CLEAN DEVELOPMENT MECHANISM
PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

This form is for the submission of a CDM PoA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-CPA-DD (using a real case).

SECTION A. General description of programme of activities (PoA)

A.1 Title of the programme of activities:

Title of the project: "*TUCANO CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil*".

Version number: 4.

Date: 02/04/2012.

A.2. Description of the programme of activities:

1. General operating and implementing framework of PoA

The primary objective of the proposed Programme of Activities (PoA) is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to environmental, social and economic sustainability by increasing the share of renewable energy in total electricity consumption for Brazil (and for the region of Latin America and the Caribbean).

Countries in the Latin America and the Caribbean region have expressed their commitment towards achieving a target of 10% renewable energy of total energy use in the region[1]. Through an initiative from the Ministers of the Environment in 2002, a preliminary meeting of the World Summit for Sustainable Development (WSSD) was held in Johannesburg in 2002[1]. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[2].

In Brazil, the privatization process of the electric sector initiated in 1995 commenced with the expectation of adequate tariffs, fewer subsidies, and better prices for generators. It drew the attention of investors to possible alternatives not available in the centrally planned electricity market. In the late 1990's a strong increase in demand contrasted with an under average increase in installed capacity caused the outbreak of the supply crisis/rationing in 2001/2002. One of the solutions the government provided was to revise legislation, favoring smaller independent energy producers. Furthermore the possible eligibility under the Clean Development Mechanism of the Kyoto Protocol drew the attention of investors to renewable energy projects.

[1] Economic Commission for Latin America and Caribbean (ECLAC) and GTZ. Renewable energy sources in Latin America and the Caribbean. Situation and policy proposals. Available at: <http://www.eclac.cl/cgi-bin/getProd.asp?xml=/publicaciones/xml/1/14981/P14981.xml&xsl=/dmaah/tpl-i/p9f.xsl&base=/dmaah/tpl/top-bottom.xsl>.

[2] WSSD Plan of Implementation, Paragraph 19 (e): "*Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries' efforts to eradicate poverty, and regularly evaluate available data to review progress to this end*". Information available at: <http://www.un.org/jsummit/html/documents/summit_docs/2309_planfinal.htm>.

2. Policy/measure or stated goal of the PoA

This PoA is a voluntary coordinated action by the managing entity *Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO)*, consisting of the implementation of renewable energy projects in Brazil. The hub of this PoA is the construction of small hydropower plants as defined by the Brazilian Regulatory Agency ("ANEEL" from the Portuguese *Agência Nacional de Energia Elétrica*) ("PCH" from Portuguese *Pequena Central Hidrelétrica*) connected to the Brazilian Interconnected System (from the Portuguese *Sistema Interligado Nacional – SIN*).

This cleaner source of electricity provides an important contribution to environmental sustainability. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generated (and emitted) in the absence of the project.

The project contributes to sustainable development since it meets the present needs without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987). In other words, the implementation of small hydropower plants ensures renewable energy generation, reduces the national electric system demand, avoids negative social and environmental impact caused by the construction of fossil fuel thermo power plants, and drives regional economies, increasing quality of life in local communities.

Therefore, the project has indisputably reduced negative environmental impacts and will develop the regional economies, resulting, consequently, in better quality of life. In other words, environmental sustainability combined with social and economic justice.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity

As mentioned in item 2 above, the proposed PoA is a voluntary action by the Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO).

A.3. Coordinating/managing entity and participants of POA:

The Coordinating or Managing Entity (CME) of *"TUCANO CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil"* is Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO). Therefore, EQAO is the entity which communicates with the CDM Executive Board and is also the Project Participant.

The table presented below lists the Project Participants of the PoA.

Table 1 – Project Participants involved in the proposed PoA

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) involved in the PoA	Kindly indicate if the Party involved wishes to be considered as Project Participants (Yes/No)

Brazil (Host)	Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO) (private entity)	No
The Netherlands	Mabanaft Carbon B. V. (private entity)	

Detailed contact information on private/public entities involved in the project activity as listed above is provided in Annex 1.

A.4. Technical description of the programme of activities:

A.4.1. Location of the programme of activities:

A.4.1.1. Host Party(ies):

Brazil.

A.4.1.2. Physical/ Geographical boundary:

The Programme of Activities will be implemented within the geographical area of Brazil. All the CDM programme activities (CPAs) included in the PoA will be implemented in Brazil taking into consideration all applicable national and/or sectoral policies and regulations.

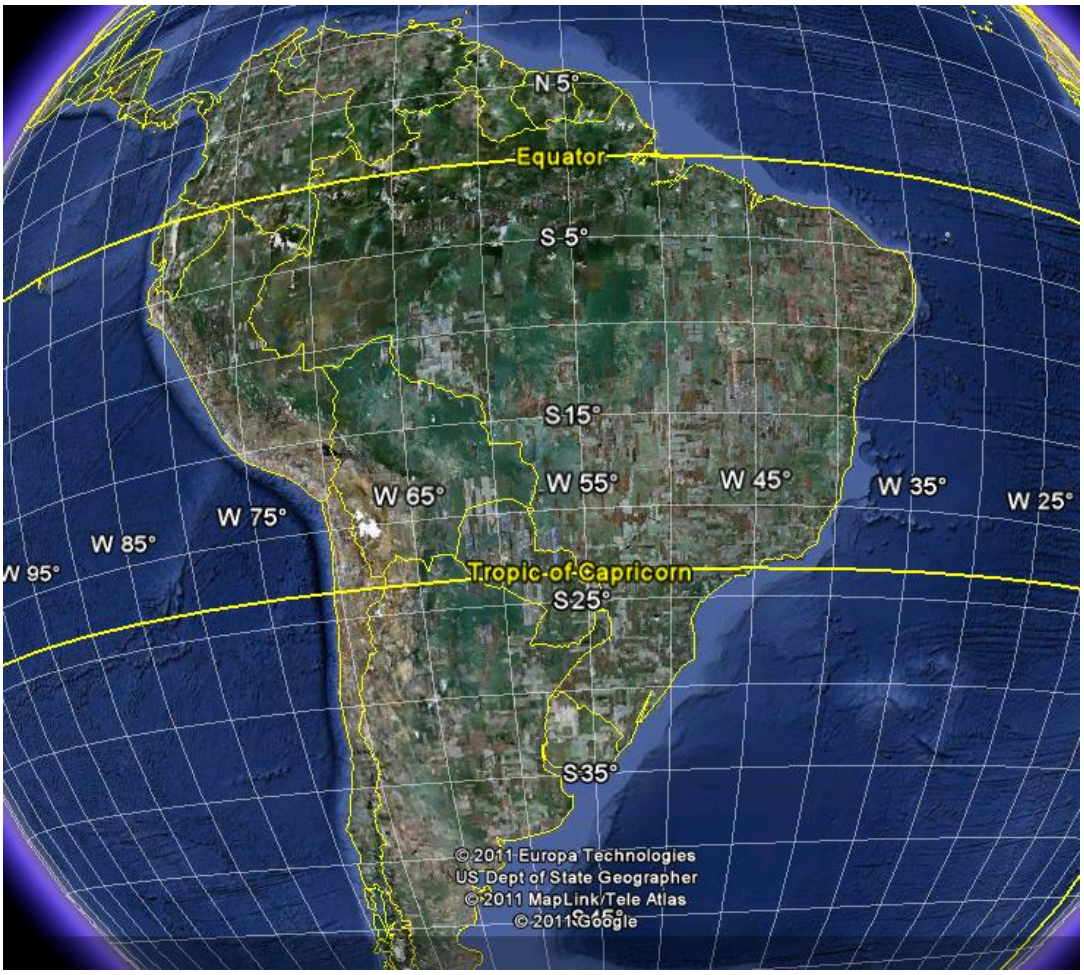

Figure 1 – Geographical boundary of POA

Source: GOOGLE EARTH (2011)[3]

A.4.2. Description of a typical CDM programme activity (CPA):

A.4.2.1. Technology or measures to be employed by the CPA:

All CPAs under this PoA consist of the implementation of small hydropower plants in Brazil as defined by ANEEL[4]. According to ANEEL Resolution nr. 394/1998[5], small hydropower plants consist of a utility with an installed capacity between 1 MW and 30 MW, and reservoir area smaller than 3 km².

[3] Available at: <http://earth.google.com/>. Accessed on July 5th, 2011.

[4] ANEEL is the entity responsible for the regulation and supervision of the electricity generation, transmission, distribution and commercialization. In addition, ANEEL mediate the interest among the agents of the electricity sector and consumers. ANEEL also grants authorizations, permissions and concessions for electric energy services (generation, transmission and distribution). Detailed information is presented at ANEEL's website: <http://www.aneel.gov.br/>.

[5] ANEEL. Agência Nacional de Energia Elétrica. Resolution nr. 394 issued on December 4th, 1998. Available at: <http://www.aneel.gov.br/cedoc/RES1998394.PDF>.

However, ANEEL Resolution nr. 652/2003[6] presents other criteria to classify utilities with installed capacity between 1 MW to 30 MW, whose reservoir areas are greater than 3 km^2. Therefore, only plants under ANEEL classification of small hydropower plants will be considered and included in this PoA independently of the installed capacity and reservoir area.

The technology to be employed in the small hydropower plants of this PoA is based on hydraulic turbines. There are many types of hydraulic turbines. The main types are Francis, Kaplan and Pelton (Figure 2); depending on the project waterfall and water flow, the type of turbine that better fits to the project design will be chosen.

Figure 2 – Examples of Pelton, Kaplan and Francis turbines, respectively

Source: ANEEL (2005)[7]

The technology to be used in the project activities which will be included in this PoA will be detailed in each CPA-DD.

A.4.2.2. Eligibility criteria for inclusion of a CPA in the PoA:

The eligibility criterion for the inclusion of a CPA under this PoA follows the Annex 3 of the 65th EB Meeting Report as presented below:

(a) The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA.

As presented in section A.4.1.2, this Programme of Activities will be implemented within the geographical area of Brazil.

(b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (*e.g.* programme logo).

[6] ANEEL. Agência Nacional de Energia Elétrica. Resolution nr. 652 issued on December 9th, 2003. Available at: <http://www.aneel.gov.br/cedoc/res2003652.pdf>.

[7] ANEEL (2005). Chapter 4 – Hydraulic energy. "Atlas de Energia Elétrica". 2nd edition. Agência Nacional de Energia Elétrica. Available at: <http://www.aneel.gov.br/aplicacoes/Atlas/download.htm>. Accessed on July 7th, 2011.

In the case of this PoA, no programme logo is planned to be developed. However, double counting can be avoided through the presentation of the geographical coordinates in each CPA.

(c) The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications.

Only small hydropower plants(s) as defined by ANEEL can be included in the PoA. Therefore, the technology to be employed in the project activity(ies) is based on hydraulic turbines. The technology/measure of the project activity has to be described in the each CPA.

(d) Conditions to check the start date of the CPA through documentary evidence.

Documented evidence of the CPA starting date has to be presented in each CPA. If the starting date of the CPA refers to a future date, documented evidence related to the future date shall be presented during the inclusion process of each CPA.

(e) Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs.

As presented in section E.1, this PoA applies the ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 12.3.0). Therefore, the CPAs have to be in compliance with applicability conditions of ACM0002, as follows:

- *The project activity is the installation of a grid-connected hydropower plant/unit (either with a run-of-river reservoir or an accumulation reservoir) at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant);*
- *In case of hydropower plants, at least one of the following conditions must apply:*
    - *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or*
    - *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per definitions given in the project emissions section, is greater than 4 W/m^2 after the implementation of the project activity; or*
    - *The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity.*
- *In case of hydropower plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project activity all of the following conditions must apply:*

- *The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2;*
- *All reservoirs and hydropower plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant;*
- *The water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;*
- *The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m^2, is lower than 15MW;*
- *The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.*

Furthermore, the project activity cannot involve:

- *Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*
- *Biomass fired power plants;*
- *Hydropower plant that result in new single reservoir or in the increase in existing single reservoir where the power density of the reservoir is less than 4 W/m^2;*
- *Retrofits, replacements, or capacity additions.*

(f) The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality.

