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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Trojes Hydroelectric Project
Version 6
Date: February 22nd 2012

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

The objective of the proposed project activity 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 (PPA's), using the Comisión Federal de Electricidad (CFE) transmission system to wheel the energy. The project activity generates GHG emission reductions by avoiding electricity generation that would be otherwise produced at fossil fuel-fired power plants.

The Trojes project generates clean electricity in a rural area located in the Municipality of Pihuamo in the State of Jalisco and the nearest city to the proposed project is Coalcomán, in the State of Michoacán.

The Trojes project has an existing dam at the site. The power plant has a capacity under design conditions of 8 MW and uses the existing pattern of irrigation flow releases to generate electricity. The existing dam is a rock filled dam with an impervious clay core centre and was built with the intent to construct future hydroelectric plant on-site.

Two diversion tunnels were constructed at the dam to divert storm water flows during dam construction. One of the diversion tunnels is being utilized to provide irrigation flows downstream from the dam. The diversion tunnel not utilized for irrigation flows contains the penstock facility to feed the powerhouse at the site. The hydroelectric facility is constructed directly downstream from the outlet of the diversion tunnels within an area previously designated for the placement of a hydroelectric facility.

The project serves to impound water mainly utilized for downstream irrigation. It is possible for this project to regulate downstream water volume. The regulating dam can accommodate some degree of varying upstream dam flow releases, thus increasing the 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 any way as a result of the development of the project.

The dam provides storage for inter annual regulation of river flows for irrigation districts located downstream. The Trojes project consists of a hydroelectric plant constructed downstream the point where the water intake tunnel for irrigation exits the dam. The hydro plant will use an existing penstock to feed the turbine. A bypass upstream of the powerhouse will allow irrigation.

The water intake for Trojes is formed by a concrete-lined tunnel with a 2 m diameter steel pipe line running inside the tunnel. The turbine is a horizontal axis Francis type rated to produce, under design conditions, 8 MW. A transmission line was constructed to connect the project activity with the national distribution grid.

Table 1. Main project characteristics

Trojes	
Transmission line	2.5 km
Turbine nominal power	10.576 MW
Generator nominal power	8,760 kVA
Design head	61.8 m
Design flow rate	15 m^3/s
Project efficiency	88%
Power under design conditions	8.0 MW

The expected annual average generation output of 38.7 GWh is distributed over the peak, intermediate and base intervals as follows:

Table 2. Trojes - Output profile

Peak	*Intermediate*	*Base*
6.4 GWh	28.6 GWh	3.7 GWh
16.5%	73.9%	9.6%

The expected annual distribution of hours of generation over the different intervals is as follows:

Table 3. Trojes – Hours of production per year

Peak (hr/yr)	*Intermediate (hr/yr)*	*Base (hr/yr)*
805	3605	463

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 greenhouse gas (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 Comisión Federal de Electricidad (CFE), increase experience in accommodating smaller distributed resources that offer potential energy, capacity and diversification benefit.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	*Private and/or public entity (ies) project participants (*) (as applicable)*	*Kindly indicate if the Party involved wishes to be considered project participant (Yes/No)*
Mexico	• Impulsora Nacional de Electricidad, S. de R.L de C.V. • Hidroelectricidad del Pacífico, S. de R.L. de C.V.	Yes
United Kingdom of Great Britain and Northern Ireland Switzerland	• BNP Paribas S.A.	Yes

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

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

A.4.1.1. Host Party(ies):

Mexico

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

Municipality of Pihuamo in the State of Jalisco in Mexico.

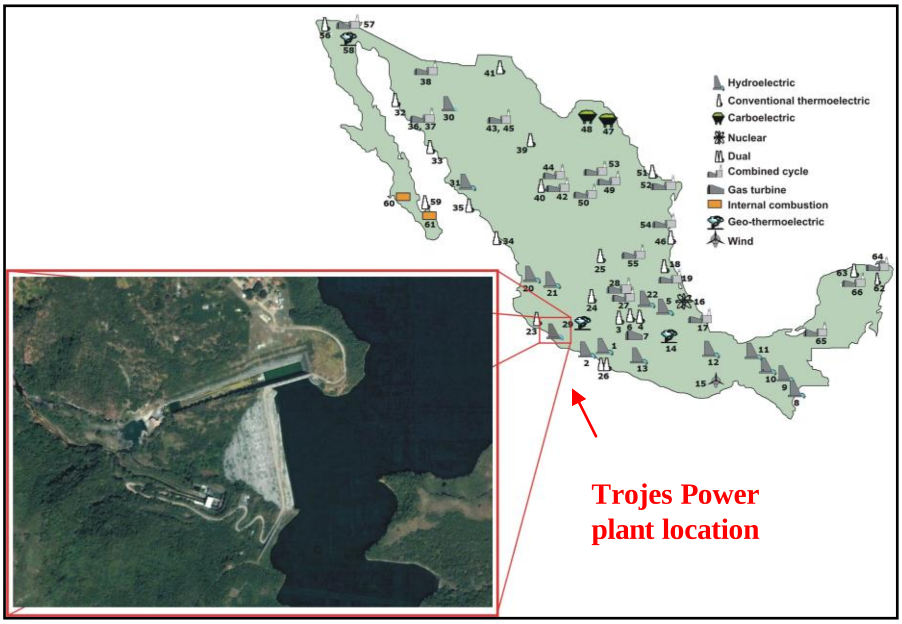
A.4.1.3. City/Town/Community etc:

The project is located within 50 kilometers south-east of the city of Colima. It is located on the Barreras River in West-Central Mexico.

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

The project is located downstream of the Trojes Dam, which was built in 1980 by the National Water Commission (CONAGUA) for irrigation purposes[1]. This dam was built to store water from three rivers: Coahuayana, Barreras and Trojes. The water released from the dam is used to irrigate the Coahuayana Irrigation District, located about 20 kilometers downstream. The project is located at 18°57’55” north latitude and 103°23’55” west longitude.

[1] National Water Commission in Mexico: “Statistics on Water in Mexico, 2010”, T4.1, pag. 84



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

Type I. Renewable Energy Projects
Category D Electricity Generation for a system

The Trojes hydroelectric project conforms to the project type and category selected, as it is a project activity which involves renewable energy generation from the installation of a new small-scale hydroelectric plant in an existing dam used for irrigation purposes and whose output will be fed into the national electricity grid (CFE), thus displacing generation from fossil fuel-fired plants. Since it is a clean and renewable source of energy, it has minimum impact on the environment. The Trojes dam was build in 1980 by CONAGUA[2] and, consistently with the methodology requirements, can be considered as an existing reservoir.

The turbine and generator for the project were made by Alstom Power who signed an Engineering/Procurement/Construction (EPC) contract with the project sponsors. This company has been manufacturing hydroelectric facilities for decades and has improved the engineering and technology used in the design and fabrication of hydroelectric turbines and generators.

