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:

FANAPEL S.A. Biomass-based CHP.
Draft PDD
16 November 2010

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

The purpose of the small-scale project activity is to provide thermal and electrical energy to the production facility using renewable biomass and partially modifying the existent cogeneration plant.

The project developer, Fanapel S.A. produces pulp and paper in a plant located in the South West of Uruguay, in Juan Lacaze.

The new equipment will substitute thermal energy and captive electrical energy which in the baseline are produced by four boilers. The project activity will also increase the amount of electricity produced the baseline, thus reducing the amount of imported electricity from the national grid. The project will not change the installed pulp and paper production capacity and will use approximately 128,000 tonnes per year of renewable biomass. The new equipment to be installed consists in a biomass-fired boiler producing steam at 63 bar (a) with a total thermal capacity of 39 MW_{th}, a multistage reaction turbine and an electrical generator of 10 MW_e (12.5 MVA).

GHG emission reductions will arise from displacing thermal and electrical generation from the fossil fuel boilers and from displacing fossil fuel based electricity generation from the national grid.

The project activity will contribute to the sustainable development of Uruguay through a reduction in the dependence on imported oil and gas, the valorization of nationally produced biomass, the decentralization of the economic activity, improved energy efficiency, and improved air quality, among others.

The main objectives of the project activity are:

a) to use forest biomass as renewable source to produce steam for the pulp and paper production requirements, and generate electricity to reduce imports from the grid;
b) to contribute to climate change mitigation and generate carbon credits providing the necessary funding to make the project feasible;
c) to achieve a positive environmental impact through substitution of electricity generated from fossil fuels in the national grid, and reducing negative environmental impacts from firing fossil fuels at the mill;
d) to contribute to the sustainable development of Uruguay through positive impacts on energy security, and to enforce the environmental image of the country;
e) to reduce the use of fossil fuels in the country through a steep reduction of its consumption and

the pulp and paper mill and at the power plants in the connected system;

f) to improve the trade balance of the country by reducing the imports of oil and gas, and by exporting carbon credits.

A.3. Project participants:

Names of the 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 participants (Yes/No)
Uruguay (host)	FANAPEL S.A.	No

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

A description of the existing co-fired generation plant is provided here for a better understanding of the project activity. The existing co-fired system is composed by five boilers and two turbo generators. The main characteristics of these equipments are detailed as follows:

1. Boiler PRS: The boiler is fired with black liquor and generates steam at 60 bar a. and 410°C. It will continue operating without changes.

2. Boiler DENAPAK: It is designed for firing fuel oil and/or natural gas and generates 45 tonnes per hour of steam at 22 bar and 390°C. It was installed in 2003. This boiler cannot be retrofitted to use biomass.

3. Boiler VUZ: it generates 25 tonnes per hour of steam at 21 bar a. and 390°C. It was built in 1947 and initially designed to fire fossil fuels. In 2005 it was retrofitted by Berkes S.A. to enable the use of biomass by adapting the boiler and installing a gasifier and a torsional chamber.

4. Boiler BERKES: it generates 15 tonnes per hour of steam at 6.5 bar a. It was built in 1995, designed to fire fossil fuels but retrofitted in 2005 by Berkes S.A. to use biomass also through gasification.

5. Boiler TFU: it generates 7 tonnes steam per hour at 13 bar. It was built in 2009 and has been rented from Turboflow since April 2010. This provisory boiler covers the plant requirements while the new cogeneration unit is installed.

6. Turbo-generator STAL, generates 1500 kW at low voltage (0.525 kV) with an inlet pressure of 20 bar.

7. Turbo-generator STAL, generates 3024 kW at medium voltage (6.3 kV) with an inlet pressure of 63 bar.

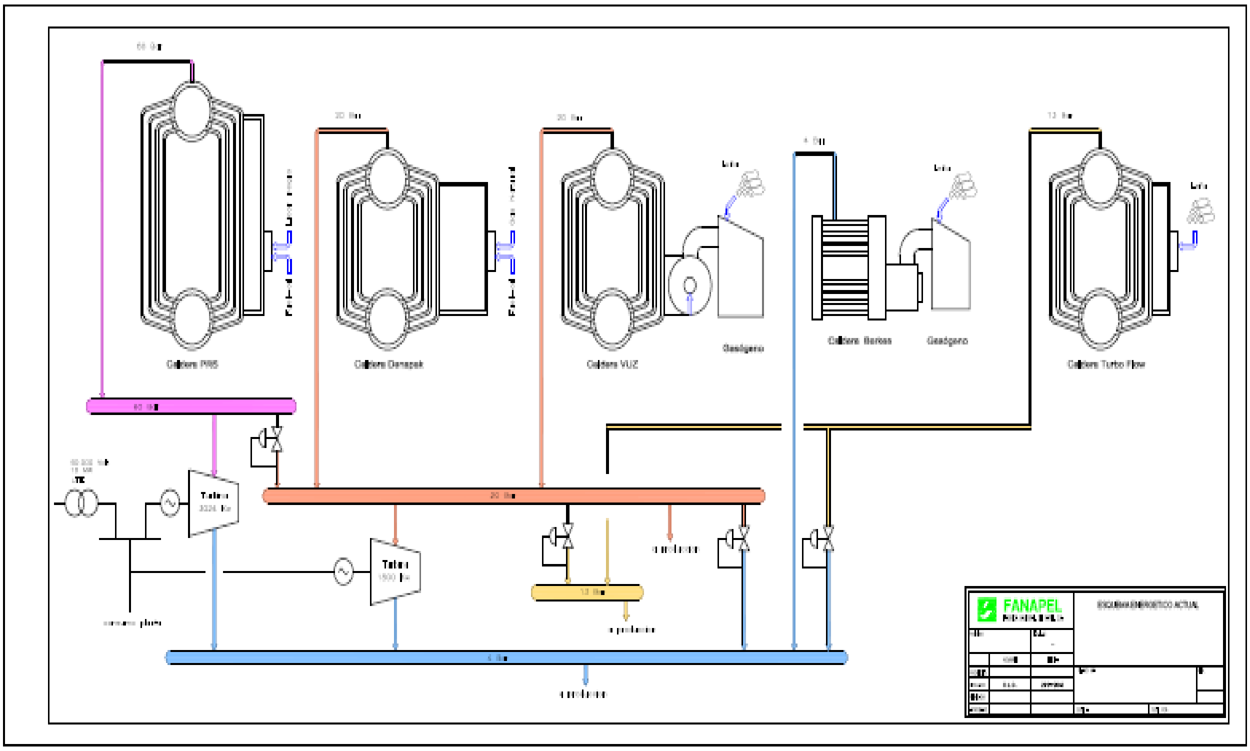

Figure 1 - Existing boiler system in the cogeneration plant

The new boiler will replace the Denapak, the Vuz and the Berkes boilers (as well as the provisional boiler hired to Turboflow). In the project scenario the configuration of the equipments will include the new biomass-fired boiler and a new turbo-generator, as described in Figure 2.
The installed capacity of the pulp and paper production facility will remain unchanged and therefore heat requirements will not vary due to the installation of the new equipment.