As mentioned in section E.5.1, additionality will be assessed in each CPA and will follow the version of methodological tool "Tool for the demonstration and assessment of additionality" (version 6.0.0). Therefore, all CPAs to be included in this PoA have to present the additionality assessment following the above mentioned tool.

(g) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis.

As mentioned in section C.1, the environmental analysis will be conducted at CPA level considering peculiarities of each project activity. Therefore, the environmental impacts and analysis have to be included in each CPA according to the project environmental studies.

In the case of the stakeholder consultation, as described in section D.1, the stakeholder consultation has been conducted at PoA level based on the requirements of the

Brazilian DNA in order to issue the Letter of Approval. Therefore, the local stakeholder consultation does not need to be conducted for the inclusion of CPAs in this PoA.

(h) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of Official Development Assistance (ODA).

The CPA implementer has to confirm that the CPA does not result in a diversion of Official Development Assistance from an Annex I country.

Besides of the criterion presented above, the following criteria have to be satisfied:

(i) The CPA has to include small hydropower plant(s) defined by ANEEL only.

Description on how the project satisfies the definition of small hydropower plants following ANEEL criteria has to be included in the CPA. Documents issued by ANEEL can be used to check this applicability condition.

(j) No energy generating equipment shall be transferred from another activity located in a non-annex I party and no existing equipment shall be transferred from the project to another activity.

The CPA implementer has to confirm that no energy generation equipment is transferred from another activity located in a non-annex I party. Since only new small hydropower plants will be included in the PoA, there is no need to demonstrate that the project does not involve "transfer from an existing equipment of the project to another project activity".

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

According to the "Programme of Activities Design Document Form (CDM-PoA-DD)", the following criteria shall be evaluated:

(i) The proposed PoA is a voluntary coordinated action

As mentioned in section A.2, the proposed PoA is a voluntary coordinated action of the managing entity *EQAO*.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA

In February 2001, the federal state-owned power utility Eletrobrás (Centrais Elétricas Brasileiras S/A) – with the Brazilian Development Bank support (BNDES from the Portuguese *Banco Nacional de Desenvolvimento Econômico Social*) – launched the "PCH-COM" program for

the promotion of electricity generation from small hydropower plant projects (ELETROBRÁS, [--])[8].

However, the program did not draw the attention from project developers since the tariff offered from Eletrobrás was lower than the market tariff. The price offered from Eletrobrás was BRL 67/MWh – the reference price of the so-called "competitive power source" or the average regular power generation addition cost –, but the reference market price of electricity for small hydropower plants at that time was around BRL 83/MWh. Thus, after four months from the program release, no proposal was received and Eletrobrás extended the deadline (CERPCH, [20--])[9].

Law nr. 10,438 dated April 2002 created the Program of Incentives to Alternative Energy Sources (in a free translation from the Portuguese *Programa de Incentivo às Fontes Alternativas de Energia Elétrica – PROINFA*). Among others, one of the initiative's goals was to increase the renewable energy sources share in the Brazilian electricity market, thus contributing to a greater environmental sustainability. In order to achieve such goals, the Brazilian government has designated Eletrobrás to act as the primary off-taker of electric energy generated by entering into long-term Power Purchase Agreements (PPAs) with alternative energy power producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers.

The creation of PCH-COM and PROINFA programs clearly indicates that, without specific support, the renewable sources and small projects would hardly be implemented.

It is worth mentioning that Brazilian Decree nr. 5,025 dated March 30th, 2004, which regulates the Law nr. 10,438/2002, states that PROINFA aims for the reduction of greenhouse gases as established by the United Nations Framework Convention on Climate Change (UNFCCC) under Kyoto Protocol, contributing to sustainable development. Therefore, the program is clearly a "Type E-" policy.

In spite of the government efforts, PROINFA project developers still faced barriers for the projects implementation which caused several delays in the operation starting of power utilities. The main barriers were as follows (MME, 2009)[10]:

- "Nationalization index" (in a free translation from the Portuguese *Índice de nacionalização*): according to the program, project sponsors should guarantee that 60% of the produced equipment and services acquisition involved in the project come from Brazil. However, the criteria and methodology to calculate this index were only published in May 2007 through MME Ordinance nr. 86/2007. Therefore, until the publication of the methodological calculation of this index, there were uncertainties for

[8] ELETROBRÁS ([--]). Conceituação do Programa PCH-COM. Information available at: <http://www.eletrobras.gov.br/EM_Programas_PCH-COM/conceituacao.asp>.

[9] CERPCH ([20--]). Article from the National Centre of Reference in Small Hydropower Plant (Centro Nacional de Referência em Pequenas Centrais Hidrelétricas). Available at: <http://www.cerpch.unifei.edu.br/Adm/materias_1/c6a22e3d8a4492cc067dc370ad1119b6.pdf>.

[10] Available at: <http://www.mme.gov.br/programas/proinfa/galerias/arquivos/apresentacao/PROINFA-ANEXO1-InstitucionalMME.pdf>.

the equipment purchase and for the signature of EPC contracts (especially for wind power projects).

- Equity capital contribution: although project developers had signed PPAs with Eletrobrás as one of the guarantees for financing obtaining, projects hardly started construction considering the lack of equity capital. In addition, financing was difficulty mainly if no great engineering/constructor companies are involved in the societal composition of the project developer.
- Lack of the local equipment supply: the increase in the demand of the external market and the postponement of the criteria to calculate the nationalization index, cause difficulties for (and prevented in some cases) the equipment purchase.
- Barriers for the power utilities connection to the national grid (mainly in the Midwestern and Northeastern region of Brazil).
- New requirements for obtaining and renewal of the environmental licenses (in the case of small hydropower plants, requirements became extremely strict).

The PROINFA was launched in 2004 through the signature of PPAs considering the operation starting in 2006. In case of non-compliance with the terms of the contract (including the electricity delivery), project sponsors should pay to Eletrobrás all the electricity negotiated for the 20 years plus the readjustment (and contractual penalty for losses and damages depending on the case). However, considering the barriers faced by project developers, the government postponed several times the deadline for operation starting of PROINFA projects without penalties.

Until the preparation of this PoA, many projects are still some with construction ceased, under construction or with PPAs cancelled.

According to Law nr. 10,348, the program would be conducted in 2 (two) phases:

a) First phase: PPAs between renewable energy producers and Eletrobrás would be signed until June 30th, 2004 for the implementation of 3,300 MW of installed capacity from power utilities with operations starting until December 30th, 2008;

b) Second phase: after achieving 3,300 MW, the goal would be the achieving of 10% of national total consumption by wind, small hydro and biomass projects. This goal would be achieved in 20 years.

The first phase of PROINFA was in fact conducted in 2004, through two public calls for projects selection on April 6th and October 5 th, however, there is no indication when the second phase will be carried out.

Another initiative from the Brazilian government for the promotion of renewable energy projects was the conduction of the 1st Energy Auction for Alternative Sources (from the Portuguese *Leilão para Fontes de Energia Alternativa - LFA*) in 2007. Thus, non-fossil fuel projects participated in this auction and renewable energy projects could compete with each other. However, the results of this auction were not satisfactory since few energy was negotiated. The

results of the auction demonstrated the disinterest from project developers and made clear the necessity of strong incentives to promote renewable energy.

The 2nd Energy Auction for Alternative Sources was held in August 2010, in which five small hydropower plants totalizing 101 MW installed capacity sold energy in the auction (6% from the total 1685.6 MW installed capacity negotiated). The 3rd Reserve Energy Auction (*Leilão de Energia de Reserva – LER*) conducted in August 2010 was also focused on renewable energy projects. In this auction, only two small hydropower plants sold energy (2.5% from the total 1,206.6 MW installed capacity negotiated).

All information (including the results) of the energy auctions conducted by the Brazilian government is publicly available at the Chamber for the Commercialization of Electric Power website ("CCEE" from the Portuguese *Câmara de Comercialização de Energia Elétrica*): <http://www.ccee.org.br/>.

In spite of the government initiatives, according to ANEEL (2011)[11], 67.7% of Brazil's generation is composed by large hydropower plants and 26.5 % of thermal power stations. Only 3 % of Brazil's installed capacity comes from small hydro power sources (3.5 GW out of a total of 114.3 GW).

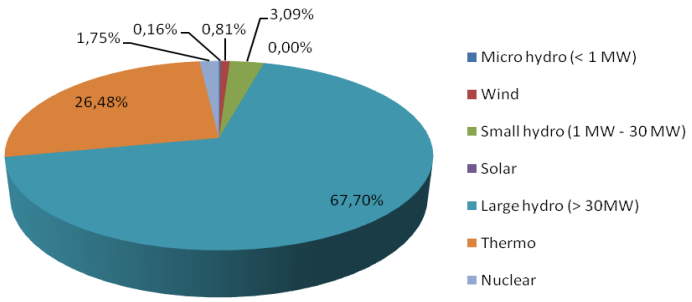

Figure 3 – Operational power projects in Brazil

Source: ANEEL (2011)[12]

The scenario presented in Figure 3 with small participation of electricity from small hydropower plants tends to continue the same. While observing authorizations/concessions granted to power projects construction during the latest three years of information available, it can be noted the increase tendency of the participation of thermo power plants in the Brazilian electricity matrix in comparison to small hydropower plants.

[11] [11] ANEEL (2011). Energy generation database (from the Portuguese *Banco de Informações de Geração – BIG*). Operational power projects in Brazil. The Brazilian Power Regulatory Agency (in a free translation from the Portuguese *Agência Nacional de Energia Elétrica*). Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>. Accessed in May 2011.

[12] ANEEL (2011). Energy generation database (from the Portuguese *Banco de Informações de Geração – BIG*). Operational power projects in Brazil. The Brazilian Power Regulatory Agency (in a free translation from the Portuguese *Agência Nacional de Energia Elétrica*). Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>. Accessed in May 2011.

In 2007, it was authorized the construction of 150 thermo power plants resulting in 5,761 MW (87.3% of the total 6,596 MW installed capacity for 2007). In the case of small hydropower plants, 36 projects only were approved, resulting in approximately 212 MW (3.2% of the total installed capacity authorized)[13].

In 2008, the scenario was the same what occurred in 2007. 371 thermo power plants received authorization to be constructed (resulting in approximately 63% of the total 18,938 MW) against 105 small hydropower plants authorized (1.55% of the total installed capacity authorized in that year)[14].

In 2009, thermo power plants participation increased 63% against 13.5% of small hydropower plants. Therefore, thermo power plants contributed to approximately 24% of the electricity matrix and small hydropower plants with approximately 3%[15].

Considering explanations above, many programs have been created to promote renewable energy projects and, in spite of the government efforts, project developers still face barriers for the implementation of small hydropower plants. These barriers can be evidenced through the results of the energy auctions for alternative sources and the participation of small hydropower plants in the Brazilian electricity matrix. The increase tendency of participation of thermo power plants in the Brazilian electricity matrix is extremely high in comparison to small hydropower plants while observing authorizations and concessions granted for energy projects construction during 2007 to 2009. Therefore, it can be demonstrated that a strong incentive is necessary to promote the renewable energy projects in Brazil, which includes the small hydropower plants. Otherwise, this type of projects would hardly be implemented.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced

The implementation of the project activities of this PoA is not based on or has not been conducted to ensure a mandatory policy/regulation. The Project Participants state that the proposed PoA is a voluntary action by the managing entity.

(iv) If mandatory a policy/regulation are enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Not applicable. As mentioned above, the implementation of the project activities of this PoA is not based on or has not been conducted to ensure a mandatory policy/regulation.

A.4.4. Operational, management and monitoring plan for the programme of activities:

[13] ANEEL (2008). 2007 ANEEL Report. Agência Nacional de Energia Elétrica (ANEEL). Page 70. Available at: <http://www.aneel.gov.br/>.

