



VALIDATION REPORT

REGARDING CHANGES FROM THE
PROJECT ACTIVITY AS DESCRIBED IN THE
REGISTERED PDD

ARAPUTANGA CENTRAIS
ELÉTRICAS S.A.

ARAPUTANGA CENTRAIS ELÉTRICAS S.A. – ARAPUCEL –
SMALL HYDROELECTRIC POWER PLANTS PROJECT

Report No: 6162 – 09/16

Date: 201~~01~~/~~10~~25/2011

TÜV NORD CERT GmbH
JI/CDM Certification Program
Langemarckstraße, 20
45141 Essen, Germany
Phone: +49-201-825-3335
Fax: +49-201-825-3290
www.tuev-nord.de
www.global-warming.de



Validation Report on requested changes	Report No. 6162 – 09/16	Rev. No. 10	Date of 1st issue: 2010/12/20	Date of this rev. 201 10/10 25/20 <u>11</u>
Project:	Title: ARAPUtanga Centrais ELétricas S.A. – ARAPUCEL – Small Hydroelectric Power PLants Project		Registration date: 2006-12-15	UNFCCC-No.: 0530
Project Participant(s):	Host party: Brazil - Araputanga Centrais Elétricas S.A; Arapucel Indaiavá S.A; Arapucel Ombreiras S.A		Other involved parties: Japan - The Chugoku Electric Power Co., Inc., Sumitomo Mitsui Banking Corporation	
Applied methodology/ies:	Title: “Consolidated baseline methodology for grid- connected electricity generation from renewable sources”		No.: ACM0002 ver.05	Scope: 01
Requested Changes:	Kind of requested changes <input checked="" type="checkbox"/> From the start <input type="checkbox"/> After implementation		Effective as of: 2003-04-17	Last issuance: 2010-04-09
Revised PDD:	Title: ARAPUtanga Centrais ELétricas S.A. – ARAPUCEL – Small Hydroelectric Power PLants Project		Draft version: 2010-02-18	Final version: 2010-12-17
Validation team / Technical Review and Final Approval	Validation Team: Jochen Schubert Fernando P. Pacheco		Technical review: Inga Köster Ingo Klein	Final approval: Eric Krupp
Validation Opinion:	<p>The changes do not raise concerns with respect to aspects outlined in paragraph 10(c) of EB 48 Annex 66 i.e.</p> <p>a. <input checked="" type="checkbox"/> additionality of the project</p> <p>b. <input type="checkbox"/> scale of the CDM project activity and</p> <p>c. <input type="checkbox"/> applicability and application of the Approved Baseline Methodology under which the project activity has been registered.</p> <p>Thus a <u>request for approval notification</u> of changes from the project activity as described in the registered PDD to the UNFCCC is deemed appropriate, in line with the requirements outlined in EB 48 Annex 66.</p>			
Document information:	Filename: <u>2011_05_11_FValR_NfCh_Arapucel_rev1_track_changes2010_12_20_FValR_NfCh_Arapucel_final</u>			No. of pages: <u>3937</u>

Formatiert: Nummerierung und
Aufzählungszeichen

Abbreviations

ANEEL	Brazilian Electricity Regulatory Agency – Agência Nacional de Energia Elétrica
CA	Corrective Action / Clarification Action
CAR	Corrective Action Request
CCEE	Trading Chamber of Electric Energy – Câmara Comercializadora de Energia Elétrica
CDM	Clean Development Mechanism
CEMAT	Electric Power Plants of Mato Grosso State - Centrais Elétricas do Estado do Mato Grosso
CER	Certified Emission Reduction
CL	Clarification Request
CO₂	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
CP	Certification Program
DNA	Designated National Authority
EB	CDM Executive Board
FAR	Forward Action Request
GHG	Greenhouse gas(es)
KW	Kilowatt
MW	Megawatt
PDD	Project Design Document
QC/QA	Quality control/Quality assurance
UNFCCC	United Nations Framework Convention on Climate Change
VVM	Validation and Verification Manual



Table of Contents	Page
1 OBJECTIVE / SCOPE	55
2 DESCRIPTION OF THE PROJECT AND REQUESTED CHANGES	66
2.1 Project Characteristics	66
2.2 Involved Parties and Project Participants	77
2.3 Project Location	77
2.4 Technical Project Description	77
2.5 Type of Requested Changes	99
2.6 Description of requested changes	99
2.7 Impact of changes on the ability to deliver emission reductions	1141
3 METHODOLOGY AND VALIDATION SEQUENCE.....	1313
3.1 Validation Steps	1313
3.2 Appointment of team members and technical reviewers	1414
3.3 Review of Documents	1414
3.4 Follow-up Interviews	1515
3.5 Resolution of Clarification and Corrective Action Requests	1515
3.5.1 Definition	1515
3.5.2 Draft Validation	1616
3.5.3 Final Validation	1616
3.6 Technical review	1616
3.7 Final approval	1717
4 VALIDATION FINDINGS	1818
5 VALIDATION ASSESSMENT SUMMARY	2626
6 VALIDATION OPINION	3129
7 REFERENCES	3230
ANNEX 1: ASSESSMENT OF FINANCIAL PARAMETERS.....	3634
ANNEX 2: ASSESSMENT OF BARRIER ANALYSIS	3735

