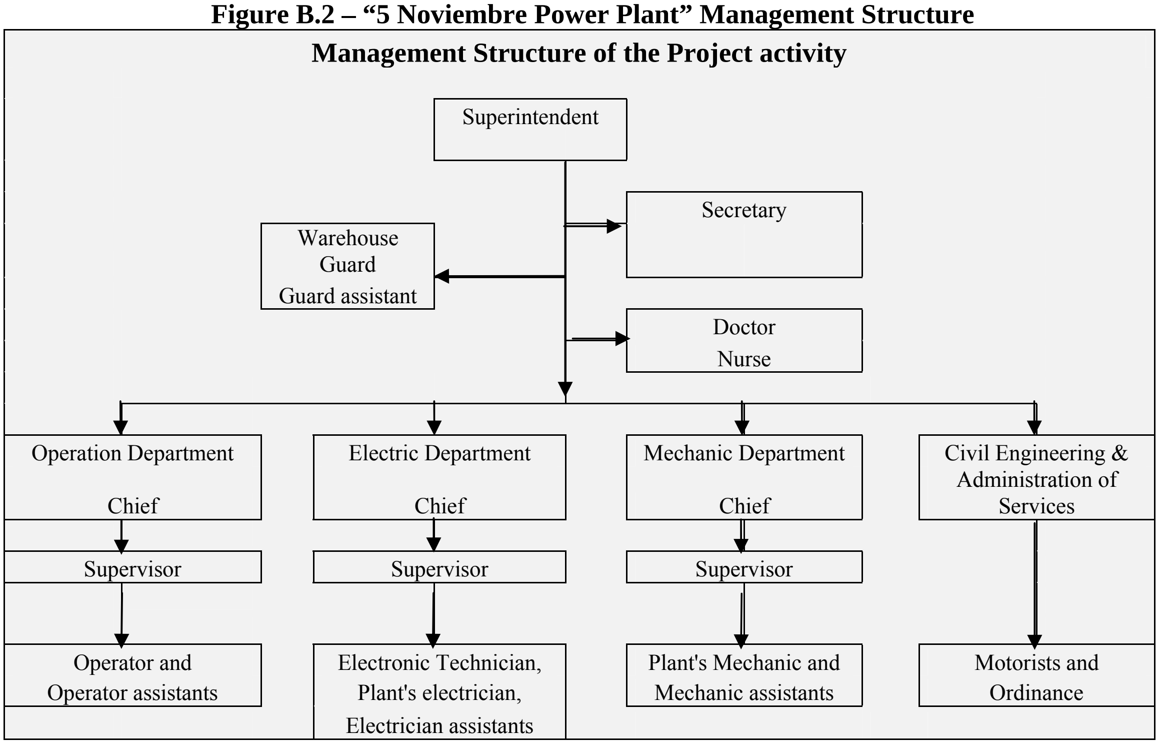
[40] This procedure is available upon request.

[41] This procedure is available upon request.

This area will be in charge of the following activities:

- Calculation and record keeping of the emissions reduced by the project activity, according to the general guidelines described in the monitoring plan. Project additional generation will be estimated by taking into account the maximum value among the actual, measured electricity production of the previously existing units in year *y*, and the estimated electricity that would have been produced by the existing units under the observed availability of the renewable resource (e.g. hydrological conditions) for the same year (see section B.7).
- Managing all the validation, registration and certification process of the project's GHG emission reduction.
- Procuring financing resources by placing the CERs in the relevant carbon markets.

Figure B.2 – "5 Noviembre Power Plant" Management Structure



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

This baseline and monitoring methodology application study was completed on 14/03/2008.

This baseline and monitoring methodology application study was completed on 14/03/2008 by Geoingeniería Ingenieros Consultores S.A., San José - Costa Rica. Phone: + (506) 2231 0167 / Fax: + (506) 2290 5297. E-mail: info@geoingenieria.co.cr

The entity above is not considered a project participant.

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:

The starting date of the Project activity is on 14/10/2008.

The project´s second international bid LP04/08 was held on 14/07/2008 and the offer evaluation process lasts 3 months. The bid´s award will be considered the project start date, since only then CEL will commit, for the first time, to expenditures related to the implementation of the project activity. The project is expected to become operational 12-15 months after the bid is awarded.

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

The Microunit will have an expected lifetime of 25 years.

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:

01/04/2009 or the project’s registration date (Whichever is latter).

C.2.1.2. Length of the first crediting period:

7 (seven) 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. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

In accordance with Articles 18 and 22 from El Salvador's Environmental Law, the project does not require the preparation of an Environmental Impact Assessment.[42]

In El Salvador, the addition of small scale units to existing plants does not require environmental impacts studies. The project's impacts are negligible since it comprises an addition of a Microunit to an existing run-of-river plant and it does not require changes in the size of the small regulatory reservoir or additional modifications to the existing facilities that may have an environmental impact.

