

PROTOTYPE CARBON FUND

**MEXICO:
EL GALLO HYDROELECTRIC PROJECT**

September 7, 2003

CONTENTS

- A. General description of project activity
- B. Baseline methodology
- C. Duration of the project activity / Crediting period
- D. Monitoring methodology and plan
- E. Calculations of GHG emissions by sources
- F. Environmental impacts
- G. Stakeholders comments

Annexes

Annex 1: Information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: New baseline methodology

Annex 4: New monitoring methodology

Annex 5: Table: Baseline data

Exhibits

Exhibit A: Analysis of Environmental Impacts

A. General description of project activity

A.1 Title of the project activity:

El Gallo Hydroelectric Project.

A.2. Description of the project activity:

(Please include in the description

- *the purpose of the project activity*
- *the view of the project participants of the contribution of the project activity to sustainable development)*

The objective of the El Gallo Hydroelectric Project is to generate renewable electricity using hydroelectric resources and to sell the generated output to Mexican consumer partners (primarily industrial users and municipalities) on the basis of power purchase agreements (PPAs), using the Comisión Federal de Electricidad (CFE) transmission system to wheel the energy. The project activity will generate greenhouse gas (GHG) emission reductions by avoiding electricity generation, and CO₂ emissions, at fossil fuel-fired power plants that would be generating electricity delivered to the grid otherwise.

The El Gallo Project consists of a 30 MW power plant at the existing dam of El Gallo on the Cutzamala river in the state of Guerrero. The land and the dam are owned by the Federal Government and Comisión Nacional de Aguas (CAN) is responsible for its administration. The dam was built between 1979 and 1998, with the two-fold objective of (i) irrigation and (ii) clean electricity generation. However, due to lack of funds the electricity generation was never implemented. The project will use the existing pattern of irrigation flow releases to generate electricity.

The Project will assist Mexico in stimulating and accelerating the commercialization of renewable energy technologies and markets at the grid level and under private ownership and operation in order to reduce GHG emissions while responding to increasing energy demand and energy diversification imperatives necessary for sustainable economic growth. Broadened private experience in the development, operation and maintenance of hydropower electricity generation is a significant option for expanding and diversifying Mexico's energy resources, and at the level of the CFE, increased experience in accommodating smaller distributed resources that offer potential energy, capacity, and diversification benefit.

A.3. Project participants:

(Please list Party(ies) and private and/or public entities involved in the project activity and provide contact information in Annex 1)

(Please indicate at least one of the above as the contact for the CDM project activity)

Host Country: Mexico

Project Proponent: Impulsora Nacional de Electricidad (INELEC), S.A. de C.V.

Project Sponsors: Corporación Mexicana de Hidroelectricidad, S.A. de C.V.
Scudder Latin American Power Fund (SLAP)

Other Project Participants: Prototype Carbon Fund (PCF)

PCF is the main CDM contact for this project activity. (Please see Annex 1 for detailed contact information).

A.4. Technical description of the project activity:

The El Gallo Project will use the existing El Gallo dam to generate electricity by impounding water mainly utilized for downstream irrigation. The existing dam is a rock filled dam with an impervious clay core center but lacks provisions for hydroelectric facilities. Additional civil works will be required to connect the Project to the existing dam and the reservoir. In addition, a 250 m long tunnel, lined with reinforced concrete will be constructed. A steel penstock to feed the turbine will be installed near the end of the tunnel.

The El Gallo dam provides storage for interannual regulation of river flows for irrigation districts located downstream. The regulating dam can accommodate some degree of varying upstream dam flow releases, thus allowing for increased flexibility in the quantity and the time intervals at which flows are released for hydroelectric generation. Irrigation demand flows will take priority and will not be modified in anyway as a result of the development of the project.

The main design characteristics of the El Gallo project are summarized in Table1.

Table 1: Main project characteristics:

<i>El Gallo</i>	
Power (MW)	30
Design head (m)	46.5
Design rate of flow (m ³ /s)	76.7
Project efficiency (%)	86.2
Transmission line (Km)	11.7

The expected total annual average generation output of 120,668 MWh is distributed over the peak, intermediate, and base intervals as follows:

Table 2: El Gallo's output profile:

<i>Peak</i>	<i>Intermediate</i>	<i>Base</i>
20,514 MWh	65,161 MWh	34,994 MWh
17%	54%	29%

A.4.1. Location of the project activity:

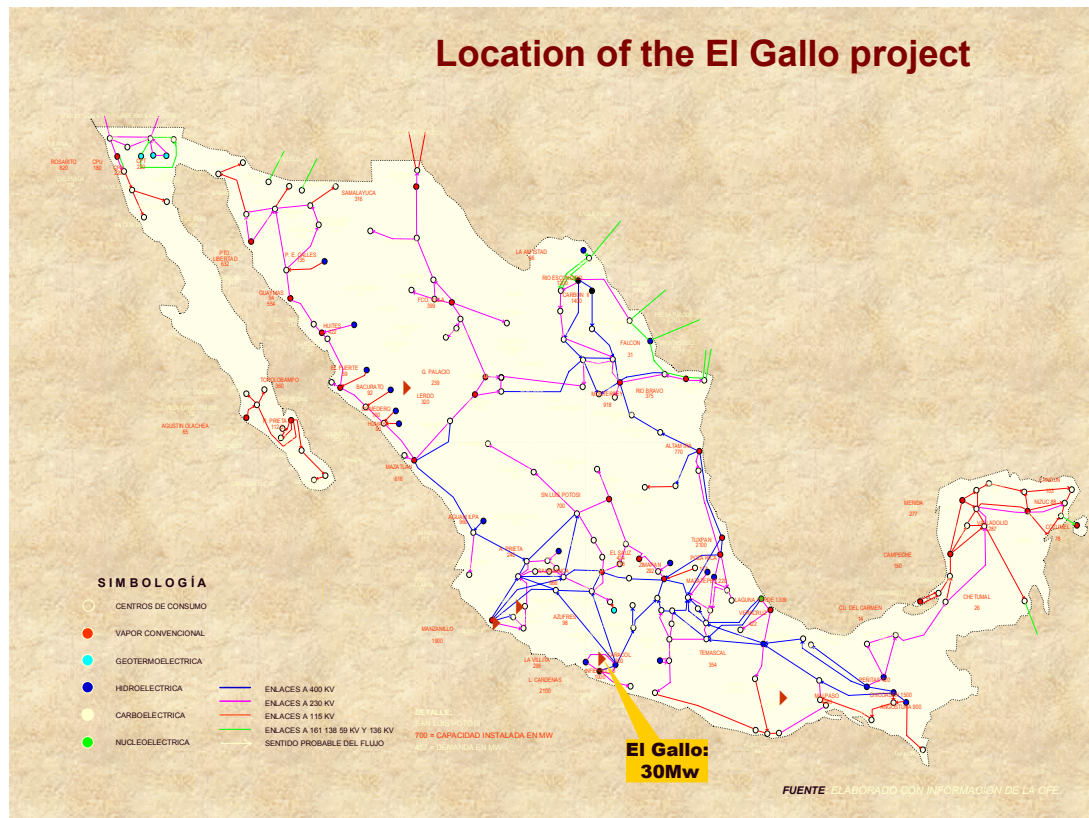
A.4.1.1 Host country Party(ies): Mexico

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

A.4.1.3 City/Town/Community etc: Town of Cutzamala de Pinzón

A.4.1.4 Detail on physical location, including information allowing the unique identification of this project activity:

The El Gallo project is located on the Cutzamala river, near the town of Cutzamala de Pinzón. The nearest major city is Toluca, which lies about 140 km to the northeast.



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

(Using the list of categories of project activities and of registered CDM project activities by category available on the UNFCCC CDM web site, please specify the category(ies) of project activities into which this project activity falls. If no suitable category(ies) of project activities can be identified, please suggest a new category(ies) descriptor and its definition, being guided by relevant information on the UNFCCC CDM web site)

In the absence of established project activity categories, the following category is suggested: “Renewable electricity generation in grid connected applications.”

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

(This section should include a description on how environmentally safe and sound technology and know-how to be used is transferred to the host Party, if any).

The Francis type hydraulic turbines and the generators to be used in the project will be manufactured by Alstrom power and VA Tech under an Equipment/ Procurement/Construction (EPC) contract with the project sponsors. Both companies have been manufacturing equipment for hydroelectric facilities for decades and have improved the engineering and technology that they use in the design and fabrication of turbines and generators.

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:

(Please explain briefly how anthropogenic greenhouse gas (GHG) emission reductions are to be achieved (detail to be provided in section B) and provide the total estimate of anticipated reductions in tonnes of CO2 equivalent as determined in section E below).

Applying the methodology described in section B.2, the implementation of the El Gallo hydroelectric plant in the Mexican electricity system will generate an annual reduction of 70,484 tCO₂ and a total reduction of 1,480,157 tCO₂ over 21 years (See Table 3). This reduction is the result of the displacement of generation from fossil fuel-fired plants that would have otherwise delivered electricity to the CFE interconnected grid.

Table 3: El Gallo ERs:

Crediting period	tCO ₂
Year 1	70,484
Year 1-7	493,386
Year 1-14	986,771
Year 1-21	1,480,157

In each crediting period, the amount of ERs generated by the project will vary directly with the metered net generation output from El Gallo. The estimations in Table 3 are based on a grid emission rate of 0.584 tCO₂equiv/MWh and an expected 120,668 MWh of electric-energy output annually. The emission rate is computed from the most recent official information on the Mexican electric power sector.

A.4.5. Public funding of the project activity:

(In case public funding from Parties included in Annex I is involved, please provide in Annex 2 information on sources of public funding for the project activity, including an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.)

No public funding is provided for this Project.

B. Baseline methodology

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

(Please refer to the UNFCCC CDM web site for the title and reference list as well as the details of approved methodologies. If a new baseline methodology is proposed, please fill out Annex 3. Please note that the table “Baseline data” contained in Annex 5 is to be prepared parallel to completing the remainder of this section.)

This baseline methodology applied to the El Gallo project is a new methodology detailed in Annex 3, and referred to as “Barrier analysis, baseline scenario development, and baseline emission rate calculation for a proposed grid-connected project that displaces power from the operation and expansion of the electric sector.” It consists of two parts. The first part establishes the additionality of the El Gallo hydroelectric project, and the second part defines the baseline scenario and provides an algorithm for calculating the corresponding baseline emission rate.

The actual emission rate is not provided by the baseline methodology, but is calculated from monitored data as per the monitoring methodology.

In applying this methodology, it is desired to make operational the recent Executive Board clarification that the additionality of a project can be supported by (1) “a qualitative or quantitative assessment of one or more barriers facing the proposed project activity (such as those laid out for small-scale CDM projects)” and (2) “an indication that the project type is not common practice” (CDM-EB-10, Annex 1).