1 OBJECTIVE / SCOPE

ARAPUTANGA CENTRAIS ELÉTRICAS S.A. has commissioned the TÜV NORD JI/CDM Certification Program (CP) to carry out the verification of 3rd monitoring period of the project

“ARAPutanga Centrais ELétricas S.A. – ARAPUCEL – Small Hydroelectric Power Plants Project”

In the context of this verification the need was identified to carry out a *validation regarding changes from the project activity as described in the registered PDD*. A corresponding FAR has been raised in the verification report¹.

This specific report covers the validation regarding changes from the project activity as described in the registered PDD with regard to the relevant requirements for CDM project activities (esp. EB 48 Annex 66 / 67). The purpose of a validation regarding changes is to have an independent third party assess whether the project is still in compliance with the

- approved CDM Methodology under which it was registered; esp. w.r.t. the applicability criteria,
- category of the CDM project activity,
- CDM additionality requirements.

The validation scope is given as a thorough independent and objective assessment to ensure that the CDM project activity still meets all relevant and applicable CDM criteria after the implementation of changes of the project design, as described in the registered PDD.

¹ <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1152891235.76/iProcess/RWTUV1232106837.71/view>

2 DESCRIPTION OF THE PROJECT AND REQUESTED CHANGES

2.1 Project Characteristics

Essential data of the project is presented in the following Table 2-1.

Table 2-1: Project Characteristics

Item	Data
Project title	ARAPutanga Centrais ELétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project
Project size	<input checked="" type="checkbox"/> Large Scale <input type="checkbox"/> Small Scale
Project Scope (according to UNFCCC sectoral scope numbers for CDM)	<input checked="" type="checkbox"/> 1 Energy Industries (renewable- /non-renewable sources)
	<input type="checkbox"/> 2 Energy distribution
	<input type="checkbox"/> 3 Energy demand
	<input type="checkbox"/> 4 Manufacturing industries
	<input type="checkbox"/> 5 Chemical industry
	<input type="checkbox"/> 6 Construction
	<input type="checkbox"/> 7 Transport
	<input type="checkbox"/> 8 Mining/Mineral production
	<input type="checkbox"/> 9 Metal production
	<input type="checkbox"/> 10 Fugitive emissions from fuels (solid, oil and gas)
	<input type="checkbox"/> 11 Fugitive emissions from production and consumption of halocarbons and hexafluoride
	<input type="checkbox"/> 12 Solvents use
	<input type="checkbox"/> 13 Waste handling and disposal
	<input type="checkbox"/> 14 Afforestation and Reforestation
	<input type="checkbox"/> 15 Agriculture
Applied Methodology	ACM0002 ver.5
Technical Area(s)	S: Renewables Hydro
CDM registration No.	0530
Crediting period	<input checked="" type="checkbox"/> Renewable Crediting Period (7 y) <input type="checkbox"/> Fixed Crediting Period (10 y)

2.2 Project Verification History

Essential events since the registration of the project are presented in the following Table 2-2.

Table 2-2: Project verification history

#	Item	Time	Status
1	Date of registration	2006-12-15	-
2	Start of crediting period ²	2002-09-01	-
3	1 st Monitoring period	2002-09-01 to 2006-12-31	Issued on 2007-10-22
4	2 nd Monitoring period	2007-01-01 to	Issued on 2008-11-

² As per the registered PDD (version 1)

#	Item	Time	Status
		2007-12-31	19
5	3 rd Monitoring period	2008-01-01 to 2008-12-31	Issued on 2010-04-09

2.3 Involved Parties and Project Participants

The following parties to the Kyoto Protocol and project participants are involved in this project activity (Table 2-3).

Table 2-3: Project Parties and project participants

Characteristic	Party	Project Participant
Host party	Brazil	Araputanga Centrais Elétricas S.A; Arapucel Indiavaí S.A ; Arapucel Ombreiras S.A
Other involved party/ies	Japan	The Chugoku Electric Power Co. Inc., Sumitomo Mitsui Banking Corporation

2.4 Project Location

The details of the project location are given in table 2-4:

Table 2-4: Project Location

No.	Project Location
Host Country	Brazil
Region:	Jauru city located in the Mato Grosso state
Project location address:	No. 2350, Barão de Melgaço District of Jauru
Latitude SHP Antônio Brennand:	15° 02' 47" S
Longitude SHP Antônio Brennand:	58° 45' 09" W
Latitude SHP Indiavaí:	15° 15' 49" S
Longitude SHP Indiavaí:	58° 43' 12" W
Latitude SHP Ombreiras:	15° 02' 23" S
Longitude SHP Ombreiras:	58° 44' 03" W

2.5 Technical Project Description

The project comprehends the operations of three run-of-river hydroelectric projects located on the Jaurú river (part of Paraguay basin), near the town of Araputanga and Jaurú, Mato Grosso state, Brazil and operated by Brennand Energia Group.