SECTION E. Stakeholders' comments

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

To confirm the approval of the project and further introduce the project activity and the CDM concept to the public/stakeholders, the project participant carried out a public presentation of the project activity. It took place on Friday February, 22nd 2008, at 8:30 a.m. in the Caribe Conference Room at the Radisson Hotel in San Salvador city, El Salvador.

Activities in preparation for the event are described below:
A preliminary research and selection for invitees was carried out by CEL. After selecting the organizations and people, CEL delivered personalized invitation cards on site. The selected stakeholders were: the local government, universities, schools, and main representatives and residents from different cities and towns from the Project's surroundings.

Also, the stakeholder presentation was announced in the two most popular newspapers in El Salvador: "El Diario de Hoy" and "La Prensa Gráfica" on February 15th 2008, one week before the event[43].

A final invitation was made via email to all employees from CEL who were related to the project activity. The importance of an active participation in the event was highlighted.

Around 50 participants attended to the stakeholder presentation representing a total of 35 organizations and institutions, located around the project site and some others around the country[44]. A bus from CEL

---

[42] MARN Resolution 10016-505-2007 is available upon request as evidence of this statement.

[43] Respective copies can be presented upon request.

was offered to the people from the Project's site to transport them to where the stakeholder presentation was held.

Phases of the stakeholder presentation:
Registration process. At the entrance of the conference room the registration process was carried on and a paper form was handed out, in which the assistants could write their questions and/or comments related to the project.

Video and presentation. At the beginning of the presentation a general video from CEL was played in order to introduce people to the activity. The video was followed by a Power Point presentation, explaining the project's details regarding technology, construction, operation and the project under the Clean Development Mechanism.

Question round. After the presentation a question round was held, using a moderator who read the questions submitted to him by each participant. At the end an open space for questions and comments was given. A compilation of the questions and answers given in this part of the presentation can be found in section E.2

A video of the entire stakeholder presentation is available and can be submitted upon request.

E.2. Summary of the comments received:

Since there is no opposition to the project, and as it was stated in section D considering that there are no environmental or social impacts involved in this project activity, most of the questions were related to general aspects of the project and with the project under the Clean Development Mechanism[45].

Mrs. Yolanda de Tobar from Centro Nacional de Producción Más Limpia (CNPML) wanted to know about the social responsibility activities related to the project activity.

Luis Ernesto Barrero from Administración Nacional de Acueductos y Alcantarillados (ANDA) asked if the plant's water inflow would have to be increased with the addition of the microunit.

Other questions made by two teachers from local schools in the project's surroundings (Complejo Educativo Católico San Francisco de Sales and Complejo Educativo Jacinto Castellanos) took into consideration a situation regarding the plantation of Teak trees in the project surroundings. The first asked if it is desirable to plant the Teak tree in the Lempa riverside because it consumes lots of water and the other one was concerned because the school was surrounded by Teak Tree, and he wanted to know if they could replace it with other forest species, because in summer it doesn't give shade to the school site.

All comments and questions were heard and answered in a clear and complete way by CEL's representative[46]. He took into consideration every doubt and concern from the people interested in the

[44] A list of the participants can be presented upon request.

[45] For example questions regarding the additional income of the project from CER's commercialization, the calculation of the emission factor, etc. These questions were addressed by the project's CDM consultant (Geoingeniería Ingenieros Consultores).

project activity. A summarized version of the answers given to the main questions is presented in the following section. No further comments were submitted.

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

The question regarding the social responsibility activities related to the project activity was answered focusing on CEL's social responsibility program that in the last years has been giving support to the communities in the areas around the project site. There are several cooperation units, for example the Educational Unit that works hand by hand with the Ministerio de Educación (in English: "Ministry of Education"), the Health Unit that works in coordination with the Ministerio de Salud (in English: "Ministry of Health"), a sports unit and so on in all the rest of the social sectors, where CEL's support is demanded. CEL always participates with the project surrounding communities in giving all kinds of support.

Regarding the question of the project's inflow, there will be no changes in the 5 de Noviembre plant's water inflow, since the new microunit will use the same reservoir.

The last comment concerning the Teak tree will be taken into account by sending an Environmental technician from CEL to the project site and its surroundings. This technician will evaluate other possible species of trees that could be planted in the Lempa Riverside. Likewise the technician will also visit the school to take into account the problem they are facing with this kind of tree.

No further comments were received from the interested stakeholders that attended the public presentation. Finally, it's important to emphasize that the residents and local government are all very supportive to the proposed project activity.