[14] ANEEL (2009). 2008 ANEEL Report. Agência Nacional de Energia Elétrica (ANEEL). Page 60. Available at: <http://www.aneel.gov.br/>.

[15] ANEEL (2010). 2009 ANEEL Report. Agência Nacional de Energia Elétrica (ANEEL). Page 57. Available at: <http://www.aneel.gov.br/>.

A.4.4.1. Operational and management plan:

The coordinating/managing entity (CME) involved in this PoA is *EQAO*. *EQAO* is responsible for the CDM related matters (development and management of CPAs, validation, approval, verification).

Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA is presented in the "Operational Procedures for the CME of Tucano CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil" and its summarization is presented below:

(i) A record keeping system for each CPA under the PoA

The CME is implementing a record keeping system for the inclusion of CPAs in the proposed PoA, which considers the following information: (a) inclusion date in the PoA, (b) name of the CPA, (c) CDM reference number, (d) name of the project activities involved in the CPA, (e) crediting period (starting and ending dates), (f) name of the plant, (g) location (municipality, state and GPS coordinates), (h) ANEEL authorizing the operation start of the plant, (i) verifications and (j) information if the CPA implementer has provided the declarations required by the CME (required declarations are described in item (ii) below).

CPAs added to "TUCANO CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil"

Inclusion date	Name of the CPA	Ref	Projects	Crediting Period		Plant's information					Comercial	
				Starting date	End date	Name	Location	Geog. Coordinates		ANEEL Ordinance (commercial operation autorization)	Verifications	Declarations of voluntary participation and conformity?
								Latitude (S)	Longitude (W)			
Not available yet	*Jambo Small Hydropower Plant*	*Not available yet*	*Jambo*	*01/jun/2014*	*31/mai/2021*	*Jambo*	*São Sebastião do Alto e Santa Maria Madalena (RJ)*	*21º59'37" S*	*42º06'59" W*	*Not available yet*	*Not available yet*	*YES*

Figure 4 – CME's record keeping system for the inclusion of CPAs in "TUCANO CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil"

The CME's record keeping system presented above will ensure that all project(s) included in the CPAs considered in this PoA will be uniquely defined, thereby avoiding double counting of the emission reductions in this PoA. This will be made possible principally through the identification of the power plants location (state, municipality and geographic coordinates).

This record keeping system will be updated by the CME every time a CPA is included in the proposed PoA according to the CDM Executive Board's approval e and as presented at the UNFCCC's website. It is important to mention that during this update, proposals for improvements in the PoA management system can be put forward.

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA

Besides of the record keeping system presented in item (i) above, for the inclusion of CPAs in the proposed PoA, the CME is implementing a database to avoid double accounting at the time of the inclusion of a new CPA. This database considers the information presented at the UNFCCC's website regarding Brazilian registered CDM Programme Activities as well as Brazilian CDM Project Activities. Since only small hydropower plants will be included in the proposed PoA, only Brazilian registered CDM projects under scope 1 – energy industries (renewable / non-renewable sources) and which apply ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and AMS-I.D "Grid connected renewable electricity generation" are considered in the database.

Although the proposed PoA applies ACM0002 methodology, AMS-I.D registered projects will be also considered and analyzed in the CME's database since small hydropower plants can have installed capacities lower than 15 MW in Brazil[16].

Registered CDM Project Activites under UNFCCC (ACM0002)

as of 26/01/2012

Registere	Title	Type	Methodolog	Ref	Host Partie
2/out/06	Cachoeira Encoberta and Triunfo Small Hydroelectric Power Plants - Brascan Energética	hydro	ACM0002 ver. 5	0520	Brazil
2/out/06	Passo do Meio, Salto Natal, Pedrinho I, Granada, Ponte and Salto Corgão Small Hydroele	hydro	ACM0002 ver. 5	0519	Brazil
15/dez/06	Repowering Small Hydro Plants (SHP) in the State of São Paulo, Brazil	hydro	ACM0002 ver. 6	0489	Brazil
15/dez/06	ARAPUtanga Centrais ELétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Projec	hydro	ACM0002 ver. 5	0530	Brazil
28/dez/06	Osório Wind Power Plant Project	wind	ACM0002 ver. 6	0603	Brazil

Figure 5 – CME's database for the registered CDM Project Activities under ACM0002 in Brazil (partially presented)

Registered CDM Project Activities under UNFCCC (AMS-I.D.)

as of 26/01/2012

Registere	Title	Type	Methodolo	Ref	Host Partie
22/jan/06	UTE Barreiro S.A. Renewable Electricity Generation Project	biomass	AMS-I.D. ver. 6	143	Brazil
11/fev/06	Koblitz - Piratini Energia S. A - Biomass Power Plant – Small Scale CDM Project	biomass	AMS-I.D. ver. 7	228	Brazil
11/fev/06	CAMIL Itaqui Biomass Electricity Generation Project	biomass	AMS-I.D. ver. 7	231	Brazil
26/fev/06	Pesqueiro Energia Small Hydroelectric Project (PESHP)	hydro	AMS-I.D. ver. 7	242	Brazil
22/abr/06	BT Geradora de Energia Elétrica S. A. – Ferradura Small Hydro Power Plant – Small Scale (	hydro	AMS-I.D. ver. 7	229	Brazil

Figure 6 – CME's database for the registered CDM Project Activities under AMS-I.D in Brazil (partially presented)

[16] According to the current Brazilian legislation, small hydropower plants can have installed capacities from 1 MW to 30 MW. ANEEL Resolution nr. 394/1998 and ANEEL Resolution nr. 652/2003 can be consulted.

Registered CDM Programme Activities in Brazil, under UNFCCC

as of 26/01/2012

Registere	Title	Type	Methodolog	Ref	Host Partie
29/out/09	Methane capture and combustion from Animal Waste Management System (AWMS) of the	methane cap.	AMS-III.D. ver. 13	2767	Brazil

Figure 7– CME's database for Brazilian registered CDM Programme of Activities

The CME's database presented above will be updated by the CME every time a new CPA is submitted for analysis of its inclusion in the PoA according to the information presented at the UNFCCC's website. It is important to mention that during this update, proposals for improvements in the PoA management system can be put forward.

At the time of the receipt of a proposal to include a CPA under this PoA, the CME will proceed as described below:

(a) The CME will confirm if the proposed project activity is already registered as a CPA under this PoA by analyzing its own record keeping system of registered CPAs;

(b) The CME will confirm if the proposed project is already registered under CDM by analyzing the database of registered CDM Project Activities and CDM Programme of Activities in Brazil;

(c) The CME will check if the proposed project is according to the eligibility criteria for the inclusion of a CPA in the PoA as established in section A.4.2.2 of this PoA;

(d) The CME will establish a relationship with the CPA implementer (through a letter of intent or contract);

(e) The CME will request the signature of the CPA implementer for two declarations:

- Declaration of voluntary participation: confirmation of awareness and agreement with the implied conditions and responsibilities related to this PoA;
- Declaration of conformity: confirmation that the proposed project does not seek registration as a single CDM project or as part of another Programme of Activities.

Therefore, it is the CME's responsibility to ensure that no double accounting will occur together with confirmation from the CPA implementers. The responsibilities for the inclusion of a CPA under the proposed PoA are divided among the CME's departments as described in the "Operational Procedures for the CME of Tucano CDM Programme of Activities for the Promotion of Small Hydropower Plants in Brazil". The system presented in this procedure and summarized above will be conducted by competent personnel and will be peer-reviewed (commercial and technical department).

The CME's system/procedure for the inclusion of new CPAs in this PoA is presented below:

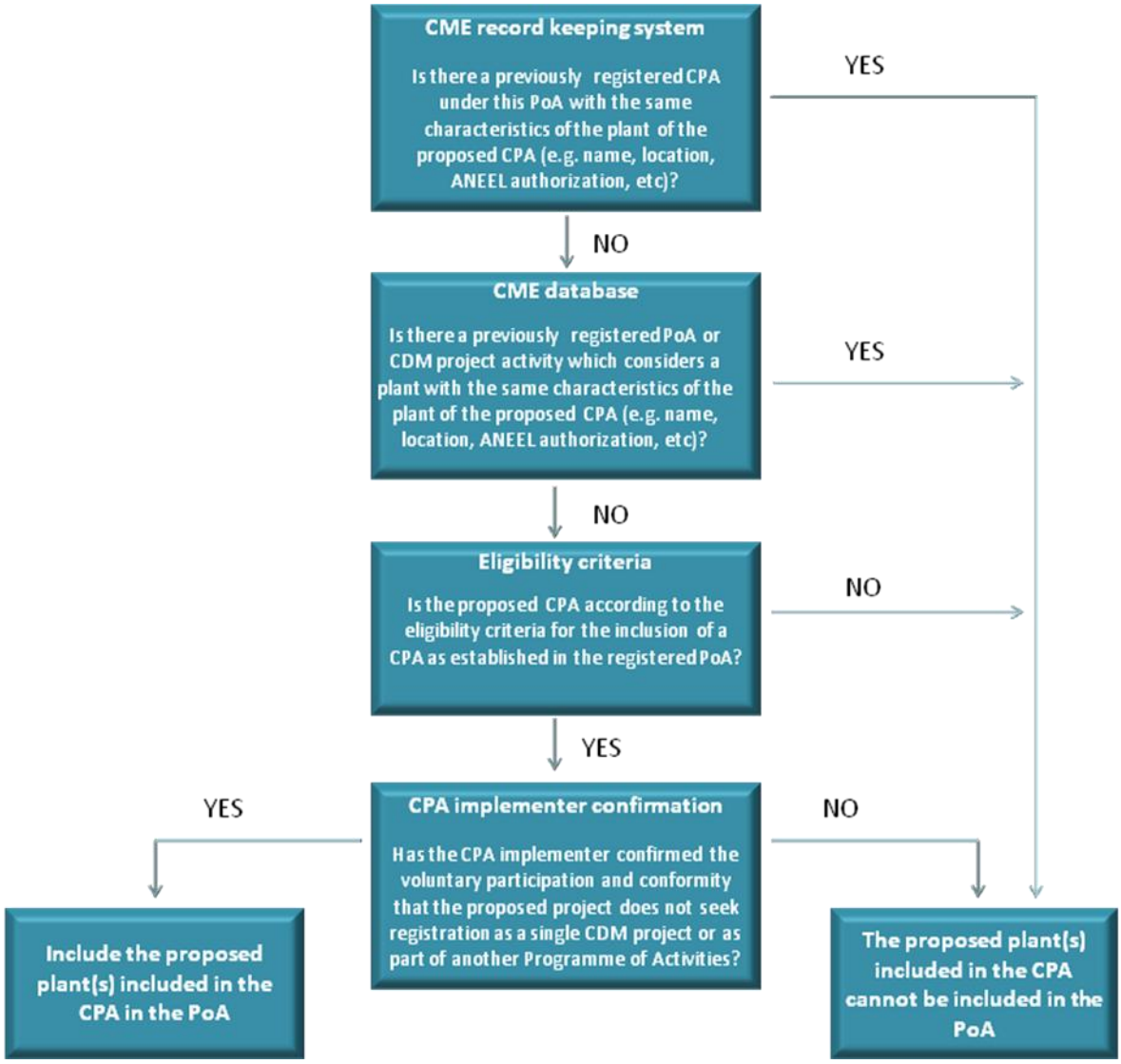

Figure 8 – CME's procedure to avoid double accounting while including new project(s) in the CPA(s) to this PoA

In summary, whenever a new CPA is identified, the information recorded in the CME's recording keeping system regarding its own projects and CME's database related to registered CDM Project Activities and CDM Programme Activities will be consulted. Thus, information regarding the small hydropower plant(s) considered in the new CPA must be compared against the CPAs already added to this proposed PoA and already registered CDM Project Activities and CDM Programme of Activities. If it is confirmed that there are no other project(s) previously added to this PoA or registered under CDM similar to the proposed project(s), the CME will proceed following items (c), (d) and (e) described above. The new CPA shall be included only after pass in the system/procedure presented above.