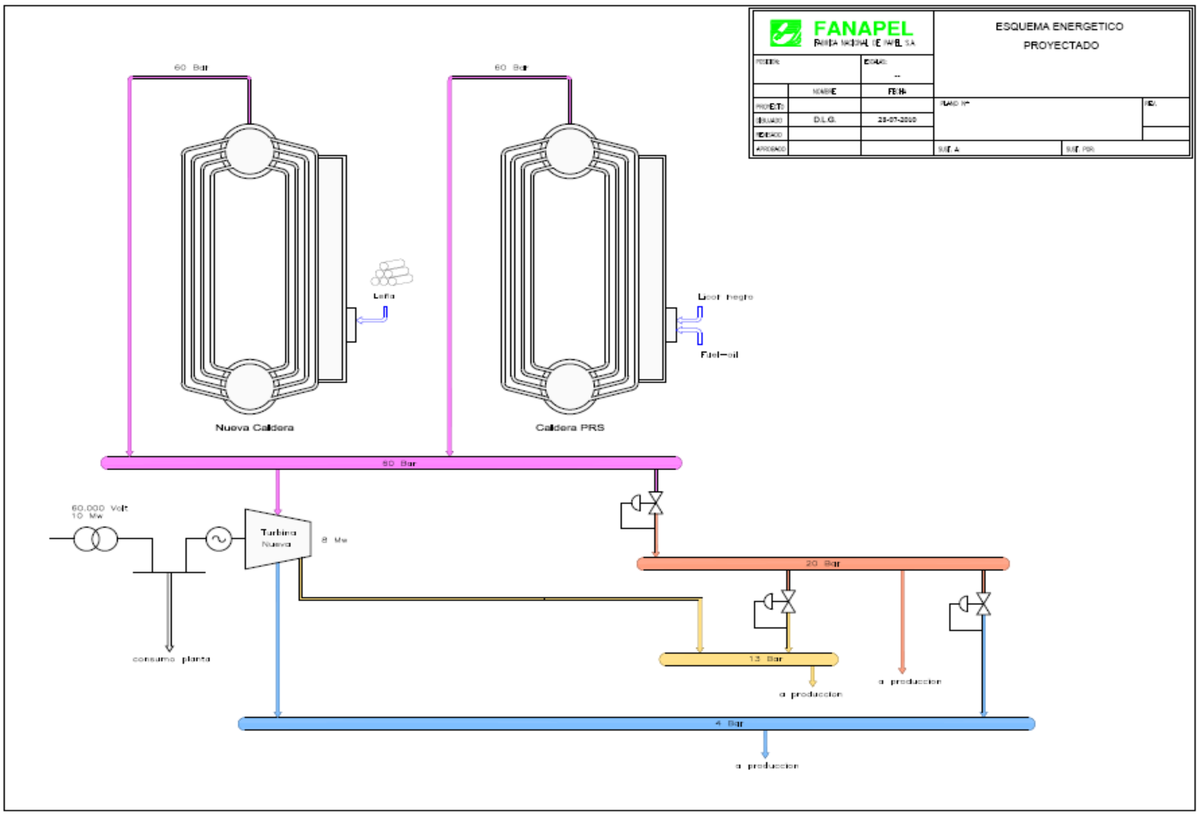

Figure 2 - New cogeneration system

The new boiler will consume renewable biomass which will be transported from different regions of the host country to Fanapel plant.

The renewable biomass will be directly combusted, consuming an estimated 15.13 t/h. The boiler will generate high pressure superheated steam and the maximum capacity is 50 t/h of steam at a pressure of 63 bar absolute and a temperature of 480°C. The boiler is equipped with a two stages super-heater, a conveyor unit, a heat economizer and a pre-heater for air inlet.

The high-pressure superheated steam produced will expand in a steam turbine that will turn the electrical generator, producing energy. Two extractions from the turbine, at 15 bar and 4 bar, are used for heat requirements of plant processes. The generator associated to the turbine will produce electrical energy enough to supply electricity to the plant and for self-consumption of the co-generation plant, thus reducing the energy currently consumed from the grid.
As in the baseline, the water for the co-generation plant will continue to be taken from the de la Plata River and will be treated in a demineralization unit in order to comply with the stringent steam parameters recommended by the boiler and turbine manufacturer.

Ashes are collected and delivered to the same municipal disposal site used at present.

The new equipment to be installed has the following characteristics:

BOILER: Turboflow

Maximal thermal capacity	39 MW_{th}
Pressure:	63 bar absolute
Temperature	480 °C
Maximum steam production	50 t/h
Fuel consumed	20 t/h of renewable biomass with 30% moisture content (wb)

TURBINE: TGM Model BTE 25

Type	Multistage, reaction, with two extraction at 15 bar and 4 bar
Steam inlet pressure	60 bar absolute
Temperature	450°C
Rated Speed	10,800 rpm
Gearbox output speed	10,800/1,500 rpm

GENERATOR: (WEG)

Power	12,500 MVA/10 MW, cos Φ = 0.8
Type	three phase synchronous
Frequency	50 Hz
Rated Speed	1,500 rpm
Generation Voltage	6.3 kV

The electrical scheme corresponding to the project scenario, including the measurement points (M) at which generated electricity will be recorded is shown in Figure 3.

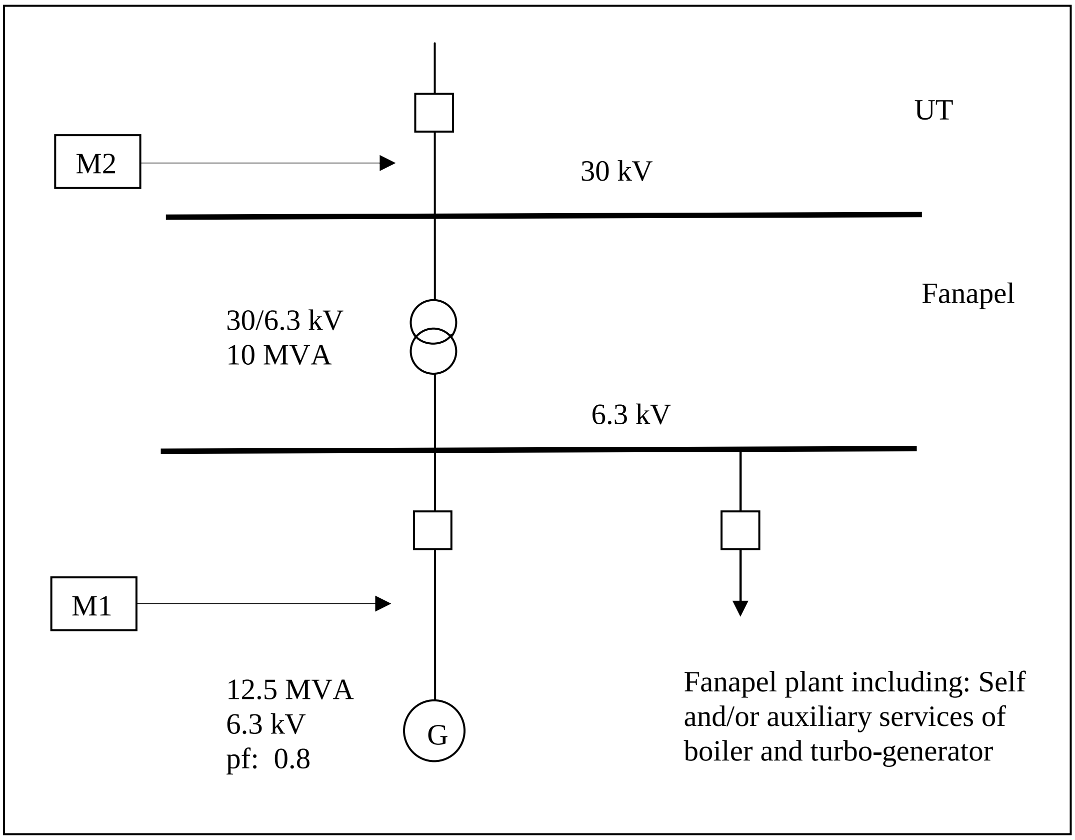

Figure 3 – Electrical Diagram

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

A.4.1.1. Host Party(ies):

Uruguay

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

Department of Colonia

A.4.1.3. City/Town/Community etc:

Juan Lacaze

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

The project activity is located in the pulp and paper mill of Fanapel, in the town of Juan Lacaze in the department of Colonia, 150 km west of Montevideo, capital city of Uruguay.
The geographical coordinates of the project location are: Latitude: - 34.4416 and Longitude: - 57.4413