[46] Original questions can be seen directly from the video, which is available upon request.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	COMISIÓN EJECUTIVA HIDROELÉCTRICA DEL RÍO LEMPA (CEL)
Street/P.O.Box:	9a. Calle Pte. #950, Centro de Gobierno
Building:	N/A
City:	San Salvador
State/Region:	San Salvador
Postfix/ZIP:	N/A
Country:	El Salvador
Telephone:	503-22116000
FAX:	503-22116231
E-Mail:	N/A
URL:	www.cel.gob.sv
Represented by:	Irving Tóchez
Title:	Licenciado
Salutation:	Mister
Last Name:	Tóchez
Middle Name:	Pabel
First Name:	Irving
Department:	Executive Director
Mobile:	-
Direct FAX:	503-22116231
Direct tel:	503-22116012
Personal E-Mail:	itochez@cel.gob.sv

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

All the information on the project’s funding is presented on section A.4

Annex 3

BASELINE INFORMATION

El Salvador Energy statistics (units in set "m" in gray) – Thermal Power Plants - 2007

Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
Duke Energy	Acajutla Unit 1	Steam Turbine	1967	30.0	FO	12,277	128,166
Duke Energy	Acajutla Unit 1	Steam Turbine			Dies.	46	
Duke Energy	Acajutla Unit 2	Steam Turbine	1970	33.0	FO		
Duke Energy	Acajutla Unit 2	Steam Turbine			Dies.		
Duke Energy	Acajutla Unit 3	Gas Turbine	1992	-	FO		
Duke Energy	Acajutla Unit 3	Gas Turbine			Dies.		
Duke Energy	Acajutla Unit 4	Gas Turbine	2007	27.0	FO	636	9,714
Duke Energy	Acajutla Unit 4	Gas Turbine			Dies.	718	
Duke Energy	Acajutla Unit 5	Gas Turbine	2001	82.1	FO	3,419	44,866
Duke Energy	Acajutla Unit 5	Gas Turbine			Dies.	1,671	
Duke Energy	Acajutla ICE 1	Internal Combustion	2001	99.0	FO	41,212	724,585
Duke Energy	Acajutla ICE 1	Internal Combustion			Dies.	75	
Duke Energy	Acajutla ICE 2	Internal Combustion	2001	51.0	FO		
Duke Energy	Acajutla ICE 2	Internal Combustion			Dies.		
Acajutla Power Plant					Fuel Oil No. 6	**57,544**	**907,331**
					Diesel	**2,511**	
Duke Energy	Soyapango Unit 1	Internal Combustion	2003	5.4	FO	3,739	49,167
Duke Energy	Soyapango Unit 1	Internal Combustion			Dies.	2	
Duke Energy	Soyapango Unit 2	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 2	Internal Combustion			Dies.		
Duke Energy	Soyapango Unit 3	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 3	Internal Combustion			Dies.		
Soyapango Power Plant					Fuel Oil No. 6	**3,739**	**49,167**
					Diesel	**2**	
Nejapa Power	Nejapa ICE 1	Internal Combustion	1995	91.0	Fuel Oil No. 6	45,288	696,800
Nejapa Power	Nejapa ICE 2	Internal Combustion	1998	53.5	Fuel Oil No. 6		
Nejapa Power Plant						**45,288**	**696,800**
CESSA	CESSA ICE 1	Internal Combustion	2001	19.2	Fuel Oil No. 6	9,608	153,433
CESSA	CESSA ICE 2	Internal Combustion	2001	13.4	Fuel Oil No. 6		
CESSA Power Plant						**9,608**	**153,433**
TEXTUFIL	TEXTUFIL ICE1	Internal Combustion	2000	44.1	Fuel Oil No. 6	14,192	222,209
Textufil Power plant						**14,192**	**222,209**
INE	Talnique	Internal Combustion	2006	51.2	Fuel Oil No. 6	19,363	351,011
INE Talnique						**19,363**	**351,011**
Borealis		Thermal	2007	13.6	Fuel Oil No. 6	4,420	73,523
Borealis						**4,420**	**73,523**
GECSA		Thermal	2007	11.6	Fuel Oil No. 6	299	4,323
GECSA						**299**	**4,323**
Total thermal fuel consumption / generation					**Fuel Oil No. 6**	**154,453**	**2,457,796**
					Diesel	**2,513**	

Source: **SIGET, MARN (detailed unit information provided by the respective plants)**

El Salvador Energy statistics – Low cost / must run plants - 2007

Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
LaGeo	AHUACHAPAN	Geothermal water-dominated system	1975 - 1980	95.0	Geothermal		607,800
LaGeo	BERLIN	Geothermal water-dominated system	1992 - 1999	100.2	Geothermal		685,200
LaGeo Geothermal Power Plants (Total geothermal generation)							**1,293,000**
CEL	GUAJOYO	Storage	1963	19.8	Hydro		81,100
CEL	CERRON GRANDE	Storage	1976	172.8	Hydro		484,000
CEL	5 DE NOVIEMBRE	Run of River	1954	99.4	Hydro		527,400
CEL	15 DE SEPTIEMBRE	Run of River	1983	180.0	Hydro		642,530
CEL Hydroelectric Power Plants (Total hydro power generation)							**1,735,030**
CASSA	CASSA (CDM)	Cogenerator	2003	20.0	Bagasse		91,600
CASSA power plant							**91,600**
Total Biomass generation							**91,600**
Total Net Generation (Thermal + Geothermal + Hydro)					**TOTAL**	**MWh**	**5,577,426**
Imports							**147,600**