The system/procedure presented above will ensure that all project(s) included in the CPAs considered in this PoA will be uniquely defined, thereby avoiding double counting of the emission reductions in this PoA.

During the inclusion of the CPA in the PoA, the CPA will be prepared by the CME's technical team and will be reviewed by the CME's technical supervisor.

It is important to mention that under the proposed PoA, training will be carried out for the operation, maintenance and monitoring of the CPAs, which is the CPA implementers' responsibility. However, there will be also internal trainings for the CME's personnel. All documents related to the training will be available in the CME's data server, which will be presented during the audit of the inclusion or verification of CPAs.

All data and information related to the CPAs will be available with the CPA implementers and the CME. All data provided by the CPA implementers to the CME will be recorded in the CME's data server, to which backup is made on a daily basis.

It is important to mention that CPAs will be validated by DOEs at the time of their inclusion in the PoA. This is another confirmation that no double counting will occur in the proposed PoA

(iii) The provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the PoA

To ensure that those operating the CPA are aware of and have agreed that its activity is being subscribed to the proposed PoA, the CPA operator/implementer has to sign a declaration of voluntary participation, stating that it has agreed with the implied conditions and responsibilities.

A.4.4.2. Monitoring plan:

The monitoring of the proposed PoA will be conducted following the ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

CME opts for a verification method that does not use sampling but verifies each CPA. Verification will occur either separately for each CPA or in groups. The record keeping system that will be implemented by the CME will ensure that no double accounting will occur and that the status of verification can be determined anytime for each CPA. Description of the monitoring plan for a typical CPA is presented in section E.7.2 of this PoA.

The monitoring of electricity generation by small hydropower plants follows the procedures established by the National Electric System Operator ("ONS" from the Portuguese *Operador Nacional do Sistema Elétrico*)[17], ANEEL and CCEE.

According to the procedures established by these entities, it will be possible to monitor total electricity exported to the grid. Beyond that, energy information will be controlled in real time by *CCEE*.

[17] ONS is entity responsible for coordinating and controlling the operation of facilities for generation and transmission of electricity in the Brazilian interconnected grid, under the supervision and regulation of ANEEL.

Since the measurement points are physically defined and the invoice measurement system and the communication infrastructure will be installed, the measurement points will be registered in the SCDE (System of Energy Data collection) managed by CCEE. Each measurement point of every small hydropower plant is individually recognized by the system. Thus, information taken from these sources ensures that no double accounting occurs.

A.4.5. Public funding of the programme of activities:

No public funding is involved in the proposed PoA.

This PoA is not a diversion of Official Development Assistance (ODA) from an Annex 1 country.

SECTION B. Duration of the programme of activities

B.1. Starting date of the programme of activities:

22/10/2011.

The starting date of this PoA is the same date of the beginning of the Global Stakeholder Process (GSP).

B.2. Length of the programme of activities:

28 years.

SECTION C. Environmental analysis

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level √

Since small hydropower plant projects have difference impacts during implementation, mainly depending on the project location, a separated description of the environment impacts and their assessment would be more reasonable if conducted at CPA level.

Furthermore, according to the Brazilian legislation, the environmental analysis and the issuance of licenses for power generation utilities are conducted by national or state environmental agency depending on the case. Therefore, the environmental analysis of the project activities will be conducted at CPA level for conservative reasons.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

In Brazil, the sponsoring of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure permits from the relevant environmental agency (federal and/or local, depending on the project).

According to the National Environmental Council ("CONAMA" from the Portuguese *Conselho Nacional do Meio Ambiente*), the following licenses must be obtained in these cases (CONAMA Resolution nr. 237/97[18]):

- The preliminary license (*Licença Prévia* or LP);
- The construction license (*Licença de Instalação* or LI); and
- The operating license (*Licenca de Operação* or LO).

The process starts with a previous analysis (preliminary studies) by the environmental department. After that, if the project is considered environmentally feasible, the sponsors have to prepare the Environmental Assessment.

The result of those assessments is the Preliminary License (LP), which reflects the environmental agency positive understanding about the environmental project concepts.

[18] Available at: http://www.mma.gov.br/port/ conama/res/res97/res23797.html.

In order to obtain the Construction License (LI) it is necessary to present (a) additional information about previous assessment; (b) a new simplified assessment; or (c) the Environmental Basic Project, according to the environmental agency decision informed at the LP.

The Operation License (LO) is a result of pre-operational tests during the construction phase to verify if all demands made by environmental local agency were fulfilled.

The project activities that will be included in this PoA must have or be in process to obtain the necessary licenses required by the Brazilian environmental regulation.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA):

Accordingly to article 3 of CONAMA Resolution nr. 237 dated December 19th, 1997 and Complementary Law nr. 38 dated November 21st, 1995, in order to issue licenses, the Environmental Impact Study (from the Portuguese *Estudo de Impacto Ambiental – EIA*) and the Environmental Impact Report (from the Portuguese *Relatório de Impacto Ambiental – RIMA*) are required for hydropower projects with installed capacity greater than 10 MW. However, according to article 12 of CONAMA Resolution nr. 237, the competent entity (environmental agency of the state or national responsible for the licensing) shall evaluate the significance of impact of the project implementation and the types of studies required for each project:

- EIA/RIMA (mentioned above) or;
- Simplified Environmental Report (from the Portuguese *Relatório Ambiental Simplificado – RAS*).

Considering explanations above, depending on the project (type, size, location, and others), an EIA/RIMA or a RAS can be requested by the environmental agency responsible for the licensing process. However, an impact assessment study will be required anyway and will be presented during the inclusion process of each CPA (if available).

SECTION D. Stakeholders' comments

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level √
2. Local stakeholder consultation is done at CPA level □

Considering the lack of knowledge of future CPAs, the local stakeholder was conducted at PoA level based on the requirements of the Brazilian Designated National Authority "*Comissão Interministerial de Mudanças Globais do Clima*" in order to obtain the Letter of Approval.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

Resolution nr. 9 dated March 20th, 2009 issued by the Brazilian Designated National Authority establishes all the requirements related to the CDM approval process for Programme of Activities. One of the requirements is the invitation for comments from local stakeholders[19] at least 15 days before the validation starting, *i.e.* the starting of the Global Stakeholder Process (GSP). The following stakeholders shall be invited:

- The Executive Secretariat of the Interministerial Commission on Global Climate Change (The Brazilian Designated National Authority);
- Brazilian NGO Forum and Social Movements for Environment and Development;
- National entities whose purposes are directly or indirectly related to the Programme of Activities;
- Federal Attorney General.

Considering the requirement above, letters were sent to the following stakeholders on October 3rd, 2011:

- The Executive Secretariat of the Interministerial Commission on Global Climate Change ("CIMGC" from the Portuguese *Secretaria Executiva da Comissão Interministerial de Mudança Global do Clima*)*;*
- Brazilian NGO Forum and Social Movements for Environment and Development ("FBOMS" from the Portuguese *Fórum Brasileiro de ONGs e Movimentos Sociais para o Meio Ambiente e Desenvolvimento*)*;*
- Brazilian National Reference Center of Small Hydropower Plants ("CERPCH" from the Portuguese *Centro Nacional de Referência em Pequenas Centrais Hidrelétricas*)*;*

[19] Information available at: <http://www.mct.gov.br/upd_blob/0201/201258.pdf>.

- Federal Attorney General (from the Portuguese *Ministério Público Federal*).

The content of the letter to be sent to local stakeholders is presented in Resolution nr. 7 dated March 5th, 2008 issued by the Brazilian DNA. Therefore, letters were prepared according to Resolution nr. 7/2008, informing the link where the PoA, related CPAs and the "Anexo III" report were made available in Portuguese for consultation and for comments. "Anexo III" is a report containing information related to the contribution of the proposed PoA to sustainable development. The link of the United Nations Framework Convention on Climate Change (UNFCCC) website where the PoA and related CPAs would be available for GSP and the contact information of the Project Participants were also included in the letter sent to local stakeholders.

Invitation letters were sent to the stakeholders mentioned above (copies of the letters and post office confirmation of receipt communication will be available upon request and were supplied to the DOE).

D.3. Summary of the comments received:

No concerns were raised in the public calls regarding the project neither in the local (demanded by the DNA) nor in the global stakeholders' process (demanded by the CDM modalities and procedures) until the preparation of this PoA.

D.4. Report on how due account was taken of any comments received:

No concerns were raised in the public calls regarding the project neither in the local (demanded by the DNA) nor in the global stakeholders' process (demanded by the CDM modalities and procedures) until the preparation of this PoA.

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA:

ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 12.3.0)[20].

E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

The ACM0002 is applicable to projects consisting of *"grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s)"*. Therefore, the methodology is applicable to the proposed project activities under this PoA.

Moreover, for hydropower plants that result in new reservoirs, the power density of the power plant shall be greater than 4 W/m^2.

E.3. Description of the sources and gases included in the CPA boundary

As described in ACM0002 methodology "*the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system which the CDM project power plant is connected to*".

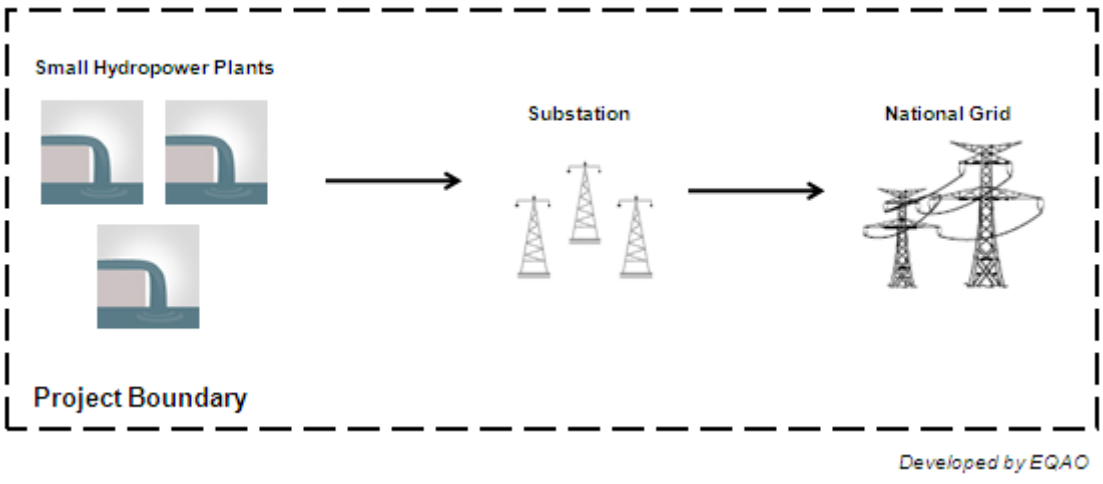

Figure 9 – Project boundary of the CPAs

[20] Available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the below table.

Table 2 – Greenhouse gases and emission sources included or excluded in the project boundary

	Source	Gas	Included ?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	Emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	Yes	Main emission source.
		N_2O	No	Minor emission source.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The CPAs to be included in the proposed PoA correspond to the installation of a new grid-connected small hydro power plant. Therefore, according to ACM0002, the baseline scenario for this option is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered PoA (assessment and demonstration of additionality of CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical CPA:

As per the paragraph 73 of the 47th EB meeting report "*additionality is to be demonstrated either at the PoA level or CPA level*". In the case of this PoA, the additionality will be assessed at the CPA level considering the specific characteristics of each project to be included in the PoA. This assessment follows the steps of the methodological tool "Tool for the demonstration and assessment of additionality": identification of alternatives, investment and/or barrier analysis and common practice analysis as presented below.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulation

Sub-step 1a. Define alternatives to the project activity:

Scenario 1: The alternative to the CPA is the continuation of the current (previous) situation of electricity supplied by the existing power plants from the interconnected system.

Scenario 2: The proposed CPA undertaken without being registered as a CDM project activity.