The name of SHP Alto Jauru was altered to Antônio Brennand according to ANEEL Resolution No. 618 dated 2003/11/25^{/RES-618/}. In this validation report regarding changes from the project activity as described in the registered PDD the new name is applied.

The generated electricity is supplied to the national grid through a local dispatcher called CEMAT – Centrais Elétricas do Mato Grosso, the buyer/distributor of electricity. Additionally, CCEE (Brazilian Chamber of Electricity Energy Commercialization) controls and monitor the electricity available in the grid. The expected life time of the project is 25 years.

The key parameters for the project are given in table 2-4:

Table 2-5: Technical data of the plants

SHP Antônio Brennand	
Turbines	
Type	VA Teck Hydro Brasil
Quantity	2
Nominal Power	10.307 kW each X 2 = 20.614 kW total
Rotation	327.27 each
Serial Numbers	(a) 040100 (b) 040101
Generators	
Type	Toshiba TAKL
Quantity	2
Nominal Power	12.2 MVA each X 2 = 24.4 MVA total
Capacity factor	0.9
Frequency	60 Hz
Rotation	327.3 each
Serial Numbers	(a) 0120081100 (b) 0120081101
Generator's installed capacity of the plant	21.960 kW
ANEEL's authorized electricity generation capacity of the plant ^{/ANEELab/}	21.960 kW

SHP Indiavaí	
Turbines	
Type	VA Teck Hydro Brasil
Quantity	4
Nominal Power	7.500 kW each X 4 = 30.00 kW total
Rotation	327.27 each
Serial Numbers	(c) 1-020201 (d) 2-020201 (e) 3-020201 (f) 4-020201



Generators	
Type	Toshiba TAKL
Quantity	4
Nominal Power	7.78 MVA each X 4 = 31.12 MVA total
Capacity factor	0.9
Frequency	60 Hz
Rotation	327.3 each
Serial Numbers	(c) 0210061100 (d) 0210061101 (e) 0210061102 (f) 0210061103
Generator's installed capacity of the plant	28.008 kW
ANEEL's authorized electricity generation capacity of the plant ^{/ANEEL/}	28.000 kW

SHP Ombreiras	
Turbines	
Type	Alstom Kaplan – Type S
Quantity	2
Nominal Power	13.505 kW each X 2 = 27.01 kW total
Rotation	300 each
Serial Numbers	(g) 000021 (h) 000037
Generators	
Type	Alston – SOH 333/59/24
Quantity	2
Nominal Power	14.500 MVA each X 2 = 29.00 MVA total
Capacity factor	0.9
Frequency	60 Hz
Rotation	300 each
Serial Numbers	(g) TBTG0064 (h) TBTG0065
Generator's installed capacity of the plant	26.100 kW
ANEEL's authorized electricity generation capacity of the plant ^{/ANEELo/}	26.000 kW

2.6 Requested changes

2.6.1 Type of Changes

The “Procedure for notifying and requesting approval of changes from the project activity as described in the registered PDD” distinguishes 2 situations as per table 2-6:

Table 2-6: Type of changes – implementation stage

Category	Implementation stage
a	Changes occur from the start of the project activity, i.e. the project has never been implemented in accordance with the description in the registered PDD
b	Permanent changes occur after the project activity has been implemented in accordance with the description in the PDD and issuance of CERs has taken place.

The changes within this project activity fall under category a).

2.6.2 Description of requested changes

The validation addresses the following change from the registered PDD:

- 1) The operational capacity of the Antônio Brennand (former Alto Jauru) hydropower plant was increased from 20 MW to 21.96 MW with the utilization of the existing hydraulic turbine service factor and existing generator capability curve. In 17 April 2003 ANEEL authorized the increase of the operational capacity^{/ANEELab/}.
- 2) The total installed capacity of the project considering the three hydropower plants was also altered in consequence of the increase in the installed capacity of the Antônio Brennand plant; from 74 MW to 75.96 MW.
- 2)3) Rotational speed of the turbines was corrected or added respectively to the revised PDD for all plants. At Indiavaí hydropower plant 4 generators with a lower power rating (7.78MVA) were installed instead of 2 generators (17.5 MW) as foreseen in the registered PDD.

The changes are described in detail in the revised PDD and the supporting documents.