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

The proposed methodology is appropriate for the El Gallo grid-connected hydroelectric project because renewable energy projects such as this are known to be disadvantaged because of barriers when compared with traditional energy sources. The El Gallo project, despite its apparently attractive financial characteristics (according to the project developer’s financial analysis, although no financial information is needed for this methodology or included in this PDD), has had severe difficulty attracting the attention of financial organizations, due to barriers that are typical of renewables opportunities in developing countries. Principally, the project has faced a prohibitive barrier to securing financing.

The methodology is applicable to the El Gallo project because:

A. Sufficient information exists to demonstrate in a transparent and conservative manner that El Gallo is subject to prohibitive barriers, and its registration as a CDM project would enable it to overcome those barriers. (It should be noted that the agreement between the project developers and the PCF is such that any risk that the Kyoto Protocol will not be ratified and that the CDM will not come into operation has been assumed by the PCF. The benefits to be derived from registration as a CDM activity will accrue regardless of the status of the Kyoto

Protocol and the CDM, insofar as the PCF will still honour the terms of their mutually contracted agreement).

B. Sufficient information exists to demonstrate in a transparent and conservative manner that the type of activity undertaken in the El Gallo project is not common practice at the present time.

C. El Gallo will displace electricity that would otherwise be provided by the operation and expansion of the grid. The grid can be clearly identified and the required data is available.

D. The Mexican electric sector is not dominated by generating sources with zero or low operating costs such as hydro, geothermal, wind, solar, nuclear, and low-cost biomass. These resources comprise a significant fraction of generation (27%, see Table A2), but do not dominate the generation mix.

B.3. Description of how the methodology is applied in the context of the project activity:

Both parts of the baseline methodology, as detailed in Annex 3, are applied to the El Gallo project:

- (i) First, the additionality of the El Gallo hydroelectric project is established based on a barrier analysis. Relevant arguments are presented both in the specific context of the El Gallo project (Step M1) and in the general context of the Mexican electric sector in which the El Gallo project will be operating (Step M2).
- (ii) Next, a justification for the baseline scenario and a transparent and conservative estimation of the baseline emission rate is carried out (Step M3), using the algorithm applied in Annex 3 and the data provided in Annex 5.

Here, the baseline methodology detailed in Annex 3 is applied to the El Gallo project. The numbering of the steps is as in Annex 3.

Part 1. Additionality argument for the El Gallo project based on barrier analysis.

Methodology Step M1. Analyze barriers to proposed project.

This methodology seeks to establish that barriers would have prevented the project from being undertaken or completed (Substep M1(a)), and to demonstrate that by registering the project as a CDM activity these barriers would be alleviated and the project enabled (Substep M1(b)). Being a registered CDM project activity, by negotiating a formal agreement with the PCF (and the World Bank as its trustee), has both financial and institutional benefits that affect the viability of a project.

Substep M1(a). Identify the relevant barriers to the proposed project activity.

The primary relevant barrier to the development of a project such as El Gallo is the difficulty in procuring financing. Several factors relevant to El Gallo contribute to this difficulty:

- *Access to financing:* The domestic financial market in Mexico has been characterized by high interest rates¹ and short loan terms over the course of the time that the El Gallo 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. One reason that it is difficult to access is that the prospective financiers look for reliable, creditworthy, sources of revenue for the project. The El Gallo project relies on negotiated power purchase agreements with off-takers, including dozens of small enterprises and municipalities, whose creditworthiness is difficult for prospective international financiers to evaluate.
- *Perceived technology risk:* The El Gallo project is not based on conventional fossil technology, which immediately raises the level of risk perceived by prospective financiers and consumers. The Mexican electric sector does have a large amount of hydro (approximately one-quarter of the capacity of the Mexican electric sector), but this is predominantly large-scale hydro that has been planned, constructed, owned, and controlled under the authority of the Comisión Federal de Electricidad (CFE). There is a very small amount of small hydro advanced by private sector developers, backed by private financing, and reliant on privately negotiated PPAs. (Private sector involvement in small hydro is discussed further below in Step M2.)
- *Transaction costs:* Being a small facility with a maximum output of only 30 MW, El Gallo 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.

The difficulty of securing financing has been borne out during the ongoing gestation period of the El Gallo project. Despite the fact that the developers of the El Gallo project first started to advance this project more than five years ago, and have shown an earnest commitment to its completion and a full confidence in its viability, the difficulty of securing project financing remains and the project has still not reached financial closure. The necessary steps to securing financing have been long and complex, with several intermediate decision points at which the project could have been deemed unbankable and terminated.

The involvement of the developer in the El Gallo project started in 1998, when the project developer invested approximately \$500,000 (roughly 1% of the capital cost of the full project) in private equity in civil construction on the site of the planned El Gallo project. At that point, the developer was a member of the construction team responsible for the existing irrigation dam on which the proposed El Gallo hydroelectric facility was ultimately based. During the planning and construction of the original irrigation dam, the developer recognized that – should the existing irrigation dam be later reconfigured to accommodate a hydroelectric facility – significant economic efficiencies could be realized if certain design features were

¹ Prevailing average annual interbank interest rates in recent years are shown in the adjoining table. The rates charged to buyers have historically exceeded the interbank rates by 4-5 % in recent years and 5-10% in the past.

Year	'96	'97	'98	'99	'00	'01	'02	'03
Mexican Interbank Interest Rate (Tasa de Interés Interbancaria de Equilibrio – TIIE)	33.66 %	21.91 %	26.89 %	24.10 %	16.96 %	12.89 %	8.17 %	7.80 %

Source: Instituto Nacional de Estadística, Geografía e Informática (INEGI).

designed and built into the original irrigation dam. Moreover, this investment was also understood by the developer to be an important demonstration to prospective PPA partners and prospective financiers of the developer's credibility as a committed investor and reliable partner. By 1998, the developer had obtained the relevant water concessions from the Comisión Nacional del Agua (CAN) and the necessary land concession from the local authorities, whereupon the permit for "self-generation" was granted by the Comisión Reguladora de Energía (CRE) to the developers in January 1999 (CRE E/130/AUT/99²). This early beginning of the El Gallo hydroelectric project is also cited in the 2001 *Prospectiva del Sector Eléctrico* of the Secretaría de Energía, which lists El Gallo as a "Hydroelectric Project in Development". Continued construction is anticipated, if not assured, and a engineering, procurement and construction contract for El Gallo has been finalized with Voith Siemens (as of March, 2003).

Despite this early start and significant progress, the completion of the El Gallo projects is still not a foregone conclusion, due to the continuing barrier posed by securing financing. The developer petitioned the CRE for an extension of the self-generation permit to September 2002 (CRE RES/105/2000) and then again for an extension to September 2004 (CRE RES/147/2002). Over this period construction has ceased. Each of these official documents cites difficulty in reaching financial closure as the cause of the interruption and postponement.

It is now expected that registration of the El Gallo project as a CDM activity and final negotiation of an emissions reduction purchase agreement with the PCF will make it possible for the developer to secure financing and allow the El Gallo project to proceed. It was in mid-2001 that the developer, at the recommendation of one of its constituent equity partners (Scudder Latin America Power Fund) decided to explore marketing of the project's CO₂ reductions as a possible source of financing. The developer thereupon commissioned a study of the carbon financing opportunities, baseline issues, and emissions reductions estimates, which was completed in November 2001. (This study is available for review by the Designated Operational Entity).

While these are strong arguments that the project was facing severe barriers that would have prevented the developer from successfully implementing it, it cannot be claimed with utmost certainty that no developer, including a potent investor with large capital resources, would not have been able to implement the project. It also cannot be claimed with utmost certainty that conditions will not suddenly and radically change, markedly improving the availability of financing for projects such as El Gallo. However, neither of these conditions seems likely enough to cast significant doubt on the claim that the project is additional.

Substep M1(b). Explain how only the approval and registration of the project as a CDM activity would enable the project to overcome the identified barriers and thus be undertaken.

The role of the registration of the project as a CDM activity would be twofold in enabling the project to overcome the identified barriers:

1. The prospect of registering the El Gallo project as a CDM activity with World Bank backing has helped establish the credibility and creditworthiness of the developer in the view

² Documents cited thus are available on the website of the Comisión Reguladora de Energía – www.cre.gob.mx.

of prospective financiers, making it possible to secure financing. In their five-year effort to launch the project, the developers of the El Gallo hydroelectric project continually faced prohibitive barriers to financing. The project developers had been seeking financing for approximately two-thirds of the value of the capital investment, primarily from international commercial banks, at terms as long as fifteen years. Long-term financing from domestic development banks and commercial banks has proven impossible to secure. A wide range of prospective financiers have been approached, many of whom were immediately deterred by the perceived level of risk. Perceived risks primarily included the technological risk of small hydro, the financial risk of a project that relied for its revenue on off-takers (industrial firms and municipalities) with uncertain creditworthiness, and the sovereign risk associated with investments in Mexico under the prevailing economic and political conditions.

The involvement of the World Bank as Trustee for the PCF as the purchaser of emissions reductions from the El Gallo project is anticipated to make this financing barrier surmountable. As part of its screening of projects in its portfolio, the PCF carries out financial, technical, social/environmental due diligence assessments which are perceived by other international financial organizations as a strong implicit endorsement. The financial organizations with whom the project developers are nearing financial closure have formally requested evidence of the PCF involvement in the El Gallo project as a precondition of the closure, which will not occur without this evidence. (These requests are available for review by the Designated Operational Entity). The requested evidence included the Letter of Intent signed between the PCF and the project developers, and the draft Term Sheet to the Emission Reductions Purchase Agreement. The project developers also had to provide explanation and background on the concept of carbon mitigation and carbon trading, and the nature of the agreement between the El Gallo project and the PCF.

2. Registering the El Gallo project as a CDM activity provides a significant amount of revenue, improving the project's cash flow and hence its bankability. The project developers anticipate that the El Gallo project will generate an estimated \$270,000 per year from the sale of emissions reductions (net of initial and annual transaction costs). This is a small but non-negligible contribution to the project's net revenue of approximately \$7.7 million/year and helps to improve the cash flow standing of the project from the perspective of the funders. Assuming the El Gallo project is approved and successfully registered, the CO₂ emissions sale in fact provides a more secure and reliable revenue stream than the project's electricity sales, especially given that the creditworthiness of the electricity purchasers is a concern of the financiers. Moreover, the carbon revenue is the only payment to the El Gallo project that is received in hard currency. This is of considerable interest to the financiers whose loans are denominated in hard currency.

Methodology Step M2. Discussion of other existing 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 El Gallo, it is necessary to investigate the current state of private sector hydroelectric activity in Mexico. As of the passage of the 1992 amendments to the Ley del Servicio Público de Energía Eléctrica, and subsequent policy initiatives, the process for self-generation, cogeneration, and independent production has been streamlined. These regulatory changes have apparently been effective, at least in part, as more than two hundred permits for independent power production have been issued since

1994, contributing a capacity of approximately 8,000 megawatts to date with more than 9,000 megawatts under construction.³

The vast majority of these projects have been conventional thermal (natural gas combined cycle, or NGCC) power plants. A total of fifteen permits have been issued for private investment in small hydroelectric, as shown in Table B1. Of these, the majority have not managed to complete the capital investment phase, undergo commissioning, and start supplying power: less than 41 MW out of 175 MW permitted is currently in operation, and the remainder have been under development for several years.