Source: **SIGET**

El Salvador Energy statistics (units in set "m" in gray) – Thermal Power Plants - 2006

Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
Duke Energy	Acajutla Unit 1	Steam Turbine	1967	30.0	FO		
Duke Energy	Acajutla Unit 1	Steam Turbine			Dies.		
Duke Energy	Acajutla Unit 2	Steam Turbine	1970	33.0	FO		
Duke Energy	Acajutla Unit 2	Steam Turbine			Dies.		
Duke Energy	Acajutla Unit 3	Gas Turbine	1992	-	FO		
Duke Energy	Acajutla Unit 3	Gas Turbine			Dies.		
Duke Energy	Acajutla Unit 4	Gas Turbine	2007	27.0	FO		
Duke Energy	Acajutla Unit 4	Gas Turbine			Dies.		
Duke Energy	Acajutla Unit 5	Gas Turbine	2001	82.1	FO		
Duke Energy	Acajutla Unit 5	Gas Turbine			Dies.		
Duke Energy	Acajutla ICE 1	Internal Combustion	2001	99.0	FO		
Duke Energy	Acajutla ICE 1	Internal Combustion			Dies.		
Duke Energy	Acajutla ICE 2	Internal Combustion	2001	51.0	FO		
Duke Energy	Acajutla ICE 2	Internal Combustion			Dies.		
Acajutla Power Plant					Fuel Oil No. 6	**60,780**	**1,001,824**
					Diesel	**7,850**	
Duke Energy	Soyapango Unit 1	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 1	Internal Combustion			Dies.		
Duke Energy	Soyapango Unit 2	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 2	Internal Combustion			Dies.		
Duke Energy	Soyapango Unit 3	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 3	Internal Combustion			Dies.		
Soyapango Power Plant					Fuel Oil No. 6	**3,572**	**48,890**
					Diesel		
Nejapa Power	Nejapa ICE 1	Internal Combustion	1995	91.0	Fuel Oil No. 6	52,161	807,805
Nejapa Power	Nejapa ICE 2	Internal Combustion	1998	53.5	Fuel Oil No. 6		
Nejapa Power Plant						**52,161**	**807,805**
CESSA	CESSA ICE 1	Internal Combustion	2001	19.2	Fuel Oil No. 6	10,791	177,430
CESSA	CESSA ICE 2	Internal Combustion	2001	13.4	Fuel Oil No. 6		
CESSA Power Plant						**10,791**	**177,430**
TEXTUFIL	TEXTUFIL ICE1	Internal Combustion	2000	44.1	Fuel Oil No. 6	13,495	216,173
Textufil Power plant						**13,495**	**216,173**
INE	Talnique	Internal Combustion	2006	51.2	Fuel Oil No. 6	857	14,277
INE Talnique						**857**	**14,277**
Borealis		Thermal	2007	13.6	Fuel Oil No. 6		
Borealis							
GECSA		Thermal	2007	11.6	Fuel Oil No. 6		
GECSA							
Total thermal fuel consumption / generation					**Fuel Oil No. 6**	**141,656**	**2,266,398**
					Diesel	**7,850**	

Source: **SIGET, MARN (detailed unit information provided by the respective plants)**

El Salvador Energy statistics – Low cost / must run plants - 2006

Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
LaGeo	AHUACHAPAN	Geothermal water-dominated system	1975 - 1980	95.0	Geothermal		629,571
LaGeo	BERLIN	Geothermal water-dominated system	1992 - 1999	100.2	Geothermal		440,009
LaGeo Geothermal Power Plants (Total geothermal generation)							**1,069,580**
CEL	GUAJOYO	Storage	1963	19.8	Hydro		86,936
CEL	CERRON GRANDE	Storage	1976	172.8	Hydro		653,487
CEL	5 DE NOVIEMBRE	Run of River	1954	99.4	Hydro		547,857
CEL	15 DE SEPTIEMBRE	Run of River	1983	180.0	Hydro		668,331
CEL Hydroelectric Power Plants (Total hydro power generation)							**1,956,610**
CASSA	CASSA (CDM)	Cogenerator	2003	20.0	Baagasse		92,011
CASSA power plant							**92,011**
Total Biomass generation							**92,011**
Total Net Generation (Thermal + Geothermal + Hydro)					**TOTAL**	**MWh**	**5,384,599**
Imports							**11,100**

Source: **SIGET**

El Salvador Energy statistics (units in set "m" in gray) – Thermal Power Plants - 2005

Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
Duke Energy	Acajutla Unit 1	Steam Turbine	1967	30.0	FO		
Duke Energy	Acajutla Unit 1	Steam Turbine			Dies.		
Duke Energy	Acajutla Unit 2	Steam Turbine	1970	33.0	FO		
Duke Energy	Acajutla Unit 2	Steam Turbine			Dies.		
Duke Energy	Acajutla Unit 3	Gas Turbine	1992	-	FO		
Duke Energy	Acajutla Unit 3	Gas Turbine			Dies.		
Duke Energy	Acajutla Unit 4	Gas Turbine	2007	27.0	FO		
Duke Energy	Acajutla Unit 4	Gas Turbine			Dies.		
Duke Energy	Acajutla Unit 5	Gas Turbine	2001	82.1	FO		
Duke Energy	Acajutla Unit 5	Gas Turbine			Dies.		
Duke Energy	Acajutla ICE 1	Internal Combustion	2001	99.0	FO		
Duke Energy	Acajutla ICE 1	Internal Combustion			Dies.		
Duke Energy	Acajutla ICE 2	Internal Combustion	2001	51.0	FO		
Duke Energy	Acajutla ICE 2	Internal Combustion			Dies.		
Acajutla Power Plant					Fuel Oil No. 6	**57,499**	**925,736**
					Diesel	**2,362**	
Duke Energy	Soyapango Unit 1	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 1	Internal Combustion			Dies.		
Duke Energy	Soyapango Unit 2	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 2	Internal Combustion			Dies.		
Duke Energy	Soyapango Unit 3	Internal Combustion	2003	5.4	FO		
Duke Energy	Soyapango Unit 3	Internal Combustion			Dies.		
Soyapango Power Plant					Fuel Oil No. 6	**1,878**	**25,408**
					Diesel		
Nejapa Power	Nejapa ICE 1	Internal Combustion	1995	91.0	Fuel Oil No. 6	49,696	763,136
Nejapa Power	Nejapa ICE 2	Internal Combustion	1998	53.5	Fuel Oil No. 6		
Nejapa Power Plant						**49,696**	**763,136**
CESSA	CESSA ICE 1	Internal Combustion	2001	19.2	Fuel Oil No. 6	11,133	179,292
CESSA	CESSA ICE 2	Internal Combustion	2001	13.4	Fuel Oil No. 6		
CESSA Power Plant						**11,133**	**179,292**
TEXTUFIL	TEXTUFIL ICE1	Internal Combustion	2000	44.1	Fuel Oil No. 6	14,653	243,458
Textufil Power plant						**14,653**	**243,458**
INE	Talnique	Internal Combustion	2006	51.2	Fuel Oil No. 6		
INE Talnique						**0**	**0**
Borealis		Thermal	2007	13.6	Fuel Oil No. 6		
Borealis							
GECSA		Thermal	2007	11.6	Fuel Oil No. 6		
GECSA							
Total thermal fuel consumption / generation					**Fuel Oil No. 6**	**134,858**	**2,137,030**
					Diesel	**2,362**	

Source: **SIGET, MARN (detailed unit information provided by the respective plants)**

El Salvador Energy statistics – Low cost / must run plants - 2005

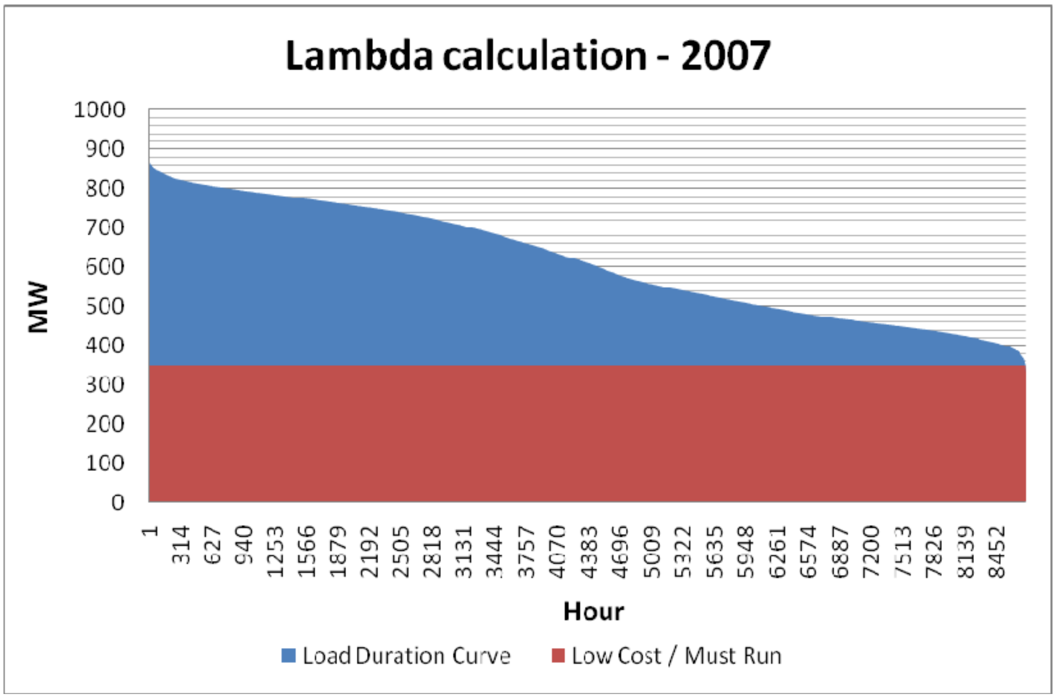
Owner	Unit	Technology	Starting Year	Capacity (MW)	Fuel Type	Fuel Consumption (000 gals)	Net Generation (MWh)
LaGeo	AHUACHAPAN	Geothermal water-dominated system	1975 - 1980	95.0	Geothermal		557,464
LaGeo	BERLIN	Geothermal water-dominated system	1992 - 1999	100.2	Geothermal		427,721
LaGeo Geothermal Power Plants (Total geothermal generation)							**985,184**
CEL	GUAJOYO	Storage	1963	19.8	Hydro		65,175
CEL	CERRON GRANDE	Storage	1976	172.8	Hydro		577,157
CEL	5 DE NOVIEMBRE	Run of River	1954	99.4	Hydro		540,921
CEL	15 DE SEPTIEMBRE	Run of River	1983	180.0	Hydro		481,173
CEL Hydroelectric Power Plants (Total hydro power generation)							**1,664,426**
CASSA	CASSA (CDM)	Cogenerator	2003	20.0	Baagasse		50,422
CASSA power plant							**50,422**
Total Biomass generation							**50,422**
Total Net Generation (Thermal + Geothermal + Hydro)					**TOTAL**	**MWh**	**4,837,062**
Imports							**322,100**