Sub-step 1b. Consistency with mandatory laws and regulations:

Both alternatives, the CPA and the alternative scenario, shall be in compliance with all regulations in accordance with the following entities: ONS, ANEEL, the Mines and Energy Ministry ("MME" in a free translation from the Portuguese *Ministério de Minas e Energia*), CCEE, the Environmental Agency of the State of the proposed project(s) included in the CPA and the CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

The "Guidelines on the assessment of investment analysis" (version 5) shall be used together with the "Tool for the demonstration and assessment of additionality".

Sub-step 2a. Determine appropriate analysis method

The additionality of a typical CPA will be demonstrated through an investment benchmark analysis (option III). Options I and II are not applicable to typical CPAs to be added to this PoA considering that none of the following applies:

Option I – Both the CDM Programme Activity and the alternatives identified in Step 1 generate financial and economic benefits other than CDM related income.

Option II – The implementation of other project types of renewable energy generation - *i.e.* cogeneration or wind farms - are not potential alternatives in the site where the project is planned.

Sub-step 2b : Option III – Apply benchmark analysis

The financial indicator identified for the project is the Internal Rate of Return (IRR). The IRR will be compared to the appropriate benchmark of the electric sector (in accordance with paragraph 12, Annex 5, EB62), which is the Weighted Average Cost of Capital (WACC) or the Cost of Equity (Ke). Preferably, both indicators (IRR and benchmark) shall be calculated in real terms.

Weighted Average Cost of Capital (WACC)

The weighted-average cost of capital (WACC) is a rate used to discount business cash flows and takes into consideration the cost of debt and the cost of equity of a typical investor in the sector of the project activity. The benchmark can be applied to the cash flow of the project as a discount rate when calculating the net present value (NPV) of the same, or simply by comparing its value to the internal rate of return (IRR) of the project. The WACC considers that shareholders expect compensation towards the projected risk of investing resources in a specific sector or industry in a particular country.

The WACC calculation is based on parameters that are standard in the market, considers the specific characteristics of the project type, and is not linked to the subjective profitability expectation or risk profile of this particular project developer. Once a small hydropower potential is discovered, any corporate entity is able to obtain the authorization from the government to build the small hydropower plant. In addition to that, even after the project proponent obtains such authorization, it can be negotiated/sold afterwards. Therefore, the use a sectorial benchmark is applicable as per the guidance provided in paragraph 13, Annex 5, EB62.

The WACC shall be valid and applicable at the time of the investment decision calculated through the formula below:

$$WACC = Wd \times Kd + We \times Ke, \text{ where:}$$

We and **Wd** are, respectively, the weights of equity and debt typically observed in the sector. The weights shall be derived from the "Guidelines on the assessment of investment analysis"[21], which considers a default value for CDM projects. **Kd** and **Ke** are, respectively, the cost of debt and cost of equity. Detailed explanations related to both calculations are presented below.

→ Cost of Debt (Kd)

Kd is the cost of debt, which is observed in the market related to the project activity, and which already accounts for the tax benefits of contracting debts. **Kd** is also derived from long term loans applied to the sector in Brazil, and therefore is based on three variables, including the interest rates of BNDES financing endeavour credit line. Kd is calculated considering the sum of:

- Financial cost (**a**);
- BNDES remuneration (**b**);

[21] Paragraph 18, EB 62, Annex 5. Available at: <http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf>.

- Credit risk rate (**c**).

The financial cost (**a**) is represented by the Long Term Interest Rate ("TJLP" from the Portuguese *Taxa de Juros a Longo Prazo*). TJLP is a variable market figure which assesses the rate of debt to be applied to the average party borrowing from BNDES. This figure is the underlying majority found in the debt portion of borrowers from the BNDES. The TJLP is based on factors pertaining to market rates and spread of corporate rates over government risk.

BNDES remuneration (**b**) and the credit risk rate (**c**) are two other factors that constitute the rate of debt companies in Brazil encounter via BNDES. The BNDES remuneration is the fee attached by BNDES for its administrative and operational costs, and for its remuneration. This rate varies according to BNDES policies and is non-negotiable and the least arguable rate in the equation. Regarding the credit risk rate, each year BNDES provides the lower and upper limits of the variation margin of that rate. It respects its perception of risks, and the banking policies. For the purposes of our calculation and due to the fact that the industry as a whole is being considered, we estimate that rate by averaging the upper limit of the margin with the rate established for loans to direct public administration of States and Cities, which is the lowest rate that could be provided to a private investor.

Two other components for the **Kd** calculation are the marginal tax rate (**t**) and inflation forecast (π). In the **Kd** calculation, the marginal tax rate (**t**) is multiplied by the Cost of debt and then by the debt to total cost of capital ratio to ascertain the debt portion of the WACC formula. In the case of Brazil, and specifically to energy projects, this tax factor could either be 34% or 0%. This is decided by the specific type of project and tax regime under which it sits.

For the Presumed Profit eligibility, corporate entities revenues must be under Forty eight million Reais per year (Article #13, Law #9.718/1998)[22].

For the Presumed Profit system, 8% of gross sales in addition to financial revenues/earnings is used as basis for the income tax calculation. To this figure a 25% rate is applied resulting in the final income tax value. For the social contribution calculation 12% of gross sales in addition to financial revenues/earnings are used as a basis for the calculation. To this figure a 9% rate is applied resulting in the final social contribution value (As per Article #518 of the Federal Decree #3000, dated 26 March 1999)[23].

[22] Publicly available information in Portuguese at: <http://www.receita.fazenda.gov.br/legislacao/leis/Ant2001/lei971898.htm>.

[23] Publicly available information in Portuguese at: <http://www.receita.fazenda.gov.br/legislacao/leis/L2Parte3.htm>.

Table 3 - – Income Tax and Social Contribution (illustrative calculation)

Income Tax	**$**
Gross Sales	1.000
Presumed Profit for income tax (8%)	80
Financial revenue	500
Total Presumed for income tax	580
Income tax due (app. 25%)	145

Social contribution	**$**
Gross Sales	1.000
Presumed Profit for social contribution (12%)	120
Financial revenue	500
Total Presumed Profit for social contribution	620
Social contribution due (9%)	55.80

Source: KPMG. "Investment in Brazil: tax." (2008)[24]

Therefore, a corporate entity that opts for the presumed profit scheme pays the same rate of income tax and social contribution regardless of its costs, expenses, other cash items such as payable interest and non-cash items such as depreciation, because these elements are not deductable under this system.

The nominal rate achieved for debt is used to calculate nominal WACC, which is used to discount nominal cash flow projections. In order to achieve the real cash flow rate, the inflation targeting figure (π) for Brazil is reduced from the nominal figure achieved. The π is obtained from the Brazilian Central Bank (www.bcb.gov.br) and has experienced very little variance in the past 5 years.

Considering explanations above, **Kd** is calculated through the following equation:

$$\mathbf{Kd = [1 + (a + b + c) \times (1 - t)] / [(1 + \pi) - 1]}$$

→ Cost of Equity (Ke)

Ke represents the rate of return for equity investments , estimated through the Capital Asset Pricing Model (CAPM). The CAPM is one of the most widely accepted models used to determine the required rate of return on equity. The CAPM calculates a newly introduced asset's non-diversifiable risk. CAPM takes into account the asset's sensitivity to non-diversifiable risk, better referred to as beta (**β**). Embedded in the model is also the market premium which can be tracked using historical data from the local or relevant equity market.

For the **Ke** calculation, the following parameters will be used:

- Risk-free rate (**Rf**);
- Equity risk premium (**Rm**);
- Estimated country risk premium (**Rc**);

[24] KPMG. Investment in Brazil: tax. São Paulo: Escrituras Editora, 2008. Publicly available in English at: <http://www.kpmg.com.br/publicacoes/livros_tecnicos/Investment_in_Brazil10_out08.pdf>

- Sectorial risk (**β**).

Rf stands for the risk free rate. The risk-free rate used for **Ke** calculation was a long term bond rate. This bond was issued by the Brazilian government, denominated in US dollars. Therefore the rate includes the Brazilian country risk. There is a higher risk associated to investing in Brazil, or in Brazilian bonds, compared to investing in a mature market such as the United States. This risk is reflected in higher returns expected on Brazilian government bonds compared to the mature markets government bonds. In considering the Brazilian government bond, this premium for a higher risk is captured in our calculations.

In order to adjust the risk-free rate (**Rf**) to the inflation adjusted rate, the expected inflation rate (for the United States) (**π'**) is reduced. For its calculation is considered the 10 Year Treasury Note (^TNX), and the TIPS (Treasury Inflation Protected Securities) are considered for its calculation, which are readily quoted in the US market. The ^TNX index carries inflation on their value while the TIPS is an index without inflation. Subtraction from the chosen period average values from the ^TNX and the TIPS results in the estimated inflation. There is no need to adjust for Brazil's expected inflation when dealing with a hurdle rate in real terms.

Sectorial risk stands for the average sensitivity of comparable companies in that industry to movements in the underlying market. The parameter considered for Sectorial Risk is the beta "**β**" derived from the correlation between returns of US companies from the sector and the performance of the returns of the US market. **β** has been adjusted to the leverage of Brazilian companies in the sector, reflecting both structural and financial risks. **β** adjusts the market premium to the sector.

Rm represents the market premium, or higher return, expected by market participants in light of historical spreads attained from investing in equities versus risk free assets such as government bond rates, investors require a higher return when investing in private companies. The market premium is estimated based on the historical difference between the S&P 500 returns and the long term US bonds returns. The spread over the risk-free rate is the average of the difference between those returns.

Note that in the formula above the factor EMBI+ (Emerging Markets Bond Index Plus), considers as the country risk premium, **Rc**. This factor accounts for the country or sovereign risk embedded in the debt of a country. Assuming that relative to the US risk-free debt market EMBI+ is 0, then Brazil's EMBI+ would calculate for the added or reduced risk relative of Brazils debt markets to the US.

Justification for the EMBI+ addition to the risk-free rate lies in the vast differences between the United States in such factors as credit risk, inflation history, politics, debt markets, and more. Ignoring these differences would result in the incorrect application of relevant environmental factors in the decision-making process of an investor in Brazil.

As mentioned in the **Kd** calculation, in order to achieve the real cash flow rate, the inflation targeting figure (**π**) for Brazil is reduced from the nominal figure achieved from the Brazilian Central Bank.

Considering explanation above, Ke is calculated through the following equation:

$$\mathbf{Ke = [(1 + Rf) / (1 + \pi') - 1] + (\beta \times Rm) + Rc}$$

Each data used to calculate the benchmark will be presented to the DOE. The spreadsheet used for WACC calculation will be available with the Project Participants and will be provided to the DOE.

Financial indicator - Internal Rate of Return (IRR)

As mentioned above, the financial indicator identified shall be the Internal Rate of Return (IRR), which can be the Project IRR or the Equity IRR. The Project IRR can be compared with the WACC and the Equity IRR can be compared with the Cost of Equity (Ke)[25]. The cash flow of each project shall be calculated considering an expected lifetime of 20 years[26].

The table presented below provides a list of the main input values as well as a brief justification for their use. Values used shall be presented in the CPA. Moreover, documents evidencing all input values used to estimate the IRR shall be supplied to the DOE and the IRR calculation spreadsheet shall be attached to the CPA.

Table 4 – Main parameters of the cash flow

Parameter	Justification/source of information used
Installed Capacity (MW)	Preferably based on the project design of the small hydropower plant or ANEEL authorization (if available).
Plant Load Factor (PLF)	As presented in the "Guidelines for the reporting and validation of plant load factors" (Annex 11, EB 48), the PLF shall be defined ex-ante as follows: "*(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval;* *(b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)*".
Energy price (R$/MWh)	The price of the PPA considered in the investment analysis.
Operation costs (BRL/year)	Preferably based on legislation, quotations, previous experience from the project sponsor with other similar project and/or other documented evidence from the project sponsor.
100% TUST or TUSD fee	In each power project, the Tariff for the Use of the Transmission System ("TUST" from the Portuguese *Tarifa de Uso do Sistema de Transmissão*) or the Tariff for the Use of the Distribution System ("TUSD" from the Portuguese *Tarifa de Uso do Sistema de Distribuição*) fee must be applied in Brazil. The choice of

[25] Guidance 12, Annex 5, EB 62. Available at: <http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf>.