At least three projects that hold permits issued around the same time as El Gallo's permit (Generadora Electrica San Rafael, Electricidad del Istmo, and Proyecto Trojes) needed to file for permit extensions on the grounds that financial closure has not been reached (CRE documents RES/106/2001; RES/018/2001; RES/019/2001). This further supports the claim that there is a significant barrier to financing for such projects.

³ *Prospectiva del Sector Eléctrico*, (SENER, 2002).

Table B.1. Private sector development of small hydroelectric power (with permits granted by the CRE in accordance with the 1992 amendments to the Ley del Servicio Publico de Energía Eléctrica).

	Developer of hydroelectric installation	Year of permit	Capacity (MW)	Status	Investment (million \$)
1	Papelera Veracruzana	1995	1.26	<i>in operation</i>	\$1.8
2	Cerveceria Cuauhtemoc-Moctezuma (hydro and internal combustion)	1995	15.00	<i>in operation</i>	\$18.0
3	Minas San Luis (hydro and steam)	1998	4.44	<i>in operation</i>	\$5.0
4	Generadora Electrica San Rafael	1998	24.00	under construction	\$12.0
5	Mexicana de Hidroelectricidad Mexhidro (Proyecto El Gallo)	1999	30.00	under construction	\$45.0
6	Compañía Industrial Veracruzana	1999	4.00	<i>in operation</i>	\$5.6
7	Electricidad del Istmo	1999	20.00	under construction	\$20.0
8	Hidroelectricidad del Pacífico	1999	8.00	<i>in operation</i>	\$8.0
9	Hidroelectricas Virita	1999	5.73	<i>in operation</i>	\$5.7
10	Proveedora de Electricidad de Occidente	1999*	19.00	under construction	\$19.0
11	Proveedora Nacional de Electricidad	1999*	5.00	under construction	\$5.0
12	Cementos Apasco, (Planta Apaxco)	2001	1.92	<i>in operation</i>	\$1.9
13	Compañía de Energía Mexicana (Planta Atexcaco)	2001	21.00	under construction	\$21.0
14	Mexicana de Electrogenación (Proyecto Trigomil)	2001	10.88	under construction	\$10.9
15	Mexicana de Electrogenación (Proyecto Tacotan)	2001	6.48	under construction	\$6.5

* Permits for Proveedora de Electricidad de Occidente and Proveedora Nacional de Electricidad were reissued in 2003.

A total of seven hydroelectric projects are listed as currently being in operation. Certain circumstances particular to seven of these hydroelectric projects have enabled them to overcome the barriers that generally apply to small hydro, allowing them to go forward and come into operation (See Table B.2.). The four main mitigating circumstances appear to be the following⁴:

(1) The seven operating projects required much less capital investment, thereby reducing or eliminating the financing barrier. The El Gallo project alone requires as much investment capital (\$45 million) as the other seven projects combined (\$46 million). Individually, six of the seven other projects required between 4% and 18% as much

⁴ References: Permits issued by CRE: 20/AUT/95; E/114/AUT/98; E/115/AUT/98; E/137/AUT/99; E/150/AUT/99; E/190/AUT/2001 and other CRE documentation.

investment capital, with the largest requiring 40% as much investment capital. Of the entire private sector small hydroelectric portfolio of 15 plants permitted by the CRE, El Gallo has the largest capital investment requirement at \$45 million, amounting to one-quarter of the capital requirement of the entire 15 project portfolio. It should also be noted that El Gallo has the greatest unit cost (\$1500/kW) of all the plants, implying a higher capital investment relative to the amount of power generated and a less attractive investment to prospective outside financiers.

(2) Some of the seven projects have been undertaken by large industrial firms that have the capital reserves on hand to allow them to make the required investments, eliminating the barrier associated with attracting outside financiers.

(3) Five of the seven projects are structured such that the electricity is entirely consumed internally, with no need for negotiation of power purchase agreements. This is relevant to the financing barrier because prospective financiers have been reluctant to provide financing to project developers whose future revenue stream depended on sales of electricity to large numbers of small enterprises and municipalities with uncertain creditworthiness.

(4) In six of the projects, the equipment was already installed and operating *before* the CRE issued the permit, offering evidence that the financing was internal, since external financiers are likely to require necessary permitting to be completed prior to financial closure.

(5) One exceptional situation is the Trojes Hydroelectric Project, undertaken by Comexhidro, the developer of the El Gallo project. This project started operating in April of 2003. The construction was completed entirely as an equity investment by the project developer, without having secured any outside financing – an approach that is not feasible for the much larger investment necessary in the case of the El Gallo project for a developer of this size. The developer made this decision in part because it would very directly provide proof to prospective financiers of the viability of small hydro projects and the credibility of the project developers.

In summary, Table B.2 indicates the relevance of these mitigating factors for the seven private sector hydroelectric projects that have been advanced through the CRE permitting process, and compares to the El Gallo project's situation.

Table B.2. Successful private sector implementations of small hydroelectric power and the factors that alleviated financing barriers.

	Project	Capital investment (\$ million)	Capacity (MW)	Case-specific circumstances that relieved financing barriers
1	Papelera Veracruzana	1.8	1.26	<ul style="list-style-type: none"> - very small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE - entirely for self-generation purposes, without need for wheeling, negotiation of PPAs, or convincing prospective financiers of creditworthiness of off-takers
2	Cerveceria Cuauhtemoc-Moctezuma	18.0	15.0	<ul style="list-style-type: none"> - fairly small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE - exclusively for self-generation purposes, without need for wheeling, negotiation of PPAs, or convincing prospective financiers of creditworthiness of off-takers - as the developer is one of Mexico's largest breweries with significant internal capital resources, project is likely to have required no outside financing - included conventional steam turbine component, decreasing technology risk as perceived by prospective financiers
3	Minas San Luis	5.0	4.44	<ul style="list-style-type: none"> - small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE - exclusively for self-generation purposes, without need for wheeling, negotiation of PPAs, or convincing prospective financiers of creditworthiness of off-takers - includes conventional internal combustion component, decreasing technology risk as perceived by prospective financiers
4	Compañía Industrial Veracruzana	5.6	4.00	<ul style="list-style-type: none"> - small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE - exclusively for self-generation purposes, without need for wheeling, negotiation of PPAs, or convincing prospective financiers of creditworthiness of off-takers
5	Proyecto Trojes, Comexhidro	8.0	8.00	<ul style="list-style-type: none"> - small capital requirement - entirely based on equity investment, with no external financing - strategic decision based on the impact on financing for El Gallo
6	Hidro-electricas Virita	5.7	5.73	<ul style="list-style-type: none"> - small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE
7	Cementos Apasco	1.9	1.92	<ul style="list-style-type: none"> - very small capital requirement - installation and commissioning of hydroelectric facilities was completed before the developer requested the self-generation permit from the CRE - exclusively for self-generation purposes, without need for wheeling or negotiation of PPAs - as developer is one of Mexico's largest cement companies with significant internal capital resources, project is likely to have required no outside financing

Proyecto El Gallo, Comexhidro	45.0	30.0	<ul style="list-style-type: none"> - large capital requirement - developer does not have sufficient internal capital resources - project required outside debt financing for approximately two-thirds of the investment, and investments from outside partners for the majority of the equity portion
-------------------------------	------	------	--

Sources: CRE documents.

In addition to the projects listed in Table B.1 undertaken with the passage of regulatory support for grid-integrated private power production, there was significant private development and operation of hydroelectric facilities in the more distant past. Table B.3 lists this older generation of privately developed hydroelectric facilities, their dates of commissioning, and their capacities. One will notice that none of these hydroelectric facilities was commissioned less than twenty years ago, and most much longer ago. Such private sector investments have ceased with the change in the energy regulatory framework and evolution of the financing environment, and all such development is now subsumed under the rubric of the self-generation modality of the Ley del Servicio Público de Energía Eléctrica as discussed above and shown in Table B.1. These hydroelectric installations, by virtue of the fact that they took place under a very different regulatory and financing situation, do not materially affect the claim that projects such as El Gallo now face prohibitive barriers to implementation.

Table B.3. Private sector development of small hydroelectric power (prior to the 1992 amendments to the Ley del Servicio Publico de Energía Eléctrica).

	date	hydroelectric facility	capacity (MW)			Date	hydroelectric facility	capacity (MW)
1	1909	Trevina	0.630		32	1937	Tala	0.160
2	1910	Puebla Guijano	0.225		33	1937	Cijara II	0.149
3	1910	Mardaker Puebla	0.135		34	1937	Magdalena	0.083
4	1911	El Progreso	0.530		35	1939	El Ingenio	0.696
5	1912	Tezintlan	1.090		36	1939	Tacambaro	0.808
6	1920	Texmelucan	0.154		37	1944	Zoquitlan	1.840
7	1920	Santa Cruz	0.950		38	1945	Torre II	0.264
8	1920	Porvenir I	0.550		39	1946	El Negro	0.800
9	1923	Hondo	0.208		40	1946	Matamoros	0.373
10	1926	Huerta	0.186		41	1950	Rio Blanco	1.930
11	1926	Hormiga I	1.360		42	1951	Cuesta	0.027
12	1926	Zavaiera	0.700		43	1951	Argovia	0.082
13	1926	Villar	0.146		44	~1952	Fincas Cafe I	0.318
14	1926	Hormiga II	0.360		45	~1952	Fincas Cafe II	0.096
15	1928	Dos Aguas	0.406		46	1954	Coatan Rio	0.610
16	1928	Tiaca	0.322		47	1954	San Angel	0.013
17	1929	El Patriotismo	0.475		48	1954	Escuitla	0.032
18	1929	Veracruzana	0.530		49	1955	DF	0.012
19	1930	Eleca	0.600		50	1955	Rosa Santa	0.124
20	1930	Trini	0.500		51	1955	La Esperanza	0.070
21	1931	Lozano	1.835		52	1956	Mexicaltzingo	0.125
22	1932	Lacar	2.240		53	1956	San Angel II	0.004
23	1932	Santiago Mexico	0.135		54	1956	Cijara	1.755
24	1933	Torre	0.115		55	1959	Cijara	2.500
25	1934	El Pinto	0.239		56	1962	Cocolapan	3.090
26	1935	Chihuahua	0.336		57	1962	Cerritos	0.564
27	1936	El Burrero	0.189		58	1962	Grande-Rincon	5.960
28	1936	Flores	0.210		59	1964	Zoquitlan	1.950
29	1936	Woodward I	0.417		60	1965	Rosa Santa	0.840
30	1936	Cijara Fabrica	0.472		61	1981	Romer	0.370
31	1936	Chiapas	1.684				total	43.574

This additionality methodology provides evidence that the registration as a CDM activity allows the El Gallo project to overcome barriers that would otherwise be likely to be prohibitive and prevent the project's completion. It also provides evidence from the Mexican electric sector that the private sector investment in small hydro is indeed subject to barriers that have impeded development, even despite the significant support provided by the 1992 regulatory changes.