Source: **SIGET**

Lambda Calculations

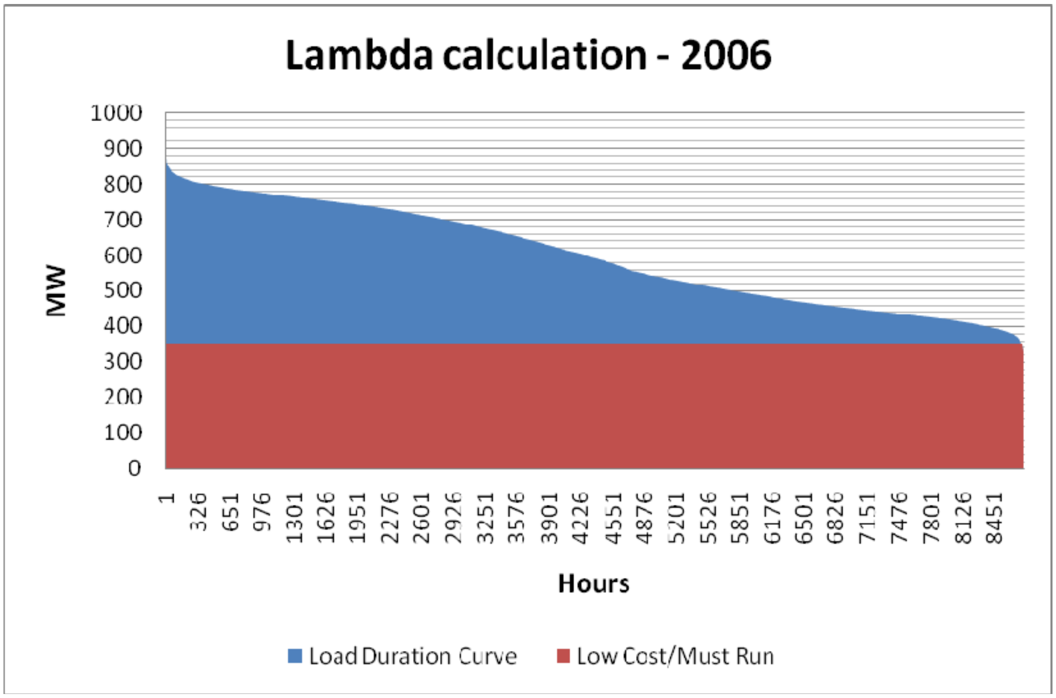
For more information about the estimation of the lambda coefficient, please refer to the latest version of the *"Tool to calculate the emission factor for an electricity system"*