The key parameters for the requested changes are given in table 2-7:

Table 2-7: Technical data of the increased installed capacity and corrected technical description of the turbines and generators

Parameter	Unit	Value
Installed capacity of the Antônio Brennand hydropower plant	MW	21.96
Total installed capacity of the project activity	MW	75.96
<u>Rotational speed of the turbines at Antônio Brennand and Indiavaí hydropower plants</u>	<u>rpm</u>	<u>327.3</u>
<u>Rotational speed of the turbines at Ombreiras hydropower plant</u>	<u>rpm</u>	<u>300</u>
<u>Number of generators installed at Indiavaí hydropower plant</u>	<u>#</u>	<u>4</u>

Parameter	Unit	Value
<u>Power rating of generators installed at Indiavaí hydropower plant</u>	<u>MVA</u>	<u>7.78</u>

Furthermore the PP has taken the opportunity to include the following approved corrections:

- name change of Alto Jauru to Antônio Brennand hydropower plant
- inclusion of additional project participants and their contact details

These changes are only of editorial nature.

2.6.3 Reasons for requested changes

The changes in the installed capacity of the Antônio Brennand hydropower plant from the previous project design have been carried out, because the hydropower potential of the Antônio Brennand plant was determined based on data from nearby rivers of the Paraguay basin. After the operation starts of the Antônio Brennand plant in October 2002, the PP could notice that the plant potential for electricity generation was too conservative foreseen, as the plant capacity factor average between November 2002 and March of 2003 was 93.3%. Due to that reason the PP decided to increase the plant installed capacity without any equipments alteration.

The project description in the registered PDD was with regard to the rotational speed of all turbines as well as the number and the power rating of the generators at Indiavaí hydropower plant inaccurate or incomplete respectively. There was no change in the technical equipment, but the hydropower plants of the project activity were implemented with the technical configuration as given in the revised version of the PDD.

2.6.4 Occurrence of changes

The changes of capacity at Antônio Brennand hydropower plant were confirmed by ANEEL on 2003-04-17^{/ANEELab/}. Since May 2003 Antônio Brennand plant operates with 21.96 MW installed capacity.

According to the validation report of the validating DOE, validation started in November 2004 when the draft PDD was submitted to the audit team. As the operational capacity of Antônio Brennand plant was increased and confirmed before that date, the changes should have been known at time of validation. The same applies for the rotational speed of the turbines of this hydropower plant and the Indiavaí hydropower plant as well as for the number and power rating of the generators of the latter, as both plants started operation before November 2004. However, as another DOE has conducted the validation of the project activity it is not possible for the validation team to explain why the changes have not been addressed in the course of the validation for registration of the project activity.

The discrepancies between the actual installed capacity at Antônio Brennand hydropower plant and information provided in the PDD were addressed and could be clarified in the course of the verification of the 1st monitoring period. Response to the corresponding request for review was submitted 06.09.07 and accepted by the Board. CERs of the 1st monitoring period were issued on 22.10.07. Together with the response to the request for review a request for deviation was submitted to notify the EB about the permanent changes. The confirmation on the submission was received on 06.09.07. At that time no formal procedure to address permanent changes from the registered PDD was in place. The CDM Registration and Issuance team considered a request for deviation not as appropriate form to address permanent changes because the request for deviation is suitable only in cases where a change in procedures of monitoring or estimated emission reduction calculations are anticipated. Consequently the request for deviation was not accepted (25.09.07). Further action was not requested from the Board at that time.

The procedures for notifying and requesting approval of changes from the project activity as described in the registered PDD and associated guidelines were adopted at EB 48 and laid down in corresponding Annex 66 to the meeting report. They came into effect on 01.10.09 after submission of the request for issuance for the 3rd monitoring period.

2.6.5 Impact of changes on the ability to deliver emission reductions

The authorized installed capacity for Indiavaí hydropower plant was 28 MW from the outset and has never changed^(ANEEL). The emission reductions for Indiavaí hydropower plant were calculated based on the authorized installed capacity 28MW. As mentioned before, this hydropower plant started operation with the actual installed turbines and generators (4 generators á 7.78 MVA). There was no change in technical equipment and the corrections in the PDD are editorial only. This applies also for the editorial corrections of the rotational speed of the turbines and the completion of information. Therefore, there is no impact on the ability to deliver emission reductions for Indiavaí and Ombreiras hydropower plant.

Whereas the increase in the Antônio Brennand installed capacity ~~The changes~~ have the potential to affect the ability of the project to generate emission reductions because the increased capacity as follows:

~~The increase in the Antônio Brennand installed capacity~~ leads to higher CER expectation as the total amount of electricity energy generation can also increase. ~~The emission reductions in the registered PDD were estimated based on 20MW.~~

3 METHODOLOGY AND VALIDATION SEQUENCE

3.1 Validation Steps

The validation of requested changes from the project from the Project Activity as described in the Registered PDD consisted of the following steps:

- Appointment of team members and technical reviewers
- A desk review of the original and revised PDD^{/PDD/} submitted by the client and additional supporting documents
- On-Site assessment (if required)
- Background investigation and follow-up interviews with personnel of the project developer and its contractors,
- Draft validation reporting – in case of CARs or CLs
- Resolution of corrective actions (if any)
- Final validation reporting
- Technical review
- Final approval of the validation,

The sequence of the validation is given in the table 3.1 below:

Table 3.1: Validation sequence

Topic	Date
On-site visit	2009-02-16 to 2009-02-17
Draft reporting finalised	2010-02-23
Final reporting finalised	2010-12-20
Technical review on final reporting finalised	2010-12-20

3.2 Appointment of team members and technical reviewers

On the basis of a competence analysis and individual availabilities a validation team, consistent of one team leader and 1 additional team member, were appointed. Furthermore also the personnel for the technical review and the final approval were determined.