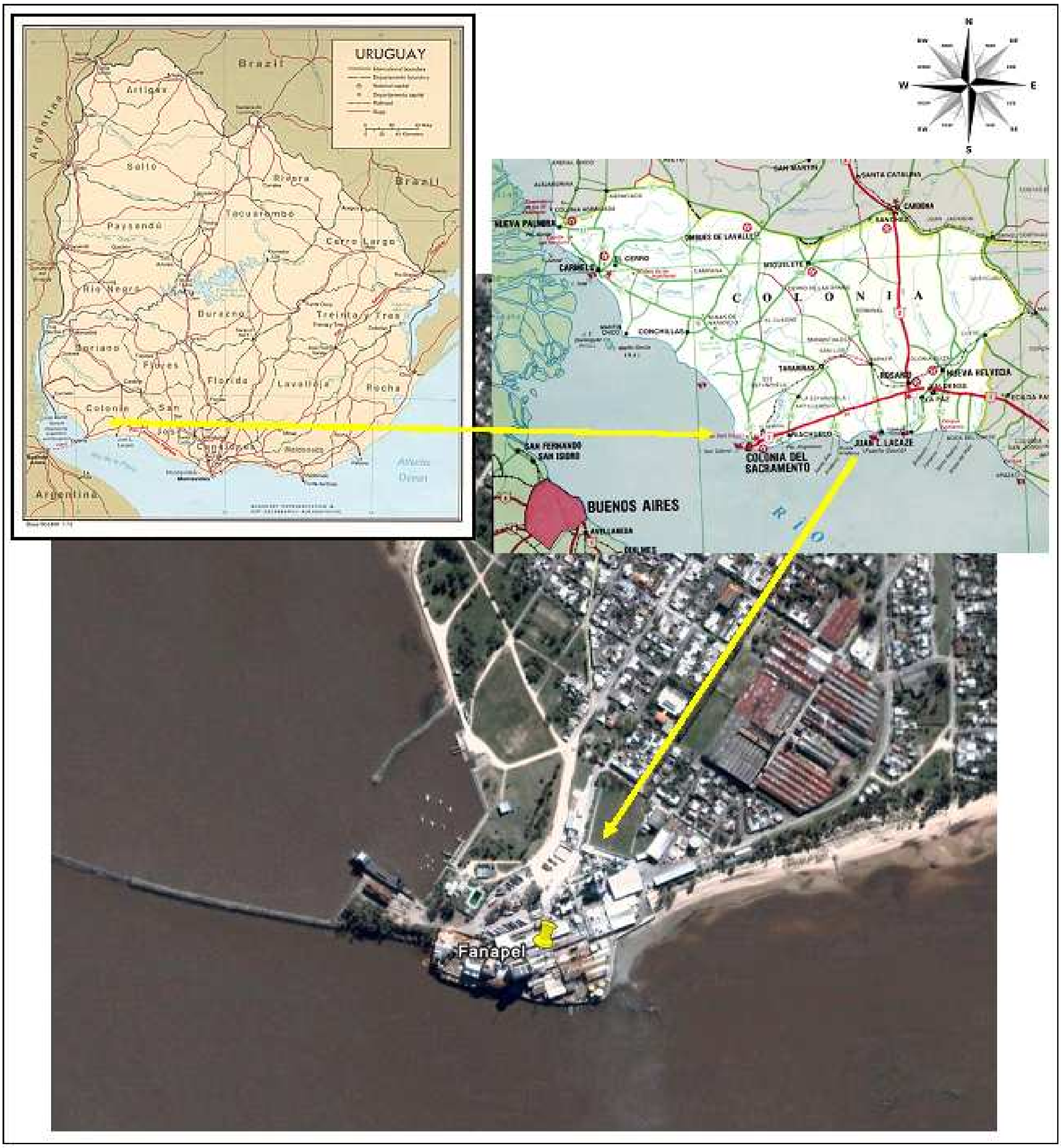

Figure 4 – Fanapel production plant

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

As per Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity falls under:
Type I, Methodology I.C. *"Thermal energy production with or without electricity" (Version #, EB 56)* for steam/heat and electricity energy produced in the new biomass based CHP plant which will displace steam/heat that are generated at present in a co-fired plant CHP plant, and; according to paragraph 17 in the methodology I.C.
Type I, Methodology I.D. *"Grid connected renewable electricity generation" (Version 15, EB 50)* for additional electric power energy that will reduce imports from grid.

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

Years	**Emission reduction due to electricity displaced in the grid**	**Emission reduction due to avoidance of using fossil fuel**	**Estimation of annual emissions reductions in tones of CO_2**
2012	28,526	24,049	52,575
2013	24,078	24,049	48,127
2014	23,605	24,049	47,654
2015	22,755	24,049	46,804
2016	22,877	24,049	46,926
2017	22,646	24,049	46,695
2018	22,804	24,049	46,853
Total estimated reductions (tones of CO2e)	**167,020**	**168,346**	**335,637**
Total number of crediting years	7 (renewable up to 21 years)	7 (renewable up to 21 years)	7 (renewable up to 21 years)
Annual average of the estimated reduction over the crediting period (tCO_2e)	**23,899**	24,049	**47,948**

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

The project will not make use of any sources of public funding from Parties included in Annex I to the Convention.

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

There are no other small-scale CDM project activities, either registered within the previous two years, or currently seeking registration with the same project participants or located within 1 km of the project boundary of the proposed small-scale activity at the closest point. Therefore, the proposed project activity is not a de-bundled component of a large-scale activity.

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:

Type I.C. *"Thermal energy production with or without electricity" (Version #, EB 56)*

Type I.D. *"Grid connected renewable electricity generation" (Version 15, EB 50)*

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

The proposed project activity is applicable to methodology I.C. Version #, explained as follows:

1. The project activity comprises the production of energy derived from renewable biomass providing thermal energy substituting fossil fuel consumption and electric generation that displaces fossil fuel fired generation in the electric system; thus causing GHG emission reductions. The biomass used by the project activity corresponds to firewood originated in forest land, and therefore complies with condition 1 a), b) and c) of the definition of renewable biomass given in EB 23 Annex 18.

2. The project activity involves the installation of a cogeneration plant of thermal and electrical energy in one process by substituting boilers in the baseline system.

3. Paragraph 3 option c) applies as the project activity produces electricity and thermal energy for on-site consumption and electricity to displace energy taken from the grid.

4. The total installed/rated thermal energy generation capacity of the project equipment is 39 MW_{th}, less than 45 MW_{th}.

5. The cogeneration unit applies to the capacity limits stated in paragraph 6 (a)

6. The project activity applies under Paragraph 8 as it seeks to modify the existing cogeneration plant to use renewable biomass.

B.3. Description of the project boundary:

According to paragraph 12 of methodology AMS-I.C, version #, the geographical site of the equipment producing the renewable energy delineates the project boundary.

In this case the boundary extends to the facilities of the pulp and paper production plant that consumes thermal and electrical energy, including the meter for energy measures bought from the national system.

B.4. Description of baseline and its development:

According to AMS I.C, project activities producing both heat and electricity including cogeneration shall apply one of the baseline scenarios described in paragraph 15. In the case of the project activity the applicable baseline scenario corresponds to the proposed option:

"(i) Electricity and/or thermal energy produced in a plant or system comprising biomass fired and/or fossil fuel fired and/or co-fired boilers; steam is fed to a single collector".

The baseline cogeneration plant is composed by four boilers, three fired with biomass and one co-fired with fuel oil and/or natural gas. The baseline emissions shall be calculated according to the proposed paragraph 32, equation (5). Historical data for at least three years prior to the project is available as required by paragraph 14.

The starting date of the project activity is June 2010 and historical data considered for calculations do not include the provisory boiler rented since April 2010.

Baseline emission for additional electrical energy over the historical values that will displace energy from the grid, will be calculated as per the procedures detailed in AMS-I.D according to paragraph 17 of methodology I.C. The baseline emissions will be calculated according to paragraphs 11 and 12 of AMS I.D.

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:

I. Timeline for the implementation of the project

Date	**Description**
2 June 2010	Purchase of Turboflow Boiler (Starting date of the project)
13 August 2010	Purchase of turbo-generator
November 2010	Start of civil works
March 2011	Start of boiler mounting (estimated)
August 2011	Start of installation of the turbo-generator (estimated)
September 2011	Start of commissioning and testing (estimated)
October 2011	Start of commercial operation (estimated)

II. Prior consideration of the CDM

The evidence of awareness of the CDM and of the fact that the CDM benefits have been decisive in the implementation of the project is given by the following:

a. Minute of the board of directors of Fanapel on 26 January 2010 (Act 2317)
b. Communication to UNFCCC on 30 July 2010

The evidence that continuing and real actions were taken to secure CDM status is given by the following:

a. Preparation of document “FANAPEL Documento Resumen para Consulta Pública” published in June 2010 and submitted to the Uruguayan DNA.
b. Publication of announcement of public consultation process in two newspapers and two radio stations in Juan Lacaze (in the region of the project site) and in Montevideo.
c. Conduction of two public audiences on 28 y 29 July 2010 in Juan Lacaze and in Montevideo, respectively, where the CDM project was presented to stakeholders.

III. Additionality

The analysis of barriers detailed next follows the Simplified Modalities and Procedures for small-scale CDM project activities (Annex II to Decision 4/CMP.1); the structure of the Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities (“Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories”); and includes the consideration of Decision EB35, Annex 34 as well as relevant provisions in the CDM Validation and Verification Manual.

Following is a table that summarizes the most relevant barriers that would prevent the project activity from being developed. Below, the barriers are justified and further explained.

Definition of barrier according Attachment A to Appendix B	**Annex 34 of EB35 “Non-binding best practices examples…….”**	**Application of Barrier to the project activity: Y/N**
Technological barriers: “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”.	Non availability of human capacity to operate and maintain the technology	N
	Lack of infrastructure to utilize the technology	N
	Unavailability of the technology	Y
	High level of technology risk	Y
Barriers due to prevailing practice: ”prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions”.	First of its kind in terms of technology	Y
	First of its kind in terms of geography	Y
	First of its kind in terms of investment and market	N
	First of its kind in terms of investor	N

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, or capacity to absorb new technologies, emissions would have been higher".	Institutional barrier or limited information	N
	Managerial resources	N
	Organizational capacity	N
	Capacity to absorb new technologies	N

a) Technological barriers:

High level of technology risk

Technological barriers are referred basically to the new boiler as part of the cogeneration plant, composed by the existing black liquor boiler and the new biomass fired boiler, and the related technical requirements for operation and control of the boiler itself and the cogeneration as a whole, including the turbine, the generator and the auxiliary systems.