Salvadorean Load Duration Curve – 2007



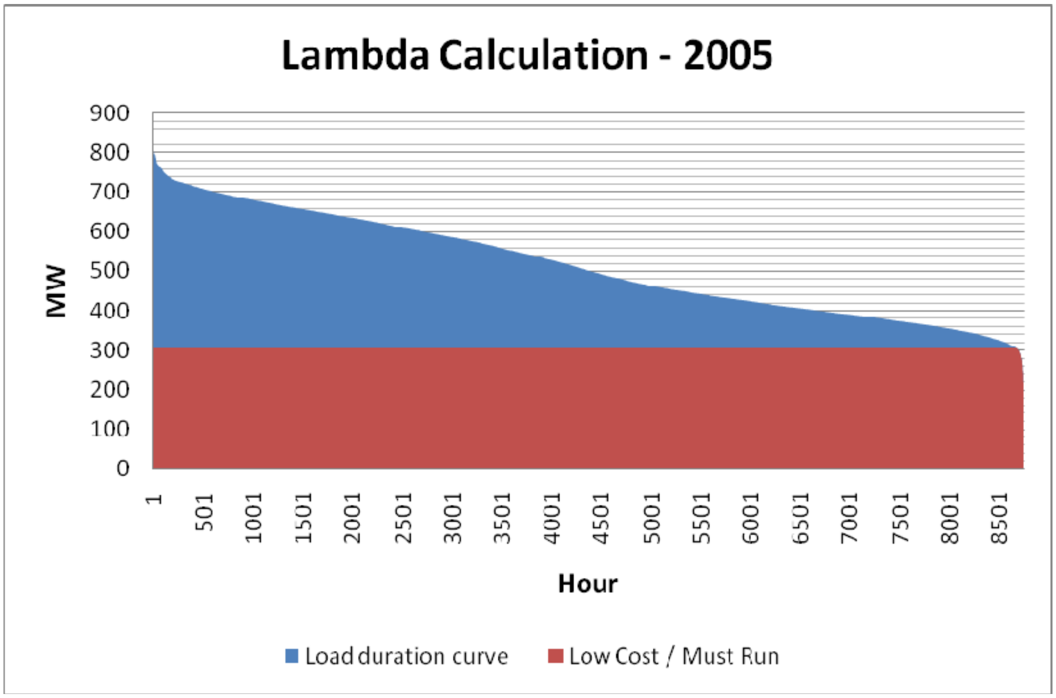
Source: Author's estimation based on information by the Transactions Unit (UT – available at www.ut.com.sv - Excel worksheet available to the DOE)

Salvadorean Load Duration Curve –2006



Source: Author's estimation based on information by the Transactions Unit (UT – available at www.ut.com.sv - Excel worksheet available to the DOE)

Salvadorean Load Duration Curve –2005



Source: Author's estimation based on information by the Transactions Unit (UT – available at www.ut.com.sv - Excel worksheet available to the DOE)

Summary of the lambda calculations

Variable	2005	2006	2007	Average
λ	0.008904	0.001712	0.000799	
1-λ	0.991096	0.998288	0.999201	
generation weight *(*)*	0.319108	0.355290	0.325602	
λ x weight	0.002841	0.000608	0.000260	0.003710
(1-λ) x weight	0.316267	0.354681	0.325342	0.996290

Source: Author's estimation based on information by the Transactions Unit (UT – available at www.ut.com.sv) and SIGET – *(*) Weights are defined, as per methodology, as the annual generation divided over the sum of the three year's generation.*

Annex 4

MONITORING INFORMATION

All the information on the project's monitoring programme is presented on section B.7.-

Annex 5

ADDITIONALITY ANALYSIS CASH FLOWS

The Cash flow analysis for the addition of a microunit at the "5 de Noviembre Power Plant" for a project lifetime of 25 years, starting in 2009 until 2033, is presented below in continual tables.

Cash flow – addition of a microunit to the 5 de Noviembre Power Plant

		1	**2**	**3**	**4**	**5**	**6**
	2008	2009	2010	2011	2012	2013	2014
Income		168,576	173,111	177,767	182,549	187,460	192,502
Maintenance		0	0	0	15,000	15,000	15,000
SIGET		907	907	907	907	907	907
UT		717	717	717	717	717	717
CUST		10,174	10,174	10,174	10,174	10,174	10,174
Insurance		5,014	5,014	5,014	5,014	5,014	5,014
EBIT	0	151,764	156,299	160,955	150,737	155,648	160,691
Depreciation		57,300	57,300	57,300	57,300	57,300	57,300
Income tax		23,616	24,750	25,914	23,359	24,587	25,848
Net Income		128,148	131,549	135,042	127,378	131,061	134,843
Capital Expenditures	-1,432,501						
Net Cash Flow	-1,432,501	128,148	131,549	135,042	127,378	131,061	134,843
CERs Revenue		24,780	24,780	24,780	24,780	24,780	24,780
Net Cash Flow inc. CERs	-1,432,501	152,928	156,329	159,821	152,158	155,840	159,622

Source: Table B.2– Assumptions for the project's financial model

Cash flow – addition of a microunit to the 5 de Noviembre Power Plant (*cont.)*

	7	8	9	10	11	12	13
	2015	2016	2017	2018	2019	2020	2021
Income	197,681	202,998	208,459	214,067	219,825	225,738	231,811
Maintenance	15,000	15,000	15,000	15,000	15,000	15,000	15,000
SIGET	907	907	907	907	907	907	907
UT	717	717	717	717	717	717	717
CUST	10,174	10,174	10,174	10,174	10,174	10,174	10,174
Insurance	5,014	5,014	5,014	5,014	5,014	5,014	5,014
EBIT	165,869	171,186	176,647	182,255	188,013	193,926	199,999
Depreciation	57,300	57,300	57,300	57,300	57,300	57,300	57,300
Income tax	27,142	28,472	29,837	31,239	32,678	34,157	35,675
Net Income	138,727	142,715	146,810	151,016	155,335	159,770	164,324
Capital Expenditures							
Net Cash Flow	138,727	142,715	146,810	151,016	155,335	159,770	164,324
CERs Revenue	24,780	24,780	24,780	24,780	24,780	24,780	24,780
Net Cash Flow inc. CERs	163,506	167,494	171,590	175,796	180,114	184,549	189,104