The list of involved personnel, the tasks assigned and the qualification status are summarized in the table 3-2 below.

Table 3-2: Involved Personnel

	Name	Company	Function ¹⁾	Qualification Status ²⁾	Scheme competence	Technical competence ⁴⁾	Host country Competence	Team Leading competence
<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms.	Jochen Schubert	TÜV NORD, Germany	TL	A	x	S	<input type="checkbox"/>	x
<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms.	Fernando P. Pacheco	TÜV NORD, Brazil	TM	E	x		x	<input type="checkbox"/>
<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms.	Ingo Klein	TÜV NORD, Germany	TR ³⁾	A	x	S	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Mr. <input checked="" type="checkbox"/> Ms.	Inga Köster	TÜV NORD, Germany	TR ³⁾	A	x		<input type="checkbox"/>	x
<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms.	Eric Krupp	TÜV NORD, Germany	FA	SA	x		<input type="checkbox"/>	X

¹⁾ TL: Team Leader; TM: Team Member, TR: Technical review; FA: Final approval

²⁾ GHG Auditor Status: A: Assessor; E: Expert; SA: Senior Assessor; T: Trainee; TE: Technical Expert

³⁾ No team member

⁴⁾ As per S01-MU03 or S01-VA070 A2 (such as A, B, C.....)

3.3 Review of Documents

The registered as well as the revised PDD and supporting background documents related to the project design and the requested changes were reviewed.

Furthermore, the validation team used additional documentation by third parties like host party legislation, technical reports referring to the project design or to the basic conditions and technical data.

3.4 Follow-up Interviews

The validation team has carried out interviews in order to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for CDM.

During validation the validation team has performed interviews to confirm selected information and to resolve issues identified in the document review. The main topics of the interviews are summarized in table 3-3.

Table 3-3: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
1. Projects & Operations Personnel, Araputanga Centrais Elétricas S.A. 2. Consultant, Ecoinvest Carbon	- Details of the project validation and earlier verifications - Project history - Technical details of plant - Intended / implemented changes from the previous project design - Impact of changes on the additionality justification - Impact on the monitoring of the project - Editorial issues of the revised PDD

A comprehensive list of all interviewed persons is part of section 7 'References'.

3.5 Resolution of Clarification and Corrective Action Requests

3.5.1 Definition

A **Corrective Action Request (CAR)** will be established where:

- mistakes have been made in assumptions, application of the methodology or the project documentation which will have a direct influence the project results,

- the requirements deemed relevant for validation of the intended / implemented changes,
- there is a risk that the changes can not be approved by the UNFCCC or that emission reductions would not be able to be verified and certified after the implementation of the changes.

A **Clarification Request (CL)** will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A **Forward Action Request (FAR)** will be issued when certain issues related to project implementation should be reviewed during the subsequent verification(s).

3.5.2 Draft Validation

After reviewing all relevant documents and taken all other relevant information into account, the validation team issues all findings in the course of a draft validation report and hands this report over to the project proponent in order to respond on the issues raised and to revise the project documentation accordingly.

3.5.3 Final Validation

The final validation starts after issuance of the proposed corrective action (CA) of the CARs CLs and FARs by the project proponent. The project proponent has to reply on those and the requests are “closed out” by the validation team in case the response is assessed as sufficient. In case of raised FARs the project proponent has to respond on this, identifying the necessary actions to ensure that the topics raised in this finding are likely to be resolved at the latest during the next verification. The validation team has to assess whether the proposed action is adequate or not.

In case the findings from CARs and CLs cannot be resolved by the project proponent or the proposed action related to the FARs raised cannot be assessed as adequate, no positive validation opinion can be issued by the validation team.

The CAR(s) / CL(s) / FAR(s) are documented in chapter 4.

3.6 Technical review

Before submission of the final validation report a technical review of the whole validation procedure is carried out. The technical reviewer is a competent GHG auditor being appointed for the scope this project falls under. The technical reviewer is not considered to be part of the verification team and thus not involved in the decision making process up to the technical review.

As a result of the technical review process the validation opinion and the topic specific assessments as prepared by the validation team leader may be confirmed or revised. Furthermore reporting improvements might be achieved.

3.7 Final approval

After successful technical review of the final report an overall (esp. procedural) assessment of the complete validation on requested changes will be carried out by a senior assessor located in the accredited premises of TÜV NORD.

Only after this step the notification or the request for approval of the changes on the project activity can be forwarded to the UNFCCC (in case of a positive validation opinion).

