



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

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**SECTION A. General description of project activity****A.1 Title of the project activity:**

La Venta II (“the project”).

Version 1.

30/08/2006.

**A.2. Description of the project activity:**

The project will be a wind power plant to be located in Mexico, in the southern state of Oaxaca. The project’s purpose is renewable electricity generation to be supplied to the Interconnected Mexican National Grid (“IMNG”). The project’s installed capacity and estimated yearly average generation will be 83.3 MW (“megawatts”) and 307,728 MWh (“megawatts hours”), respectively. The project is expected to displace 205,380 tons of carbon dioxide equivalent (“tCO<sub>2</sub>e”) per year, which will account to 1,437,660 tCO<sub>2</sub>e for the first crediting period (7 years), generating the equivalent amount of greenhouse gasses emissions reductions (“ERs”). The project’s greenhouse gasses (“GHG”) emissions will be negligible, thus there will be no need to monitor leakage and it will not be taken into account when calculating ERs.

The project will consist in the installation of 98 wind turbine-generators (WTG) each of 0.85 MW capacity, which will add to an 83.3 MW total capacity. The WTG will be distributed in 4 rows approximately 600 meters away from each other. The WTG will be approximately 130 meters away from each other; the height of the WTG will be 44 meters approximately.

The spatial extent of the project boundary is the IMNG. The project will be connected to the IMNG through a 19 km-transmission line that connects to the Juchitán II substation of the IMNG, which belongs to the *Comisión Federal de Electricidad* (“CFE”). The total expected generated electricity will be dispatched to the grid and be commercialized by CFE, which is the developer operator and owner of the project. The project will have an expected minimum plant operating life of 21 years. The project has obtained all applicable permissions/authorizations required for its construction and operation, and complies with all environmental requirements mandated by *SEMARNAT* (Mexican Environmental authority and Designated National Authority)<sup>1</sup>.

The project contributes to sustainable development by:

- a) Assisting the *IMNG* to keep thermal plants shut and use them only as stand-by power generation, when displacing expensive heavy fuel, diesel, coal and gas-fired generation thus reducing CO<sub>2</sub> emissions to the atmosphere by generating energy without GHG emissions<sup>2</sup>.
- b) Employing local labor in construction and plant management.
- c) Contributing to Mexico’s fiscal accounts through the payment of taxes<sup>3</sup>.
- d) Helping the country improves the hydrocarbons trade balance through reduction of oil imports to be used for electricity generation.
- e) Spurring Oaxaca State’s economy since it consumes materials of Oaxaca such as cement, metals, wood, and construction equipments, among others.

<sup>1</sup> Environmental requirements for the project’s construction and operation mandated by *SEMARNAT* in order to keep the project’s EIA approval, is monitored according to the “*Programa de Vigilancia Ambiental*”, complying with country regulations.

<sup>2</sup> The project’s technology is considered load base in the IMNG, thus the project has priority in dispatch and so dispatches all the energy that it produces.

<sup>3</sup> Although the sponsor is a public entity, it pays income taxes.



f) Serving as a demonstration project for clean renewable electricity generation in the country, being the first large scale wind power plant in the country to be built and that will supply electricity to the grid<sup>4</sup>.

### A.3. Project participants:

Name of Party involved (*) (host) indicates a host Party):	Private and/or public entity(ies) project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
México (host)	Comisión Federal de Electricidad ("CFE").	No
Spain	International Bank for Reconstruction and Development (IBRD) as the Trustee of the Spanish Carbon Fund (SCF).	Yes
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party (ies) and any known project participants (e.g. those proposing a new methodology) shall be identified.		

Source: World Bank

The Official Contact Person for the Clean Development Mechanism ("CDM") project activity will be:  
Joelle Chassard  
Carbon Fund Manager  
The Spanish Carbon Fund  
The World Bank  
Washington DC.  
USA.

Contact information is listed in Annex 1.

### A.4. Technical description of the project activity:

#### A.4.1. Location of the project activity:

##### A.4.1.1. Host Party(ies):

México.

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

Oaxaca State/ Juchitán de Zaragoza Municipality.

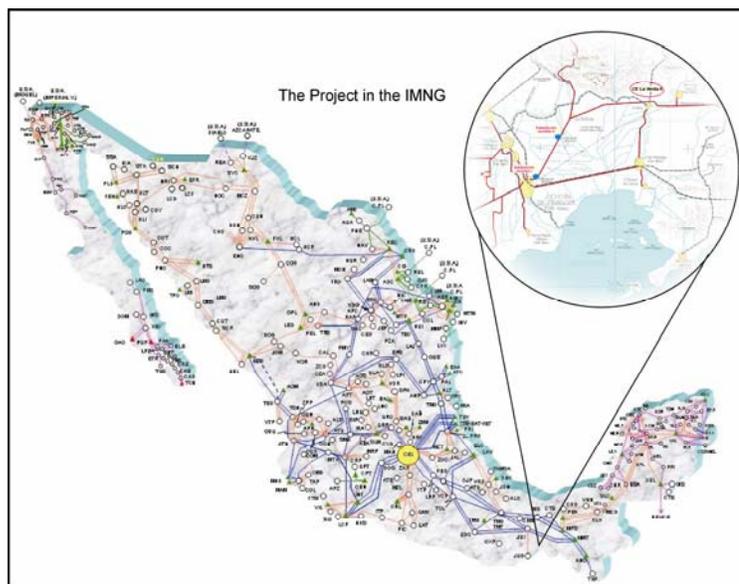
##### A.4.1.3. City/Town/Community etc:

Mexican Native Community ("Ejido") La Venta.

<sup>4</sup> There are only 2 other wind power plants currently functioning in the country, which are off-grid Guerrero Negro (0.6 MW) and grid-connected La Venta I (1.575 MW).

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

The project will be located in the Southern State of Oaxaca, in the Municipality of Juchitán de Zaragoza, in the Ejido La Venta. The project site is 500 meters north from La Venta locality and 30 km northeast from Juchitán de Zaragoza City (capital of the Municipality of Juchitán de Zaragoza). The project will be located at 30 masl and will impact a 949.84 hectares total area<sup>5</sup>.



Source: The sponsor.

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

The project falls into:

Scope number: 1.

Sectoral scope: Renewable energy.

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

The technology of the project is horizontal axis wind turbines<sup>6</sup>. The project will be composed by 98 WTG of 3 blades each (with power control) and an active system for rotor<sup>7</sup> orientation. Under wind high speed, a control system will keep the power at the plant's nominal value. Under wind slow speed, a control system will optimize the energy production, selecting an optimal combination of revolutions and angle of attack<sup>8</sup>.