Technology experience of Fanapel for biomass fired boilers is related to black liquor and small biomass boilers with gasification. In the case of boilers with gasification they are limited to low pressure steam production. Fanapel will gather experience on direct firing using firewood with the boiler hired until the definitive new boiler will be installed.

The experience in the country on biomass fired boilers relates to heat and steam production with low pressure and temperatures. All boilers manufactured by Turboflow in the host country until 2008 firing biomass are of low pressure[1], and experience for high pressure is only one boiler fired with rice husks that began operation at August 2010. The new technology tries to achieve high efficiency rates in biomass fired steam boilers for the production of electrical energy and steam (cogeneration), with a complete fuel combustion, reaching high pressure and superheated steam to produce electric energy (i.e. Rankine cycle)[2]. The use of a less advanced technology for burning biomass would have led to higher emissions in the electric system because less energy generated with fossil fuels would be displaced.

The new technology requires basically (among other complementary equipment) the installation of a direct firing system for biomass and a boiler producing high pressure superheated steam.

The operation in parallel of an electric generation synchronous machine connected to a grid requires control and protection systems for regulating the electrical, mechanical and thermal parameters, not only for assuring the adequate operation during normal operation conditions but also to prevent damage of the different components of the equipment (boiler, turbine and generator) in case of sudden disturbance in the electric system or grid. The regulations by the National Load Dispatch Centre (ADME) impose

[1]. See document from Turboflow

[2] According to Annex 1: Categorization of project technologies for power generation, included in the 34th meeting report of CDM – Meth Panel, Annex 10 "Note on the barrier of "first of its kind" , the projected technology of Fanapel project activity corresponds to "Solid biomass combustion in high steam pressure (greater or equal to 60 bar)"

restrictions on frequency, voltage and reactive power. Other control systems are necessary for regulation and protection of the power plant itself, especially those associated with normal- and over -speed of the turbine, burning of fuel and heat generation. An extreme situation to prevent is the possible outage (sudden opening of the main switch) when the generator is delivering maximum power capacity, which would cause immediate interruption of steam supply to the turbine and of heat generation by stopping the burning of fuel. Although control theory is known, practical technology applications to the type of biomass fuel, burning and heating control in the boiler are new and need to be developed. Additionally, it is also necessary that the overall control system takes account of flow of steam to be provided to the pulp and paper plant. Control technology described above is directly associated with firing and steam production technologies to be installed.

Fanapel's experience in electricity generation for self consumption is limited to two small turbo-generators that provide approximately 30% of the energy required by the pulp and paper plant. The rest of the energy requirements are provided by UTE. With the project activity installed, almost all required electricity will be generated by the new turbo-generator. Therefore, in spite of electricity back-up from the grid (UTE), risks about steady electricity provision will increase.

The uncertainties about developing the new technology, as explained above, imply to assume high risks. The risks include higher costs for technical development, technical test and corrective actions during commissioning and time delays related to uncertainties of reaching the most appropriate technical solutions.
Also, human capacity to operate and maintain the new technology of the boiler needs to be developed.

Unavailability of the technology

The type of boiler and burning system to be used by the project activity is not available in Uruguay at the time of start of the project activity. This can be verified in the document of the equipment manufacturer. It can be also verified in web sites of ADME, DNCU and DNETN[3] about power units and plants connected to the electrical system in Uruguay.

b) Barriers due to prevailing practice

Fanapel is the only pulp and paper production plant in Uruguay. Fanapel is part of the Celulosa Argentina group that also operates a pulp and paper plant in Bermudez (Argentina). The prevailing practice in these plants has been to generate energy based on firing black liquor complemented with fossil fuel fired boilers. As explained above, Fanapel retrofitted two of the three boilers to use gasified woody biomass. It is clear that continuing with this prevailing practice would have led to higher emissions than the proposed project activity.
The first biomass based generation connected to the grid in Uruguay was the cogeneration plant of a pulp mill (Botnia, now UPM, registered as CDM project) that was commissioned in November 2007. It is expected that at the end of 2010 the total installed power using biomass in the country would be about 100 MW, which represents less than 4 per cent of the total power capacity available in the country (most of the biomass power generated at UPM plant is not included in this estimate).

[3] www.adme.com.uy, www.dncu.gub.uy. www.dnetn.gub.uy

First of its kind in terms of technology

The applicable geographical area is considered as the whole country Uruguay (as the applicable geographical area is not defined in the baseline and monitoring methodology the host country is used as default). The project technology has not been in commercial operation in Uruguay (applicable geographical area).

The project activity shall start commercial operation (estimated in the 1st quarter of 2012), after the CDM-PDD has been submitted to the DOE and published for public comments. The proposed project activity is among the first of its kind for *projects of cogeneration using firewood logs (solid biomass) in Uruguay (applicable geographical area)*.

At the date of submission of the PDD to the DOE there were no similar boilers operating under these conditions, this is, firing firewood logs for high pressure and overheated steam to generate steam for heat process and electric power to reduce the energy taken from the grid[4]. Similar project activities (Bioener, Galofer and Weyerhauser Productos) have been submitted to the CDM (currently under validation). All projects use also solid biomass combustion in high steam pressure greater or equal to 60 bar, but the technology of Fanapel project activity is different from them because, Bioener and Weyerhaueser use wood chips and sawdust including biomass gasification, and Galofer uses rice husks while the project activity of Fanapel uses direct combustion of firewood.

First of its kind in terms of geography

The project activity is located in Uruguay and is among the first of its kind of energy generation based on the use of renewable biomass. At the project starting date (June 2010) there was no power unit using firewood biomass connected to the national electrical grid[5].

Since the end of 2008, the National Load Dispatch Centre is operated by ADME and statistics are published in its web site since 2009[6].

c) Summary of Barrier Analysis

According to the analysis described in this section, it is demonstrated that the most relevant barriers are "technological barriers and prevailing practice barriers". These have shown to prevent the implementation of the project activity without registration in the CDM. Our analysis has demonstrated that Fanapel S.A. project activity is the **first of its kind** in terms of several of the conditions included in EB 35 Annex 34.

[4] See document "UTE- Generación distribuida en operación.pdf

[5] See documents in footnote 5 and UTE- Generación distribuida en operación

[6] See several documents "mensual_enero2009", etc. Monthly Reports and others information about electrical market in Uruguay can be found in www.adme.com.uy

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Total emission reduction for the project activity is estimated as the sum of baseline emissions from: a) Displacement of fossil fuel used for cogeneration steam/electricity and b) displacement of electricity consumption from the grid, minus the project and leakage emissions.

$$ER_y = BE_y - (PE_y + LE_y)$$

Where:

ER_y	Total emission reduction
BE_y	Baseline emissions in year y due to: displacement of electricity from the grid, t CO_2-e/year plus emission avoidance from the use of fossil fuels t CO_2-e/year
PE_y	Project emissions
LE_y	Leakage

1. **Baseline emissions for steam and electricity that displaces the energies generated in the co-fired cogeneration plant**

The baseline emissions will be calculated according to proposed equation (5) of paragraph 32:

$$BE_{BSystem,y} = \left(\frac{EG_{BSystem,PJ,y}}{\eta_{BL,BSystem}}\right) * EF_{BSystem,CO2}$$

Where:

$BE_{BSystem,CO2,y}$	The baseline emissions from thermal and electrical energy displaced by the project activity during the year *y* (tCO_2e)
$EG_{BSystem,PJ,y}$	The net quantity of energy (electricity/thermal) supplied by the project activity during the year *y* (TJ)
$EF_{BSystem,CO2}$	CO_2 emission factor of the baseline system calculated as the weighted average emission factor (in energy basis) among the identified fossil fuels established using three years average historical data (tCO_2/TJ).
$\eta_{BL,BSystem}$	The efficiency of the boiler system that would have been used in the absence of the project activity

As explained above, the pulp and paper plant will not increased the production, and thermal and electrical power requirements will be the same after the project activity is implemented.

$$EG_{BSystem,PJ,y} = EG_{processes,y} + EG_{turbines,y}$$

Where:

$EG_{proccess/y}$	Energy delivered to the plant processes in year y (TJ)
$EG_{turbines/y}$	Energy delivered to the turbines in year y (TJ). This value is calculated ex-ante based on three year average historic data (TJ)

2. Baseline emissions from displacement of electricity generation from the grid (methodology I.D.)

The baseline emissions from electricity generation (in tonnes of CO_2 per year) are estimated as the increment of electricity displaced annually by the project activity (in MWh) from the grid, calculated as the difference between present electric generation and the historically average electric energy produced in the baseline cogeneration system (3 MW), multiplied by the baseline emission factor of the project electricity system (in tonnes of CO_2 per MWh):

$$BE_{gen,PJ,y} = EG_{BL,y} * EF_{CO2}$$

Where:

$BE_{gen,y,}$	Baseline Emissions in year y; t CO_2
$EG_{BL,y}$	Energy baseline in year y; MWh. Equivalent to the total energy displaced in the grid.
EF_{CO2}	CO_2 emission factor of the grid in year y; t CO_2-e/MWh

$EG_{BL,y}$ is calculated as the difference between actual electricity received from the grid minus average value received during the three years of historical data.