Part 2. Calculation of a baselines emission rate for the El Gallo project.

Methodology Step M3(a). Define the baseline scenario and calculate the baseline emission rate.

In this step, the baseline scenario is defined and the emission rate is calculated for the El Gallo project. As discussed in Annex 3, the baseline scenario accounts for the effects of the project on both the operating margin (affecting the operation of power plants on the grid) and the build margin (delaying or avoiding the construction of future power plants), and a corresponding emission rate is approximated for each of these effects.

The Operating Margin is approximated by Mexico's entire electric generation mix, excluding its hydro, geothermal, wind, and nuclear capacity. Emissions of CO₂ for the CFE generation mix can be calculated directly from Mexican government data, as provided in the annual report from the *Prospectiva del Sector Eléctrico* of the Secretaría de Energía⁵. Generation by source is also provided in the *Prospectiva* (p. 70). For the year 2001, this value for the operating margin emission rate (exclusive of the specified zero and low-cost sources) was 0.764 tCO₂/MWh (See details in Annex 5, Table A1).

The Build Margin is approximated by the five most recent plants built or the most recent 20% of the generating units built, whichever is smaller in capacity. In the year 2001 (the last year for which the *Prospectiva* gives data), 96% of new capacity was natural gas combined cycle (NGCC). (In fact, until 2006 Sener anticipates that most of the units to be added to the system will be NGCC plants⁶, after which CFE anticipates adding peaking large hydro plants, replacements for aging combustion turbines as well as NGCCs). Therefore, it is assumed that NGCC plants are reasonably representative of the recent trends in new generation capacity. For the purposes of an *ex ante* estimate of the baseline, an emission rate of 404 tCO₂/MWh is used as a standardized emission factor value for NGCC plants in Mexico (See details in Annex 5, Table A3).

We adopt the default weight factors for this project, equally weighting the impact of El Gallo on the operating margin and the build margin. The baseline scenario is a situation in which the generation provided by the El Gallo project is instead provided by electricity from an equal mix of (1) new, efficient natural gas combined cycle plants, and (2) a set of generating units approximating the existing capacity in the Mexican electric sector, consuming a mix of roughly 57% fuel oil, 27% natural gas, 15% coal, and 1% diesel. In other words, El Gallo causes NGCC plants to be deferred or delayed relative to the electric sector expansion that would have occurred otherwise, and also directly displaces in the system dispatch a combination of fuels equal to the above-mentioned mix.

Using formula under Step M3 in Annex 3 thereby gives a baseline emission rate of:

$$\text{BaselineEmissionRate}(tCO_2 / MWh) = \frac{0.764 + 0.404}{2} = 0.584$$

The emissions reductions calculated from this process are as follows:

⁵ Sener, 2002. *Prospectiva del Sector Eléctrico, 2002-2011* and previous years. www.energia.gob.mx/work/appsite/publicaciones/PROS_ELECT1.pdf

⁶ Sener, 2002: *Prospectiva del Sector Eléctrico, 2002-2011*, p. 64.

The net annual generation is estimated to be: **120,668 MWh**
(See Annex 5, Table A5 for details and calculations.)

The baseline emission rate is: **0.584 tCO₂/MWh**
(See Annex 5, Table A4 for details and calculations.)

The net annual reductions are estimated to be: **70,484 tCO₂**
(See Annex 5, Table A5 for details and calculations.)

The net reductions over a 21-year crediting lifetime are estimated to be: **1,480,157 tCO₂**
(See Annex 5, Table A5 for details and calculations.)

This is a projected *ex ante* emission rate that is given here as a reasonable estimation of the baseline emission factor.

It is proposed that this emission rate is calculated *ex post* annually in accordance with the monitoring methodology and plan (Section D) using the proposed formulae and official data and information (Section E). A Designated Operational Entity shall determine and confirm that the baseline emission rate has been calculated in accord with the monitoring plan. The purpose of this *ex post* revision is to increase the accuracy of the baseline emission rate, as discussed further in the monitoring methodology (Annex 4), and increase the conservatism of the baseline, as discussed immediately below.

Methodology Step M3(b). Justify conservatism of baseline methodology in the case of the project.

With respect to the conservatism of the barrier analysis, in the case of El Gallo there is only a small chance that the project would have secured funding and proceeded in the absence of the carbon agreement with the PCF. There is only a small risk that the project developers would have identified an alternative strategy for overcoming the financing barrier, given the amount of time and effort devoted unsuccessfully to securing financing over the five years prior to the negotiating of the carbon agreement with the PCF. Moreover, there is no evidence elsewhere in the Mexican electric sector that developers have regularly been successful at developing small hydroelectric projects. In addition, this relatively small risk that the El Gallo project would have been implemented anyway is further offset by (1) the small size of the project (30 MW), which generates only a modest amount of emissions reductions credits, and (2) the ancillary benefits of successfully developing a project based on small hydro technology, insofar as it helps to lay the foundation for further dissemination of the technology. The risks, therefore, of this project being non-additional are small and offset by the project's technology-diffusing benefits.

In the case of Mexico, a very recent analysis by the Asociación de Técnicos y Profesionistas en Aplicación Energética (ATPAE)⁷ have recommended the above estimation methodology as a conservative approximation of the emissions factor of the avoided generation as

⁷ ATPAE, a professional organization of energy engineers, is conducting an analysis of baseline options for the Mexican electric sector that is being reviewed by the Secretaría de Energía and is due to be released shortly. <http://www.atpae.org.mx/>

calculated by more sophisticated and data-intensive methods. For the years 1999-2001, the operating margin calculated by this methodology, which is approximated by the average emission rate of all plants not including those with zero or low operating costs, is shown by the ATPAE study to be a good approximation of the operating margin calculated by executing the full dispatch model operated by the Centro Nacional de Control de Energía (CENACE). For the three years in which a quantitative comparison was done (1999-2001), the estimation adopted here fell approximately 10% or less below the estimation of the full dispatch model. While there is no guarantee that this would remain true indefinitely, there are qualitative reasons to believe this conservatism is built into the estimation:

- (1) The excluded sources, which are all low carbon, are unlikely to contribute much to marginal generation anyway, so excluding them does not unduly inflate the estimated emission rate. The sources are unlikely to contribute because they entail zero fuel cost, and have correspondingly low operating costs; and,
- (2) The included sources include a significant proportion of high efficiency, low-emissions NGCC, which are relatively unlikely to contribute much to marginal generation yet they do lower the estimated emission rate. In the future, this effect will continue, as significant NGCC capacity additions are planned.

The use of an *ex post* monitoring methodology to update the baseline emission rate on an annual basis will improve the accuracy of the baseline emission rate estimation, in part by accounting for continued improvements over time in overall power plant efficiency and the expected increased contribution of NGCC power plants to the Mexican electric sector mix. Specifically, in the case of Mexico, this is an improvement on an *ex ante* the emissions estimate for the following reasons: (1) An emission rate that is updated *ex post* will be more accurate, because the electric sector is expanding rapidly, and expected to continue to do so over the twenty-one year lifetime of the El Gallo project, hence the portfolio of generation technologies and the fuel mix will evolve substantially; (2) Because the proportion of low-emissions NGCC in the generation mix is increasing, an updated baseline estimate is likely to be more conservative than a baseline estimate fixed at the outset of the project.

B.4. 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 (*i.e. explanation of how and why this project is additional and therefore not the baseline scenario*)

The Steps M1 and M2 establish that this project would not occur without its registration as a CDM project, *i.e.* it is not in the baseline. Step M3 estimates the emission rate of the displaced electricity, which is shown to be higher than the emissions of the project (which are zero). The project therefore is both additional and reduces anthropogenic emissions of GHG below the levels that would have occurred in the absence of the registered CDM project activity.

B.5. Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The boundary that is relevant for the application of the baseline methodology defines where alternatives to the proposed Project are likely to be found. The baseline methodology determines the baseline scenario for the Project within the following boundaries:

- *Geographic and system boundary of electric grid:* Power projects that feed into the Mexican grid can be established almost anywhere in the country. The geographic boundaries for the calculation are therefore Mexico's national borders. Currently, imports are a very small contribution to the grid; amounting to less than 0.16% (326 GWh / 197,106 GWh) of total system generation in 2001 (and have remained over the past decade below 0.7%). The El Gallo Project applies a maximally conservative method of including imports in the calculation of the operating margin as if they were from a zero-carbon source (See Table A.2).

B.6. Details of baseline development

B.6.1 Date of completing the final draft of this baseline section (DD/MM/YYYY):

7 September 2003

B.6.2 Name of person/entity determining the baseline:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex I.)

1. Sivan Kartha, skartha@tellus.org, Tellus Institute/SEI-Boston, 11 Arlington St., Boston, MA 02116. Tel: 1-617-266-5400. Mr. Kartha is not a project participant.
1. Prototype Carbon Fund, World Bank, 1818 H Street, Washington DC 20433 (contact: Ms. Odil Tunali-Payton, otunalipayton@worldbank.org). The PCF is a project participant.

C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

(For a definition by the Executive Board of the term "starting date", please refer to UNFCCC CDM web site. Any such guidance shall be incorporated in subsequent versions of the CDM-PDD. Pending guidance, please indicate how the "starting date" has been defined and applied in the context of this project activity.)

01/05/2005.

C.1.2. Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m)*

25 y.

C.2 Choice of the crediting period and related information: *(Please underline the appropriate option (C.2.1 or C.2.2.) and fill accordingly)*

(Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases, the starting date of the crediting period can be prior to the date of registration of the project activity as provided for in paras. 12 and 13 of decision 17/CP.7 and through any guidance by the Executive Board, available on the UNFCCC CDM web site)

C.2.1. Renewable crediting period (at most seven (7) years per period)

C.2.1.1. Starting date of the first crediting period (DD/MM/YYYY):

01/05/2005.

C.2.1.2. Length of the first crediting period (in years and months, e.g. two years and four months would be shown as: 2y-4m):

7 years.

C.2.2. Fixed crediting period (at most ten (10) years): not applicable

C.2.2.1. Starting date: not applicable

C.2.2.2. Length (max 10 years): not applicable

D. Monitoring methodology and plan

(The monitoring plan needs to provide detailed information related to the collection and archiving of all relevant data needed to

- estimate or measure emissions occurring within the project boundary;*
- determine the baseline; and;*
- identify increased emissions outside the project boundary.*

The monitoring plan should reflect good monitoring practice appropriate to the type of project activity. Project participants shall implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring report.

Operational entities will verify that the monitoring methodology and plan have been implemented correctly and check the information in accordance with the provisions on verification. This section shall provide a detailed description of the monitoring plan, including an identification of the data and its quality with regard to accuracy, comparability, completeness and validity, taking into consideration any guidance contained in the methodology.

Please note that data monitored and required for verification and issuance are to be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.)

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

(Please refer to the UNFCCC CDM web site for the name and reference as well as details of approved methodologies. If a new methodology is proposed, please fill out Annex 4.)