The 98 WTG will be each of 0.85 MW capacity, which will add to a total capacity of 83.3 MW. The WTG will be distributed in 4 rows approximately 600 meters away from each other<sup>9</sup>. The WTG will be approximately 130 meters away from each other; the hub height of the WTG will be 44 meters. The WTG will be clustered in 5 independent circuits from which the energy will be collected. Each WTG will

<sup>5</sup> According to its EIA (updated) – this area is named “polígono de influencia”.

<sup>6</sup> Horizontal axis wind turbines meaning: A “normal” wind turbine design, in which the shaft is parallel to the ground, and the blades are perpendicular to the ground.

<sup>7</sup> Rotor meaning: The blade and hub assembly of a wind generator.

<sup>8</sup> Angle of attack meaning: The angle of relative air flow to the blade chord.

<sup>9</sup> Row1, Row2, Row3, and Row4 will have 23, 23, 27 and 25 WTG, respectively; and will be of 3,600 meter; 3,400 meter; 3,300 meter; and 3,700 meter - length, respectively.



count with an individual transformer to raise the voltage of the energy from 0.6 KV up to 34.5 KV which is the voltage required for its transmission to the project's substation ("La Venta II Substation"), in which the main transformer will be placed. This main transformer will raise the voltage again from 34.5 KV to 230 KV, for its transmission and interconnection with the IMNG through the 19 Km-230 KV-transmissions line built for this purpose. The Scada Control System will be placed in La Venta II Substation and will be accessed remotely from Juchitán's control room. There will be 7 electricity meters located in La Venta II Substation: One for each independent circuit (a total of 5 meters – recording at 34.5 KV) and two for the project's total energy generated (recording at 34.5 KV and at 230 KV). The meters located in La Venta II Substation will be of 0.2% precision level and will comply with country regulations<sup>10</sup>.

The project will transfer environmentally safe and sound technology and know-how to Mexico by:

- Hiring local labor in all of its implementation phases<sup>11</sup>. During operation, the staff working in operation and maintenance of the project will be preferably local people<sup>12</sup>, previously trained if necessary.
- Being the first large scale wind power plant in the country to be built and that will supply electricity to the IMNG, this way serving as a technological example for implementing this type of technology in Mexico.
- Diminishing the financial risk for future similar projects.

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

Once implemented, the project is estimated to reduce 205,380 tCO<sub>2</sub>e annually, generating an expected total of 1,437,660 tCO<sub>2</sub>e for the duration of the initial 7-year crediting period.

The project estimated annual ERs, over the first 7-year crediting period, are as follow:

<b>Year</b>	<b>Annual estimation of emissions reductions in tonnes of CO<sub>2</sub>e</b>
2006 <sup>13</sup>	34,230
2007	205,380
2008	205,380
2009	205,380
2010	205,380
2011	205,380
2012	205,380
2013 <sup>14</sup>	171,150
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	<b>1,437,660</b>
<b>Total number of crediting years</b>	<b>7</b>
<b>Annual average over the crediting period of estimated reductions (tonnes of CO<sub>2</sub>e)</b>	<b>205,380</b>

Source: World Bank.

#### **A.4.5. Public funding of the project activity:**

<sup>10</sup> Please see electricity meters specifications in Annex 3.

<sup>11</sup> According to the project's construction contractor, during construction the personnel hired will vary per month from 5 to 250 workers, with a median of 50 workers/per month for the total construction time.

<sup>12</sup> According to the sponsor, there will be between 15 and 20 people permanently employed during operation. According to the Environmental Impact Assessment, during construction, it is estimated that the project will hire 90% of its non-qualified labor locally and 10% of it regionally and out of its qualified labor the project will hire 20% locally, 10% regionally, and 70% nationally.

<sup>13</sup> From 01/11/2006 up to 31/12/2006.

<sup>14</sup> From 01/01/2013 up to 31/10/2013.



No public funding from an Annex I country is involved in this project, meaning no Official Development Assistance (“ODA”) funding is involved in this project. The project is developed by a Mexican public company; the project’s initial capital structure is 100% debt since it is developed under the concept of Financed Public Project or *Obra Publica Financiada* (“OPF”).

## **SECTION B. Application of a baseline and monitoring methodology**

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

Approved consolidated baseline methodology ACM0002-Version 6: Consolidated baseline methodology for grid-connected electricity generation from renewable sources (“the methodology”).

The methodology will be used in conjunction with the approved monitoring methodology ACM0002-Version 6 (“the monitoring methodology”).

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

The project will be a grid-connected zero-emission renewable power generation activity and meets all the conditions stated in the methodology (ACM0002). These conditions are:

- The project will be a wind power plant that supplies electricity installed capacity addition (83.3 MW) to the *IMNG*.
- The project will not be an activity that involves switching from fossil fuels to renewable energy at the project site
- The electricity grid (the *IMNG*) will be clearly identified and information on the characteristics of this grid is available.

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

CO<sub>2</sub> only.

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

The baseline scenario is “electricity that would have been otherwise generated by the operation of grid-connected power plants and by the addition of new generating sources”. Following the selected methodology: ACM0002, the baseline emission factor is calculated as a combined margin (“CM”), consisting of the weighted average of the simple operating margin emission factor (“OM”) and the build margin emission factor (“BM”), weights being 75% and 25%, respectively - all margins expressed in tCO<sub>2</sub>/MWh. The project boundary for the project is the *IMNG*. Since no leakages or emissions were identified for the project, emissions reductions will be equal to the baseline emissions. The baseline emission factor is fixed ex-ante for the first crediting period. The margins calculation can be seen under B.6.4.

The estimated ERs per year for the first crediting period equal 205,380 tCO<sub>2</sub>/yr<sup>15</sup> times seven, which is equal to 1,437,660 tCO<sub>2</sub> or estimated ERs<sup>16</sup>.

<sup>15</sup> All margins were rounded to the fifth decimal, but the CERs per year were rounded down to the nearest integer.

<sup>16</sup> All margins estimations can be seen in E.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 CDM project activity (assessment and demonstration of additionality):**

The following steps from the “Tools for the demonstration and assessment of additionality” - Version 2 - will be completed in this section:

- Step 0: Preliminary screening based on the starting date of the project activity.
- Step 1: Identification of alternatives to the project activity consistent with current laws and regulations.
- Step 2: Investment analysis.
- Step 3: Barriers analysis.
- Step 4: Common practice analysis.
- Step 5: Impact of registration of the proposed activity as a CDM project activity.