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

Table 4. Emission reductions

Years	Annual Estimation of emission reductions in tones of CO_2
2010 (April to December)	11,656
2011	15,542

[2] National Water Commission in Mexico: "Statistics on Water in Mexico, 2010", T4.1, pag. 84

2012	15,542
2013	15,542
2014	15,542
2015	15,542
2016	15,542
2017 (January to March)	3,885
Total estimated reductions (second seven years)	108,792
Total number of crediting years	7 x 3 = 21
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	15,542

In each crediting period, the amount of ERs generated by the project will vary directly with the metered net generation output from Trojes. The estimations in Table 4 are based on a grid emission rate of 0.4016 tCO_2e/MWh and an expected 38,7 GWh of electric-energy output per year from Trojes. The emission rate is computed from the most recent three years with official information on the Mexican electric power sector.

Provided that the first crediting period ends in March 2010, for this year's calculation, we are considering only 9 months, while the other three months will be computed in 2017.

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

There is no public funding involved in the proposed project activity.

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

According to the simplified M&P for small-scale CDM project activities, a small scale project is a debundled component of a larger project if there is a registered small-scale activity or an application to register another small scale activity:

- With the same participants
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The Project is not a part of any large scale project or program and is not a debundled component of a larger project activity. As mentioned, the Trojes project is the first hydroelectric plant to be placed on the three rivers abovementioned. Moreover, Trojes is not overlapping any small-scale project within 1 km of its project boundary which is already registered or in the process of applying for registration as a small-scale CDM project.

SECTION B. Application of a baseline and monitoring methodology

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

Version 17 of the methodology AMS-I.D has been used.

Type I.	Renewable energy project
Category I	Renewable Electricity Generation for a Grid
Version	17 (Approved at EB 61)

The baseline was updated according to the tool "Validity of the original/current baseline and to update the baseline at the renewal of a crediting period, Version 03" (EB 65) consistently with the "Procedures for renewal of the crediting period of a registered CDM project activity" version 06, approved at EB 63.

The methodology "Tool to calculate the emission factor for an electricity system", version 02 approved at EB 50 was used to calculate the emission factor for the grid. Information utilized to calculate the emission factor is the most recent publicly available information from official sources and consists of electricity generation during years 2003-2008.

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

This *Project Activity* complies with the applicability conditions of the Small-Scale-Methodology Type I.D Version 17 (AMS-I.D v17) The applicability of AMS.1-D v17 is discussed below:

Table B.2.1 AMS-I.D Applicability Conditions

AMS-I.D v17	*Project Activity*
This category comprises renewable energy generation units, such as photovoltaic, **hydro**, tidal/wave, wind, geothermal and renewable biomass supplying electricity to a national or regional grid. Project activities that displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit shall apply AMS-I.F.	The Project Activity is a hydroelectric power plant. Electricity generated by the hydroelectric power plant is supplied to the Grid, displacing electricity that would have been produced by fossil fuel fired generating units.
This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition1; (c) involve a retrofit2 of (an) existing plant(s); or (d) involve a replacement3 of (an) existing plant(s).	The project activity falls under (a) install a new power plant at the site.
Hydro power plants with reservoirs that satisfy at least one of	The project activity is implemented in an existing reservoir

AMS-I.D v17	*Project Activity*
the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir (in operation for at least three years before the implementation of the project activity) with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	with no change to the volume of the reservoir. The reservoir was built in 1980 by CONAGUA[3] and, consistently with the methodology requirements, can be considered as an existing reservoir.
In the case of biomass power plants, no other biomass types than renewable biomass are to be used in the project plant.	Not applicable to the project activity
If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel5, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable to the project activity
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable to the project activity
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable to the project activity
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The project activity has a maximum output capacity (defined according to "Simplified modalities and procedures for small-scale clean development mechanism project activities") lower than 15 MW (refer to Table 1 for more specific characteristics on the project activity).

B.3. Description of the project boundary:

Version 17 of AMS-I.D refers to boundary as "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to".

[3] National Water Commission in Mexico: "Statistics on Water in Mexico, 2010", T4.1, pag. 84

The project boundary comprises all the components of the project activity like the water reservoir generated by the existing dam on the Barreras River in the municipality of Pihuamo, the diversion tunnels, the power house and the substation. Also, the Mexican electrical grid is included in the project boundary; however the power plants located in the Baja California region have been excluded from the boundary due to their connection to a grid outside the National Interconnected System.

Since the water reservoir already existed and no expansions were realized for hydroelectric production[4], according to the AMS-I.D, no emissions for water reservoir were calculated.

Therefore the only CO_2 emission considered for baseline determination come from fossil fuel combustion for grid electricity generation.

B.4. Description of baseline and its development:

In this section, the "Procedures for renewal of the crediting period of a registered CDM Project Activity", version 06 (approved at EB 63) was followed for determining the updated baseline. Therefore, the latest tool "Validity of the original/current baseline and to update the baseline at the renewal of a crediting period, Version 03" (approved at EB 65) was used as part of this review.

It is important to mention that, according to paragraph 3 of the procedures for renewal of the crediting period, the demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have resulted from that scenario.

Compared to the registered PDD, though some data and parameters were updated and the latest tools were used, the same baseline scenario was followed due to no changes in the project activity and to unvaried external conditions.

Information on data sources and emission factor is provided below:

1. Information on annual electricity generation by each plant (excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation), delivering to the CFE interconnected grid as well as the fuel consumption and self consumption and recent capacity addition is obtained from SENER (*Secretaría de Energía*), especially from the annual *Prospectiva del Sector Eléctrico 2004-2013, 2005-2014, 2006-2015, 2007-2016, 2008-2017 and 2009-2024.* SENER is the Energy Ministry of Mexico, and the information used for this Project Activity are extracted from official reports on the electricity supply (ie."Prospectiva del Sector Eléctrico"). The same report referenced official sources such as those from the Comisión Federal de Electricidad (CFE) and the National Company Petroleos Mexicanos (PEMEX). The efficiency of the power plants is calculated by CFE as stated in the Table No. 47 of the "Prospectiva del Sector Eléctrico 2009-2024", while fossil fuel CO_2 emission factors are obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

[4] National Water Commission in Mexico: "Statistics on Water in Mexico, 2010", T4.1, pag. 84

2. CO_2 emissions due to electricity generation are calculated from data on electricity generation efficiency, and fuel CO_2 content. Power plants efficiencies have been taken from the document "Prospectiva del Sector Eléctrico 2008-2017" published on the SENER website. Fossil fuel CO_2 emission factors are from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

3. The CO_2 emission factor for the electricity Grid will be re-calculated over the project's crediting life as described in Section B.6.

4. For establishing operating margin and build margin an ex-ante approach was followed.

Update of the baseline for the second crediting period

This update is done according to the tool "Validity of the original/current baseline and to update the baseline at the renewal of a crediting period, Version 03", EB 65.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies.

In the first crediting period, all the power plants connected to the grid, including IPP's, CFE power plants and Luz y Fuerza del Centro (LFC) were considered in the baseline. As mentioned in this document, LFC was a state-owned electricity company who was in charge of the generation and distribution of electricity in the central part of Mexico, mainly in Mexico City. However, on October 11, 2009 an Official Decree for eliminating LFC was issued. From that date, CFE took control of the operation and administration of the electricity in the whole country. Despite this measure, the baseline considered in the first crediting period is not altered.