4 VALIDATION FINDINGS

The findings (CARs, CLs and FARs) of validation process are summarized in the tables below.

Finding:	CL 1
Classification	<input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	<p>Please, it is necessary to make clear in the PDD the differences between the ANEEL's electricity energy authorization and the equipment's installed capacity of the plants. Additionally, the following minor alterations needs to be addressed in the revised PDD:</p> <ul style="list-style-type: none"> a) Updated the turbines rotation information (rpm) for all plants; b) For Indaivaí plant please updated the generators information (number and nominal power) c) Please detail the generators' data for the Ombreiras plant.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>Turbines and generators description was reviewed in the PDD according to the equipments' tags. Pictures of turbines and generators tags have been provided to the DOE.</p> <p>Although, the turbines and generators description in the registered PDD present minor difference for the one presented in the equipments' tags, PPs call attention to the fact that hydropower plants of the project operate according to the installed capacities authorized by the environmental agency of Mato Grosso State (which can be confirmed by the operation licenses) and authorizations issued by the Brazilian Electricity Regulatory Agency (from the Portuguese <i>Agência Nacional de Energia Elétrica - ANEEL</i>).</p> <p>Project Participants clarify that the installed capacity of a hydropower plant is not determined by the sum of nominal power of turbines/generators only. According to the Mines and Energy Ministry (from the Portuguese <i>Ministério de Minas e Energia – MME</i>) and Centrais Elétricas Brasileiras S/A – Eletrobrás (2000), the installed capacity of a hydropower plant is determined through the equation below:</p> $Pot = \frac{EF_e}{F_c}$ <p>Pot = installed capacity (MW); EF_e = guaranteed energy (MW-ave); F_c = capacity factor (%).</p> <p>Where:</p>

Finding:	CL 1
	$EF_e = \frac{\mu \cdot g \cdot Q \cdot H_{liq}}{1000} \times \Delta t$ <p> μ = turbine-generator efficiency (%); g = acceleration due to gravity - (9.8 m/s²); Q = minimum flow (m³/s); H_{liq} = water flow (m); Δt = time (1 s). </p> <p>Considering explanations above, the minor difference of the turbines and generators description presented in the equipments' tags and the registered PDD does not affect the installed capacity of the small hydropower plants of the project. Power plants connected to the electricity grid must operate according to the installed capacity authorized by the local and national entities only.</p>
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>Minor corrections were correctly addressed in the revised version of the PDD. Additionally, it was clarified by PP the calculation approach used by ANEEL to identify the authorized installed capacity of the plants. However, to be transparent it is necessary to revise the PDD including information regarding the plant determined capacity according to ANEEL and the installed equipments. Revision is necessary.</p> <p><u>CL remains open.</u></p>
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>As mentioned by PP slight differences do not affect the installed capacity of the project and small hydropower plants cannot operate with a difference installed capacity than the one approved by ANEEL and environmental agencies.</p> <p>Since the Chamber of Electric Energy Commercialization (in a free translation from the Portuguese <i>Câmara de Comercialização de Energia Elétrica – CCEE</i>) checks and writes up the national electricity exported to the grid by power plants, any deviations are identified. CCEE makes feasible and regulates the national electricity commercialization.</p> <p>Additionally, information related to installed capacity of small hydropower plants and compliance to national/local entities was included. Please refer to the PDD attached to this response. ANEEL authorizations and Operational Licenses are also attached.</p>



Finding:	CL 1
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>Section A.4.3 of the PDD was revised and clarification on the plant installed capacity was included. According to Brazilian rules and legislation ANEEL controls the electricity market, which includes the operational power plants capacity. The Operational License clearly indicates the installed capacity of the plant according to ANEEL determination. The information provided in the PDD complies with the installed capacities defined in the operational licenses.</p> <p><u>CL closed.</u></p>
Conclusion <i>Tick the appropriate checkbox</i>	<p><input type="checkbox"/> To be checked during the first periodic verification</p> <p><input type="checkbox"/> Appropriate action was taken</p> <p><input checked="" type="checkbox"/> Project documentation was corrected correspondingly</p> <p><input type="checkbox"/> Additional action should be taken</p> <p><input checked="" type="checkbox"/> The project complies with the requirements</p>

Finding:	CL 2
Classification	<input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	<p>The following correction are necessary to be done in the ER calculation:</p> <p>a) Please provide for the period Jan-August 2009 a separate ER calculation in accordance with the PDD;</p> <p>b) In the CER calculation sheet it is necessary to round down the sum of ER in the cell H25 of the "A.4.4.1" sheet.</p>
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>a) Considering DOE comments, PPs reviewed the emission reduction calculation spreadsheet.</p> <p>b) Total estimated reductions were rounded down in the PDD.</p>
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>a) Please check the ER for the period January to August 2009 in PDD section A.4.4.1 and E.6. The value is not consistent with the ER calculation.</p> <p>b) Ok, topic solved. The ER was revised and the sum is rounded down.</p> <p>Additionally, please refer to the following:</p> <p>c) Please use the actual electricity generation data already available at time of validation. Please correct the PDD accordingly.</p>
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>a) Considering the DOE comments, PPs reviewed the emission reduction spreadsheet and PDD.</p> <p>b) Ok.</p> <p>c) According to the UNFCCC's website, the Global Stakeholder Process of Arapucel started in May 2005. Therefore, actual electricity generated by the project for the years of 2002, 2003 and 2004 was included in the ER spreadsheet.</p>