**Step 0 - Preliminary screening based on the starting date of the project activity**

Carbon finance help was sought before the starting date of the project activity and such evidence is made available to the DOE. However, project participants do **not** wish to have the crediting period starting prior to the registration of the project. Hence, step 0 is waived for the project.

**Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations****Sub-step 1a. Define alternatives to the project activity:**

In addition to the alternative of implementing the proposed project activity not undertaken as a CDM project activity, there are two identified realistic and credible alternatives available to the project participants that provide outputs or services comparable with the proposed CDM project activity:

- 1) Implement the project as a wind power plant development **without** CDM assistance<sup>17</sup>.
- 2) Implement the project as a natural gas combined cycle power plant<sup>18</sup>.
- 3) Do not implement any power generation project.

**Sub-step 1b. Enforcement of applicable laws and regulations**

The identified alternatives are in compliance with all applicable legal and regulatory requirements. The 3 identified alternatives comply with México’s Electricity Public Service Law (“EPSL”). Articles 1, 2, 3 and 4 of México’s EPSL confirm that the alternatives are a real possibility available to the project developer, as follow:

-Article 1 of México’s EPSL confirms that it is the exclusive right of the Mexican nation to generate, conduct, transform, distribute, and provide electricity as a public service. Therefore, there will not be granted concessions to privates and the nation will make good use of the goods and natural resources that are required to perform this right through the CFE<sup>19</sup>.

-Article 2 of México’s EPSL confirms that every act related with the electricity public service is of public character.

-Article 3 of México’s EPSL confirms that the following are not public services:

- Electricity generation for self-consumption, cogeneration or small production

<sup>17</sup>Defining the application area of the alternatives as the State of Oaxaca, out of the renewable energy technologies that could be used in the zone: hydro, solar and nuclear (geothermal plants will not be available in the zone): none of them can be considered as “likely”: A hydro’s output would have been of less quality than the project’s because as Mexico’s rainy season only last 2 months (September and October) the load factor of a hydro would be around 30% against that for the project which is 43%; solar technology is very sensitive to strong winds which are abundant in Oaxaca and this technology is inexistent in the IMNG; and nuclear is not a widely spread technology (there is only one nuclear power plant of 1,365 MW in the IMNG which is much larger than the project).

<sup>18</sup>As this technology presents the highest net efficiency conversion (“NEC”) among fossil fuel-fired power plant technologies available in the country, it ousts other types of fossil fuel –fired power plant technologies that are most expensive to operate.

<sup>19</sup> The sponsor.



- Electricity generation developed by private producers to be sold to the CFE
  - Electricity generation to be exported derived from cogeneration, private production and small production.
  - Electricity imported from persons exclusively for self-consumption.
  - Electricity generation for emergencies because of electricity public service interruptions.
- Article 4 of México's EPSL confirms that electricity public service involved the following:
- The planning of the Mexican National Grid.
  - The generation, conduction, transformation, distribution and selling of electricity.
  - The developing of all constructions, installations and works that require planning, execution, operation and maintenance of the national electric system.

*Because the 3 alternatives identified are in compliance with all applicable laws and regulations and are also realistic and credible alternatives available to the project participants, the project is additional under step 1.*

### **Step 2 – Investment Analysis**

This analysis shows why the proposed project activity is economically and financially less attractive than other alternatives identified, without the revenue from the sale of CERs. To conduct the investment analysis the following four sub-steps will be taken:

#### **Sub-step 2a. Determine an appropriate analysis method**

The CDM project activity generates financial and economic benefits other than CDM related income, therefore the Cost Analysis (Option I) cannot be taken. Out of the comparison analysis (Option II) and the benchmark analysis (Option III), the comparison analysis (Option II) was chosen.

#### **Sub-step 2b - Option II. Apply the comparison analysis**

The identified financial indicator is the: The Levelized Cost of Energy Production (\$/MWh).

#### **Sub-step 2c – Calculation and comparison of financial indicators**

##### **The formula for the calculation of the Levelized Cost of Energy is the following:**

The formula to calculate the levelized cost for the project is the following:

$$\text{Cost per MWh} = [\text{Investment} \times \text{CRF} + \text{O\&M Annual}] / \text{Annual Generation (MWh)}$$

Where,

*Investment:* Total investment in the project (\$).

*CRF:* Capital recovery factor equals the equivalent annual cost of the capital investment/ capital investment.

$\text{CRF} = \text{Annuity of Investment Cost at 12\% discount rate and years of annual payments equal to years of operating life}^{20} / \text{Investment Cost}$ .

*O&M:* Annualized operation and maintenance costs. It does neither include financial costs nor income tax<sup>21</sup>.

*Generation:* Annual average generation in MWh.

$$\text{Cost per MWh (\$/MWh)} = \frac{(\text{Equivalent Annual Investment Cost} + \text{Annual O\&M Cost}) (\$)}{\text{Annual Generation (MWh)}}$$

#### **Assumptions and Variables:**

<sup>20</sup> And zero ending cash balance.

<sup>21</sup> Since the latter will depend on an unknown variable which is the project net income.



<b>Assumptions</b>	
Discount Rate - Source: The Sponsor	12%
Exchange Rate - Source: Official Newspaper (Jan 17, 2006)	10.7

<b>The Project (83.3MW - 21 years) Variables:</b>	
Installed Capacity (MW):	83.3
Annual Generation	307,728
Cost per MWh - La Venta II (\$) - Source: The Sponsor	1.030
Cost per MW - La Venta II (\$) - Source: The Sponsor	27,374.84
Initial Investment Cost (\$) - Source: The Sponsor	103,711,577.4

<b>Gas Combined Cycle Plant (83.6MW - 30 years) Variables:</b>	
Installed Capacity (MW):	83.60
Cost per MWh - CC Gas (\$) - Source: COPAR	40.39
Fuel (\$/MWh) - Taken from COPAR doc. Page A4 Table A1	39.21
Cost per MW - CC Gas (\$) - Source: COPAR page A7	26,786.38
Load Factor - Source: COPAR Page 1.8 Table 1.2	80%
Generation (MWh)	585,869
Initial Investment (\$) - Source: Gas Turbine World 2004-05 Handbook Page 38	48,989,600
NEC plant 291 MW (from COPAR doc. Page 1.8 Table 1.2)	50.36%
Income for Installed Capacity (MW-year)	125,249

Source: The stated ones in table above; mainly COPAR 2005, Gas Turbine World 2004-05 Handbook, the sponsor.