(If a national or international monitoring standard has to be applied to monitor certain aspects of the project activity, please identify this standard and provide a reference to the source where a detailed description of the standard can be found.)

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" (See Annex 4 for description of new monitoring methodology).

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

The following methodology is appropriate for the proposed project because it is used in conjunction with the baseline methodology "Barrier analysis, baseline scenario development, and baseline emission rate calculation for a proposed grid-connected project that displaces power from the operation and expansion of the electric sector" and the data and other information required is publicly available and can be accessed and reviewed. This monitoring methodology also can be expected to improve the accuracy of the baseline emission rate by allowing for its yearly calculation based on updated data.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Being a hydropower project, no emissions from the Project activity were identified. There are therefore no entries in the following table.

ID number <i>(Please use numbers to ease cross-referencing to table D.6)</i>	Data type	Data variable	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)	For how long is archived data to be kept?	Comment

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

Indirect emissions can result from project construction, transportation of materials and fuel and other up-stream activities. In the case of the proposed Project, these emissions are thought to be comparable to the life cycle emissions would result from the eventual construction and operation of alternative capacity. The life-cycle emissions of alternative power generation plants, in particular of fossil fuel power plants, are typically higher than from hydro power plants when including emissions due to the mining, refining and transportation of fossil fuel. The Project does not claim emission reductions from these activities. Therefore, no significant net leakage from the above activities was identified.

Project emissions in the form of methane can also result from the construction and operation of a water reservoir if biomass is permanently submerged in this process. The Project is a hydropower plant based on an existing irrigation dam. Additional submersion of biomass and its eventual conversion to methane is therefore not part of the Project's design and related methane emissions will not occur.

Thus, no sources of emissions were identified, and therefore no data will be collected and archived (see summary discussion below). There are therefore no entries in the following table. Please refer to B.5. and E.2. and to the Baseline Study and Monitoring Plan for more information.

ID number <i>(Please use numbers to ease cross-referencing to table D.6)</i>	Data type	Data variable	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)	For how long is archived data to be kept?	Comment

The Project targets only CO₂ emissions and will not claim the reductions of other GHGs included in Annex A of the Kyoto Protocol. The Project has also not been identified as a source of emissions of any of these GHGs.

D.5. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

(Depending on the methodology used to determine the baseline this table may need to be filled. Please add rows to the table below, as needed.)

The following data are used to determine the baseline of emissions within the Project boundaries.

ID number (Please use numbers to ease cross-referencing to table D.6)	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1	Electricity generation of the Project delivered to grid (net of parasitic consumption)		MWh	m	Yearly	all	electronic and paper	crediting period plus 3 years	-
2	Electric sector GHG emissions from fuel consumption for power production (in power plants as defined in section B3, Part 2)		tCO ₂	<i>Prospectiva</i>	Yearly	ditto	ditto	ditto	-
3	Electric sector generation (from power plants as defined in section B3, Part 2)		MWh	<i>Prospectiva</i>	Yearly	ditto	ditto	ditto	-
4	New additions to sector (as defined in section B3, Part 2)		plants & emissions factors	Sener, CFE	Yearly	ditto	ditto	ditto	-

D.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored.

(data items in tables contained in section D.3., D.4. and D.5 above, as applicable)

All monitored and collected data is subject to auditing and verification.

Data (Indicate table and ID number e.g. D.4-1; D.4-2.)	Data type	Uncertainty level of data (High / Medium / Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.5.-1.	Electricity generation of the Project	Low	Yes	To ensure accuracy, electronic commercial metering will be placed at the generation bus. The metering system will comply with technical specifications for commercial metering. Since all power is wheeled via the CFE transmissions/distribution system, metering will comply with CFE standards. Information is to be compared with billing information.
D.5.-2	Electric sector emissions	Low	Unknown (i.e., internal to SENER)	Data is acquired from SENER (usually published in <i>Prospectiva</i>).
D.5.-3	Electric sector generation (from included plants)	Low	Unknown (i.e., internal to SENER)	Data is acquired from SENER (usually published in <i>Prospectiva</i>).
D.5.-4	New additions to sector	Low	Unknown (i.e., internal to SENER)	Data is acquired from SENER (usually published in <i>Prospectiva</i>).

D.7 Name of person / entity determining the monitoring methodology:

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1 of this document.)

1. Sivan Kartha, skartha@tellus.org, Tellus Institute/SEI-Boston, 11 Arlington St., Boston, MA 02116. Tel: 1-617-266-5400. Mr. Kartha is not a Project participant.
2. Prototype Carbon Fund, World Bank, 1818 H Street, Washington DC 20433 (contact: Ms. Odil Tunali-Payton, otunalipayton@worldbank.org). The PCF is a Project participant.

E. Calculation of GHG emissions by sources

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary:

(for each gas, source, formulae/algorithm, emissions in units of CO₂ equivalent)

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 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity: *(for each gas, source, formulae/algorithm, emissions in units of CO₂ equivalent)*

Of the types of leakage identified in Annex 3, Section 7, the El Gallo project gives rise to emissions only from the initial construction. There are no emissions arising from fuel handling (extraction, processing, and transport), nor does El Gallo cause additional emissions from inundation of land and anaerobic digestion of biomass, because El Gallo is based on an existing irrigation impoundment already in use. It is therefore assumed that the indirect emissions associated with El Gallo are less than those associated with the generation sources in the baseline scenario. Those sources are predominantly fossil based and give rise to emissions from both plant construction and fuel handling. (The project sponsors do not calculate and take credit for the assumed reduction in indirect emissions.) Therefore, no formulae for estimating leakage are required here.

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

The sum is zero.

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline: *(for each gas, source, formulae/algorithm, emissions in units of CO₂ equivalent)*

Baseline emissions are calculated by the following formula:

“The annual generation: (the project’s annual electricity dispatched to the grid) times (the CO₂ emission rate of the estimated baseline)”

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

Determination of baseline emission rate (as per section B3, Part 2)
(tCO₂ /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
(tCO₂)

The net annual generation is estimated to be: **120,668 MWh**
(See Annex 5, Table A5 for details and calculations.)

The baseline emission rate is: **0.584 tCO₂/MWh**
(See Annex 5, Table A4 for details and calculations.)

The net annual reductions are estimated to be: **70,484 tCO₂**
(See Annex 5, Table A5 for details and calculations.)

The net reductions over the 21 year crediting lifetime are estimated to be: **1,480,157 tCO₂**
(See Annex 5, Table A5 for details and calculations.)

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

Since 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 5.

F. Environmental impacts

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

(Please attach the documentation to the CDM-PDD.)

The analysis of the potential environmental impacts of the El Gallo Projects is attached as Exhibit A.

F.2. If 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 that has been undertaken in accordance with the procedures as required by the host Party.*

The environmental impacts of the Project are considered insignificant because the area had already been impacted by prior dam construction. Please see Exhibit A for further details.

G. Stakeholders comments

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

There have been consultations with the farmers downstream from the irrigation district who use the water stored in the dam. There have also been consultations with affected landowners along the route of the transmission line. The developer was requested to include NGOs in the communication campaign but no relevant NGOs were identified.

G.2. Summary of the comments received:

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

A negotiation process has been followed with the landowners along the path of the transmission line, and agreements have been signed with them. The process was supervised by the agrarian authorities. Finally, the agreements were taken to the attention of a notary, and the amount of right of way payment was given to the landowners.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Administración y Servicios de Generación Eléctrica S.A: de C.V.
Street/P.O.Box:	Bosques de Ciruelos
Building:	190 – 303 A
City:	México
State/Region:	D.F.
Postfix/ZIP:	11700
Country:	México
Telephone:	52 55 55 96 89 214
FAX:	52 55 52 51 60 65
E-Mail:	jmekler@asergen.com.mx
URL:	
Title:	Director General
Salutation:	Mr.
Last Name:	Camhaji
Middle Name:	
First Name:	Salomón
Department:	Director General
Mobile:	52 55 54 16 85 95
Direct FAX:	52 55 52 51 60 65
Direct tel:	
Personal E-Mail:	scamhaji@asergen.com.mx

Organization:	World Bank Prototype Carbon Fund
Street/P.O.Box:	1818 H Street, NW
Building:	MSN MC4-414
City:	Washington
State/Region:	DC
Postfix/ZIP:	20043
Country:	United States of America
Telephone:	+1-202-473 6010
FAX:	+1-202-522 7432
E-Mail:	otunalipayton@worldbank.org
URL:	www.carbonfinance.org
Title:	Project Manager and Portfolio Coordinator
Salutation:	Ms.
Last Name:	Payton
Middle Name:	Tunali
	Odil
Direct FAX:	+1-202-614-0391
Direct tel:	+1-202-473-6774
E-mail :	otunalipayton@worldbank.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding in the El Gallo Project.

Annex 3

NEW BASELINE METHODOLOGY

(The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. A baseline shall cover emissions from all gases, sectors and source categories listed in Annex A of the Kyoto Protocol within the project boundary. The general characteristics of a baseline are contained in para. 45 of the CDM M&P.

For guidance on aspects to be covered in the description of a new methodology, please refer to the UNFCCC CDM web site.

Please note that the table “Baseline data” contained in Annex 5 is to be prepared parallel to completing the remainder of this section.)

1. Title of the proposed methodology:

“Barrier analysis, baseline scenario development, and baseline emission rate calculation for a proposed grid-connected project that displaces power from the operation and expansion of the electric sector”.

2. Description of the methodology:

2.1. General approach *(Please check the appropriate option(s))*

- Existing actual or historical emissions, as applicable;
- Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
- The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

2.2. Overall description (other characteristics of the approach):

This methodology consists of two parts. The first part establishes the additionality of the proposed project, and the second part describes the baseline scenario and provides a baseline emission rate. Together, these aim to estimate the emissions of an economically attractive course of action, taking into account barriers to investment and the prevailing investment environment in the relevant power sector.

The first part of the methodology (Part I) has two steps. The first step (Step M1) assesses the barriers that are relevant to the proposed project. As a demonstration of additionality,

this step is in accordance with the clarification provided by the 10th meeting of the Executive Board, July 29, 2003 (CDM-EB-10, Annex 1):

“2. Examples of tools that may be used to demonstrate that a project activity is additional and therefore not the baseline scenario include, among others:

(b) A qualitative or quantitative assessment of one or more barriers facing the proposed project activity (such as those laid out for small-scale CDM projects);”

The second step (Step M2) demonstrates that the proposed project activity is not a conventional activity in common practice in the relevant sector. This step is in accordance with the clarification provided by the 10th meeting of the Executive Board, July 29, 2003 (CDM-EB-10, Annex 1):

“2. Examples of tools that may be used to demonstrate that a project activity is additional and therefore not the baseline scenario include, among others:

(d) An indication that the project type is not common practice (e.g. occurs in less than [$<x\%$] of similar cases) in the proposed area of implementation, and not required by a Party's legislation/regulations.”