Furthermore, the Law for Renewable Energy Usage and its regulation were issued in October 2008 and September 2009 respectively. The aim of these regulations is providing support for the efficient and sustainable use of electricity.

None of these regulations go against or oppose to the established baseline for the first crediting period, since the power plants and IPPs continue the generation of electricity for feeding the grid.

Step 1.2: Assess the impact of circumstances

The only new circumstance to the baseline is the new management of the former LFC power plants. From the decree issuance, CFE is in charge of the operation, maintenance, distribution and transmission of electricity generated by the LFC power plants. However, these plants are already connected to the grid and no change in the baseline is foreseen. This change, in fact, is only administrative and has no implications on the baseline scenario.

Step 1.3: Assess whether the continuation of the use of current baseline equipment is technically possible.

This step is not applicable since the project activity is not considering the adaptation, installation, or modification of existing equipment.

Step 1.4: Assessment of the validity of the data and parameters

The parameters determined at the start of the crediting period were updated in order to consider the newest data available. This update includes all values used in the calculation of the grid emission factor, including the Operating Margin (OM), Build Margin (BM), emission factors from fuels, and efficiencies of the technologies used in the power plants.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The baseline scenario of the first crediting period was not reassessed because changes in relevant mandatory national and/or sectoral policies and in other circumstances have not determined the end of the validity of baseline scenario for the second crediting period.

Step 2.2: Update the data and parameters

IPCC default values and parameters determined at the start of the crediting period were updated in order to consider the newest data available. The updated values can be found in Section B.6.2, B.6.3 and B.7.1.
Also baseline emissions for the second crediting period were updated on the base of the latest approved version of the "Tool to calculate the emission factor for an electricity system", version 02, EB 50. The updated calculations can be found in section B.6.1, and the updated summary of the emissions in section B.6.4.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to the attachment A to the simplified M&P for small scale CDM projects, project participants shall provide an explanation showing that the project activity would not have occurred anyway due to at least one of the following barriers:

a. Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
b. Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
c. Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
d. Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The analysis presented below demonstrates that the barriers hindering the proposed project activity in the base case are related primarily to institutional issues and to the structure of the electricity market and power sector in Mexico. These types of barriers are covered under the barrier classes C and D stipulated for small-case CDM projects above.

The Trojes project displaces a portfolio of thermal generation units in the Mexican electrical system. The expansion plan which the CFE produced in the document "Prospectiva del Sector Eléctrico 2007-2016" indicates that hydropower's share of the total generation will drop from about 13% in 2006 to about 8% by 2016. Although hydroelectric resources constitute a sizeable portion of the total installed capacity, hydroelectric plants have low generating costs and will be dispatched regardless of the generation from the Trojes project. The chosen baseline methodology thus represents the more realistic of the two options available.

Project barriers and the importance of carbon finance

In general, the barriers to this type of investment in Mexico typically involve (a) transaction costs of identifying and negotiating with multiple power off-takers and maintaining supply-demand balance, (b) payment risks associated with the off-takers, (c) legal deficiencies inherent in the self-supply scheme, and hence lack of legal remedies in the event of unilateral termination, and in consequence (d) difficulties in securing financing, especially long-term debt financing, for such developments. The requirements with respect to permits, authorizations and contract are identical for small and large hydro projects resulting in significantly higher transaction or development costs for smaller projects.

Trojes hydroelectric project is included, together with three other projects, in the INELEC Umbrella Project, but, due to difficulties to obtain credit for the four projects, Benito Juárez project had to be taken out of the proposed Umbrella Project[5]. Trojes is one of the first small-scale hydro projects to be allowed as an auto-generator in Mexico. Being one of the first of its kind, securing sufficient financing of the project was difficult and delayed the development of the project. Some of the concerns of investors have stemmed from the legal and institutional framework in Mexico. Importantly, the financial sector in Mexico has been reluctant to provide the loans for the project and obtaining the concessionary rights have proven to be very time-consuming. It had not been possible to obtain the necessary loans without having the concessions needed to operate the Trojes hydro plant and all the necessary PPAs with the consumer partners. This has resulted in a delay of 2 years of the project.

In this situation, it has been essential to demonstrate the project sponsor's willingness and capability to develop the project. Therefore, the construction of the Trojes project started in January 2002, even though financial closure had not been reached at that point (financial closure was reached in August 2004). The decision to begin the construction work was important, first, in order to gain the support of government authorities, including acquiring the necessary government support to receive the permits and concessions required to achieve financial closure and, second, in order to prove the capability to develop the project to potential consumers. In the absence of construction work that has demonstrated the willingness and

[5] Inelec tried to finance Trojes, Chilatán, El Gallo and Benito Juárez all together by obtaining a loan for 70% of the Project Cost, but the finance, obtained in a syndicated loan from Scotiabank – Inverlat, FMO and BANOBRAS, was obtained only for 50% of the project cost and as the developers did not have any more capital to invest, decided to finance only 3 of the projects and leave Benito Juarez Project outside the loan and to find in a later stage, finance for that project.

capability to develop the project, it would not have been possible to convince consumer partners to sign long term PPAs with the project sponsor and the banks to finance the Umbrella Project.

The project sponsor took carbon finance into account before construction work commenced in January 2002. In discussions on financing with the equity partner, Scrudder Latin America Power Fund, the sponsor commissioned a study on carbon finance opportunities in mid-2001. Based on this advice, the sponsor commissioned a study on carbon finance options and on how these could benefit the project financing. The study also examined how baselines would be determined and how ERs would be calculated. A report prepared by an external consultant was completed in November 2001. The first inquiry about carbon finance by the PCF was made on November 27, 2001[6].

The generated output from the project is sold to industrial users and municipalities in Mexico at a lower price than the CFE's price. Municipalities who become partners reduce their costs of street light electricity, and industry partners reduce their electricity consumption costs relative to peak energy from the CFE tariff. This could expose the project to market and regulatory risks. The CFE could reduce their electricity price(s) in order to stimulate consumers to switch from Trojes/INELEC back to CFE. Moreover, the CFE could increase the wheeling tariffs, or other costs, incurred by the Trojes project.

Importantly, carbon finance will make it possible for the project to sell electricity at a lower price than it could otherwise. Carbon finance makes it possible to reduce the electricity price so that it is sufficiently attractive and competitive compared to CFE's tariffs. Without carbon finance, the return on the investment would not be attractive enough to justify the investment in the project.

The reluctance and concerns of investors and consumer partners regarding the Trojes project should be understood in the light of the state controlled Mexican electric power sector, the CFE tariff structure that is currently in place, the dominance of the state-owned utility CFE within the power sector, and the lack of private entities with experience with the operation of hydroelectric plants.

The income from the sell of Emission Reduction Certificates was critical to obtain financing to build the project.