The gas CC plant's levelized cost has been subtracted in the income for capacity that the gas CC plant receives but the project does not receive, to make the comparison possible.

Levelized Cost for the project (83.3 MW – 21 years) and for a combined cycle gas-fired power plant (83.6 MW – 30 years):

**The Project (83.3 MW) - 21 years**

Equivalent Annual Cost	<b>13,714,828.5</b>
Variable Annual Cost	<b>2,597,284.01</b>
Generation	<b>307,728.00</b>
Levelized Cost	<b>53.01</b>

**CC Gas Power Plant (83.6 MW) - 30 years**

Equivalent Annual Cost	<b>6,081,748</b>
Variable Annual Cost	<b>15,433,004</b>
Generation	<b>585,869</b>
Levelized Cost	<b>36.72</b>

Source: World Bank calculation using assumptions and variables stated above.

**Comparison:** Since the project has a higher cost indicator than the alternative (53.01\$/MWh > 36.72\$/MWh), the project cannot be considered the most financially attractive alternative.

**Sub-step 2d. Sensitivity Analysis**

The following variables will undergo a sensitivity analysis to prove the robustness of the conclusion given in sub-step 2c.

The Project:



- a) Load Factor (+-20%)
- b) The Initial Investment Cost (+-20%)

The Project	Load Factor*80%	Load Factor*100%	Load Factor*120%
Initial Investment *120%	77.14	61.92	51.77
Initial Investment *100%	66.00	53.01	44.35
Initial Investment *80%	54.86	44.09	36.92

Source: World Bank calculation.

Both the project's initial investment (\$103,711,577) and the project's load factor (42.17%) are multiplied by 80%, 100%, 20%, respectively; and it is shown that at all scenarios the project is still more expensive than the alternative (36.72\$/MWh).

By analyzing the comparative charts above, it can be concluded that the project is additional at all load factors and at all initial investment costs run in the sensitivity analysis.

*Hence, since the project financial unattractiveness concluded in Sub-Step2c. has proven to be robust to reasonable variations in the critical assumption, the project is unlikely to be the most financially attractive alternative. Meaning the project is additional under step 2.*

### **Step 3. Barrier Analysis**

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

Wind power plants projects face barriers that prevent them from being carried out if they are not registered as CDM activities. In particular, the project faced two main barriers: investment barrier, technological barriers and barriers due to prevailing practice.

**(a) Technological barrier:** The project will be the first large scale wind power plant built to be operating in Mexico. Basically the project will confirm the vast research done on strong wind potential on this region of Oaxaca – this research started some years ago. This research has been enforced by the project developer, who built La Venta I (1.575 MW) small wind power plant demonstrative project in 1994, which is as of today the largest wind power plant in operation in the country and the only one in the IMNG<sup>22</sup>.

**(b) Barrier due to prevailing practice:** Mexico is rich in oil and gas reserves<sup>23</sup>; this clearly explains why the prevailing practice in Mexico is fossil fuel-fired electricity generation as of today, and this path is envisaged to continue, as the country still has a vast gas potential unused for electricity generation, which is to be further explored in the coming years.

National policies are currently fostering the national use of combined cycle plants as can be seen in the following table:

#### **Programming of Installed Capacity Requirements for the IMNG (2006-2013)**

<sup>22</sup> There is another wind power plant existent in the country named Wind Power Plant Guerrero Negro of 0.6 MW but this plant does not belong to the IMNG and is even smaller than La Venta I demonstrative project. Guerrero Negro is located in Baja California Sur.

<sup>23</sup> The local price of residual fuel oil in Mexico is approximately 10-12% lower than that in the international market based on the vast oil reserves existent in Mexico, because it is abundant in Mexico.



	2006	2007	2008	2009	2010	2011	2012	2013	Total (MW)	Total (%)
Gas Combined Cycle	2,269	1,168	134	1,517	1,124	1,520	1,586	904	10,222	62%
Renewable	85	754	101	101	126	101	1,001	-	2,269	14%
Coal					700				700	4%
Not Determined							1,248	1,992	3,240	20%
	2,354	1,922	235	1,618	1,950	1,621	3,835	2,896	16,431	100%

Source: World Bank with data provided by CFE – Programming Area.

The document Energy National Program 2001-2006 page 26 affirms that Mexico has the 9<sup>th</sup> place in oil reserves and the 9<sup>th</sup> place in natural gas reserves and that the fiscal income strongly depends on the income generated by the oil national industry. In page 76<sup>24</sup> of this document it is stated that only by a growth in the national fossil fuel industry higher than the growth in the gross domestic product, Mexico could avoid the dependency on fuel provisions from abroad. In this sense, the government has a special interest in promoting the fossil fuel potential of the country because it is the directly impacted by the performance of this industry. In page 81<sup>25</sup> of this document it is stated an especially favourable position towards investment in the natural gas industry, among any other source to generate energy.

As of today, the large participation of fossil fuel technology in the electricity generation matrix of the IMNG can be seen in the following table (IMNG generation in 2005):

Technology in the IMNG	MWh 2005	%
Coal	32,655,396	16%
Natural Gas CC	66,434,698	33%
Wind	4,329	0%
Geothermal	1,740,776	1%
Hydro	27,611,389	14%
Nuclear	10,804,906	5%
Natural Gas	3,869,885	2%
Diesel	249,766	0%
Residual Fuel Oil	60,828,336	30%
Total	204,199,481	

Source: World Bank using data from CENACE.

As shown in the table above, the renewable energy share in the IMNG is only 15%, and the wind source technology is almost 0 (exactly 0.002%).

**Sub-step 3b. Show how the identified barriers would not prevent the implementation of at least one of the alternatives:** The two identified barriers that the project faced will not prevent the alternative: “implement the project as a natural gas-fired power plant” (alternative 2) and “not implementing any power generation project” (alternative 3).

**(b) Technological barrier (Barrier 2)**

**(b.1.) Does not prevent Alternative 2:** There is vast experience in Natural gas-fired combined cycle power plant (Alternative 2) and this technology has a higher market share in the country.

**(b.2) Does not prevent Alternative 3:** Technological complexities would not prevent inactivity or “not implementing any power generation project” but on the contrary it would foster this alternative for the sponsor.

<sup>24</sup> Under Objective 1 of the Energy Sector Program 2001-2006: Secure a sufficient provision of energy at international standards and competitive prices counting with energy companies: public and private with world class.