The second part of the methodology (Part II) consists of one step (Step M3). This step provides a justification for and a description of the baseline scenario for the displaced generation. It then provides a transparent and conservative estimate for the baseline emission rate corresponding to this baseline scenario. This part of the methodology provides an explicit *ex ante* value for the emissions baseline. The monitoring plan also provides a means by which *ex post* monitoring can refine and improve the accuracy of the emissions baseline rate over the lifetime of the project.

Applicability criteria:

This proposed methodology can be used if the following conditions apply.

- 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).
- 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.
- 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.
- D. The project is in an electric 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.

The Methodology consists of the following steps.

Methodology Part I

Additionality argument for the proposed project based on barrier analysis:

Methodology Step M1. Analyze barriers to proposed project.

Substep M1(a). Identify the relevant barriers to the proposed project activity.

Establish that there are prohibitive barriers within the relevant sector that would prevent the proposed project from being carried out and coming to completion, assuming the project were not registered as a CDM activity.⁸ The types of barriers that can be considered are those adopted by the Executive Board as legitimate barriers to the implementation of small-scale projects including, for example, financial, technological, capacity, and regulatory barriers (cdm.unfccc.int/EB/Meetings/007/eb7ra06.pdf).

Provide transparent information, including documented evidence, and offer conservative interpretations of this documented evidence as to how it demonstrates the existence and significance of the identified barriers. Anecdotal evidence can be included, but alone is not sufficient proof of barriers.

Substep M1(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.

This step helps to prove that the barriers identified in Substep M1.a. are indeed *prohibitive* barriers. If the proposed project were able to overcome the identified barriers without registration as a CDM project, then the barriers would be surmountable, and they would not be sufficient proof of additionality.

Explain how the approval and registration of the project as a CDM activity, and the attendant benefits and incentives derived therefrom, sufficiently alleviate the identified barriers to enable the project to be undertaken. The benefits and incentives can be of various types, such as:

- the financial benefit of the revenue obtained by selling the CO₂ emissions reductions.
- the institutional benefits of collaborating with partners in the emissions reductions transaction (e.g., the profile and creditability arising from having established a binding contractual agreement with an international institution for the purchase and sale of emissions reductions).
- the technical and capacity building benefits provided by partners in the emissions reductions transaction (e.g., the technical capacity to carry out environmental, social, and technical due diligence that increases the confidence of prospective financiers).

Methodology Step M2. Analysis of other activities similar to the proposed project.

⁸ Prohibitive barriers are those that impose enough of an obstacle that the proposed project would have an extremely low likelihood of being carried out and coming to completion if it were unable to obtain the benefits (financial, technical, institutional, etc.) that derive from approval and registration as a CDM activity.

Provide a sufficiently comprehensive analysis of any other activities implemented previously or currently underway that are similar to the proposed project activity. Projects should be considered similar if they are in the same country and rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Provide quantitative information where relevant.

If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity faces prohibitive barriers. Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is subject to prohibitive barriers. This can be done by comparing the proposed project to the other similar activities, and pointing out and documenting essential distinctions between them that explain why the similar activities did not face the prohibitive barriers to which the proposed project is subject.

Methodology Part II

Methodology Step M3(a). Define the baseline scenario and calculate the baseline emission rate.

In many situations, the operation of the national electric sector incorporates a mix of different types of generating sources, and the expansion of the electric sector involves the concurrent development of several types of generating sources. This baseline methodology is appropriate in such cases in that it does not attempt to approximate the complex ongoing process of electric sector operation and expansion as the choice to invest in *one unique*⁹ *generating source*. Instead, this methodology assumes that the impact of the proposed project is dispersed throughout the electric sector's ongoing operation and expansion in a manner that cannot be characterized as the deferral of one specific alternative investment. The application of this methodology does not require an explicit comparison between the proposed project and a *single, specific* alternative investment; i.e., it does not seek to identify a specific best alternative investment that is assumed to be undertaken in the absence of the proposed project. (If it were possible to do so, one could quantify the baseline emission rate based on the presumed technical characteristics of the specific alternative investment. For example, if the baseline scenario for a proposed baseload natural gas plant is determined to be an investment in a baseload coal plant of the same capacity at the same location, the corresponding coal emission rate could be the baseline).

The proposed methodology posits a baseline scenario that captures the proposed project's impacts, which are dispersed throughout the electric sector's ongoing operation and expansion, in terms of its two contributions. The first contribution accounts for the project's impacts on the *operating* margin (affecting the operation of power plants on the grid). The impact on the operating margin accounts for the fact that the system operator will adjust the output of other existing plants on the system in response to the output of the proposed project. The second contribution accounts for the project's impacts on the *build* margin (delaying or avoiding the construction of future power plants). This second contribution accounts for the fact that even a small project is likely to *delay* the commissioning of new

⁹ Or two or a small number of potential project options.

generation sources, if not directly *displace* a specific other new generating source. In fact, this delay effect is a reasonable assumption where a) there is a planned or unplanned sequence of new facilities to be built, and b) the timing of construction is affected by the need to balance supply and demand, either through maintaining the reserve margin above a threshold level (in planned systems) or through the price signals created by rising demand that motivate new investments. By increasing generation, a new project will increase reserve margins or dampen price signals, delaying the timing of the series of planned or market-induced investments in new power supply. In fact, this delay effect can be expected to effect total emissions at the build margin to a degree that is comparable in magnitude to the effect on the project's effect on emissions at the operating margin.

The process for considering these two aspects of the baseline scenario and estimating the emission rate of the displaced electricity is as follows. First, the system operating margin is approximated by the entire electric generation mix, excluding sources with zero or low operating cost on the grounds that the operation of these plants would be essentially unaffected by the additional generation from the proposed project.¹⁰ These excluded 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 (excluding the mentioned sources) in proportion to their generation. Given this assumption regarding the operating margin, the baseline operating margin emission rate (*OM*) is approximated as the generation-weighted average emission rate for the sector (excluding the mentioned sources).

Second, the system build margin is approximated by a mix of plants that reasonably represents recent trends in electric sector expansion. The recommended mix is the five power plants most recently commissioned or the most recently built 20% of the system generating sources, whichever amounts to less capacity. (If the five most recently commissioned power plants is selected, it should be demonstrated that this is a recent reflection of the power sector's expansion, and not an anomalous, unrepresentative cohort of five plants). Given this assumption regarding the build margin, the baseline build margin emissions (*BM*) rate is approximated as the weighted average emission rate for the identified mix of recent plants.

This methodology recommends a simple, conservative default approach for accounting for imports. Net imports are to be included in the total generation mix for the purposes of calculation of the operating margin, with their emission rate assumed to be zero (as if they are provided entirely by renewable electricity sources). The benefits of this approach are that it (1) is calculationaly straightforward, (2) requires no data from outside the national system, and (3) is a maximally conservative approximation. The project developer can use an assumption other than the default assumption if it can be rigorously justified.

The relative weighting of the operating margin emission rate (w_{OM}) and the build margin emission rate (w_{BM}) will depend on the characteristics of the electric sector. The proposed default weighting is $\frac{1}{2}$ *OM* and $\frac{1}{2}$ *BM*. The project developer can adopt a different weighting if justified. The justification can take into account factors such as the following:

1. Conservatism (increase the weighting of the lower of the two emission rates)

¹⁰ This assumption is a poor approximation in systems that are dominated by these sources, thus the methodology is inapplicable in such cases. (See applicability criterion D.)

2. Size (increase the weighting of the build margin for a larger projects, operating margin for smaller projects)
3. Firm or non-firm power (increase the weighting of the build margin for firm plants, and the operating margin for non-firm plants).
4. Rate at which electric sector is expanding (increase the weighting of the build margin in a rapidly expanding electric sectors)
5. Amount of reserve capacity (increase the weighting of the operating margin if there is a large amount of reserve capacity).
6. Time since the commissioning of the CDM project (increase the weighting of the operating margin toward the beginning of the project's lifetime, and the build margin toward the end).

This baseline estimation methodology is consistent with the methodology¹¹ approved for small-scale projects ("Simplified methodologies for baseline determination and monitoring plans", Appendix B), which recommends as an accepted baseline emission rate:

- (a) The average of the "approximate operating margin" and the "build margin", where:
 - (i) The "approximate operating margin" is the weighted average emissions (in kg CO₂equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;
 - (ii) The "build margin" is the weighted average emissions (in kg CO₂equ/kWh) of recent capacity additions to the system, defined as the lower of most recent 20% of plants built or the 5 most recent plants;

The baseline emission rate is thus:

$$\text{BaselineEmissionRate (tCO}_2\text{ / MWh)} = (w_{OM} \times OM) + (w_{BM} \times BM) \quad (\text{Eq. 1})$$

where *OM* is the calculated operating margin value factor (in tCO₂/MWh), and *BM* is the calculated build margin value factor (in tCO₂/MWh) and *w_{OM}* and *w_{BM}* are their respective weights (and *w_{OM}* + *w_{BM}* = 1). Total emissions, *E*, are given as the sumproduct of the fuels used in generation multiplied by the specific CO₂ emission rate for that fuel.

$$E(\text{tonCO}_2\text{ / year}) = \sum_j E_j \quad (\text{Eq. 2})$$

Where *E_j* = CO₂ emissions per year in tons for fuel *j*.

For each *E_j*, the emissions are calculated as:

$$E_j = Q_j * F_j \quad (\text{Eq. 3})$$

Where *Q_j* = quantity of fuel *j* in year, and
F_j = CO₂ emissions per unit for each fuel *j*.

Thus *E* can be calculated directly as the following sumproduct:

¹¹ Note, the small-scale definition is ambiguous in that "lower" could refer to either capacity or emission rate. The methodology proposed here is consistent with the first interpretation.

$$E = \sum_j Q_j * F_j, \text{ for all } j \quad (\text{Eq. 4})$$

The Operating Margin Emissions are defined as the generation-weighted average emissions per electricity unit (tCO₂/MWh), excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation and are derived from the following equation:

$$OM = \sum_j E_j \div \sum_j K_j \quad (\text{Eq. 5})$$

Where K_j = electricity generation from fuel j,

The Build Margin Emissions are defined as the emissions from the selected representative set of recent plants (such as the 5 most recent plants built or the most recent 20% of the generating units built).

$$BM(tCO_2 / MWh) = \frac{\sum_{j=1}^m e_j \times G_j}{\sum_{j=1}^m G_j} = \frac{e_1 \times G_1 + e_2 \times G_2 + \dots + e_m \times G_m}{G_1 + G_2 + \dots + G_m} \quad (\text{E.6})$$

where G_j = the generation (MWh) from unit j,
 e_j = the emission rate (in tonnes CO₂/MWh) for unit j, and
 j = individual plants included among the selected representative set of plants.

Methodology Step M3(b). Justify conservatism of baseline methodology in the case of the project.

Whether this baseline estimation methodology is a conservative and accurate approximation of the actual electricity displaced will depend on the electric sector in question. Arguments should be presented explaining why this is can be expected to be a conservative baseline methodology, in light of the conditions of the relevant electric sector.