According to methodology AMS I.D., there are two options applicable for estimating the baseline emission factor of the grid, as described in section B.4 above. In this case option a), use of a combined margin is selected.

The “*Tool to calculate the emission factor for an electricity system*” (version 2) is used for the estimation of the baseline emission factor. Following are the choices made in application of the steps of this tool.

Step 1 Identify the relevant electric electricity systems

The project electricity system comprises all the power plants located in the National territory of Uruguay that are physically connected to the grid. This includes the bi-national hydro-power dam of Salto Grande, located on the Río Uruguay, and shared between Uruguay and Argentina. This is the default definition given in the tool.

All imports will come from connected electricity systems located outside of Uruguay. Therefore, following the guidance given by the tool, an emission factor of 0 t CO_2 per MWh is chosen for electricity imports.

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

Option I is chosen, only grid plants are included in the calculations.

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

Option (c) (dispatch data analysis OM) is chosen, given that hourly dispatch data are available in Uruguay for all sources connected to the grid. This choice is justified by the fact that dispatch data analysis OM is the option with the highest accuracy in the estimation of the baseline emission factor.

$$EF_{grid.OM-DD,y} = \frac{\sum_h EG_{PJ,h} \times EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EF_{grid,OM\_DD,,y}$	Dispatch data analysis operating margin CO_2 emission factor in year *y* (t CO_2-e/MWh)
$EG_{PJ,h}$	Electricity displaced by the project activity in hour *h* of year *y* (MWh)
$EF_{EL,DD,h}$	CO_2 emission factor of power units in the top of the dispatch order in hour *h* in year *y* (t CO_2-e/MWh)
$EG_{PJ,y}$	Total electricity displaced by the project activity in year *y* (MWh)
h	Hours in year *y* in which the project activity is displacing grid electricity
y	Year in which the project activity is displacing grid electricity

$$EF_{EL,DD,h} = \frac{\sum_n EG_{n,h} . EF_{EL,n,y}}{\sum_n EG_{n,h}}$$

Where:

$EF_{EL,DD,h}$	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (t CO_2-e/MWh)
$EG_{n,h}$	Net quantity of electricity delivered to the grid by power unit *n* in hour *h* (MWh)
$EF_{EL,n,y}$	CO_2 emission factor of power unit *n* in year *y* (t CO_2-e/MWh)
n	Power units in the top of the dispatch
h	Hour in year *y* in which the project activity is displacing grid electricity

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

The operating margin will be estimated annually by monitoring of the relevant parameters.

Hourly emission factor or fuel consumption data from the plants in the project electricity system are expected to be available for monitoring. These data will preferably be obtained from the reports by the National Load Dispatch Centre (DNCU). Alternatively, in case they are not available, plant-default factors will be used.

The set of power units at the top of the dispatch will be determined based on the merit order given by UTE, as described in Section B.4.

The energy displaced by the project activity ($EG_{PJ,h}$) will be the difference between the energy generated by the new generator and the historical average value generated by the generated that are eliminated.

For the purpose of the ex-ante estimation of the operating margin emission factor, a future generation scenario was developed, based on an assumed increase in electricity demand and average annual generation by existing and projected new sources. Details about the projected power generation by the different sources in the baseline scenario, as well as the selected plant-default emission factors, are given in Annex 3.

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

The power units built most recently in the project electricity system are shown in the following table:

Table 4 Recently built power plants

Unit #	Name	Start year	Capacity (MW)	Fuel
1	Los Caracoles 1 (UTE)	2009	10	Wind generation
2	Agroland Nuevo Manantial	2009	10.45	Wind generation
3	Zenda	2008	3.2	Diesel, natural gas
4	Punta del Tigre (units 5 and 6)	2008	100	Diesel, natural gas
5	Botnia (CDM registered)	2007	32	Black liquor
6	San Borja Diesel Engines	2007	3	Diesel
7	Punta del Tigre (units 1 to 4)	2006	200	Diesel, natural gas
8	Las Rosas	2005	1	Biogas from residues
9	Interconnection Brasil (Rivera)	2004	70	-------
10	Rivera Diesel Engines	1995	2	Diesel
11	La Tablada	1992	225	Diesel

The set of five power units built most recently (excluding Botnia, registered CDM project not dispatched) does not usually comprise 20% or more of total generation. Therefore, a larger number of units have to be selected for their inclusion in the build margin, comprising 20% of total generation. This implies including two units (#10 and #11 in the table above) that were built more than 10 years ago. Units #10 and # 11 are excluded from BM calculations according to the provisions of the methodological tool and Botnia CDM project is also not included as it is not dispatched.

Regarding vintage of data, Option 1 is selected (build margin is estimated ex-ante, and will not be monitored) using data available for year 2009.

Step 6. Calculate the build margin emission factor

The build margin emission factor is calculated by the generation-weighted average emission factor of all power units identified in *Step 4*, during the most recent year for which power generation data is available, calculated as:

$$EF_{grid.BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

Application of equation above resulted in an estimated emission factor for the build margin of 0,590 t CO_2/MWh. This value shall remain fixed throughout the first crediting period.

Step 7. Calculate the combined margin emission factor

The combined margin emissions factor is calculated as follows:

$$EF_y = (\omega_{OM} \cdot OM + \omega_{BM} \cdot BM)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (t CO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (t CO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

The default value of 0.5 is selected for the weights ω_{OM} and ω_{BM} for the first crediting period. According to the guidance given by the tool, the corresponding values for the second and third crediting periods will be set at 0.25 and 0.75, respectively. Estimation of the combined margin emission factor for the first crediting period is shown in the following table:

Table 5 Emission factors for operating, build and combined margins estimated ex-ante

Year	OM Emission Factor (tCO_2/MWh)	BM Emission Factor (tCO_2/MWh)	CM Emission Factor (tCO_2/MWh)
2010	0.699	0.591	**0.645**
2011	0.508	0.591	**0.550**
2012	0.505	0.591	**0.548**
2013	0.542	0.591	**0.567**
2014	0.549	0.591	**0.570**
2015	0.537	0.591	**0.564**
2016	0.545	0.591	**0.568**

All data presented in this table are calculated in the electronic worksheet that is attached to the documentation presented to the DOE for validation.

3. Project Emissions

Sources of project emissions are fuel oil consumption in the black liquor boiler. Historical average value of 920 tonnes of fuel oil consumed is supposed to continue and is used for ex-ante project emission calculations. The related annual emission is estimated at 2,865 tCO_2/y.

4. Leakage Emissions

Leakage emissions consist of incremental CO_2 emissions from fossil fuel use due to incremental wood biomass transportation as compared to the baseline. While in the baseline wood biomass is transported from plantations to the Fanapel plant, in the project, more biomass is transported due to the consumption of the new boiler of the cogeneration plant.
Regarding combustion residues (ashes), they will continue to be transported to the municipal disposal site located at a short distance from the project site, and therefore these emissions are neglected.

Project emissions are estimated as follows:

$$PE_{y,transp} = \left[\sum \left(\frac{Q_{y,i}}{CT_y} \right) \cdot DAF_{w,i} \right] \cdot EF_{CO_2,Tr} + \left(\frac{Q_{y,ash}}{CT_{y,ash}} \right) \cdot DAF_{ash} \cdot EF_{CO_2,Tr}$$

Where:

Q_y	Quantity of waste burned in the plant in the year *"y"*
CT_y	Average truck capacity for transportation wood residues (tonnes/truck)
$DAF_{w,1}$	Average incremental distance for biomass transportation from plantations to Fanapel (km)
$EF_{CO2,Tr}$	CO_2 emission factor from fuel use due to transportation (tCO_2/km, IPCC default values)

No equipment is transferred to the plant nor from the plant, so this source of leakage needs not to be considered.

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

Data / Parameter:	$\eta_{BL,BSystem}$
Data unit:	-
Description:	The efficiency of the boiler system that would have been used in the absence of the project activity
Source of data used:	Historical three years registered data from plant operation
Value applied:	65.6%
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{BSystem,CO2}$
Data unit:	t CO_2-e/TJ
Description:	CO_2 emission factor of the baseline system calculated as the weighted average emission factor (in energy basis) among the identified fossil fuels established using three years average historical data (tCO_2/TJ).
Source of data used:	Historical three years registered data from plant operation
Value applied:	16.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{EL,m}$
Data unit:	t CO_2/MWh
Description:	CO_2 emissions per MWh of electricity generated by each power plant or unit m, included in the build margin
Source of data used:	Official data provided by UTE
Value applied:	(see table below)
Justification of the choice of data or	

Units or plants	E.Factor
Punta del Tigre	0,677
San Borja	0,879
Zenda	0,600

description of measurement methods and procedures actually applied :	
Any comment:	BM factor calculated ex-ante based on these emission factors shall remain constant during first crediting period. **BM factor results in 0,591 tCO2/MWh**

Data / Parameter:	$EG_{baseline,h}$
Data unit:	MWh
Description:	Average of last three years electric energy received in the plant in the baseline in 1 hour.
Source of data to be used:	Historical data registered.
Value of data	6.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is taken from UTE (Distribution utility) receipts. Measurements are official data and QA/QC of meters is according to the Sistema de Medición Comercial (Commercial Measurement System) regulated by URSEA, regulation entity of energy and water.
Any comment:	Historical monthly energy received and calculations are included in the worksheet.