<sup>25</sup> Under Objective 3 of the Energy Sector Program 2001-2006: Promote the participation of Mexican enterprises in energy infrastructure projects.



(c) **Barrier due to prevailing practice (Barrier 3):**

**(c.1.) Does not prevent Alternative 2:** In fact natural gas-fired combined cycle power plants (Alternative 2) are foreseen to be the most attractive technology to be used in the IMNG in the coming years, and fossil fuel fired power plant in general is the widely spread technology existent in the IMNG already.

**(c.2) Does not prevent Alternative 3:** There are no penalties to “not investing” (Alternative 3), thus this alternative does not face any barrier.

Since the Alternatives are affected less strongly/not prevented by the identified barriers that the project has to faced, they are viable alternatives and should not be eliminated from consideration.

*Two barriers have been identified that would prevent the implementation of this type of proposed project activity (wind power plants) but did not prevent/affect less strongly at least one of the alternatives identified; consequently, the project is additional under Step 3.*

**Step 4. Common Practice Analysis:**

**Sub-step 4a. Analyze other activities similar to the proposed project activity<sup>26</sup>**

The only two wind power plants existing in the country is grid-connected La Venta I (1.575 MW) and off-grid Guerrero Negro (0.6 MW). Fossil fuel technology in the country is widely-spread, and combined cycle natural gas fired power plants are the preferable choice for the future, as it presents the highest net efficiency conversion among fossil fuel technologies available in the country.

**Sub-step 4b. Discuss any similar options that are occurring<sup>27</sup>**

No similar activities (wind power plants) are occurring without Carbon Finance help. The project will be the first large scale wind power plant to be built and to be operating in the IMNG.

*Under Sub-Steps 4a and 4b, the claim that the proposed activity is common practice is not called into question. Thus, the project is not common practice but a very unusual occurrence that endangered its existence without attaining CDM Status. Meaning the project is additional under Step 4.*

**Step 5. Impact of CDM Registration**

CDM registration will alleviate the financial hurdles of the project (**Step 2. Investment analysis**) since it would provide risk-free revenue<sup>28</sup>, attached to the project’s annual generation. The CERs revenues were used to offset the project’s investment costs by about 10.8%, decreasing the project’s levelized cost by about 7.9%. The sponsor considered the impact of CDM revenues very important for the project’s financial viability.

As of today, taking a credible CERs price of \$7.23 per tCO<sub>2</sub>e<sup>29</sup> - CERs revenues could improve the project’s financial gap by \$4.83/MWh<sup>30</sup> or by 30% as follow:

<sup>26</sup> Analysis avoids CDM projects.

<sup>27</sup> Analysis avoids CDM projects.

<sup>28</sup> Except for CDM risk.

<sup>29</sup> Reference: State and Trends of Carbon Market 2006.

<sup>30</sup> (53.01-36.72)-(48.18-36.72)=\$4.83/MWh.

**The Project Levelized Cost with and without CERs revenues**

<b>Impact:</b>	<b>Without CERs</b>	<b>With CERs</b>
Levelized Cost - Project	53.01	48.18
Levelized Cost Alternative Natural Gas Fired combined Cycle Plant	36.72	36.72
Difference w/o CERs	16.285	
Difference w CERs		11.46
Improvement	-30%	(4.83)

Source: Calculations are own production based on Investment Analysis.

As shown in the analysis, CDM registration alleviates the financial hurdles faced by the project as it impacts its levelized cost and thus alleviates the barriers faced by it, as well.

*Since the approval and registration of the project as a CDM activity alleviate the economic and financial hurdles (Step 2) and other identified barriers (Step 3) to a reasonable extent, it is concluded that the project is additional under Step 5.*

***Because all of the above steps were satisfied, the CDM project activity is not the baseline scenario, meaning the project is additional.***

**B.6. Emission reductions:****B.6.1. Explanation of methodological choices:**

ACM0002-Version 6 was selected for the project.

The build margin was based on the latest 20% built of power plant in generation because such sample was greater than the latest 5 power plants built in the system. The OM selected is the Simple Operating Margin Emission Factor because data for the Dispatch Data Analysis OM is not publicly available and the IMNG has less than 50% of low-cost/must-run plants since decades ago. The weights of 75% and 25% for the OM and the BM respectively were taken given that they are the default weight values for wind power plants as the project is.

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

*(Copy this table for each data and parameter)*

<b>Data / Parameter:</b>	
Data unit:	MWh.
Description:	Energy dispatched to the IMNG.
Source of data used:	CENACE
Value applied:	307,728
Justification of the choice of data or description of measurement methods and procedures actually applied :	Electricity meters installed comply with country regulations. Meters specifications can be seen in annex 3.
Any comment:	-

**B.6.3 Ex-ante calculation of emission reductions:**

Ex-ante OM = 0.73753 tCO<sub>2</sub>/MWh.

Ex-ante BM = 0.45709 tCO<sub>2</sub>/MWh.

Ex-ante CM = 0.66741 tCO<sub>2</sub>/MWh.

The annual project ERs estimated are: 205,380 tCO<sub>2</sub>e or ERs; and for the duration of the first crediting period 1,437,660 tCO<sub>2</sub>e or ERs.



The calculations of the margins can be seen in B.6.4.

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

The margins calculation was performed by the following steps:

##### **Step 1: Calculation of the ex-ante OM**

The Simple OM is the generation-weighted average emission per electricity unit (tCO<sub>2</sub>/MWh) of all generation sources serving the system, not including low-operating cost and must run power plants, and was calculated as follow:

$$EF\_OMy = \text{Sumproduct} [Fi,j,y * COEF] / \text{Sum Generation}_{j,y}$$

where j refers to power sources, i refers to the fuel used, and y to the year in which actual ERs occur, and j does not take into consideration low-cost/must-run resources. Following the methodology, for the project, the COEF of imports should be zero and exports should not be discounted from the generation data.

##### **Step 2: Calculation of the ex-ante BM**

The BM is defined as the generation-weighted average emission factor (tCO<sub>2</sub>/MWh) of a sample of power plants. Such sample should be composed by either the 5 most recently built plants or the plants whose aggregated generation comprises the most recent 20% of the IMNG generation in the year of project generation occurrence, whichever group's generation is greater – both lists should exclude CDM-Status plants. The methodology, gives 2 options for the calculation of the BM. The first option was selected – this option required the BM to be calculated ex-ante based on the most recent information at the time of PDD submission<sup>31</sup>. Imports are considered as a build margin source with COEF equal to zero, since these imports come from other countries<sup>32</sup>.