[26] Maximum assessment period as recommended by the guidance 3, Annex 5, EB 62. Available at: <http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf>.

	TUSD or TUST fee depends if the power plant is directly or indirectly connected to the electricity connection network (in a free translation from the Portuguese *rede básica de conexão*). However, independently if the project is directly or indirectly connected to the electricity connection network, the fee shall be paid. Electricity producers using renewable sources receive a 50% discount in the TUST and TUSD fee. This discount aims at boosting investments in renewable energy projects and shall be considered as a Type E- policy as defined by Annex 3, EB 22. Additionally, according to this clarification, type E- policies[27] do not need to be considered in the development of the baseline scenario if implemented after 11 November 2001. The reduction in the TUST/TUSD fee was established by ANEEL Resolution nr. 77 dated 18/08/2004[28]. Therefore, the discount is not going to be taken into account.
Investment	Preferably based on quotations from the manufacturers as well as from the EPC services providers.

Sub-step 2c : Calculation and comparison of financial indicators

The Internal Rate of Return (IRR) of the project shall be compared to the benchmark calculated above.

Sub-step 2d: Sensitivity analysis

As required by the Additionality Tool, a sensitivity analysis shall be conducted to demonstrate whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. Therefore, the sensitivity analysis of the project shall be conducted by altering the following parameters:

- Increase in project revenues (energy price and plant load factor/energy assured);
- Reduction in running costs (operation costs and investments).

According to the Guidelines on the Assessment of Investment Analysis "*only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation*". In addition, it states that "*variations in the sensitivity analysis should at least cover a range of +10% and -10%*". Therefore, financial analysis shall be performed based on the criteria established above.

While conducting the sensitivity analysis, in cases which the resulted IRR surpasses the benchmark, an assessment of the probability of the occurrence of this scenario in comparison to the

[27] From paragraph 6.b) of Annex 3, EB 22 Type E- policies are *National and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).*

[28] Available in Portuguese at <http://www.aneel.gov.br/cedoc/ren2004077.pdf>. Accessed on 02/09/2011.

likelihood of the assumptions in the presented investment analysis shall be included and discussed here considering the context of the project activity.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

Not applicable. Additionality will be demonstrated through the investment analysis (Step 2).

SATISFIED/PASS – Proceed to Step 4

Step 4. Common practice analysis

According to the methodological tool "Tool for the demonstration and assessment of additionality":

"Unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), and for measures different from those listed in paragraph 6 the above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region (…)

§6 Measure (for emission reduction activities) is a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework:

(a) Fuel and feedstock switch;
(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);
(c) Methane destruction;
(d) *Methane formation avoidance".*

Considering the measures presented above, the CPA applies option (b) since the project(s) to be considered in the CPA will consist of a switch from grid electricity generation to electricity generation from water source (hydropower plants)[29]. Therefore, only hydropower plants have to be considered in the common practice analysis and only the additionality test is applied.

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Not applicable since the CPAs to be included in the proposed PoA apply option (b) of the measures described in paragraph 6 of the methodological tool "Tool for the demonstration and assessment of additionality". Please refer to the additionality test below.

Sub-step 4b. Discuss any similar options that are occurring:

Not applicable since the CPAs to be included in the proposed PoA apply option (b) of the measures described in paragraph 6 of the methodological tool "Tool for the demonstration and assessment of additionality". Please refer to the additionality test below.

In accordance with paragraph 47 of the additionality tool, the following additionality test has to be applied:

Step 1*: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

The output range of +/-50% of the design output or capacity of the proposed project(s) to be considered in the CPA has to be calculated and presented here.

Step 2*: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1 as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities and projects undergoing validation shall not be included in this step.*

In order to conduct the analysis of Step 2, the definitions of geographical area and output as presented in the methodological tool "Tool for the demonstration and assessment of additionality" have to be used as follows.

(i) Output

The methodological tool "Tool for the demonstration and assessment of additionality" defines "output" as "*goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking)*". Therefore, in the case of this PoA, the output considered is the renewable electricity generated by grid-connected hydropower power plants.

(ii) Applicable geographical area

The methodological tool "Tool for the demonstration and assessment of additionality" states:

> "*Applicable geographical area covers the entire Host Country as a default; if the technology applied in the project is not country specific, then the applicable geographical area should be extended to other countries*".

The technology to be used in the project(s) to be considered in the CPAs is not country specific. Nevertheless, some important aspects regarding the technology have to be considered. Brazil has an

[29] Analogously to the example presented in Annex 8 of the EB 62.

extension of 8,514,876.599 square kilometres[30] (with over 4,000 km distance in the North-South as well as in the East-West axis) and 6 distinct climate regions: sub-tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). Considering the distinct climate conditions, precipitation varies from 500 to more than 3,000 mm/year[31]. These varieties of climate obviously have strong influence in the technical aspects related to hydropower plant implementation *since meteorological events have strong influence in hydrologic process*[32]. As cited by VESELKA (2008) *"climate affects all major aspects of the electric power sector from electricity generation, transmission and distribution system to consume demand for power"*[33].

An evidence of the climate regional distinctiveness can be noted by the spot price value division into sub-markets (South, Southeast/Midwest, Northeast, and North), known as Settlement Price for the Differences ("PLD" from the Portuguese *Preço de Liquidação das Diferenças*). PLD is used to price the purchase and the sale of electricity in the short term market.

Nevertheless, the climate conditions are not the only distinguishing feature among the several Brazilian regions. For the use of the transmission system, the Tariff for the Use of the Distribution System ("TUSD" from the Portuguese *Tarifa de Uso do Sistema de Distribuição*) or Tariff for the Use of the Transmission System ("TUST" from the Portuguese the *Tarifa de Uso do Sistema de Transmissão*) has to be applied. The TUSD/TUST tariff varies depending on the state where the power plant is connected to. TUSD/TUST is established under ANEEL regulation and has strong impact in the financial analysis of a project. Just for reference, from the first semester of 2010, TUSD in São Paulo state (located in the same region of Minas Gerais) was BRL 1.82/kW[34] and BRL 4.64/kW[35] in Minas Gerais state (more than two times higher than São Paulo).

Furthermore, each state has a specific environmental agency responsible for determining the technical standards required to obtain all environmental licenses, with regional regulations and distinct administrative process established by each state region.

Therefore, when evaluating the different climate conditions of each region, the specific environmental regulatory framework of each state, the energy price subdivision per markets and different values of TUSD/TUST applied at each Brazilian state, it's clear that the national territory does not consist of the same "comparable environments" as required by the methodological tool "Tool for the demonstration and assessment of additionality". Undoubtedly, these differences among the Brazilian states (climate, energy price, transmission/distribution costs and environmental legislation) have

[30] Available at: http://www.ibge.gov.br/english/geociencias/cartografia/default_territ_area.shtm.

[31] Public information available at *Instituto Nacional de Metereologia – INMET*'s website. Gráfico de normais climatológicas (1961-1990): <http://www.inmet.gov.br/>.

[32] PINTO, J. A. Climatic indicators study for long term prediction in the river flow of Alto São Francisco basin (in a free translation from the Portuguese *Estudo de indicadores climáticos para a previsão de longo termo de vazões na bacia do Alto São Francisco*). Universidade Federal de Minas Ferais: Belo Horizonte, 2005. Available at: <http://www.smarh.eng.ufmg.br/defesas/20D.PDF>.

[33] VESELKA, T. D. Balance power: A warming climate could affect electricity. Geotimes. Earth, energy and environment news. American Geological Institute: August, 2008. Available at: < http://www.agiweb.org/geotimes/aug08/article.html?id=feature_electricity.html>.

[34] ANEEL Resolution nr. 961 issued on April 6th, 2010. Available at: < http://www.aneel.gov.br/cedoc/atreh2010961.pdf >.

[35] ANEEL Resolution nr. 960 issued on April 6th, 2010. Available at: < http://www.aneel.gov.br/cedoc/atreh2010960.pdf >.

technical, financial and regulatory impacts for the implementation of hydropower plants. Therefore, it is reasonable to consider only projects located in same state of the proposed project(s) to be considered in the CPAs.

***Step 3**: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.*

According to the methodological tool "Tool for the demonstration and assessment of additionality", different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the applicable geographical area and measure applied in the proposed CPAs):

(a) Energy source/fuel

Only electricity generation from water source (hydropower plants) has to be considered in this analysis.

(b) Feed stock

Not applicable.

(c) Size of installation (power capacity):

(i) Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);

(ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);

(iii) Large.

According to the current Brazilian regulation, small scale hydropower plants are defined as plants with installed capacities between 1MW and 30MW and reservoir areas no greater than 3km[236]. Since the project(s) to be included in the CPA is inserted in the context of the Brazilian legislation, it is reasonable to compare the proposed project(s) to be included in the CPAs with other small hydropower plants according to the Host Country definition of small scale power plants (and not to the CDM-EB definition of small scale).

Considering explanations above, no large scale hydropower plants as defined by ANEEL can be considered in this common practice analysis. Therefore, the technology that delivers the same output of the proposed CPAs in the context of the measure and applicable geographical area is the electricity generation by grid-connected small hydropower plants. Large scale hydropower plants have to be considered as having different technology to the proposed project(s) to be included in the CPA.

[36] *ANEEL – Agência Nacional de Energia Elétrica. Resolution nr. 652, issued on December 9th, 2003.*

(d) Investment climate in the date of the investment decision, inter alia:

(i) Access to technology

Small hydropower plants can differ significantly from each other considering the region to be implemented, climate, topography, availability of transmissions lines, river flow regularity, etc. For those reasons alone it is extremely difficult and not reasonable to compare different hydropower potential and plants. Moreover, hydropower plants cannot be optimally placed (close to load centers and transmission lines) and easily transferred (moved to a new region where a better tariff is offered) as, for example, modular fossil-fuel-fired (diesel, natural gas) power plants. Differences may be even larger if no big water storage is possible, as in the case of small hydropower plants.

Therefore, depending on the project location, differences related to the technical aspects of small hydropower plant projects have influence in their implementation, even if small hydropower projects are located in the same region. Considering that these technical differences obviously have influence in the investment/financing of a project and project sponsors have different investment capacity, financial information has to be considered when small hydropower projects are analyzed. If financial information or incentives of similar projects is accessible or publicly available, this information has to be used in the analysis following the additionality tool; otherwise, this criterion can be excluded from the common practice analysis.

(ii) Subsidies or other financial flows

If subsidies of other financial flows were identified for other projects (although this information is not always publicly available), they have to be considered as different technologies to the proposed project(s) to be included in the CPA.

(iii) *Promotional policies*

As mentioned in section A.4.3, PROINFA is a Program of Incentives to Alternative Energy Sources launched by the Brazilian government in 2002. This program provides better tariffs through long-term PPAs. Therefore, projects which have been participating in PROINFA cannot be compared with projects which do not receive this type of incentive. Since the project(s) to be included in the CPA do(es) not receive PROINFA incentive, PROINFA projects have to be considered as having different technology to the proposed project(s) to be included in the CPA.

(iv) *Legal regulations*

Electricity sector framework: Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the

government initiated the privatization process. However, by the end of 2000 results were still modest. Although further initiatives, aiming to improve electric generation in the country, were taken between the 1990's and 2003, they did not attract new investment to the sector. In 2003, the recently elected government decided to fully review the electricity market institutional framework in order to boost investments in the electric energy sector. Market rules were changed and new institutions were created such as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética – EPE*) – an institution responsible for the long term planning of the electricity sector with the role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (CCEE) – an institution responsible for the management of electric power commercialization within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[37]. Given the new regulatory framework, the Project Participants have to consider only projects which started operation from April of 2004 onwards. Projects that started operations before the new electricity framework have to be considered as having different technology to the proposed project(s) to be included in the CPA.