Data / Parameter:	$EG_{turbines,y}$
Data unit:	TJ
Description:	Average of last three years heat input in the turbines
Source of data to be used:	Historical data registered.
Value of data	286
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Historical monthly energy registered in plant and calculations are included in the worksheet.

6.3 Ex-ante calculation of emission reductions:

The emission reductions were estimated by applying the methodology equations, and using the methodological choices detailed in Section B.6.1 above.
Detailed calculation is provided in the attached worksheet.

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

Summary:

YEAR	Estimation of project activity emissions (tCO_2e) [7]	Estimation of Baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reduction (tCO_2e)
2010	2,865	58,249	2,808	52,575
2011	2,865	53,801	2,808	48,127
2012	2,865	53,328	2,808	47,654
2013	2,865	52,478	2,808	46,804
2014	2,865	52,600	2,808	46,926
2015	2,865	52,369	2,808	46,695
2016	2,865	52,527	2,808	46,853
TOTAL	**20,065**	**375,352**	**19,658**	**335,637**
Average	**2,865**	**53,622**	2,808	**47,948**

Thermal and electrical generation component of the cogeneration plant:

YEAR	Estimation of project activity emissions (tCO_2e)	Estimation of Baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of emission reduction (tCO_2e)
2010	2,865	29,723	2,808	24,049
2011	2,865	29,723	2,808	24,049
2012	2,865	29,723	2,808	24,049
2013	2,865	29,723	2,808	24,049
2014	2,865	29,723	2,808	24,049
2015	2,865	29,723	2,808	24,049
2016	2,865	29,723	2,808	24,049
TOTAL	**20,055**	**208,061**	**19,658**	**168,346**
Average	**2,865**	**29,723**	2,808	24,049

[7] Project Emissions due to fuel oil consumption of black liquor boiler are considered here.

Electrical energy component for displacing energy from grid:

YEAR	Estimation of project activity emissions (tCO_2e)	Estimation of Baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of emission reduction (tCO_2e)
2010	0	28,526	0	28,526
2011	0	24,078	0	24,078
2012	0	23,605	0	23,605
2013	0	22,755	0	22,755
2014	0	22,877	0	22,877
2015	0	22,646	0	22,646
2016	0	22,804	0	22,804
TOTAL	**0**	**167,020**	**0**	**167,020**
Average	**0**	**23,899**	**0**	**23,899**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	Q_y
Data unit:	Tonnes
Description:	Biomass consumed (firewood/lumber) in year y
Source of data to be used:	
Value of data	128,000
Description of measurement methods and procedures to be applied:	All trucks carrying biomass shall be weighted in an scale at the gate of the plant
QA/QC procedures to be applied:	Maintenance and calibration of the scales will be carried out periodically according to national standards. Decree of Executive Power 27/986 (year 1986) regulate use of industrial scales. Testing and calibration is made by the Direction of legal metrology of LATU (Technological Laboratory of Uruguay).
Any comment:	

Data / Parameter:	$FC_{FO,y}$
Data unit:	tonnes
Description:	Fuel oil combusted in black liquor boiler in the year y
Source of data to be used:	Register in plant
Value of data	920
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Meters are calibrated in plant
Any comment:	

Data / Parameter:	$NCV_{FO,y}$
Data unit:	GJ/t
Description:	
Source of data to be used:	Official data provided by ANCAP
Value of data	0.0402
Description of measurement methods and procedures to be applied:	

QA/QC procedures to be applied:	Data is provided by ANCAP
Any comment:	

Data / Parameter:	***$EG_{process,y}$***
Data unit:	TJ
Description:	Energy delivered to the process in year y (TJ)
Source of data to be used:	
Value of data	3,284
Description of measurement methods and procedures to be applied:	Calculated
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	***$Q_{steam,y}$***
Data unit:	m^3/h
Description:	Quantity of steam flow
Source of data to be used:	Various meter installed in plant
Value of data	
Description of measurement methods and procedures to be applied:	Continuous monitoring, integrated hourly and at least monthly recorded
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	***T***
Data unit:	°C
Description:	Temperature
Source of data to be used:	Various meter installed in plant
Value of data	
Description of measurement methods and procedures to be applied:	Continuous monitoring, integrated hourly and at least monthly recorded
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	***P***
Data unit:	kg/cm^2
Description:	Pressure
Source of data to be used:	Various meter installed in plant
Value of data	
Description of measurement methods and procedures to be applied:	Continuous monitoring, integrated hourly and at least monthly recorded
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EG_{GRID,h}$
Data unit:	Mwh
Description:	Electricity received from the grid by the project activity in hour *h* in year y
Source of data to be used:	Meter of UTE according to SMC
Value of data	1.2
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Meters will be calibrated periodically, according to national standards of the Commercial Measurements System.
Any comment:	

Data / Parameter:	$FE_{EL,m,y}$
Data unit:	t CO_2/MWh
Description:	The amount of CO_2 emissions per MWh generated by each power source m in hour h of year y in the interconnected system.
Source of data to be used:	Hourly, monthly or yearly data provided by UTE or DNCU (data are expected to be available),

Value of data

	2012 - 2013			Since 2013		
Unit	fuel	Efficiency	Emission factor tCO_2/MWh	fuel	Efficiency	Emission factor tCO_2/MWh
Sala B-3 Sala B-4	Residual fuel oil	325 g/kWh	1.118	Residual fuel oil	325 g/kWh	1.118
5ta.	Residual fuel oil	242 g/kWh	0.836	Residual fuel oil	242 g/kWh	0.836
6ta.	Residual fuel oil	250 g/kWh	0.867	Residual fuel oil	250 g/kWh	0.867
Engines M1	Residual fuel oil	200 g/kWh	0.639	Nat.gas		0.451
TAA -1	Residual fuel oil	396 g/kWh	1.129	Residual fuel oil	396 g/kWh	1.129
CTR-1	gasoil	$280m^3/kWh$	0.852	gasoil	$280m^3/kWh$	0.852
CTR-2	gasoil	$280m^3/kWh$	0.852	gasoil	$280m^3/kWh$	0.852
CTI - 1a 4	gasoil		0.677	Nat.gas		0.547
CTI - 5y 6	gasoil		0.677	Nat.gas		0.547
Diesel engines	gasoil		0.879	gasoil		0.879
Zenda	N.gas		0.428	N.gas		0.428
Engines M2	Residual fuel oil	200 g/kWh	0.639	N.gas		0.451

Description of measurement methods and procedures to be applied:	Official statistics; publicly accessible and reliable data source.
QA/QC procedures to be applied:	Data will be checked for consistency with plant default emission factors. If inconsistencies are found, the likely reasons will be investigated.
Any comment:	The use of plant default factors will not cause any significant differences with respect to the use of actual data, although the latter should be more accurate if available.

Data / Parameter:	$EG_{n,h,y}$
Data unit:	MWh
Description:	Electricity generation of the plants n, during hour h in year y, connected to the grid or Electricity generation of sources in the interconnected system (i.e., of those plants included in the operating margin).
Source of data to be used:	Hourly data provided by National Load Dispatch Centre.