3. Key parameters / assumptions (including emission factors and activity levels), and data sources considered and used:

The above baseline methodology requires at least the following information, the correctness of which is to be confirmed by a Designated Operational Entity.

- Information on the conditions in the power sector for private sector investors. This should include documented information regarding barriers faced by investors, including financial, technical, regulatory, etc. conditions. *Data source:* Project proponent, government agencies, specialized international organizations, commercial organizations.

- Information on the current operation of the electric sector, including existing generation mix and fuel use, and recent additions. *Data source:* Government agencies, specialized international organizations.

4. Definition of the project boundary related to the baseline methodology:

(Please describe and justify the project boundary bearing in mind that it shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the project activity. Please describe and justify which gases and sources included in Annex A of the Kyoto Protocol are included in the boundary and outside the boundary.)

The baseline boundaries generally used for electric power capacity expansion projects define where possible alternatives to the proposed project are likely to be found:

- *Geographic boundary:* The country's (or region's) territory (for transnational system possibly also the relevant territory of neighboring countries), where power expansion facilities could be located and would compete with the proposed project.
- *System boundary:* The country's (or region's) interconnected power system (for transnational system possibly also the relevant system in neighboring countries), into which the proposed project would feed power and where it would displace the power generation of other sources.
- *Time boundary:* The baseline methodology applies throughout the lifetime of the project, subject to the revision and updating discussed in the monitoring methodology (Annex 4).

5. Assessment of uncertainties:

(Please indicate uncertainty factors and how those uncertainties are to be addressed)

The proposed methodology can lead to an erroneous baseline scenario if:

- Any of the three conditions set out in Section 2.2 above is not met. The careful assessment of the project circumstances and confirmation by a Designated Operational Entity of the validity of the discussion and the conclusions drawn is imperative to mitigate risks and ensure credibility of the result.
- Any of the key assumptions/parameters listed under 3. above are not correct or complete, in particular the generation for the project and the generation and fuel consumption in the electric sector are not calculated correctly and/or conservatively. The Designated Operational Entity must carefully check all assumptions used to ensure a conservative result.
- Since the barrier analysis argument relies on information that is highly specific to the project in question, it is necessary that assertions are clearly documented in the PDD and verifiable by the Designated Operational Entity.

6. Description of how the baseline methodology addresses the calculation of baseline emissions and the determination of project additionality:

(Formulae and algorithms used in section E)

The baseline methodology first establishes that the proposed project faces prohibitive barriers that would almost certainly prevent its being carried out without its registration as a CDM activity. It also confirms that the registration as a CDM activity directly enables the project to be implemented (Step M1). The baseline methodology then provides evidence that there are no similar activities occurring in the same sector, which would contradict the claim that prohibitive barriers exist (Step M2). Since Steps M1 and M2 do not provide a single specific alternative investment as the baseline scenario, but simply assume the ongoing operation and expansion of the electric sector without the project, the next step provides a simple algorithm for estimating the baseline emission rate based on such ongoing operation and expansion, which must then be confirmed to be conservative in the relevant electric sector (Step M3). These steps, carried out properly with adequate supporting evidence, provide a determination of additionality and a baseline emission rate for comparison to the project emission rate.

7. Description of how the baseline methodology addresses any potential leakage of the project activity:

(Please note: Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary and which is measurable and attributable to the CDM project activity.)

(Formulae and algorithms used in section E.5)

The main indirect emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). This baseline methodology does not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. The project developer must justify why the project is not responsible for such indirect emissions to a degree that exceeds corresponding indirect emissions from the baseline scenario.

Import and export of electricity is another potential source of leakage. In the calculation of the baseline emission rate, this methodology includes exports (whose generation characteristics are generally aggregated into national data). This methodology also includes imports, for which characteristics are generally *not* included in national data, by recommending the easily applied conservative default assumption that all imports are produced by zero-emissions sources.

8. Criteria used in developing the proposed baseline methodology, including an explanation of how the baseline methodology was developed in a transparent and conservative manner:

This baseline methodology was developed to be transparent and conservative by virtue of the following characteristics:

- The methodology requires the inclusion of documented, verifiable information as evidence of barriers and the manner in which approval and registration as a CDM activity would enable the project to overcome those barriers, subject to verification and subsequent monitoring.
- The methodology requires an explanation of existing similar activities in the electric sector in question.
- The methodology avoids dependence on dispatch models (whose complexity may render them non-transparent), expansion projections (which are typically subject to substantial revision), or investment models (which are sensitive to underlying assumptions).
- The methodology relies on straightforward calculation based on readily available data to calculate the baseline emission rate.
- This methodology relies on a methodology to estimate the baseline emission rate that has already been vetted and applied in the case of small-scale CDM projects.

9. Assessment of strengths and weaknesses of the baseline methodology:

Strengths:

The baseline methodology:

- allows additionality to be demonstrated for projects whose additionality results from qualitative barriers to project implementation.
- provides a transparent, easily calculated estimate of the baseline emission rate based on readily available data.
- gathering of the applicable carbon intensity factors, data archiving and reporting can be done centrally at the sector level.
- does not require availability of difficult to acquire data, projections, or the running of non-transparent expansion planning models.

Weaknesses:

The baseline methodology:

- requires presentation, and then review, of a qualitative argument constructed from a diverse range of information sources.
- relies on certain approximations (such as the approximation that the project's impact on the operating margin is reasonably approximated by assuming it is proportionate across all sources that do not have low or zero operating cost), and assumptions (such as the assumption that the project's impact on the build margin is reasonably captured by assuming it delays and/or displaces generation corresponding to the most recent five or 20%) that – despite being reasonable – are not confirmed.

10. Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account:

- The proposed baseline methodology explicitly takes into account national and/or sector policies and circumstances, in that it allows developers to present arguments regarding the impact of local conditions on the feasibility of project implementation and the existence of barriers.

Annex 4

NEW MONITORING METHODOLOGY

Proposed new monitoring methodology

(Please provide a detailed description of the monitoring plan, including the identification of data and its quality with regard to accuracy, comparability, completeness and validity)

1. Brief description of new methodology

(Please outline the main points and give a reference to a detailed description of the monitoring methodology).

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."

This monitoring methodology is applicable to a proposed project using the baseline methodology "Barrier analysis, baseline scenario development, and baseline emission rate calculation for a proposed grid-connected project that displaces power from the operation and expansion of the electric sector" providing that the data and other information required is publicly available and can be accessed and reviewed.

The proposed monitoring methodology consists of three parts. The first part involves measuring the generation provided by the project. The second part involves determining, on an annual basis, the electric sector generation and fuel consumption, and the plants mostly recently commissioned, to allow an *ex post* recalculation of the baseline emission rate in accordance with Step M3 of the baseline methodology. The third part provides for an ongoing check on the claim that the project remains additional.

An *ex post* approach has been proposed for calculating the baseline emission rate in order to improve the accuracy and conservatism of the methodology. The use of *ex post* measurements takes into account information about the evolution of the electric sector after the project begins. This improves accuracy because (1) generation technologies and fuel mix of the plants operating in a given sector change over time, affecting the operating margin, and (2) the recent additions to the power sector can be observed rather than merely projected.

Part I

The first part of the methodology monitors the power dispatched by the project and any emissions associated with its operation. The data regarding net power dispatched to the grid by the proposed project is needed on an annual basis. This can be aggregated from data recorded at whatever frequency is convenient to the monitor (i.e., whatever time resolution is needed to allow to capture permanently changing load conditions in the grid over the daily cycle.) This is necessary to determine emission reductions, which are calculated by multiplying the electricity delivered by the project to the grid by the calculated baseline emission rate. The methodology assumes that each kWh generated by the project and delivered to the grid or consumed by an auto-generator results in an equivalent reduction in generation by grid-connected power plants.

Part II

The second part of the methodology monitors the relevant characteristics of the electric sector so as to use observable data on the existing electric grid to calculate the emission rate corresponding to the baseline operating margin (*OM*) in accordance with the baseline methodology step M3. Specifically, it is necessary to monitoring, on an annual basis, generation from all the included plants (i.e., excluding sources with zero or low operating cost) and their fuel consumption. These data do not need to be monitored on a plant-by-plant basis; it is sufficient to obtain this data on an aggregate basis. In many cases these data are available from the national energy authority, and sufficiently accurate data may even be available from the International Energy Agency (although possibly with a year or more time lag). It is also necessary to obtain carbon content coefficients, but if local data is not available, standard IPCC carbon content coefficients can be used.

It is also necessary to monitoring recent additions to the electric sector, including plant-specific emissions factors (based on nameplate efficiencies, if necessary) in order to calculate the emission rate corresponding to the build margin (*BM*). If plants have been commissioned too recently to have generation data that reflects operation under standard operating conditions (e.g., capacity factors and efficiencies might be unrepresentatively low due to plant startup issues) then nameplate efficiencies should be used to calculate emission rates in a conservative manner.

Part III

The third part of the monitoring methodology provides information that reconfirms the continued validity of the claim that the project is additional. Specifically, the information needed is that which can ensure that the claims made in Baseline Methodology Step M2 are still valid. This can be done by using the data gathered in Part II above regarding recent additions to the electric sector to show that there is not a significant increase in activities similar to the project activity. The absence of a significant increase in activities similar to the project activity is then taken as an indicator that the prohibitive barriers to the project activity are still in place.

2. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived

(Please add rows to the table below, as needed)

Which data to collect or to use in order to monitor emissions from the project activity depends to a large extent on the project type and the project circumstances. For example, there is usually no need to monitor project emissions from renewable energy projects as their operation does not result in emissions. If the project uses fossil fuels, fuel consumption may be monitored.

The table is left empty, because it cannot be completed without reference to the characteristics of a specific project.

ID number <i>(Please use numbers to ease cross-referencing to table 5)</i>	Data type	Data variable	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)	For how long is archived data kept?	Comment

3. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources

(Please add rows to the table below, as needed.)

The monitoring boundaries do not include the construction phase of the project and associated emissions (outside of temporal or geographic boundary) or any life cycle emissions or emissions from fuel handling (extraction, processing, and transportation), or inundation of land. The project developer must justify why the project is not responsible for such emissions to a degree that exceeds corresponding emissions from the baseline scenario.

Which data are monitored to determine leakage typically depends on project type and circumstances and the table below is therefore not filled in for this monitoring methodology.

ID number <i>(Please use numbers to ease cross-referencing to table 5)</i>	Data type	Data variable	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)	For how long is archived data kept?	Comment

4. Assumptions used in elaborating the new methodology:

(Please list information used in the calculation of emissions which is not measured or calculated, e.g. use of any default emission factors)

The proposed monitoring methodology builds on the following assumptions, which must be satisfied as conditions before the proposed methodology can be applied.

1. The project is a relatively minor addition to a system’s electric generation capacity (compared to overall system capacity), which replaces power that would otherwise be provided by the ongoing operation and expansion of the electric grid.
2. Sufficient data on generation, fuel consumption (in the aggregate), and newly commissioned generating sources is publicly available or can be obtained by the project operator, e.g. through cooperation with the system operator and possibly with other plant operators.