Finding:	CL 2
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>a) Ok, topic closed. The PDD and CERs calculation spreadsheet was revised and no more deviations can be detected. The values in PDD and ER calculation are consistent.</p> <p>b) OK</p> <p>c) Ok, item solved. The actual electricity generation data from 2002 (operation starts) until 2004 (last year before PDD Global Stakeholder Consultation process) was utilized in the revised ER calculation sheet. The PDD was revised accordingly. The data were also cross checked with the approved monitoring report of the first monitoring report. No deviations could be identified.</p> <p>CL closed.</p>
Conclusion <i>Tick the appropriate checkbox</i>	<p><input type="checkbox"/> To be checked during the first periodic verification</p> <p><input type="checkbox"/> Appropriate action was taken</p> <p><input checked="" type="checkbox"/> Project documentation was corrected correspondingly</p> <p><input type="checkbox"/> Additional action should be taken</p> <p><input checked="" type="checkbox"/> The project complies with the requirements</p>

Finding:	CL 3
Classification	<input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	<p>In the ER calculation and the investment calculation differing capacity factors are used. Moreover in response to CAR 1 in the 2nd periodic verification for PCH Ombreiras and PCH Indiavaí for both plants a capacity factor of 0.9 is assumed which differs significantly from the capacity factors indicated in both calculations. Please clarify.</p>
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>In Brazil, the official capacity factor of hydropower plants are not freely determined by the project sponsors, <i>i.e.</i>, they are not within the control of project sponsors (§5, Annex 67, EB 48). The official capacity factors of the hydropower plants of the project were authorized by ANEEL only in 2006:</p> <ul style="list-style-type: none"> Alto Jauru: Decree nr. 15 issued on May 24th, 2006; Indiavaí: Decree nr. 24 issued on June 6th, 2006; Ombreiras: Decree nr. 18 issued on May 26th, 2006. <p>Project Participants clarify that project sponsors took into account the information available at that time of the decision making for the CDM validation. In reality, the publication of the ANEEL Decrees defining the official capacity factor of the small hydropower plants happened after the project validation only. For that reason, the information related to the official capacity factor of the project power plants were not known and investment analysis were based on reasonable assumptions made by project sponsors at the time of</p>



Finding:	CL 3
	<p>the investment decision taken by the project participants.</p> <p>According to the “Guidelines on assessment of different types of changes from the project activity as described in the registered PDD” (Annex 67, EB 48), “the re-assessment of additionality shall be based on all original input data, thereby – in case of investment analysis – in principle only modifying the changed key parameters in the original spreadsheet calculations”.</p> <p>Considering explanations above, alterations made in the PDD were associated only to the increased of the installed capacity of Alto Jauru power plant (1.96 MW additional). Regarding the estimated emission reduction calculation, in fact, estimated electricity generation were different from the ones presented in the financial analysis. Therefore, Project Participants reviewed the electricity generation in the CERs spreadsheet, which is attached to this response.</p>
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>The argument presented by PP is understandable. However, it is necessary to send the revised CERs calculation spreadsheet to proper assess the revision done.</p> <p><u>CL remains open.</u></p>
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	<p>Revised CERs calculation spreadsheet is attached to this response.</p>
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	<p>The revised CER calculation spreadsheet was sent to the DOE using the capacity factors available at the time of investment decision. The discrepancy between the capacity factors authorized by ANEEL and the data used at time of validation could be clarified in an appropriate manner. An update of the capacity factors is not required as per Annex 67, EB 48.</p> <p><u>CL closed.</u></p>
Conclusion <i>Tick the appropriate checkbox</i>	<p><input type="checkbox"/> To be checked during the first periodic verification</p> <p><input checked="" type="checkbox"/> Appropriate action was taken</p> <p><input checked="" type="checkbox"/> Project documentation was corrected correspondingly</p> <p><input type="checkbox"/> Additional action should be taken</p> <p><input checked="" type="checkbox"/> The project complies with the requirements</p>

Finding:	CL 4
Classification	<input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	<p>Investment barrier:</p> <p>a) The return on equity value with CERs of Antônio Brennand is inconsistent between the provided financial spreadsheet and the revised PDD.</p>