The project is operated by an external company called Myocen, S. de R.L. de C.V. who operates the plant according to international standards, they are also responsible for monitoring and registering the electricity generation on a daily basis and for executing any corrective action recommended by Energía Nueva Energía Limpia de México S.A. de C.V. (Enel). Enel will conduct internal audits on a monthly basis and will determine the amount of electricity to be generated according to the annual program and to the Comisión Nacional de Agua (CONAGUA) authorization.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the AMS-I.D. the emission reductions can be calculated with the following equation:

[6] The documentary evidence is available for inspection by a designated operational entity.

$$ER_y = BE_y - PE_y - LE_y \qquad (1)$$

Where:

ER_y:	Emission reductions due to displacement of electricity during the year y (tCO_2/y)
BE_y:	Baseline emissions in year y (tCO_2/y)
PE_y:	Project emissions in year y (tCO_2/y)
LE_y:	Leakage emissions in year y (tCO_2/y)

Considering that for the project activity the water reservoir already exists and the power plant installation did not result in the increase of the basin, project emissions are set to zero.

Furthermore, since the electricity generating equipment is not transferred from another activity, leakages are also absent.

Thus equation (1) becomes:

$$ER_y = BE_y = EG_y * EF_{CO2,grid,y} \qquad (1)a$$

Where:

EG_y:	Net quantity of electricity generated as a result of the project activity during the year y (MWh)
$EF_{CO2,grid,y}$:	CO_2 emission factor (CEF) for the electricity displaced due to the project activity during the year y (tCO_2/MWh).

Step 1 Identify the Relevant Electricity Systems

For the purpose of this document and following the "Tool to calculate the emission actor for an electricity system V2 (Tool)", the entire Mexican grid is considered. The regions in the Mexican grid are interconnected, then the relevant electric power system is the entire Mexican grid[7]. It is important to mention that the public information released by the Mexican Energy Ministry *SENER* is presented for type of fuel for consumption, fuel share and technology for gross generation and power share and not specifically for regions.

The relevant electric power system considered in the baseline scenario and for updating the parameters is the National Interconnected System, comprising all the power plants located in Mexico except for the states of Baja California and Baja California Sur, which are not yet connected to the rest of the country. According to the last information from SENER[8] the interconnection of these regions of Baja California and Baja California Sur to the National Interconnected System - *SIN* is being considered. Only grid power plants are included in the calculation, that is to say off-grid power plants are excluded.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

[7] Source: SENER "Prospectiva del Sector Eléctrico 2009-2024"

[8] Prospectiva del Sector Eléctrico 2009-2024, page 85.

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I. Only grid power plants are included in the calculation
Option II. Both grid power plants and off-grid power plants are included in the calculation

For the Trojes project, Option I is considered, therefore only grid power plants are included in the calculation. Option I corresponds to the procedure contained in earlier versions of the "Tool to calculate the emission factor for an electricity system".

The emission factor can be calculated in a transparent and conservative manner as follows:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system".
OR
b) The weighted average emissions (in $kgCO_2e/kWh$) of the current generation mix. The data of the year in which the project generation occurs must be used.

In this case option a) was selected.

Step 3 Select a method to determine the operating margin (OM)

As per the tool, the calculation of the operating margin emission factor (EFgrid,OM,y) is based on one of the following methods:
(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

In this case, option (a) was chosen because the low-cost/must run resources in Mexico are well below the 50% of total grid generation in both the average of the five most recent years and in the long-term normal for hydroelectricity production[9]. Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. For Mexico, the average of the five most recent years low-cost-must-run percentage ranged between 19 to 25%, as shown in **Annex 3** of this PDD.

[9] SENER Prospectiva del Sector Eléctrico 2009-2024, Cuadro 21, p 110.

The operating margin was calculated using the Simple OM method (low-cost/must-run resources constitutes less than 50% of total grid generation) on the base of data on net electricity generation, fuel types and total fuel consumption of the project electricity system.

According to the Tool, for the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either the *ex-ante* or *ex-post* data vintages. For this calculation the **ex ante** option data vintage was used, where three year generation weighted average, based on the most recent data available at the time of submission of the updated PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method.

The Simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including the low-cost/must-run power plants/units.

The simple OM may be calculated:

- Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit, or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

a) The necessary data for Option A is not available, and

b) Only nuclear and renewable power generation are considered as low-cost/must run power sources and the quantity of electricity supplied to the grid by these sources is known; and

c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

Option B is used because Option 1 has been chosen due to the following:

- Information for each power unit is not available as needed for option A;
- Nuclear and renewable power generation are considered as low-cost/must-run power sources in Mexico; and
- Option 1was chosen in Step 2 – ie. off-grid power plants are not included in the calculation.

Under Option B – *Calculation based on total fuel consumption and electricity generation of the system*, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{m}\left(FC_{i,y} * NCV_{i,y} * EF_{CO_2,i,y}\right)}{EG_y} \quad eq(7)^{10}$$

$EF_{grid,OMsimple,y}$:	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$:	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$:	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$:	CO2 emission factor of fossil fuel type *i* in year *y* (tCO_2/TJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year $_y$ (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year *i*
y	The relevant years as per the data vintage chosen in Step 3. The three most recent years for which data is available at the time of submission of the updated PDD to the DOE for validation (ex ante option)

$EF_{CO2,i,y}$ (in tC/TJ) can be found in the Reviewed 2006 IPCC Guidelines for Greenhouse Gas Inventories: Workbook. Data for FCi,m,y can be found in the TJ/day in the Prospectiva Reports[11]

Step 5. Identify the group of power units to be included in the build margin (BM)

The sample group of power units *m* used to calculate the build margin consists of either:[12]

(a) The set of five power units that have been built most recently; or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

For the Project Activity, Option (b) was chosen because the Tool to Calculate the Emission Factor for an Electricity System V2 specified that "the set of power units that comprises the larger annual generation shall be selected", and as is shown in the SENER report[7] the set of power capacity additions in the electricity system which comprise 20% of the system generation which has been built most recently, comprise the larger annual generation capacity than the set of five power units that have been built most recently. The power unit's built date is considered the date it starts supplying electricity to the grid. Capacity additions from retrofit of power plants are not included in the calculation.

[10] Tool to calculate the emission factor for an electricity system V2.

[11] Prospectiva del Sector Eléctrico 2007-2016, 2008-2017, 2009-2024

[12] If this approach does not reasonably reflect the power plants that would likely be built in the absence of the project activity, project participants are encouraged to submit alternatives proposals for consideration by the CDM Executive Board.

Step 6 Calculate the Build Margin Emission Factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ Eq(13)[13]

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	power units included in the build margin
y	Most recent historical year for which power generation data is available.

According to the "Tool to calculate the emission factor for an electricity system V2", for the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of the submission of the request for renewal of the crediting period to the DOE.

The CO_2 EF for each power unit is calculated using Option A2 in *Step 4 (a)*. The CO_2 emission factor of each power unit was calculated using the following equation.

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} * 3.6}{\eta_{m,y}}$$ Eq (3)[10]

Step 7: Calculate the Combined Margin Emissions Factor

The combined margin emissions factor was calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \qquad (14)$$

Where:

$EF_{grid,CM,y}$:	Combined margin CO_2 emission factor (i.e. $EF_{CO2,grid,y}$) in year y (tCO_2/MWh)
$EF_{grid,BM,y}$:	Build margin CO_2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$:	Operating margin CO_2 emission factor in year y (tCO2/MWh)
w_{OM}:	Weighting of operating margin emission factor (%)

[13] Tool to calculate the emission factor for an electricity system, V2

w_{BM}: Weighting of build margin emissions factor (%)

As specified in the Methodology and the Tool, w_{OM} is 25% and w_{BM} is 75% is used for this second crediting period.