There are no other specific assumptions used in elaborating the monitoring methodology. However the application of this monitoring methodology in specific project cases or in simplified form may involve specific assumptions such as technical parameters, including emission factors.

5. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored. *(see tables in sections 2 and 3 above)*

This table can only be completed for concrete projects and is left empty.

Data <i>(Indicate table and ID number e.g. 3.-1; 3.-2.)</i>	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.

6. What are the potential strengths and weaknesses of this methodology? *(please outline how the accuracy and completeness of the new methodology compares to that of approved methodologies).*

Strengths:

The monitoring methodology:

- provides a transparent, easily calculated estimate of the baseline emission rate, for which the necessary monitoring, calculation of the applicable carbon intensity factors, data archiving and reporting is simple and can be done centrally at the sector level.
- can reduce monitoring at the project level to a reading of power meters and, if necessary, collection of data on project emissions and leakage.
- reduces the calculation of emission reductions to a simple multiplication of annual generation output with the appropriate emission factor.

Weaknesses:

The monitoring methodology:

- because the monitoring methodology is for the purpose not only of measuring project emissions but also for creating an *ex post* baseline emission rate, it requires the collection of sector level data.

7. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

No.

Annex 5

TABLE: BASELINE DATA

(Please provide a table containing the key elements used to determine the baseline (variables, parameters, data sources etc.). For approved methodologies you may find a draft table on the UNFCCC CDM web site. For new methodologies, no predefined table structure is provided.)

The following table summarizes the numerical results from the equations listed above. The table presents data, data sources and the underlying computations that are available in the excel-spreadsheet attached to the PDD:

TABLE A1	A	B	C	D	E	F
	fuel share %	fuel consumption TJ/year	carbon content tC/TJ	emissions (2001) tCO2/year	generation (2001) GWh	emissions rate tCO2/MWh
	Chart 23, p. 71, (SENER, 2002)	(= A x 1,594,685)	Inventory Workbook (IPCC, 1996)	(= B x C)	See Table A2	(= E / D)
Fuel Oil	57.4%	915,349	21.1	70,817,516		
Natural Gas	26.8%	427,376	15.3	23,975,770		
Diesel	1.2%	19,136	20.2	1,417,356		
Coal	14.6%	232,824	25.8	22,025,151		
		1,594,685		118,235,793	154,698	0.764

TABLE A2	A	B	C	D
	generation GWh	excluded sources	included generation GWh	excluded generation GWh
	Chart 15, p. 49, (SENER, 2002)	Annex 3, Baseline Methodology	(= A) if included	(= A) if excluded
turbogas	5,457		5,457	-
geo+eolica	5,573	X	-	5,573
nuclear	8,726	X	-	8,726
dual	14,109		14,109	-
carbon	18,567		18,567	-
ciclo combinado	25,378		25,378	-
hidraulica	28,435	X	-	28,435
vapor + interna	90,861		90,861	-
importaciones	326		326	-
	197,432		154,698	42,734

TABLE A3		units	equation or source	
A	NGCC efficiency	%		50.0%
B	natural gas consumption	TJ/GWh	(= 3.6 (TJ/GWh) / A)	7.20
C	natural gas carbon content	tC/TJ	Inventory Workbook (IPCC, 1996)	15.3
D	NGCC emissions rate	tCO2/MWh	(= B x C / 1000 x (44 / 12))	0.404

TABLE A4		units	equation or source	
A	Estimated operating margin emission rate	tCO2/MWh	Table A1	0.764
B	Estimated build margin emission rate	tCO2/MWh	Table A3	0.404
C	Estimated baseline emission rate*	tCO2/MWh	(= (A + B) / 2)	0.584

* This is the ex ante approximation to the baseline. Actual baseline will be calculated ex post as per monitoring methodology.

TABLE A5		units	equation or source	
A	EI Gallo capacity	MW	project developers	30.59
B	capacity factor	%	project developers	45%
C	annual generation*	MWh	(= A x B x 8766)	120,668
D	baseline emission rate	tCO2/MWh	See Table A4	0.584
E	annual emissions reductions	tCO2	(= C x D)	70,484
F	crediting period	years	project developers	2005 - 2025
G	crediting lifetime	years	difference	21
H	total emissions reductions over crediting lifetime	tCO2	(= E x G)	1,480,157

*This is an estimate. Actual generation will be monitored as per monitoring methodology.

Exhibit A

Mexico El Gallo Project: An Analysis of Environmental Impacts

September 2003

The project will be located on the Cutzamala river at the existing dam of El Gallo, in the state of Guerrero. The land and the dam are owned by the Federal Government, with Comisión Nacional de Aguas (CNA) being responsible for its administration. The dam was built between 1979 and 1998 with the twofold objectives of: (i) irrigation, and (ii) electric generation. However, due to lack of funds, the generation component was never implemented. The area, already deteriorated by the dam construction, is not complex in terms of potential ecological and socioeconomic impacts. The areas of potential minimum impacts are :

Hydrology:

The Cutzamala river watershed is formed by the upstream tributaries Porungeo, Tilostoc which rises up to 3000 m in Nevado de Toluca, and Tuzantla which originates in Zitacuaro at 2700 m. The river has an average annual flow of 88 m³/s. Upstream there are only temporary agricultural activities and no industrial activities. As a consequence, it is estimated that the river has good water quality. The river is contained at the dam maintaining a reservoir at a level of 423 millions of m³, having a total annual demand downstream for irrigation of 400 millions of m³. The project does not involve the elevation of the dam. The natural average flow of the river is about 88 m³/s, the present maximum flow usage for irrigation is about 24 m³/s and the minimum about 2 m³/s. The river has a downstream length of 330 km reaching the Pacific Ocean.

Flora and Fauna:

The host environment is semi-arid, the vegetation of the area being secondary and homogenous in terms of species. The area where the power plant will be built is practically devoid on any vegetation due to the dam construction. There are mainly scrubs, bushes, mainly *ipomoea quamolit* and *acacia cochliacantha*, and a limited amount of herbaceous vegetation. Besides the reservoir, which will not be affected by the project, there are no known critical natural habitats in the area of the project. Due to the prior dam construction, native fish species are not abundant in the river downstream.

The project will entail the construction of transmission lines, the length of which will be 12 km.

Potential Environmental Impacts:

Water Quality and Quantity:

The project does not entail new dam construction, nor an increment in the existing dam capacity. The few modifications in civil works and the construction of a tunnel imply the minimum elevation, with removable structures, of the existing regulating reservoirs with no negative impacts associated.

In terms of quality, there are no water quality analyses of the rivers involved. However, it is anticipated that the water shows no relevant deterioration due to the fact that there are no upstream agricultural or industrial activities. No major changes in water quality are expected as a consequence of the plant construction. A water quality monitoring plan will be set up as part of the prevention and mitigation plan.

In terms of quantity, the developer has agreed with CNA that the current irrigation pattern will not be affected by the project and an agreement has been signed for a maximum water usage in the dam. However, the water intake needed for the project and the proposed further use of the power plant's discharge will affect water flow and water level. Both water flow and level will be significantly increased, as reflected in the following table:

	El Gallo Project
Average original flow (m ³ /s)	88.8
Maximum Current flow for irrigation (m ³ /s)	24
New Designed flow for irrigation + generation (m ³ /s)	76.7

As a result of the mentioned increases in flow and level, the existing regulating reservoirs will be elevated by 0.5 meters in order to offset this impact, maintaining as a consequence the current irrigation cycles.

Taking into account that this hydroelectric plant will generate at peak hours for about 7-10 hrs per day during 2-4 months per year, the flow will need to be restricted to a minimum during these periods. A 7 km stretch of the Cutzamala river will be affected by the change in water flow and level.

Although Mexican legislation does not require the definition of a minimum ecological flow to avoid or minimize severe impacts on aquatic ecosystems, the developer was requested to establish and respect an ecological flow. The following table presents the estimated minimum ecological flow for the river based on two of the most common methodologies:

Methodology	Estimated Minimum Ecological Flow (m ³ /s)
Mean Annual Flow	88.8
Tennant Method: Establishes a minimum of 10% of mean annual flow in order to guarantee fish survival	8.88
Mean daily flow with a 90% probability of being exceeded	15.7

Based on the CNA irrigation necessities and their own generating requirements, the developer has established a minimum ecological flow of 4 m³/s.

It is evident that the introduction of the generating plant will have a positive impact in terms of the minimum flow if it is compared with the current minimum irrigating flow set by the CNA, which is 2 m³/s. This minimum flow is considered adequate and any potentially negative impact on the ecosystem is further reduced by: (i) the presence of effluents to the main river; (ii) the long distance between the dam and regulating reservoir, which flattens the hydrogram; (iii) spillway release is not taken into consideration in this calculation, and (iv) land irregularities in the river bed create transitory impoundments for aquatic species.

CNA will be informed about the determination of the minimum flow in order to get their official agreement to it. Hydrological impacts will be kept at a minimum and the stretch of the river will always have sufficient water.

Biodiversity Impacts:

The main potential impacts are: (i) clearing of native vegetation and trees; and (ii) increasing hydrological imbalance in the river. The project will entail clearance of secondary vegetation and a minimum number of trees along the transmission lines which are not aligned across any urban setting, they are set almost 100% on agricultural lands. However, as indicated in the Mitigation Plan, adequate compensation measures will be implemented. There are no vegetable species in the area under protection of Mexican laws. As previously indicated, the impact on biodiversity will be minimal due to the advance state of deterioration of the site. Freshwater biodiversity will not be further affected while the minimum established ecological flow will guarantee that the riverine vegetation remains unchanged. Impact on fisheries was also deemed of low magnitude and importance as native species are not abundant in the rivers and taking into account that the river flow be will improved in all of the cases.

Construction Impacts:

The construction of civil works will not entail potentially negative impacts on the surrounding natural habitats. The proper management of excavation materials, river and drainage crossings, and the reduction of nuisances such as dust, noise, increased traffic, pedestrian safety, will need careful engineering planning, close supervision and a continuous and intense community information programs. All environmental requirements for construction will be part of an Environmental Construction Manual which will be enforced by the engineering supervision firm.

Cultural Heritage:

Neither the powerhouse nor the transmission line alignments affect sites of historical or archeological value. The project will not generate visual impacts that could affect the tourist or scenic value of the area.

Environmental Management Plan (EMP):

The Environmental Assessment Report (EAR) recommends a number of measures to mitigate potential environmental impacts during the construction and operation phases.

Minimum Ecological Flow: Perhaps the most important environmental measure for the project is the requirement to keep a minimum flow as indicated above. This requirement will be monitored by a external environmental auditing firm.

Reforestation Plan: A program for identification, inventory and rescue of species of interest will be established. In addition, the site will be reforested with native species. However the area to be reforested is minimum.

Environmental Management during construction: Environmental and social mitigatory measures to be implemented during the construction phase are included in the technical specifications that will be included in bidding documents and construction contracts.

Implementation Capacity: The EMP will be implemented by the project sponsor through its contractors and will be enforced by an environmental auditing firm.