The BM was calculated ex-ante by applying to the selected sample the following formula:

$$EF\_BM_y \text{ (tCO}_2\text{/MWh)} = [ \sum_{i,m} (Fi,m,y) \times (COEF_{i,m}) ] / [ \sum_m GEN_{m,y} ];$$

m = plants of the selected sample, F = their annual generation in MWh, COEF = their tCO<sub>2</sub>/MWh factor, GEN = total sample's annual generation, i = technology.

##### **Step 3: Calculation of the CM**

Following the methodology, the baseline emission factor is the CM calculated as the weighted average of the OM and the BM as follows:

$$CM = w_{OM} \times OM + w_{BM} \times BM$$

OM and the BM ex-ante calculation was based on most recent data available at the time of PDD submission.

The  $w_{OM}$  and  $w_{BM}$  by default for wind-power plants according to the methodology, are 0.75 and 0.25, respectively; because of their intermittent and non-dispatchable nature.

##### **Step 4: Calculation of the project's ERs prior to validation.**

ERs per year for the project are to be calculated ex-post annually from the following multiplication:

<sup>31</sup> 2005 data.

<sup>32</sup> There is no connection between any isolated system within Mexico and the IMNG. As of today Mexico exchanges electricity with Belize and USA only. In the future, Mexico will exchange electricity with other Central American countries. The interconnection of the IMNG with the Central American Interconnection System ("SIEPAC") is programmed to occur in January 2008. This will enable the exchange of electricity between Mexico and the rest of Central America through Guatemala. The transmission line Tapachula-Los Brillantes (400 KV) is the only transmission line that will use Mexico to connect with SIEPAC.



Baseline emissions (tCO<sub>2</sub>e) = CM x (annual project generation in MWh) = ERs per year (tCO<sub>2</sub>e).

The estimated ERs per year for the first crediting period equal 205,380 tCO<sub>2</sub>/yr<sup>33</sup> times seven, which is equal to 1,437,660 tCO<sub>2</sub> or estimated ERs<sup>34</sup>.

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

#### **B.7.1 Data and parameters monitored:**

(Copy this table for each data and parameter)

<b>Data / Parameter:</b>	
Data unit:	MWh.
Description:	Energy dispatched to the IMNG.
Source of data to be used:	CENACE
Value of data applied for the purpose of calculating expected emission reductions in section B.5	307,728
Description of measurement methods and procedures to be applied:	Electricity meters installed complying with country regulations; records double checked with receipt of sales.
QA/QC procedures to be applied:	No especial monitoring equipment is needed. The sponsor will count with a monitoring plan and pre-programmed spreadsheets so the sponsor will just need to collect the information as described and apply the formula as directed in the monitoring plan. The Dispatch Center named <i>Centro Nacional de Control de Energía</i> (“CENACE”) will be the only data provider for the project generation data. Although CENACE belongs to CFE (the project sponsor), it has independence on its procedures, own legislation and an international standards quality certification achieved. The project staff designated will confirm the data (only variable to be monitored is the electricity generated by the project dispatched to the grid) with own records and own records will be double checked with sales receipts.
Any comment:	N/A.

#### **B.7.2 Description of the monitoring plan:**

The monitoring plan consists of the following two items:

#### **I. Emissions Reductions Calculation Procedure (“ERCP”) and Required Spreadsheets**

The data’s year for the ERs monitoring is the year of project generation: November 1st-October 31st. La Venta II project ERCP consists of 1 spreadsheet organized as follows:

-Worksheet #1: The Baseline Emission Factor is fixed ex-ante for the first crediting period and thus ERs depend only on the multiplication of the fixed baseline emission factor (“CM”) calculated in this

<sup>33</sup> All margins were rounded to the fifth decimal, but the CERs per year were rounded down to the nearest integer.

<sup>34</sup> All margins estimations can be seen in E.4.



document to be 0.66741 tCO<sub>2</sub>/MWh times the project generation in the year – this is to be calculated by the ERCP Manager.

Worksheet#1  
CEF:  
0.66741 tCO<sub>2</sub>/MWh

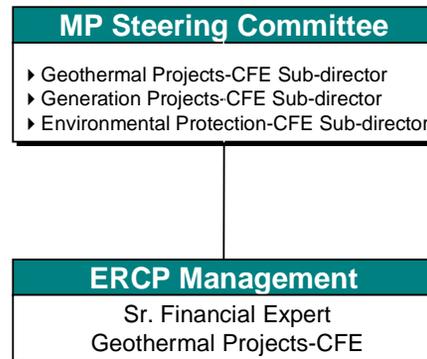
Date-time	La Venta II Generation (MWh)	La Venta II ERs (tCO <sub>2</sub> e)
11/01/06 0:15	0.00	0.00
...	...	...
10/31/07 24:00	0.00	0.00
Total 1rst year of the Crediting Period	0.00	0.00

## II. The ERCP Organizational Structure and Quality Assurance and Control Procedure



Monitoring Plan (MP) – Emissions Reductions Calculation Procedure

ERCP Organizational Structure



Source: World Bank production with responsibilities accorded with the sponsor.



## Monitoring Plan (MP) – Emissions Reductions Calculation Procedure ERCP Quality Control

- Data**
  - ▶ The project generation data.
  - ▶ Make coordination with CENACE to be able to implement this document.
  - ▶ Check calibration of electricity meters, periodically.

---

- Quality of Data Collection**
  - ▶ Which data comes? The above
  - ▶ By what means does it come? By E-mail/ CD
  - ▶ How does it come? In Excel
  - ▶ How frequently does it come? Yearly
  - ▶ From whom does it come? From CENACE
  - ▶ To whom does it comes? ERCP Manager

---

- Quality of Data Processing**
  - ▶ Original Data
  - ▶ Organized Data
  - ▶ Entered Data
  - ▶ Processed Data
  - ▶ Result

---

- Quality of Data Storage**
  - ▶ Prevent Excel versioning problem, by keeping “a new” Excel software package.
  - ▶ Keep all data for 2 years after the first crediting period (9 years).
  - ▶ Save the ERCP file with the last date in which an alteration was made.
  - ▶ Keep all written documentation in a folder.

---

- Quality of Data Delivery**
  - ▶ Provide to the verifier e-mails /CD through which the data provider (CENACE) delivered the original data
  - ▶ Provide to the verifier receipt of sales to final clients
  - ▶ Provide to the verifier all calculations made (all steps of data processing) by showing all preliminary versions of spreadsheets saved in disk

Source: World Bank Production.