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

Data / Parameter:	**$\eta_{m,y}$**
Data unit:	(%)
Description:	Average net energy conversion efficiency of each power plant included in the electric power system
Source of data used:	Prospectiva del Sector Eléctrico 2009-2024 published on the SENER website
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The efficiency of the power plants is calculated by CFE as stated in the Table No. 47 of the "Prospectiva del Sector Eléctrico 2009-2024". For turbogas and combined cycle units the efficiencies are assessed under ISO conditions of 15°C, 60% relative humidity and atmospheric pressure at sea level. For internal combustion units, the efficiencies are assessed under ISO 3046/1-1986 conditions (temperature of 25°C, 30% relative humidity and atmospheric pressure equal to 1 bar)
Any comment:	When more than one efficiency value could have been applied, the most conservative option was always selected (i.e. highest efficiency values)

Data / Parameter:	**$EF_{CO2,m,i,y}$**
Data unit:	tCO_2/TJ
Description:	Average CO_2 emission factor of fuels used in power plants
Source of data used:	2006 IPCC Guidelines default values at the lower limit of uncertainty at a 95% confidence interval
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data on the emissions factors for different fuel types is available on the 2006 IPCC Guidelines.
Any comment:	

Data / Parameter:	**$EG_{m,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid (National Interconnected System) during year 2003, 2004, 2005, 2006, 2007 and 2008.
Source of data used:	SENER, Prospectiva del Sector Eléctrico 2004-2013, 2005-2014, 2006-2015, 2007-2016, 2008-2017, 2009-2024
Value applied:	See Annex 3
Justification of the	The most recent official data available at the time of submission of the updated

choice of data or description of measurement methods and procedures actually applied :	PDD to the DOE for validation were used.
Any comment:	

Data / Parameter:	**$FC_{i,y}$**
Data unit:	TJ
Description:	Amount of fossil fuel type *i* consumed in the project electricity system during year 2006, 2007 and 2008.
Source of data used:	SENER, Prospectiva del Sector Eléctrico 2007-2016, 2008-2017, 2009-2024
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The most recent three historical years official data available during the second crediting period baseline recalculation exercise were used (ex-ante option).
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/Gg
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
Source of data used:	2006 IPCC Guidelines default values at the lower limit of uncertainty at a 95% confidence interval
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The most recent default values from the IPCC Guideline available during the second crediting period baseline recalculation exercise were used (ex-ante option). This is defined once at the start of every crediting period. The Project Activity is now in its second crediting period.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The equations used to estimate the emission reductions are provided in Section B.6.1. The calculation tables are included in Annex 3. The available data for calculating the emissions reductions corresponds to the years 2004, 2005, 2006, 2007 and 2008, which was published by the Secretaría de Energía in the Prospectiva del Sector Eléctrico 2004-2013, 2005-2014, 2006-2015, 2007-2016, 2008-2017, 2009-2024. The project installed capacity is 8 MW under design conditions, and the electricity generation estimated for the second crediting period is 38.7 GWh. The OM, BM and CM emission factor are summarized in Table 5, 6 and 7 respectively.

Table 5. Trojes – Operating Margin Emission Factor

Operating Margin of the Mexican Electricity Grid	Years 2006	2007	2008
Electricity Generation [MWh]	177,178,000	187,437,000	179,863,000
CO_2 Emissions [t]	109,167,802	110,085,343	94,247,771
Operating Margin [tCO_2/MWh]	0.6143	0.5865	0.5230

Table 6. Trojes – Build Margin Emission Factor

Build Margin of the Mexican Electricity Grid	2008
Electricity Generation [GWh]	49,090,943
CO_2 Emissions [t]	12,024,095
Build Margin [tCO_2/MWh]	0.3439

Table 7. Trojes – Combined Margin emission factor

Carbon Emission Factors	tCO_2/MWh
Weighted Average Operating Margin 2006-2008	0.5746
Build Margin 2008	0.3439
Combined Margin	**0.4016**

The summary of the ex-ante estimation of emission reductions is presented in the Section B.6.4.

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

The Table 6 summarizes the ex-ante estimation of emission reductions.

Table 6. Trojes – Ex ante estimation of emission reductions

Years	Estimated project emissions [tCO_2e]	Estimated baseline emissions [tCO_2e]	Estimated leakage emissions [tCO_2e]	Estimated emission reductions [tCO_2e]
2010 (April-December)	0	11,656	0	11,656
2011	0	15,542	0	15,542
2012	0	15,542	0	15,542
2013	0	15,542	0	15,542
2014	0	15,542	0	15,542
2015	0	15,542	0	15,542
2016	0	15,542	0	15,542
2017 (January-March)	0	3,885	0	3,885

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{facility,y}$: Electricity generated and delivered to the grid by the project activity**
Data unit:	MWh
Description:	Net generation by the Trojes hydroelectric plant – i.e. Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data to be used:	CFE invoices
Value of data	Annual estimated generation of 38.7 GWh
Description of measurement methods and procedures to be applied:	Electricity will be measured by a cumulative meter (located on the CFE electrical substation) and recorded monthly. This meter is owned by CFE and readings are used for invoicing.
QA/QC procedures to be applied:	The hydroelectric power plant has an internal meter located in the control room, from where the data is obtained on a daily, weekly, monthly, and annual basis. The monthly generation is compared with the information provided by CFE. Measurement results from fiscal meters will be cross-checked with the energy reports generated by the SCADA System and used by Myocen supervisor to generate the daily, weekly, monthly and yearly reports.
Any comment:	Data will be archived at least for two years after the end of the last crediting period.

B.7.2 Description of the monitoring plan:

The monitoring methodology used by the project activity consists of metering the electricity generated by the renewable technology and supplied to the grid. Below the description of the monitoring procedure for data measurement, quality assurance and quality control is reported.

The hydroelectric power plant has a cumulative meter that records the electricity delivered to the grid. The project activity has another meter located inside the facility for internal reference. This meter is used to register on a daily basis the electricity generation. Table 7 summarizes the characteristics of these meters.