(e) Other features, inter alia:

(i) Unit cost of output (unit costs are considered different if they differ by at least 20 %);

As mentioned in "access to technology" item, the Project Participants have to make up their most to make a reasonable comparison although information related to the unit cost of output is not always available.

Outcome: Considering the criteria mentioned above, the Project Participants will consider projects as having the same technology to the proposed project(s) to be included in the CPAs if they are classified as small hydropower plants which are located in the same state of the proposed project(s) and starting operations from April 2004 onwards. Projects which have been receiving PROINFA incentive have to be considered as having different technology to the proposed project(s) to be included in the CPA

Step 4: Calculate factor $F=1- N_{diff} /N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity. The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

The Project Participants have to calculate F and $N_{all}-N_{diff..}$ If the factor F is greater than 0.2 and $N_{all}-N_{diff.}$is greater than 3, then the proposed project(s) to be included in the CPA is considered as "common practice".

[37] http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.848.htm

Spreadsheet with complete research of the common practice analysis has to be presented to DOE during the inclusion process of each CPA.

SATISFIED/PASS – Project is ADDITIONAL

E.5.2. Key criteria and data for assessing additionality of a CPA:

The "Combined tool to identify the baseline scenario and demonstrate additionality" is not applicable for greenfield facilities where the output could be provided by other existing facilities or new facilities that could be implemented in parallel with the CDM project activity. Therefore, the methodological tool "Tool for the demonstration and assessment of additionality" was used.

The key criteria for assessing additionality of a CPA when proposed to be included in the registered PoA are detailed below:

Step 1 – It has to be confirmed that the alternative scenarios presented in section E.5.1 above are the credible and are in compliance with mandatory laws and regulations at the time of the inclusion process of each CPA.

Step 2 – The investment analysis of a typical CPA must be conducted as described above in section E.5.1 in the CDM-PoA-DD. The result shall demonstrate that the IRR of a project is lower than the WACC, thus unequivocally show that the alternative of the project developer is not to invest in the project.

Step 3 – It is not applicable.

Step 4 – The common practice analysis of a typical CPA shall be conducted analysing small hydropower plants implemented within the PoA's boundary, by applying the criteria presented above in section E.5.1. to official and publicly available database (*e.g.* ANEEL database). If any similar option is identified, demonstration of why the existence of a similar project does not contradict the outcome of step2 and/or 3 of the additionality test shall be discussed.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

Emission reductions (ER_y)

According to the selected approved methodology ACM0002, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \textbf{Equation 1}$$

Where:

ER_y = Emission reductions in year y (tCO_2e);

BE_y = Baseline emissions in year y (tCO_2);

PE_y = Project emissions in year y (tCO_2e).

Baseline emissions (BE_y)

Baseline emissions for a typical CPA are determined following the procedures established by the ACM0002 methodology. From the methodology "*Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants*".

The calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows, as recommended by ACM0002, the procedures established in the methodological tool "*Tool to calculate the emission factor for an electricity system*" (version 2.2.1). According to this tool, the Project Participants shall apply six steps in order to calculate the baseline emission factor as further detailed below.

I. Calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$)

STEP 1 - Identify the relevant electricity systems

According to the tool, "*if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

The Brazilian DNA published Resolution nr. 8, issued on May 26th, 2008, defining the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence this figure will be used to calculate the baseline emission factor of the grid.

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

Option I of the tool is chosen, which is to include only grid power plants in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

Dispatch data analysis in not an available option for the calculation of the operating margin since it is only applicable for the *ex-post* vintage. The simple operating margin can only be used where low-cost/must-run resources[38] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normalities for hydroelectricity production. The table below shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. The results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

Table 5 - Share of hydroelectricity generation in the Brazilian interconnected system, 2006 to 2011

Year	Share of hydroelectricity (%)
2006	91.81%
2007	92.79%
2008	88.62%
2009	93.27%
2010	88.77%
2011	91.18%

Source: ONS (2011)[39]

The fourth alternative, an average operating margin, is an oversimplification and does not reflect in any way the impact of the project activity on the operating margin. The use of the dispatch data analysis method is only applicable to the *ex-post* vintage for determining the emission factor, which is not the

[38] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

[39] Operador Nacional do Sistema: Histórico de Geração. Available at <http://www.ons.org.br/historico/geracao_energia.aspx>.

vintage chosen by the Project Participants. Therefore, the simple adjusted operating margin will be used to determine the grid emission factor.

STEP 4 - Calculate the operating margin emission factor according to the selected method

According to the tool "*the simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m)".*

The simple adjusted OM was calculated based on the net electricity generation and a CO_2 emission factor for each power unit – *i.e.* similarly to Option A of the simple OM method – as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y) \cdot \frac{\sum_m EG_{m.y} \times EF_{EL,m,y}}{\sum_m EG_{m.y}} + \lambda_y \cdot \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}} \qquad \textbf{Equation 2}$$

Where,

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y*

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$EF_{EL,k,y}$ = CO_2 emission factor of power unit *k* in year *y* (tCO_2/MWh)

m = All grid power units serving the grid in year *y* except low-cost/must-run power units

k = All low-cost/must run grid power units serving the grid in year *y*

y = The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

Considering that only data on electricity generation and the fuel types used in each of the power units was available, the emission factor was be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as per **Option A2** of the simple OM method. The following formula was used:

$$EF_{EL,m,y} = \cdot \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}} \qquad \textbf{Equation 3}$$

Where,

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

Information used to determine this parameter was supplied by ONS, which is an official source, as recommended by the tool. ONS is a private sector, non-profitable entity, founded on August 26th, 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the National Interconnected Grid under supervision and regulation of the Brazilian Power Regulatory Agency (ANEEL, [--])[40].

STEP 5 - Calculate the build margin (BM) emission factor

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

The sample group of power units *m* used to calculate the build margin shall be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh).

From the most recent consolidated information the $SET_{5\text{-}units}$ are: UTE Linhares, UHE Salto Pilão, UTE Camaçari, UTE Tocantinópolis and UTE Viana. The electricity generated by these set of plants ($AED_{SET\text{-}5\text{-}units}$) in 2010 was 662,143 MWh.

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the

[40] Information available at: <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>. Accessed on July 15th, 2011.

calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh).

Not considering the CDM project activities, in 2010, the Brazilian electricity System generated (AEG_{total}) 465,919,678 MWh. A large number of plants comprise 20% of AEG_{total}. This information ($SET_{\geq 20\%}$) can be checked in the calculation spreadsheet attached to this PoA. The annual electricity generation of $SET_{\geq 20\%}$, corresponding to the parameter $AEG_{SET-\geq 20\%}$, is 93,183,936 MWh.

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample); Identify the date when the power units in SETsample started to supply electricity to the grid. If none of the power units in SETsample started to supply electricity to the grid more than 10 years ago, then use SETsample to calculate the build margin. Ignore steps (d), (e) and (f).

From data presented in items (a) and (b), it can be observed that $SET_{\geq 20\%}$ is greater than $SET_{5\text{-}units}$. Therefore, SET_{sample} corresponds to $SET_{\geq 20\%}$. The oldest plant comprised in SET_{sample} started to supply electricity to the grid in January 1998. Hence, steps (d), (e) and (f) of the tool are applicable.

(d) Exclude from SETsample the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set (SETsample-CDM) the annual electricity generation (AEGSET-sample-CDM, in MWh).

Plants which have started to supply electricity to the grid more than 10 years ago were excluded. Four registered CDM Projects were included in the SET_{smaple}. The electricity generation by resultant set of plants, corresponds to the parameter $AEG_{SET\text{-}sample\text{-}CDM}$, is 74,902,471MWh.

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (*i.e.* AEGSET-sample-CDM $\geq 0.2 \times$ AEGtotal), then use the sample group SETsample-CDM to calculate the build margin. Ignore steps (e) and (f).

From the results presented above, $AEG_{SET\text{-}sample\text{-}CDM}$ is lower than AEG_{total}. Then, steps (e) and (f) were applied.

(e) Include in the sample group SETsample-CDM the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set (SETsample-CDM->10yrs).

Five power plants that started to supply electricity to the grid more than 10 years ago were

included. The resultant set $SET_{sample\text{-}CDM\text{->}10yrs}$ is identified in the grid emission factor calculation spreadsheet.

The build margin was calculated following the same approach described above in step 4, and considering the set of plants identified above. Please refer to the spreadsheet attached to the PoA for the calculations.

From the result of the sample group of power units *m*, the BM is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{Equation 4}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh);

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh);

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year *y* (tCO_2/MWh);

m = Power units included in the build margin;

y = Most recent historical year for which power generation data is available.

The CO_2 emission factor of power unit m in year *y* ($EF_{EL,m,y}$) parameter is calculated as determined as per the guidance in step 4 (a) for the simple OM, using options A1, A2 or A3. The build margin was calculated following the same approach described above in step 4, *i.e.* Option A2.

In terms of vintage, **option 1** is chosen. In this sense, the build margin was calculated using the most recent information available on units already built for sample group *m* at the time of PoA-DD submission to the DOE, *i.e.* 2010.

STEP 6 – Calculate the combined margin (CM) emission factor

The calculation of the combined margin (CM) emission factor is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with

less than 10 registered CDM projects at the starting date of validation; and

- The data requirements for the application of step 5 above cannot be met.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad \textbf{Equation 5}$$

Where,

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh);

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh);

w_{OM} = Weighting of operating margin emissions factor (%);

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

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period,6 unless otherwise specified in the approved methodology which refers to this tool.

Since all projects to be considered in this PoA are small hydropower plant projects, the weights used for the operating and build margin are 0.50 for both.

(b) Simplified CM

The combined margin is calculated using equation 4 above with the following conditions:

- $w_{BM} = 0$;
- $w_{OM} = 1$.

Under the simplified CM, the operating margin emission factor ($EF_{grid,OM,y}$) must be calculated using the average OM (option (d) in step 3 of the "Tool to calculate the emission factor for an electricity system).

As presented in Step 3, the operating margin emission factor was calculated based on the simple adjusted OM and, therefore, this option is not applicable to the proposed PoA.

II. Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity ($EG_{PJ,y}$)

According to ACM0002, the calculation of $EG_{PJ,y}$ is different depending on the case of the project as follows:

(a) Greenfield plants (installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity);

(b) Retrofits and replacements of an existing renewable energy power plant;

(c) Capacity addition to an existing renewable energy power plant.

The CPAs to be added to this PoA in the future may consist of new small hydropower plants only and, therefore:

$$EG_{PJ,y} = EG_{facility,y} \qquad \textbf{Equation 6}$$

Where,

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh).

The quantity of net electricity generation supplied by the project' plant to the grid in year *y* ($EG_{faciclity,y}$, in MWh) is determined, for the purpose of ex-ante estimative as being equal to the installed capacity of each plant multiplied by the plant load factor and by the number of hours in which the plant is forecasted to be operational during year *y*.

However, the energy exported to the grid by the power plants is commonly calculated by the assured energy (in MW- ave) of projects, which is the result of the multiplication of the installed capacity and the PLF.

The assured energy (from the Portuguese *energia assegurada*) of a hydropower plant is calculated based on hydrological data, height of the dam and efficiency of turbine/generator/transformer. It represents the electricity to be dispatched to the grid by a power plant and, therefore, it constitutes the quantity of electricity available for commercialization (the sale of electricity cannot surpass the assured energy of a project).

According to ANEEL (2005)[41], "*the assured energy is associated to the estimated long-term operational conditions of power plants, assuming a specific risk of electricity supply (deficit) mainly when electricity generation is related to hydrologic variability whose hydropower plants are subjected to…for the assured energy calculation, it is considered the forced/programmed unavailability*".

[41] Information available at ANEEL's website: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/energiaassegurada.asp>.

It is important to mention that the assured energy of a power plant is not freely determined by project sponsors, but it has to be calculated according to the methodology established by the Brazilian Power Regulatory Agency ("ANEEL" in a free translation from the Portuguese *Agência Nacional de Energia Elétrica*)[42].

In the Brazilian electricity sector, the assured energy is always used to estimate the electricity to be dispatched to the grid of a power plant.