Value of data

	Wind power plants							
year	Caracoles	Amplin	Agro/N.Man	Carac. 2	Fortuny	Kentilux	LuzdeMar	Future
2012	3,6	0	1,30	3,6	2,79			
2013	3,6	0	1,30	3,6	2,79	3	2,73	30
2014	3,6	0	1,30	3,6	2,79	3	2,73	60
2015	3,6	0	1,30	3,6	2,79	3	2,73	90
2016	3,6	0	1,30	3,6	2,79	3	2,73	120
2017	3,6	0	1,30	3,6	2,79	3	2,73	150
2018	3,6	0	1,30	3,6	2,79	3	2,73	180

	Biomass fired plants										
year	L.Ros.	Botnia	Galofer	Bioener	Fenirol	Weyer	Linderdat	Ponlar	Aguia	Alur	Future
2012	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	0
2013	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	56
2014	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	70
2015	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	84
2016	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	98
2017	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	112
2018	0,2	25,6	9,8	8,4	7	3,5	3,5	3,5	1,4	3,5	126

Average Equivalent Power MW		
R.Negro	SGU	total
274	394	667,6
282	410	691,5
290	426	716,4
299	441	740,5
299	441	740,5
299	441	740,5
299	441	740,5
299	441	740,5
299	441	740,5
299	441	740,5
299	441	740,5

Fossil fired power plants	Units	Beginning year	Installed Power MW	Available factor adopted/MW 2012-2014		2015-2018	
Batlle y Ordoñez	Sala B-3	1955	50	50%	25	0%	0
	Sala B-4	1955	50				0
	5ta.	1970	88	70%	62	65%	57
	6ta.	1975	125	70%	88	65%	81
	Motors M1	2010	80	80%	64	80%	64
Turbina Mald.AA	1	1985	25	85%	21,3	85%	21,3
La Tablada(CTR)	CTR-1	1992	104	70%	72,8	70%	72,8
	CTR-2	1992	103	70%	72,1	70%	72,1
Punta del Tigre	CTI - 1a 4	2006	200	70%	140	70%	140
Punta del Tigre	CTI - 5y 6	2008	100	70%	70	70%	70
Diesel engines	(x)	(xx)	5	90%	4,5	90%	4,5
Zenda(Branaa)	(xx)	2008	3	80%	2,4	0,8	2,4
Nueva Central	Motors M2	2013	200	80%	160	80%	160
(x) Several units connected to distribution network							
Rivera	1	1995	2				
San Borja	1	2007	3				

Description of measurement methods and procedures to be applied:	Official statistics; publicly accessible and reliable data source. Data is published diary by DNCU
QA/QC procedures to be applied:	Measurements are made according to Commercial Measurement System approved by URSEA (URSEA Decision No. 14002 of 27 November 2002)
Any comment:	

Data / Parameter:	***CT_y***
Data unit:	t/load
Description:	Load capacity of the trucks that will carry biomass from the plantations to the Fanapel plant.
Source of data to be used:	Scales at Fanapel plant
Value of data	30
Description of measurement methods and procedures to be	Truck loads will be monitored by weighing each load reaching the power plant and counting the number of trucks.

applied:	
QA/QC procedures to be applied:	The amount of biomass transported by truck will be monitored accurately, as all truck loads will be recorded. Maintenance and calibration of the equipments will be carried out according to national standards.
Any comment:	

Data / Parameter:	***Origin of each truck load (wood residues)***
Data unit:	---
Description:	Identification of plantation of origin of truck loads arriving to the power plant, for the purpose of determining the transportation distance.
Source of data to be used:	Documentation of transportation
Value of data	Varies with the plantation of origin (for ex-ante calculations an average distance of 200 km is assumed)
Description of measurement methods and procedures to be applied:	Plantations of origin will be identified in transportation documents ("remitos") carried by truck drivers. The origin of each load will be recorded at the plant along with information on truck plate, weight of load, time of arrival and other information relevant to each truck load.
QA/QC procedures to be applied:	Information from "remitos" will be cross-checked monthly with wood residues transaction documentation between Fanapel and each of the plantations.
Any comment:	

B.7.2 Description of the monitoring plan:

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organized in terms of the collection and archiving of complete and reliable data.

Prior to the start of the crediting period, the organization of the monitoring team and the monitoring procedures will be established. There will be a CDM Manager who will have the overall responsibility for the monitoring system of the project, ensuring reliable monitoring procedures. These procedures will detail the organization, control and steps required for certain key monitoring system features, including: record, collection, quality control and quality assurance of data along with all issues concerning equipment maintenance and calibration.

1. Monitoring procedures for electricity generation

The monitoring methodology shall follow the procedures of the methodology I.C and the chapter III of the "Tool to calculate the emissions factor of the electricity system". Parameters to be monitored are detailed in B.7.1.

<u>Metering of electricity received from or supplied to the grid.</u>

The amount of energy supplied to the grid shall be measured according to the Commercial Measuring System - CMS - (approved by Resolution 14/002 dated 27/11/2002). These measurements shall be applied in each node where energy is delivered to or retired from the grid.

It is ADME´s responsibility (Administrator Council of the Electricity Market) to verify the correct functioning of the system according to Art. 354, 355 and 356 of the Electricity Market Regulation (approved by Decree 360/002, dated 11/9/02).

Measurement equipment in each point (node) shall at least be composed of: a) two meters (main and back up); b) current and voltage transformers; and c) communication system with ADME. Quality control of measurements shall be performed according to Title VI of CMS referred to above. Audit reports are necessary for meter approval. These audit reports must be performed by official auditors according to Title VIII of MCS. Failures of main measurements are processed according Title XI of MCS.

Measurements are recorded hourly by DNCU (National Load Dispatch Centre) and published at www.dncu.gub.uy or ADME webpage (www.adme.gub.uy).

2. Monitoring procedures for biomass

The parameters to be monitored include: amount of biomass combusted, quantity of combustion residues, average truck load capacity, identification of the origin of each truck load of biomass entering the plant and the corresponding transportation distance. Following is a description of the monitoring plan for each of these parameters.

All trucks carrying biomass that arrive at Fanapel S.A. plant will be weighed at the gate both before and after discharging. These trucks will be carrying a bill with a unique identification number and Fanapel logo or identification, stating the truck details, the type and weight of the load, as well as its origin.

Copies of the bills will be left in the plant's office, where they will be archived, and their details loaded on an electronic worksheet, along with the truck weights. Data will be processed and the amount of ashes leaving the plant will be estimated on a monthly basis.

3. Monitoring procedures steam/heat

All measurement of flows of steam and water, pressures and temperatures, required for calculations shall be continuously monitored and recorded as usual.

4. Data and records management

At the end of each month the monitoring data will be filed electronically and all the electronic files will be backed-up. The project developer will keep invoices corresponding to electricity sales.

All printed documentation will be stored and made available to the verifier to ensure information reliability.

The CDM Manager of the project will be responsible for checking the data (according to a formal procedure) and for managing the collection, storage and archive of all data and records.

Data for verification and issuance will be kept for at least two years after the end of the crediting period or the last issuance of CER.

4. Detailed monitoring plan and documents

A detailed monitoring plan including documents and worksheets will be available at the start of the crediting period. Worksheets for registering data and calculations shall be integrated to the Scada.

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

Baseline study and monitoring plan were completed on November 2010 by Carbosur SRL.

Responsible persons: Daniel Martino, Miguel Oronoz and Robert Dietrich.

Contact details:
daniel.martino@carbosur.com.uy
Misiones 1372/304, Montevideo 11.000, Uruguay
Ph. +598 2 915 3514

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:

2 June 2010, purchase of boiler

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

25 years

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

C.2.1. Renewable crediting period

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

Date of CDM registration

C.2.1.2. Length of the first crediting period:

7 years

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

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

An Environmental Impact Assessment (EIA) was carried out and the Environmental Permit has been granted by the Uruguay's environmental authority (DINAMA). No negative environmental impacts have been identified.

In addition, and following the directives of the tool specially developed by the DNA, the contribution of the project to the host country's sustainable development has been assessed through a series of pre-defined criteria and indicators. This assessment showed a highly positive contribution of the project. The corresponding documents to both EIA and assessment of the contribution to sustainable development will be submitted to the CDM Designated National Authority of Uruguay for requesting the Letter of Approval.

The main environmental benefits identified by the EIA are the following:

- Reduction of emissions of particulate matter, SO_x, and NO_x, occurring in the baseline due to burning of fossil fuels for electricity generation in the project electricity system.
- Neutral effects on soil, water resources and biological diversity.

No trans-boundary impacts have been identified.

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:

N/A

SECTION E. Stakeholders' comments

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

E.2. Summary of the comments received:

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	FANAPEL S.A.
Street/P.O.Box:	
Building:	
City:	Montevideo
State/Region:	Montevideo
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Baseline scenario for electricity generation

For the purpose of the ex-ante estimation of the grid emission factor, an electric scenario was projected based on conservative assumptions. These assumptions are related to the expected evolution of national electricity demand, and the characteristics of the load dispatched (hydroelectric generation, volume of imports and thermal generation) in terms of availability, lifetime and merit order, for the first crediting period.

Following is a description of the baseline scenario for electricity generation. All data presented below is taken from an electronic excel sheet that is attached to the documentation presented to the DOE for validation and verification.

The **project electricity system** comprises all the power plants located in the National territory of Uruguay that are physically connected to the grid. This includes the bi-national hydro-power dam of Salto Grande, located on the Uruguay River, and shared in identical parts (50/50) by Uruguay and Argentina.

Each of the power units connected to the electricity system has a factor capacity that indicates the percentage of its nominal capacity that is available for generation.