Table 7 – Meters characteristics

Meter	*Characteristics*
Metering 1 – Main	Commissioning date: March 2003 Instrument type: Electricity meter, one way Serial Number: S/N PR-0506A068-02 Manufacturer Model Nr.: ION 8400 Specific location: Trojes Power Plant, CFE's substation, Presa Trojes
Metering 2 – Backup	Commissioning date: March 2003 Instrument type: Electricity meter, one way

	Serial Number: N/S AR-0012A368-02 Manufacturer Model Nr.: ION 8400 Specific location: Trojes Power Plant, CFE's Substation, Presa Trojes

The meters are owned and maintained by CFE, according to the "Interconnection Contract", CFE is responsible for the annual calibration of the meter. The procedure HPA-PROC-2009-01 dated on 13 May 2009 and following the "Interconnection Contract" between CFE and Hidroelectricidad del Pacífico, CFE is responsible to coordinate all the jobs required for the verification of the meters by an authorized company. Hidroelectricidad del Pacífico is responsible to report any deficiency encountered in the meters, as well as coordinate the lock out activities to the substation when requested by CFE. Below, a brief description of the activities considered in this procedure:

1. CFE through the Transmission Direction (GDDCOcc) and Trojes facility will agree the Metrology Laboratory that will conduct the calibration tests for the meters on an annual basis. According to the contract between CFE and Hidroelectricidad del Pacífico, the meter maintenance cost will be responsibility of CFE.
2. GDDCOcc must submit to Trojes facility the annual program for meter testing and calibration. Also, at least 15 days prior conducting the tests CFE must notify Trojes. Preferably, the testing dates must concur with the maintenance period.
3. Any job conducted at the meters must be authorized by CFE and Trojes jointly.
4. Additional tests can be requested by either party, and must be scheduled within 20 days after the request, or as soon as the program allows the coordination of these activities.
5. If the tests show that the meters are not accurate with a difference of 0.2% or a greater percentage, adjustments will be conducted to fix this difference and the deficiency period of all the measurements conducted with the faulty meter.
6. The results from the tests must be recorded and registered. CFE and Trojes will keep the file of the tests and calibration.

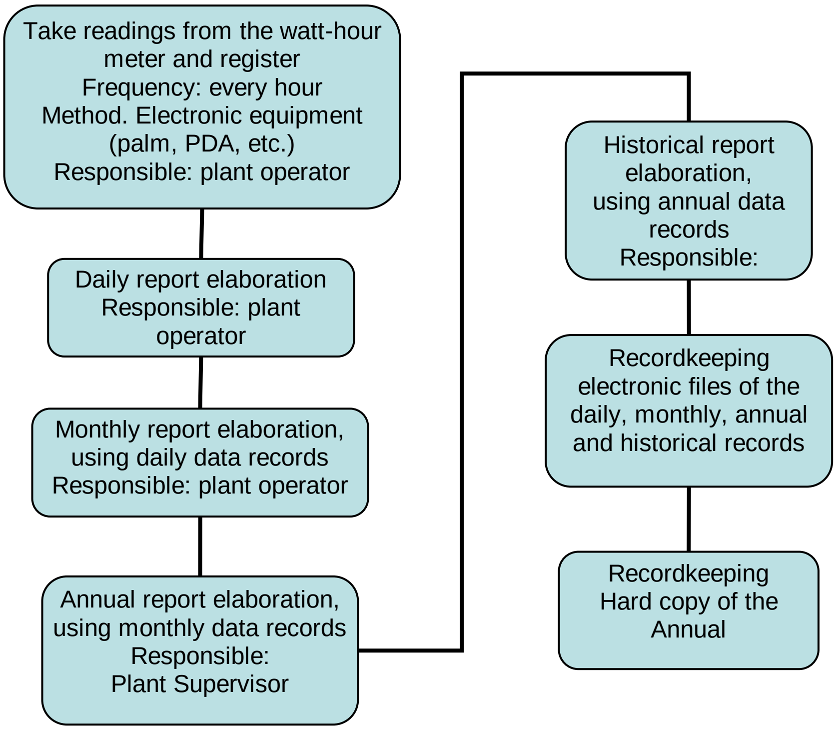
On a monthly basis, a CFE operator gets the information from this meter, to recognise the total generated electricity by de Plant. The energy generation is filled in electronic files through the SCADA system. Information is used by Myocen supervisor to generate the daily, weekly, monthly and yearly reports. Internal registers are also used to collect data manually. These reports are the relevant information to compare with those from CFE. The access to the reports is controlled by passwords which are reserved to the use of the Supervisor of the Plant, the Operational Manager, and the Country Manager of Enel.

Table 8 establishes the frequencies for the report elaboration as well as personnel responsible.

Table 8 – Trojes Operational reports

Report	*Frequency*	*Responsible*
Daily Operation Report	Daily	Operator
Monthly Operation Report	Monthly	Plant Supervisor
Annual Operation Report	Annual	Plant Supervisor
Historical Report	Monthly	Plant Supervisor

Figure 1 - Recordkeeping and reporting



At the end of the month, reports from CFE and Myocen are compared and agreed for final invoicing.

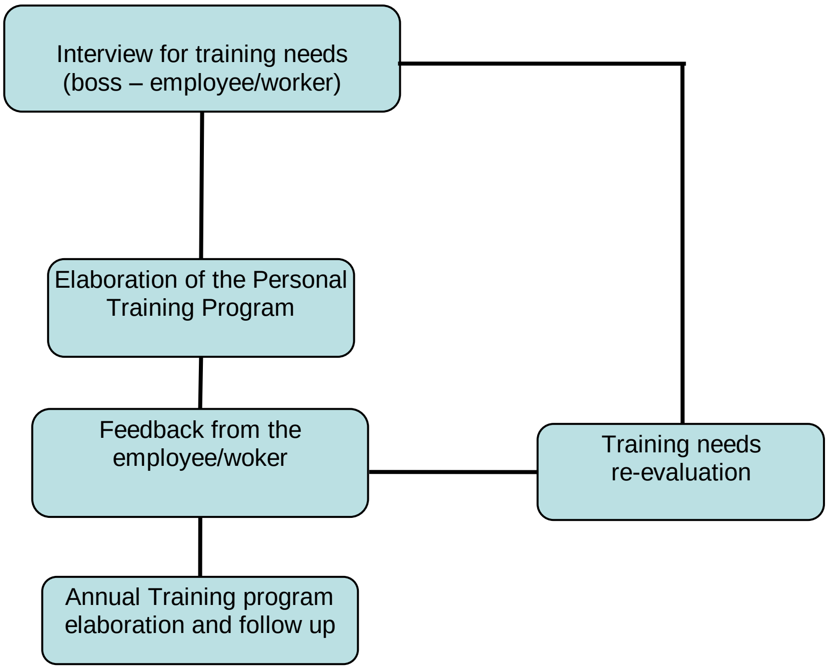
The plant has a main and a backup system. In case the main system fails, the backup system intervenes and replaces it. Information is automatically collected from the equipment at the plant through the SCADA system.

Quality control and quality assurance procedures will ensure the quality of data controlled. The CFE meter provides the final invoiced reading and is therefore considered as the official electricity generation data. Since the metering is owned by CFE, this company is in charge of its maintenance and calibration.

The energy generating equipment was not transferred from another activity, then leakages effects do not need to be accounted for.

Data will be archived electronically for at least two years after the end of the crediting period.
Trojes facility has the procedure INST-HPA-OP-2009-02 for the identification of training needs for employees and workers at the facility. From the training needs, an annual program is elaborated and followed. Figure 2 shows the flow diagram for this training procedure.

Figure 2 – Training needs identification



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

This updated baseline and the monitoring methodology for the renewal of the crediting period were finalized on 22nd February 2012

The entity responsible for the application of the baseline and monitoring methodology to this project activity is ERM (not a project participant).

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The construction work on the Trojes project started in January 2002, and the project started generating electricity on April 1, 2003.