Project emissions (PE_y)

According to ACM0002, *for most renewable power generation project activities, PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:*

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{Equation 7}$$

Where,

PE_y = Project emissions in year y (tCO_2e);

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2);

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e);

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e).

Emissions from fossil fuel combustion ($PE_{FF,y}$)

According to the methodology, only geothermal and solar thermal projects have to account emissions from the consumption of fossil fuels. Therefore, in the case of the proposed CPA, $PE_{FF,y}$ = 0 tCO_2.

Emissions from the operation of geothermal power plants due to the release of non-condensable gases ($PE_{GP,y}$)

Considering that the CPA to be considered in the context of the proposed PoA consists of the construction of small hydropower plants, there are no emissions related to non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y}$ = 0 tCO_2.

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

[42] Detailed explanation related to assured energy is available at: <http://www.aneel.gov.br/arquivos/pdf/caderno3capa.pdf>.

According to ACM0002, new hydropower projects that result in new single or multiple reservoirs, shall account for project emissions as follows:

a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000} \qquad \textbf{Equation 8}$$

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs of hydropower plant in year *y* (tCO_2e);

EF_{Res} = Default emission factor for emissions from reservoirs of hydropower plants, and the default value as perEB23 is 90 Kg CO_2e/MWh;

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).

b) If power density (*PD*) of the project is greater than 10W/m^2, $PE_{HP,y}$ = 0 tCO_2.

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad \textbf{Equation 9}$$

Where:

PD = Power density of the project activity, in W/m^2;

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W);

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero;

A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2);

A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

Leakage calculation (LE_y)

According to the methodology, "*no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected".* Therefore, leakage emissions related to the implementation of the proposed project activity are 0 tCO_2.

Emission Reductions (ER_y)

As per the explanations provided above emission reductions is equal to the baseline emissions minus project emissions and leakage. For detailed calculation procedures to be applied in each CPA, please refer to section E.6.2. below.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:

Emission reductions (ER_y)

According to the selected approved methodology ACM0002, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \textbf{Equation 10}$$

Where:

ER_y = Emission reductions in year y (tCO_2);

BE_y = Baseline emissions in year y (tCO_2);

PE_y = Project emissions in year y (tCO_2e).

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \qquad \textbf{Equation 11}$$

Where,

BE_y = Baseline emissions in year y (tCO_2);

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh);

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an

electricity system" (tCO_2/MWh).

I. Calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$)

STEP 1 - Identify the relevant electricity systems

Following Resolution nr. 8, issued by the Brazilian DNA on May 26th, 2008, the Brazilian Interconnected Grid corresponds to the system to be considered. It covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest) as presented in the figure below.

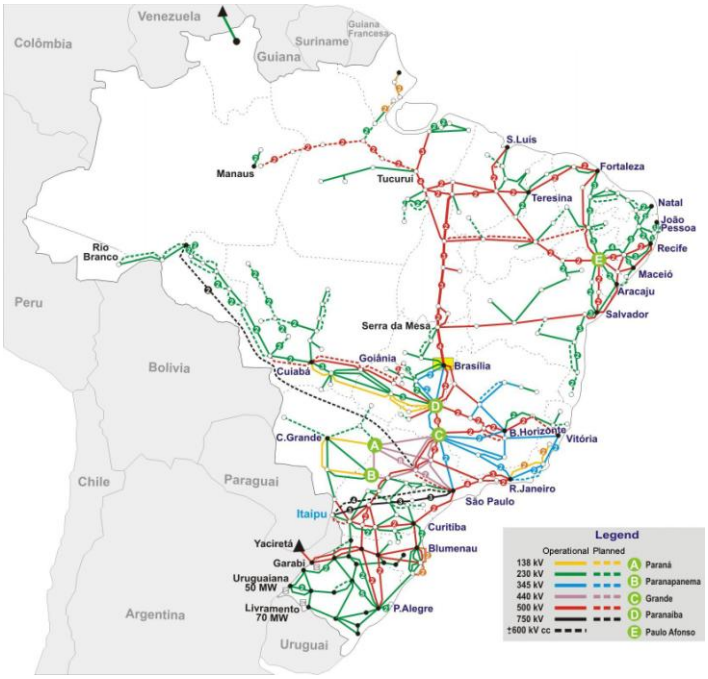

Figure 10 – Brazilian Interconnected System

Source: ONS (2011)[43]

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

Option I was chosen and only grid connected power plants were considered.

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

The simple adjusted operating margin was chosen method for the calculation of this parameter. Please refer to section E.6.1. for the proper justification.

[43] ONS (2011). Mapas do SIN. Available at < http://www.ons.org.br/conheca_sistema/mapas_sin.aspx>.

STEP 4 - Calculate the operating margin emission factor according to the selected method

A spreadsheet containing all data used to determine the operation margin was supplied to the DOE. The result is presented below.

$$EF_{grid,OM\text{-}adj,y} = 0.2609\ tCO_2e/MWh$$

STEP 5 - Calculate the build margin (BM) emission factor

The build margin was calculated following the same approach described above in step 4. This parameter will be validated since the *ex-ante* option was chosen. The sample group of power units *m* used to calculate the build margin are identified in the spreadsheet supplied to the DOE which is also attached to the PoA-DD.

The result for the build margin emission factor is presented below.

$$EF_{grid,BM,y} = 0.1166\ tCO_2e/MWh$$

STEP 6 – Calculate the combined margin (CM) emission factor

Applying the results presented above in STEPS 4 and 5 above to the Equation 5 presented in section E.6.1. and considering the weights $w_{OM} = 0.5$ and $w_{BM} = 0.5$, we have:

$$EF_{grid,CM,y} = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

$$EF_{grid,CM,y} = 0.5 \times 0.2609 + 0.5 \times 0.1166$$

$$EF_{grid,CM,y} = 0.1887\ tCO_2e/MWh$$

II. Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity ($EG_{PJ,y}$)

As described in section E.6.1, only greenfield projects will be included in the PoA and, therefore, $EG_{PJ,y} = EG_{facility,y}$. The quantity of net electricity generation supplied by the project' plant to the grid in year *y* ($EG_{faciclity,y}$, in MWh) is determined for the purpose of ex-ante estimative as being equal to the assured energy multiplied the number of hours in which the plant is forecasted to be operational during year *y* or as the assured energy multiplied by the number of hours in which the plant is forecasted to be operational during year *y*. The assured energy or the PLF has to follow the "Guidelines for the reporting and validation of plant load factors" as mentioned in section E.6.1.

Project emissions (PE_y)

As explained in section E.6.1, only emissions from water reservoirs of hydropower plants ($PE_{HP,y}$) are applicable to the proposed PoA. Therefore, the power density of each utility considered in the CPAs will be calculated and shall be greater than 4 W/m^2 as required by ACM0002.

If the resulted power density is greater than 4 W/m^2 and less or equal to 10 W/m^2, project emissions will be calculated according to ACM0002. Otherwise, $PE_{HP,y} = 0$.

Leakage emissions (LE_y)

As explained in the above section, there are no sources of leakage emissions associated with the implementation of a typical CPA considered in the context of the proposed PoA. Therefore, $LE_y = 0$.

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydropower plants, this value is zero.
Source of data used:	Project site.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determine the installed capacity based on recognized standards.
Any comment:	The methodology states that this value shall be applied for new hydropower plants.

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.
Source of data used:	Project site
Value applied:	0
Justification of the	Measured from topographical surveys, maps, satellite pictures, etc.

choice of data or description of measurement methods and procedures actually applied:	
Any comment:	The methodology states that this value shall be applied for new hydropower plants.

Data / Parameter:	EF_{Res}
Data unit:	$kgCO_2e/MWh$
Description:	Default emission factor for emissions from reservoirs of hydropower plants.
Source of data used:	Decision by EB23
Value applied:	90 $kgCO_2e/MWh$
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value as presented in ACM0002.
Any comment:	Applicable only if the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2.

Data / Parameter:	$EF_{CO2,m,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PoA-DD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the recommendation of the *"Tool to calculate the emission factor for an electricity system"*. IPCC default values are being used since this information is neither provided by fuel suppliers nor regional and/or local default values are publicly available.

Any comment:	-

Data / Parameter:	$EG_{m,y}$ *and* $EG_{k,y}$
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *m* or *k* in year *y*
Source of data used:	Official publications. Data from the National Electric System Operator was used.
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PoA-DD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the PoA-DD to the DOE for validation (*ex-ante* option).
Any comment:	For methodological choices details, please refer to section E.6.1.

Data / Parameter:	$\eta_{m,y}$
Data unit:	-
Description:	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data used:	Default values provided in Annex 1 of the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PoA-DD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the recommendation of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section E.6.1.

Data / Parameter:	$EF_{grid,OM-adj,y}$
Data unit:	tCO_2/MWh

Description:	Simple adjusted operating margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.2609
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section E.6.1.

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build Margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.1166
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section E.6.1.

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each CPA:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project/unit to grid in year *y*.
Source of data to be	Project activity site.

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined in each CPA-DD.
Description of measurement methods and procedures to be applied:	Continuously measurement and at least monthly recording. Data from electricity meters, which can be checked through sales receipt or by documents from the Chamber of Electric Energy Commercialization (from the Portuguese *Câmara Comercializadora de Energia Elétrica – CCEE*). Electronically archived.
QA/QC procedures to be applied:	Cross check measurement results with sales receipt (records for sold electricity) or internal control (if available). If data from CCEE is made available to check the net electricity of the project and sales receipt can be used to verify the net electricity generated by the project, sales receipt will be used for cross-checking purposes. It may be available the project sponsor internal control at that time of the verification, which can also be used for cross-checking purposes. Equipments used have by legal requirements extremely low level of uncertainty). Frequency and procedure of calibration of electricity meters will be conducted following ONS requirements.
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydropower plant after the implementation of the project activity.
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined in each CPA-DD.
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards. Installed capacity of the power plant will be checked by DOE during verification on-site visit. TAG's equipment and licenses issued by the Environmental Agency of the State will be available at that time. Electronically archived.

QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	To be defined in each CPA-DD.
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc. The reservoir are will be monitored through topographical data in the location of the project activity (made once at the time of the project design) and the reservoir level, which will yearly monitored by project sponsor. Electronically archived.
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	TEG_y
Data unit:	MWh
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*.
Source of data to be used:	Project activity site.
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	To be defined in each CPA-DD.
Description of measurement methods and procedures to be applied:	Continuous measurement and at least monthly recording.

QA/QC procedures:	Equipments used have by legal requirements extremely low level of uncertainty.
Any comment:	Applicable to hydropower project activities with a power density of the project activity (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2.

E.7.2. Description of the monitoring plan for a CPA:

The project activity will proceed according to the "Approved consolidated baseline and monitoring methodology ACM0002" – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

There will be energy meters at the power plants and at the nearest substations to each power plants of the proposed PoA. These substations adjust the tension of the electricity generated by the power plants and dispatch it to the national grid.

Meters located at the plant will measure the gross electricity and meters located at the substation will measure the net electricity of the project activities. The net measurement will be used for invoicing and, also, for emission reduction purposes. The gross measurements are only for internal control and cross-checking data, in case of significant discrepancies (losses share).

It is important to mention that meters located in the substation have to be the ones specified by the Chamber of Electric Energy Commercialization (from the Portuguese *Câmara de Comercialização de Energia Elétrica - CCEE*). CCEE makes feasible and regulates the electricity energy commercialization. In addition, CCEE will have online access to the measurement data from the meters located at the substation.

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

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

Date of completion of the application of the methodology to the project activity study (DD/MM/YYYY): 02/04/2012.

Name of person/entity determining the baseline:

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EQAO is the CME and the project CDM advisor.

Annex 1

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Represented by:	Mrs. Patricia Rosenthal Liebesny
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diverted of an Official Development Assistance (ODA) from an Annex 1 country.

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Annex 3

BASELINE INFORMATION

This section is intentionally left blank.

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Annex 4

MONITORING INFORMATION

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