Source: Table B.2– Assumptions for the project's financial model

Cash flow – addition of a microunit to the 5 de Noviembre Power Plant (*cont.)*

	14	15	16	17	18	19	20
	2022	2023	2024	2025	2026	2027	2028
Income	238,046	244,450	251,025	257,778	264,712	271,833	279,145
Maintenance	15,000	15,000	15,000	15,000	15,000	15,000	15,000
SIGET	907	907	907	907	907	907	907
UT	717	717	717	717	717	717	717
CUST	10,174	10,174	10,174	10,174	10,174	10,174	10,174
Insurance	5,014	5,014	5,014	5,014	5,014	5,014	5,014
EBIT	206,234	212,638	219,214	225,966	232,900	240,021	247,333
Depreciation	57,300	57,300	57,300	57,300	57,300	57,300	57,300
Income tax	37,234	38,834	40,478	42,167	43,900	45,680	47,508
Net Income	169,001	173,803	178,735	183,800	189,000	194,341	199,825
Capital Expenditures							
Net Cash Flow	169,001	173,803	178,735	183,800	189,000	194,341	199,825
CERs Revenue	24,780	24,780	24,780	24,780	24,780	24,780	24,780
Net Cash Flow inc. CERs	193,780	198,583	203,515	208,579	213,780	219,120	224,605

Source: Table B.2– Assumptions for the project's financial model

Cash flow – addition of a microunit to the 5 de Noviembre Hydro Station (*cont.)*

	21	22	23	24	25
	2029	2030	2031	2032	2033
Income	286,654	294,365	302,284	310,415	318,765
Maintenance	15,000	15,000	15,000	15,000	15,000
SIGET	907	907	907	907	907
UT	717	717	717	717	717
CUST	10,174	10,174	10,174	10,174	10,174
Insurance	5,014	5,014	5,014	5,014	5,014
EBIT	254,842	262,553	270,472	278,603	286,954
Depreciation	57,300	57,300	57,300	57,300	57,300
Income tax	49,386	51,313	53,293	55,326	57,413
Net Income	205,457	211,240	217,179	223,278	229,540
Capital Expenditures					
Net Cash Flow	205,457	211,240	217,179	223,278	229,540
CERs Revenue	24,780				
Net Cash Flow inc. CERs	230,236	211,240	217,179	223,278	229,540

Source: Table B.2– Assumptions for the project's financial model

Annex 6

ESTIMATION OF PRICE TREND USING TIME SERIES ANALYSIS

A time series analysis was performed in order to estimate the time trend followed by the energy price. The analysis was based on a price series from the UT comprising more than 52 thousand observations from 2002 to 2007. Outliers (mostly, wrong observations like negative or zero values) were excluded from the sample. Besides from the deterministic trend included in the model, six control variables were included (namely: season, peak, rest, Saturdays, Sundays and holidays; each one of them taking the value 1 in case the price corresponded to the wet season, peak hour time, rest hour time or a non labour day). The results from the estimation[47] are as follows:

Dependent Variable: LOG(PRICE)
Method: Least Squares
Date: 03/04/08 Time: 16:56
Sample: 1 52387
Included observations: 52,387

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.838682	0.004181	918.1507	0.0000
YEAR	0.026568	0.000788	33.71691	0.0000
SEASON	0.011434	0.002693	4.245618	0.0000
PEAK	0.418825	0.003993	104.8907	0.0000
REST	0.277544	0.003256	85.23944	0.0000
SATURDAYS	-0.068870	0.003906	-17.63327	0.0000
SUNDAYS	-0.145853	0.003911	-37.28995	0.0000
HOLIDAYS	-0.064719	0.009851	-6.569839	0.0000

R-squared	0.219793	Mean dependent var	4.143473
Adjusted R-squared	0.219689	S.D. dependent var	0.348821
S.E. of regression	0.308132	Akaike info criterion	0.483577
Sum squared resid	4973.146	Schwarz criterion	0.484931
Log likelihood	-12658.57	F-statistic	2107.965
Durbin-Watson stat	0.528835	Prob(F-statistic)	0.000000

The coefficient on the "year" variable implies that the price grows at an approximate 2.66% rate every year after accounting for other effects (i.e. keeping the control variables constant). In particular, the exact rate is obtained as $e^{0.26568} - 1 = 0.0269$, which is the value used for the additionality analysis presented on Section B of this PDD[48].

- - - - -

[47] The estimation was performed using the econometric package Eviews version 5.0. The worksheet with the time series is available upon request by the DOE.

[48] For a detailed discussion on time series analysis and the use of dummy variables refer to Woolridge, Jeffrey, "*Introductory econometrics: a modern approach*". South-western College Publishing (2000).