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

50 y

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

C.2.1. Renewable crediting period

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

Starting date of first crediting period: 01/04/2003
Starting date of second crediting period: 01/04/2010

C.2.1.2. Length of the first crediting period:

7 y

C.2.2. Fixed crediting period:

NA

C.2.2.1. Starting date:

NA

C.2.2.2. Length:

NA

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

An Environmental Impact Statement was submitted to the Environmental Authority for review and approval. The Environmental Impact Assessment has been officially approved by Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT) and the developer has designed and made available a website to inform the public about the EIA and the INELEC Projects Umbrella.
Website: www.asergen.com.mx

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

The project will not have major environmental impacts. The areas that might have relevant environmental effects include:
1. Hydrology: The main impact will be generated by variations in discharge flow due to the peak hour operation of the plant. These variations may affect: (i) the stream bed and surrounding ecosystem, and (ii) the agricultural irrigation. These impacts will be mitigated by (i) maintaining a minimum flow (ecological flow) established according to Mexican Federal regulations, CONAGUA regulations which will be CONAGUA's responsibility to extract from their extraction valves to preserve the ecosystem, and (ii) the irrigation patterns will not be modified. The developer has established a legal agreement with CONAGUA in this regard. To technically comply with this agreement, the developer increased the level of the regulating reservoir.

2. Flora and Fauna: The host environment is semi-arid, being the vegetation of the area secondary and homogenous in terms of species. There are mainly scrubs, bushes, mainly huizache (Acacia sp.) and a limited amount of herbaceous vegetation. As a result of the dam construction fish native species are not abundant in the river downstream. There are fishing activities only in the reservoir of foreign species. There are neither critical natural habitats, nor threatened species in the area of the project. As a result of these facts, and due to the project characteristics, there will be no relevant impact in terms of flora and fauna.

3. Transmission lines: The design of transmission lines was done in such a way that no resettlements will be necessary. The lines will essentially pass through agricultural lands. The Rights of Way (ROW) where necessary, have already been granted. The minimum vegetation to be affected was manually removed.

SECTION E. Stakeholders' comments

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

There have been consultations with the farmers downstream from the irrigation district that use the water stored in the dam. There have also been consultations with affected landowners along the route of the transmission lines. The farmers were invited to know about the project through the CONAGUA who manages the irrigation district downstream. The landowners and the people that live in the surroundings were contacted directly and through the Presidents of the agrarian modules "Presidentes ejidales". The developer was requested to include NGOs in the communication campaign but no relevant NGOs were identified.

E.2. Summary of the comments received:

The comments received were:

- How people who own land that will be affected by the construction of the transmission line were going to be compensated.
- What will happen to the fish that live in the dam after the power house is built and electricity is being generated, and
- If they will get less water for irrigation purposes because of the operation of the power.

E.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 lines, and agreements have been signed with each one of them. The process was supervised by the agrarian authorities. Finally, the agreements were taken to the attention of a notary who certified the payment made to each landowner.

A schematic explanation was given to show how fish will still live in the dam and how they will not die because of electrocution in the dam. The developer explained that the speed of water entering the intake is very slow and therefore the fish will not be dragged through the penstock.

The permit obtained from the CONAGUA was presented to the stakeholders, in the permit it is clearly stated that the generation plant will only use the amount of water determined by the CONAGUA and that amount is based in the water used for irrigation or when the dam is spilling.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the proposed project activity.

Annex 3

BASELINE INFORMATION

The power plants considered for this calculation including the start-up operation date are included below:

Power plant ID	Name of the Generation Unit	Technology	Fuel	Date operations started
21	Manzanillo II	TC	FUEL OIL	
19	Jorge Luque [LyFC]	TC/TG	GAS	22/12/1960
31	Guaymas II (Carlos Rodriguez Rivero	TC	FUEL OIL	10/08/1962
51	Poza Rica	TC	FUEL OIL	04/02/1963
27	Francisco Villa	TC	FUEL OIL & GAS	22/11/1964
22	Salamanca	TC	FUEL OIL & GAS	19/06/1971
48	Dos Bocas	CC	GAS	14/08/1974
50	Gómez Palacio	CC	GAS	05/01/1976
24	Altamira	TC	FUEL OIL & GAS	18/05/1976
34	Lerma (Campeche)	TC	FUEL OIL	09/09/1976
32	Mazatlán II (Jose Aceves Pozos)	TC	FUEL OIL	13/11/1976
35	Mérida II	TC	FUEL OIL & GAS	01/04/1981
49	El Sauz	CC	GAS	29/07/1981
38	Río Escondido (Jose Lopez Portillo)	CAR	COAL	21/09/1982
30	Puerto Libertad	TC	FUEL OIL	01/08/1985
23	Villa de Reyes	TC	FUEL OIL	01/11/1986
57	Nachi-Cocom	TC/TG	FUEL OIL & DIESEL	16/04/1987
20	Manzanillo (Manuel Alvarez Moreno)	TC	FUEL OIL	24/07/1989
29	Lerdo (Guadalupe Victoria)	TC	FUEL OIL	18/06/1991
17	Tula (Francisco Perez Rios)	TC/CC	FUEL OIL & GAS	30/06/1991
39	Carbón II	CAR	COAL	02/11/1993
44	Petacalco (Plutarco Elias Calles)	DUAL	FUEL OIL & COAL	18/11/1993
37	Valladolid (Felipe Carrillo Puerto)	TC/CC	FUEL OIL & GAS	30/06/1994
36	Topolobampo II (Juan de Dios Batiz)	TC	FUEL OIL	12/06/1995
28	Samalayuca	TC	FUEL OIL & GAS	12/05/1998
45	Samalayuca II	CC	GAS	12/05/1998
65	Hermosillo	CC	GAS	21/12/1998
26	Río Bravo (Emilio Portes Gil)	TC/TG	FUEL OIL	01/07/1999
64	Mérida III	CC	GAS	09/06/2000
46	Huinalá I y II	CC/TG	GAS	17/09/2000
69	El Encino (Chihuahua II)	CC	GAS	09/05/2001
64	Hermosillo (PIE)	CC	GAS	01/10/2001
72	Saltillo	CC	GAS	19/11/2001
70	Tuxpan II	CC	GAS	15/12/2001
75	Río Bravo II	CC	GAS	18/01/2002

78	Monterrey III	CC	GAS	27/03/2002
79	Altamira II	CC	GAS	01/05/2002
81	El Sauz (Bajio)	CC	GAS	04/06/2002
71	Tuxpan III y IV	CC	GAS	23/05/2003
47	Campeche	CC	GAS	28/05/2003
83	Chihuahua III	CC	GAS	09/09/2003
80	Naco - Nogales	CC	GAS	04/10/2003
80	Altamira III y IV	CC	GAS	24/12/2003
25	Tuxpan (Adolfo Lopez Mateos)	TC/TG	FUEL OIL & GAS	03/01/2004
76	Río Bravo III	CC	GAS	01/04/2004
18	Valle de Mexico	TC/CC	GAS	01/06/2004
73	La Laguna II	CC	GAS	22/04/2005
77	Río Bravo IV	CC	GAS	31/04/2005
87	Valladolid III	CC	GAS	01/06/2006
86	Tuxpan V	CC	GAS	01/09/2006
85	Altamira V	CC	GAS	01/11/2006
89	Tamazunchale	CC	GAS	01/06/2007
90	El Cajón	HID		01/06/2007