Energy Demand

Estimation of National energy demand for electricity during the first crediting period is based on historical data from the last 30 years. Historical energy demand shows an increase at an annual rate of 4%, thus this is the value to be used for the baseline scenario. Table A-1 shows the estimated demand of electricity in Uruguay (in GWh) during the first crediting period of the project.

In the case of the Fanapel S.A project, the project activity will reduce about 42 GWh /year to the expected demand that represents less than the 0,36% of the total future demand estimated.

Table A-1 - Electricity demand for the first crediting period (GWh/year)

2012	2013	2014	2015	2016	2017	2018
10,492	10,911	11,348	11,802	12,274	12,765	13,275

Load dispatch

National Law No. 16837 (1997) abolished the State monopoly for electricity generation and created a market for energy transactions. This market is administrated by ADME (National Administrator of Electric Market) and its operation is performed by DNCU (National Load Dispatch Centre). Although this new frame has not yet been completely implemented, the actual rules made possible the building of privately owned generation units (particularly renewable wind and biomass). Different modalities for operation (free dispatch, distributed generation) are being implemented for selling and buying energy to the monopoly distributor (UTE).

a) Hydroelectric generation

Hydroelectric power plants in the Uruguayan interconnected system are: the bi-national hydro-power dam of *Salto Grande*, located on the Uruguay River (shared with Argentina) and the hydroelectric power plants of *Gabriel Terra*, *Baygorria* and *Constitución* (*Palmar*) located on the *Negro* River.

Uruguayan electricity system is strongly dependent on hydroelectric generation. Total installed hydroelectric power is 1,558 MW, while maximum historical demand peak was 1,698MW[8]. Historical energy generation from hydroelectric plants is between 4,686 GWh and 9,017 GWh.

Due to the particular characteristics of water resource in Uruguay, it is very difficult to get reliable estimations of future generation. On one hand, as a result of the variability of the rainfall regime, hydroelectric generation in warm temperate zones like Uruguay is highly fluctuating and does not follow any statistical distribution. In addition, water storage capacity of the dam lakes is limited to 2-3 days in *Salto Grande*, 6 months in *Gabriel Terra*, 1 week in *Constitución* and no storage capacity in *Baygorria*.

Existing official studies for operation, planning and dispatch decisions are based on average historical values for water flow in the dams.

In order to estimate hydroelectric generation for the first crediting period of the proposed project activity, it was assumed that exports corresponding to hydro electrical energy will be gradually reduced and will be incorporated to average historical hydro generation in order to fulfil part of the future increase in local energy demand. Since average hourly generation of hydroelectric plants is below nominal capacity, no availability or capacity factor is assumed.

The potential for hydro power generation has been reached and, therefore, no further additions are expected to occur in the future. Further expansion of the hydro installed capacity would require the flooding of vast areas with correspondingly very high investment costs. A tender for the installation of mini hydro plants implemented by UTE in 2006 did not return any bids.

Variable cost of water is zero and investment costs and repayment of major investment is assumed to occur during 100 years, resulting in also reduced annual costs. Due to this hydroelectric sources are the first to be dispatched after wind energy.

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[8] Recorded in August 3 2010.

Table A-2 Hydro power generation for the first crediting period

Average equivalent power	
year	MW
2012	**716**
2013	**741**
2014	**741**
2015	**741**
2016	**741**
2017	**741**
2018	**741**

b) Wind Generation

Long term estimations for average wind energy generation can be calculated using statistical distribution models of the wind resources. For the purpose of ex-ante estimations an average capacity factor of 30% is assumed based on studies of different local resources. Note that for Agroland and Nuevo Manantial the capacity factor is expected to be less than 20%. The production from wind farm Caracoles installed by UTE is reaching a capacity factor of 36%. (See Table A-3).

As variable costs for wind generation is considered to be zero, wind power generation plants are, together with hydro electric power plants the first to be dispatched.

Table A- 3. Wind power generation projected for the first crediting period

c) *Biomass-fired plants*

As explained above, carbon finance results in private investment in new power and co-generation units using biomass as fuel.

Table A-4 shows a list of the existing and expected biomass power plants with the corresponding average equivalent generation power. According to data from experts on the matter and from official documents, variable costs for biomass power plants are lower than those of fossil fuel power plants. So, biomass plants are dispatched before fossil fuel units.

For all biomass generator purchase agreement with UTE is based on free dispatch.

Taking account of little historical information (units were incorporated since ends of 2008) and in order to estimate future availability some considerations have been made depending of type of biomass and application.

In the case of the actual and future generation to be produced in excess in cellulosic pulp mills and deliver to the grid, a high availability of 80% is assumed.

In the other cases, most of them are co-generation plants and energy production depends on type production of main plant. Additionally project developers have faced technological barriers and commissioning process have not yean achieve the nominal capacity estimated. It is expected that by the year 2012 availability factor will increase over the registered at present.

Distributed generation defined as a capacity less than 5 MW, is paid based on "spot prices" and it is not yet very clear which should be their participation in the market.

Table A-4 Biomass power generation projected for the first crediting period

Biomass Unit or Plants	Starting year	Installed power	2012	2013	2014	2015	2016	2017	2018
Las Rosas	2005	1	20%	20%	20%	20%	20%	20%	20%
Botnia (*)	2007	32	80%	80%	80%	80%	80%	80%	80%
Galofer	2010	14	70%	70%	70%	70%	70%	70%	70%
Bioener	2010	12	70%	70%	70%	70%	70%	70%	70%
Fenirol	2010	10	70%	70%	70%	70%	70%	70%	70%
Weyerhauser	2010	5	70%	70%	70%	70%	70%	70%	70%
Linderdat	2010	5	70%	70%	70%	70%	70%	70%	70%
Ponlar	2010	5	70%	70%	70%	70%	70%	70%	70%
Alur	2011	5	70%	70%	70%	70%	70%	70%	70%
Aguia Maderas	2011	2	70%	70%	70%	70%	70%	70%	70%
Fanapel	2012	5	0%	0%	0%	0%	0%	0%	0%
Future 2012	2012	0							
Future 2013	2013	70		80%	80%	80%	80%	80%	80%
Future 2014	2014	20			70%	70%	70%	70%	70%
Future 2015	2015	20				70%	70%	70%	70%
Future 2016	2016	20					70%	70%	70%
Future 2017	2017	20						70%	70%
Future 2018	2018	20							70%
Annual total power (MW)			66	122	136	150	164	178	192

Botnia CDM proyect registered at may/2008

*UPM (Before Botnia)CDM project registered in May 2008

d) Fossil-fuel fired thermal generation

Future capacity additions are likely to occur in order to have a firm back up for hydroelectric and wind generation and to compensate outage of older thermal units.

The projected scenario assumes that an additional 400/500 MW combined power generation plant fired with gas oil or natural gas would be installed in Punta del Tigre. First gas turbine it is expected to start operation in 2013.

Also, official information indicates that a re-gasification plant of natural gas is likely to be installed in Uruguay in 2013 in order to increase natural gas disposal at the country. Power units that are expected to change its fossil fuel to natural gas are indicated in Table A-6. The turbines installed at present in Punta del Tigre Plant are able to operate with natural gas. Other feasible alternatives as generation based on fossil fuel or carbon would result in increasing emission factor of the system. To consider the natural gas option is a conservative option for reductions of emissions.

Table A-5 includes a list of units connected to the system and future additions of fossil fuel based thermal units.

Table A-5 Fossil fuel power generation and availability factors considered for ex-ante estimations the first crediting period.

Table A- 6 includes units or plants emissions factors considered for ex-ante calculations. It is expected that in the future ADME will publish fuel consumption of the different plants and therefore emissions factors would be calculated on actual values considering NVC of each fuel

Table A-6 Default plant emission factors considered for the first crediting period.

e) Energy imports and exports

There are three interconnection points for energy exchange with the neighbouring countries Argentina and Brazil.

The extra high voltage transmission line of 500 kV in Uruguay is connected to the Argentinean grid (2,000-MW capacity), since 1980, enabling energy imports from Argentina and, indirectly, from Brazil.

Two other links connect local transmission lines of 150 kV to 132 kV lines of Argentinean (Paysandú) and Brazilian (Rivera)132 kV grid. The connection with Brazil is through a frequency conversion plant (50/60Hz, 70 MW) and is in operation since 2004.

A new interconnection point between Uruguay and Brazil is planned to be constructed in the near future, to enable the connection of 500-kV local lines with the 320-kV transmission lines of Brazil. Total

capacity projected of this interconnection is 500 MW. This investment has been decided recently, but date to begin commercial operation it is yet unknown.

Even though imports from both Argentina and Brazil have been of a relatively important magnitude in the last few years, several changes in political and commercial circumstances of these countries have resulted in a reduction in their electricity surpluses. Due to this, the projected scenario assumed for the baseline considers that energy exchanges would be limited to emergency situations only.

Annex 4

MONITORING INFORMATION

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