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

The baseline study and monitoring methodology were completed on 30/01/2006 on behalf of The Spanish Carbon Fund by:

Ms. Paola C. Solidoro

World Bank Consultant

The World Bank Carbon Finance Business Unit.

The Spanish Carbon Fund is also a project participant listed in annex 1 of this document.

**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:**

09/09/2005 (DD/MM/YYYY).

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

21y-0m.

**C.2 Choice of the crediting period and related information:****C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

01/11/2006 (DD/MM/YYYY).

**C.2.1.2. Length of the first crediting period:**

7y-0m.

**C.2.2. Fixed crediting period:****C.2.2.1. Starting date:**

N/A

**C.2.2.2. Length:**

N/A

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

An Environmental Impact Assessment (“EIA”) was a legal requirement for the project. Under article 5, fraction 5, bullet I of the General Law of Ecologic Equilibrium and Environmental Protection-Ruling in Environmental Impact, any wind power plant developer should previously ask authorization to SEMARNAT (*Dirección General de Impacto y Riesgo Ambiental*) in regards to environmental impacts. This authorization was granted by SEMARNAT on July 29<sup>th</sup>, 2004 and is granted upon compliance with 17 terms<sup>35</sup> and 5 conditions that belong to the 6<sup>th</sup> term – being the first condition applying the established monitoring program (“*Programa de Vigilancia Ambiental*”). The project’s EIA and its following updates are made available to the designated operational entity (“DOE”). The firm that performed the EIA was *Instituto de Ecología, Asociación.Civil (“AC”)*, a recognized national environmental firm. The total

<sup>35</sup> Which define the characteristics of the plant, to which authorization is being granted.



impacted area defined in the EIA is 949.84 hectares. In addition, the World Bank triggered particular Safeguard Policies and established a set of actions to be taken by the sponsor.

**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:**

*SEMARNAT* declared that the environmental impacts of the project are possible to be partially or complete mitigated thus not causing an ecological disequilibrium, and so are not significant. *SEMARNAT* added that the project will be in line with the Ecologic Equilibrium and Environmental Protection General Law (“*EEEPGL*”) -Ruling in Environmental Impact.

Potential negative environmental impacts identified in the EIA were basically two:

- Bird and bats population endangered (most important environmental problem).
- Land clearing occasioning loss in fauna and in flora.
- Change in the scenery.

The potential negative social impact identified is basically one:

- Land deforestation occasioned by the project will provoke the loss of terrain for agriculture which will affect negatively the economy of the owners of such land<sup>36</sup>.

Each of the potential impacts identified in the EIA counts with a mitigation measure which the sponsor is keen to abide to. All mitigations measures are stated in the Environmental Management Plan (“*EMP*”), which is part of the EIA. Article 15 of the *EEEPGL*-Ruling states that the project developer is in the obligation of repairing, preventing or minimizing any environmental impacts of the project, assuming the totality of the costs incurred for this obligation.

The terms and conditions established for the project by *SEMARNAT* will be monitored by The *Procuraduría Federal de Protección Ambiental* (“*PROFEPA*”) according to the *Programa de Vigilancia Ambiental*, which is especially designed for the project. In addition, the World Bank developed a Monitoring Plan for the project, to secure its compliance with World Bank Safeguard Policies triggered; targets established will be monitored by the verifier.

**SECTION E. Stakeholders’ comments**

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

The local stakeholders identified are the habitants of Ejido or locality La Venta<sup>37</sup>. No houses are located within 200 m distance from the WTG. Habitants of Ejido La Venta were interviewed as part of the EIA performed by *Instituto de Ecología, Asociación.Civil*. Comments were raised through various field research campaigns organized.

**E.2. Summary of the comments received:**

The project has been positively accepted by Ejido La Venta, as per Act signed as of July 18th, 2004. The comments received referred basically to the following questions:

- Request for more information about the area to be affected by the project
- Request for information on who was going to be responsible for damages that the project could generate.
- Request for information on what would be the benefits of the project.

<sup>36</sup> WTG and highways to be built will occupy less than 30 hectares. Land owners affected will be paid an annual rent accorded with the sponsor.

<sup>37</sup> 1,814 habitants, closest locality to the project site.



- Request that benefits be for all communities surrounding the project not only for the ones which terrain is directly affected by the project.

No other major comments or questions were received as reported in the local stakeholders' consultation of the EIA.

In addition, the sponsor visited the principal authorities of the Ejido La Venta, to inform them about the project and in such actions received the following list of requests for the Ejido:

- Pavement Streets.
- Computers
- Vehicles
- Improvements to the local school.
- Free electricity service

Among a larger list of similar requests - not directly related with the project.

The sponsor recommended that the Ejido La Venta formalize such requests through a letter. From this point in time, the Social Development Area of CFE took charge on dealing with these requests.

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

On regards to the information requested: The sponsor responded all information requests raised by local stakeholders described in G.2 through the meetings with the authorities of Ejido La Venta.

On regards to the social actions requested: The sponsor has opened a trust of 7,834,000 Mexican Pesos (783,400 US Dollars) to be spent in a social agenda agreed with the ejido La Venta upon Act signed on December 12<sup>th</sup>, 2005. The social actions accorded to be covered by this budget are the following:

- A classroom for the local science and technology college of Oaxaca.
- Acquisition of computer(s) for the local school.
- Offices for the ejido "house" or meeting room.
- Pavement of one street of the ejido.
- Public electrification.
- Leveling of parcels that are within the area of direct impact of the project (where the WTG would be placed) named "*polígono de influencia*".

Other commitments of CFE with La Venta project are the following:

- Pay applicable indemnizations in time, and annual rent to land owners affected by the project.
- Restrict the activities of construction and assembling to avoid affecting additional land and/or agricultural land.
- Give training and promote the environmental consciousness among workers to facilitate the implementation of proper environmental measures.

These later list of commitments are part of the project's EMP and will be monitored according to the *Programa de Vigilancia Ambiental*.