Carbon emission factors for fuels used in Mexican power plants, taken from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Fuel	**CEF**
Unit	**tCO_2/TJ**
Natural gas	54.3
Fuel oil	75.5
Diesel	72.6
Coal	87.3

Low Cost Must Run Percentage for the most recent 5 Years

2004	
TECHNOLOGY	ANNUAL GENERATION (MWh)[10]
Combined cycle	72,267,000
Dual	7,915,000
Gas turbine	2,772,000
Coal	17,883,000
Internal	610,000
Nuclear	9,194,000
Standard Thermoelectric	66,334,000
Renewable (hydro, geo, wind)	31,659,000
TOTAL	208,634,000
self consumption [9]	11,252,000
Nett Electricity Generation	**197,382,000**
TOTAL GENERATION	167,781,000
Low Cost Must Run (%)	**20%**

2005	
TECHNOLOGY	ANNUAL GENERATION (MWh)[10]
Combined cycle	73,381,000
Dual	14,275,000
Gas turbine	1,358,000
Coal	18,380,000
Internal	780,000
Nuclear	10,805,000
Standard Thermoelectric	65,077,000
Renewable (hydro, geo, wind)	34,915,000
TOTAL	218,971,000
self consumption [9]	11,252,000
Nett Electricity Generation	**207,719,000**
TOTAL GENERATION	173,251,000
Low Cost Must Run (%)	**21%**

2006	
TECHNOLOGY	ANNUAL GENERATION (MWh)[10]
Combined cycle	91,064,000
Dual	13,875,000
Gas turbine	1,523,000
Coal	17,931,000
Internal	854,000
Nuclear	10,866,000
Standard Thermoelectric	51,931,000
Renewable (hydro, geo, wind)	37,035,000
TOTAL	225,079,000
self consumption [9]	10,264,000
Nett Electricity Generation	**214,815,000**
TOTAL GENERATION	177,178,000
Low Cost Must Run (%)	**21%**

2007[4]	
TECHNOLOGY	ANNUAL GENERATION (MWh)[10]
Combined cycle	102,674,000
Dual	13,375,000
Gas turbine	2,666,000
Coal	18,101,000
Internal	1,139,000
Nuclear	10,421,000
Standard Thermoelectric	49,482,000
Renewable (hydro, geo, wind)	34,694,000
TOTAL	232,552,000
self consumption [9]	11,252,000
Nett Electricity Generation	**221,300,000**
TOTAL GENERATION	187,437,000
Low Cost Must Run (%)	**19%**

2008[5]	
TECHNOLOGY	ANNUAL GENERATION (MWh)[10]
Combined cycle	107,830,000
Dual	6,883,000
Gas turbine	2,802,000
Coal	17,789,000
Internal	1,234,000
Nuclear	9,804,000
Standard Thermoelectric	43,325,000
Renewable (hydro, geo, wind)	46,203,000
TOTAL	235,870,000
self consumption [9]	
Nett Electricity Generation	**235,870,000**
TOTAL GENERATION	179,863,000
Low Cost Must Run (%)	**24%**

Calculation of CO_2 emission factors for electricity on the base of technology adopted and fuel type

Power plants efficiencies have been taken from the document Prospectiva del Sector Eléctrico 2008-2017 published on the SENER website www.sener.gob.mx.

Technology	Fuel	Gross Generation	Gross Efficiency	Self Consumption	Energy Consumption		CO_2 emissions
		GWh	%	%	GWh	TJ	tCO_2/MWh
Conventional thermal							
Conventional thermal (2 x 350 MW/unit)	Gas	1	37,58%	5,80%	2,66	9,58	0,5202
Conventional thermal (2x 160 MW/unit)	Gas	1	36,39%	6,20%	2,75	9,89	0,5372
Conventional thermal (2 x 84 MW/unit)	Gas	1	32,45%	6,40%	3,08	11,09	0,6024
Conventional thermal (2 x 37.5 MW/unit)	Gas	1	30,69%	8,30%	3,26	11,73	0,6370
Turbogas							
Aeroderivada gas (1 x 41.9 MW)	Gas	1	37,11%	1,10%	2,69	9,70	0,5268
Aeroderivada gas (1 x 102.7)	Gas	1	39,42%	1,50%	2,54	9,13	0,4959
Industrial gas (1 x 84.4 MW)	Gas	1	29,44%	1,00%	3,40	12,23	0,6640
Industrial gas F (1 x 186.9 MW)	Gas	1	35,62%	0,80%	2,81	10,11	0,5488
Industrial gas G (1 x 266.30 MW)	Gas	1	35,24%	0,80%	2,84	10,22	0,5547
Aeroderivada diesel (1 x 39.4 MW)	Diesel	1	36,40%	0,80%	2,75	9,89	0,7180
CCGT							
CCGT (1 x 1F)	Gas	1	50,27%	2,90%	1,99	7,16	0,3889
CCGT (2 x 1F)	Gas	1	50,47%	2,80%	1,98	7,13	0,3873
CCGT (3 x 1F)	Gas	1	50,60%	2,70%	1,98	7,11	0,3863
CCGT (1 x 1G)	Gas	1	51,47%	2,80%	1,94	6,99	0,3798
CCGT (2 x 1G)	Gas	1	51,66%	2,70%	1,94	6,97	0,3784
Internal combustion							
Internal combustion (1 x 42.2)	Diesel	1	45,07%	3,90%	2,22	7,99	0,5799
Internal combustion (2 x 18.4)	Diesel	1	44,18%	7,30%	2,26	8,15	0,5916
Internal combustion (3 x 3.6)	Diesel	1	37,82%	9,10%	2,64	9,52	0,6911
Coal							
Coal (2 x 350 MW)	Coal	1	37,87%	7,20%	2,64	9,51	0,8299
Coal Supercritical without Desulphurisation (1 x 700)	Coal	1	43,08%	6,40%	2,32	8,36	0,7295
Coal Supercritical Desulphurised (1 x 700 MW)	Coal	1	43,08%	10,60%	2,32	8,36	0,7295
Nuclear (1 x 1,356 MW)	N/A	1	34,54%	29,44%	2,90	10,42	0,0000

<u>Summary of Operating, Build and Combined Margin calculation.</u>

Operating Margin of the Mexican Electricity Grid	**Years**		
	2006	**2007**	**2008**
Electricity Generation [GWh]	177,178,000	187,437,000	179,863,000
CO_2 Emissions [t]	109,167,802	110,085,343	94,247,771
Operating Margin [tCO_2/MWh]	0.6143	0.5865	0.5230

Build Margin of the Mexican Electricity Grid	**2008**
Electricity Generation [GWh]	49,090,943
CO_2 Emissions [t]	12,024,095
Build Margin [tCO_2/MWh]	0.3439

Carbon Emission Factors	tCO_2/MWh
Weighted Average Operating Margin 2006-2008	0.5746
Build Margin 2008	0.3439
Combined Margin	0.4016

Annex 4

MONITORING INFORMATION

No further background information used in the application of the monitoring methodology is available at the moment.

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