**Annex 1**  
**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	<i>Comisión Federal de Electricidad</i>
Street/P.O.Box:	
Building:	Boulevard Adolfo Ruiz Cortines # 4156, 5 <sup>th</sup> floor, Col. Jardines del Pedregal
City:	Mexico DF
State/Region:	Mexico DF
Postfix/ZIP:	01900
Country:	Mexico
Telephone:	(5255) 52294400 ext. 44000 or 44238.
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Project Manager
Salutation:	Mr.
Last Name:	Aguinaco
Middle Name:	
First Name:	Vicente
Department:	Environmental Protection - CFE
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Organization:	The Spanish Carbon Fund
Street/P.O.Box:	
Building:	1818H Street
City:	Washington DC
State/Region:	Washington DC
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Country:	Unites States of America
Telephone:	
FAX:	
E-Mail:	<a href="mailto:IBRD-carbonfinance@worldbank.org">IBRD-carbonfinance@worldbank.org</a>
URL:	The Spanish Carbon Fund
Represented by:	
Title:	Carbon Fund Manager
Salutation:	Ms.
Last Name:	Chassard
Middle Name:	
First Name:	Joelle
Department:	World Bank Carbon Finance Business Unit
Mobile:	
Direct FAX:	
Direct tel:	



Personal E-Mail:	
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**Annex 2**  
**INFORMATION REGARDING PUBLIC FUNDING**

N/A

**Annex 3**  
**BASELINE INFORMATION**

**Margins Calculation:****Simple OM ex-ante:**

Technology	MWh	NEC	TJ	C	O	tCO2/tC	tCO2e	tCO2e/MWh
Coal	29,664,595	33.28%	320,891	25.8	0.98	3.67	29,749,168	1.00
Natural Gas Combined Cycle	60,912,012	40.21%	545,345	14.5	0.995	3.67	28,849,207	0.47
Wind	4,957	0.00%	-	0	0	3.67	-	-
Geothermal	1,503,031	0.00%	-	0	0	3.67	-	-
Hydro	24,146,988	0.00%	-	0	0	3.67	-	-
Nuclear	10,166,783	0.00%	-	0	0	3.67	-	-
Natural Gas Symple Cycle	5,874,428	29.95%	70,611	14.5	0.995	3.67	3,735,371	0.64
Diesel	351,333	18.84%	6,713	20.2	0.99	3.67	492,264	1.40
Residual Fuel Oil	63,365,797	31.59%	722,117	21.1	0.99	3.67	55,309,134	0.87
Total	195,989,924							
Low-Cost/Must-Run	35,821,759							
Total - Low Cost Must Run	160,168,165						118,135,144	
Imports	7,427.2							
<b>OM=</b>	<b>0.73753</b>							

Source: World Bank Production with data provided by CENACE and NECs provided by the sponsor.

**Build Margin ex-ante<sup>38</sup>:**

Tech. Part Technology	MWh	NEC	TJ	C	O	tCO2/tC	tCO2e	tCO2e/MWh
0% Coal	0	33.28%	-	25.8	0.98	3.67	-	#DIV/0!
95% Natural Gas Combined Cycle	40,963,715	40.21%	366,748	14.5	0.995	3.67	19,401,275	0.47
0% Wind	0	0.00%	-	0	0	3.67	-	#DIV/0!
2% Geothermal	932,226	0.00%	-	0	0	3.67	-	-
2% Hydro	717,068	0.00%	-	0	0	3.67	-	-
0% Nuclear	0	0.00%	-	0	0	3.67	-	#DIV/0!
1% Natural Gas Symple Cycle	408,876	29.95%	4,915	14.5	0.995	3.67	259,992	0.64
0% Diesel	3,773	18.84%	72	20.2	0.99	3.67	5,286	1.40
0% Imports	143.94	0.00%	-	0	0	3.67	-	-
0% Residual Fuel Oil	0	31.59%	-	21.1	0.99	3.67	-	#DIV/0!
Total	43,025,802		-				19,666,553	
<b>BM=</b>	<b>0.45709</b>							
<b>CM=</b>	<b>0.66741</b>							

Source: World Bank Production with data provided by CENACE and NECs provided by the sponsor.

**Combined Margin ex-ante:**

$$CM=0.75*0.73753+0.25*0.45709 = 0.66741$$

Source: World Bank Calculation

**IMNG Net Efficiency Conversion:**

Technology	Average	Median
Coal	33.09%	33.28%
Natural Gas Combined Cycle	39.13%	40.21%
Natural Gas Simple Cycle	23.96%	29.95%
Diesel	20.39%	18.84%
Residual Fuel Oil	30.05%	31.59%

<sup>38</sup> Only imports that come to the IMNG through AEP and FRONTERA entered in the BM following the methodology.



Source: The sponsor. Note: Only the above final numbers were provided by the sponsor. Median values provided by the sponsor were taken for the margins calculation since the sponsor advised of the presence of extreme values in their averages calculation.

**IMNG Exports and Imports 2005, 2004, 2003:**

IMNG Exports 2005: 235,157.2 MWh.

IMNG Imports 2005: 3,613.7 MWh.

IMNG Exports 2004: 235,367.8 MWh

IMNG Imports 2004: 374.2 MWh.

IMNG Exports 2003: 188,091.5 MWh.

IMNG Imports 2003: 18,293.5 MWh.

Source: CENACE

**Juchitán II and La Venta II Substations – Electricity Meters specifications (at 230 KV):**

Measurement Specifications (at 25°C / 77°F)	Features
Parameter	Accuracy $\pm$ (%Reading + %Nominal Current)
Voltage (L-L) (L-N)	0,1%
Frequency (47 – 63Hz)	$\pm$ 0,01 Hz
Current (I1, I2, I3)	0,1% + 0,002%
Current (I4)	0,4%
<b>kW, kVAR, kVA (unit PF)</b>	<b>0,2% + 0,001%</b>
kW, kVAR, kVA ( $\pm$ 0,5 PF)	0,3% + 0,003%
<b>kWh, kVARh, kVAh</b>	<b>Class 0,2</b>
Power Factor at Unity PF	0,5%
Harmonics (to 63 <sup>rd</sup> )	1%
Harmonics (to 40 <sup>th</sup> )	IEC 6100-4-7
K factor	5%
Crest Factor	1% Full Scale

Source: The sponsor. Equipment Manual ION series 8300-8500<sup>39</sup>.

The meters count with a self-verification and calibration function, which is manual and determined by the operation and maintenance personnel of the electricity substations. The verification is annual and consists in the comparison of the project's electricity meters with other electricity meter, that is made for this purpose, when there are errors the personnel follows with the maintenance/reappearance of the electricity meter.

**Annex 4**  
**MONITORING INFORMATION**

Please see section B.7.2.

<sup>39</sup> It can be seen that the precision is 0.2% for the electricity measurement at 230 KV.