Finding:	CL 4
	<p>b) The values of project IRR of table 6 differs to the values given in sheet "sensitivity" of the financial spreadsheet.</p> <p>c) Could you please clarify against which benchmark the equity IRR has been compared?</p>
<p>Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i></p>	<p>a) PPs reviewed the spreadsheet since there were some values which were not reviewed in the previous version. Please refer to the spreadsheet and PDD attached.</p> <p>b) PPs reviewed the spreadsheet since there were some values which were not reviewed in the previous version. Please refer to the spreadsheet and PDD attached.</p> <p>c) While performing the validation of the project, the Step 3 – Barrier analysis of "Tool for the demonstration and assessment of additionality"(version 1)³ was used. Therefore no formal financial analysis was performed to assess and demonstrate additionality. A simplified calculation of the project's IRR was carried out just to show the small difference towards a short term indicator used in various risk-free investment opportunities.</p> <p>Considering the first barrier mentioned in the registered PDD "investment barrier", Project Participants clarify that the small increase in the installed capacity of Alto Jauru project does not change the investment environment in Brazil at the time of the implementation of the small hydropower plants of the project. Although the additionality of Arapucel project was assessed through the barrier analysis, Project Participants conducted a depth analysis by reviewing the cash flow of Alto Jauru project. Therefore, installed capacity of the plant was increased (and consequently, the project revenues). All other assumptions were not changed and original data were used.</p> <p>The revision of the project cash flow of Alto Jauru project results in an IRR of 20.3% (18.4% in the registered PDD). As explained in the registered PDD, "RoE is very similar to SELIC rate in effect at the time of financing although the project is a riskier investment as compared to Brazilian government bonds". SELIC rate is not explicitly mentioned in the registered PDD, however, analyzing SELIC rate average in the period before the time of the projects financing, a value of 22.36% (see registered PDD, table 6) is obtained, above the estimated IRR of the project activity.</p>
<p>DOE Assessment #1 <i>The assessment shall encom-</i></p>	<p>a) and b) Antônio Brennand investment analyses spreadsheet was correctly revised by the PP and the values are in accordance</p>

³ Available at: <<http://cdm.unfccc.int/EB/016/eb16repan1.pdf>>.



Finding:	CL 4
<p><i>pass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i></p>	<p>with the revised PDD.</p> <p>c) The validation confirms that the additionality of this project was proven based on a barrier analysis. Thus, the re-assessment needs to focus on the impacts of the capacity increase on the barriers claimed for additionality (see also Annex 2). The unfavourable investment climate at time of decision making was considered as a significant barrier. The validation team confirms this assessment and is also convinced that the small increase of capacity in one of the three hydropower plants would not have influenced the investment climate.</p> <p>A simplified investment analysis for Antônio Brennand was provided to substantiate additionally the financing risks at that time. To be consistent throughout the project documentation, the PPs were requested to update the simplified investment calculation including the actually installed capacity. All other input parameter remained unchanged This was verified by cross checking the revised spreadsheet with the original version. The expected average return on equity for all three facilities increased slightly from 17.9 to 18.7 %. However, the expected return on equity for each plant separately as well as for all three facilities is still below the average Selic rate in the period 1996 – 2004 and thus the financing risks still persist.</p> <p><u>For further information on the additionality re-assessment please refer also to section 5.2 and Annex 2.</u></p> <p>CL closed.</p>
<p>Conclusion <i>Tick the appropriate checkbox</i></p>	<p><input type="checkbox"/> To be checked during the first periodic verification</p> <p><input checked="" type="checkbox"/> Appropriate action was taken</p> <p><input checked="" type="checkbox"/> Project documentation was corrected correspondingly</p> <p><input type="checkbox"/> Additional action should be taken</p> <p><input checked="" type="checkbox"/> The project complies with the requirements</p>

Finding:	CL 5
<p>Classification</p>	<p><input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR</p>
<p>Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i></p>	<p>Please address the name change of Alto Jauru or correct the name. In addition, please include the additional project participants and their contact details in the PDD.</p>
<p>Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i></p>	<p>The change of Alto Jauru small hydropower plant to Antonio Brennand was included in the PDD. In addition, current authorized project participants were included according DOE request. See reviewed PDD attached to this response.</p>
<p>DOE Assessment #1 <i>The assessment shall encom-</i></p>	<p>The name change was correctly addressed in section A.2 of the PDD. Additionally, section A.3 and Annex 1 of the PDD were</p>



Finding:	CL 5
<i>pass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	updated. <u>CL closed.</u>
Conclusion <i>Tick the appropriate checkbox</i>	<input type="checkbox"/> To be checked during the first periodic verification <input type="checkbox"/> Appropriate action was taken <input checked="" type="checkbox"/> Project documentation was corrected correspondingly <input type="checkbox"/> Additional action should be taken <input checked="" type="checkbox"/> The project complies with the requirements

Finding:	CL 6
Classification	<input type="checkbox"/> CAR <input checked="" type="checkbox"/> CL <input type="checkbox"/> FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	The following correction/clarification are necessary to be done in Antônio Brennand financial calculation: Please explain why the value for civil works and equipment has been increased although the capacity was increased without purchase of additional equipment (sheet "Funding and Amortization").
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Cash flow spreadsheet of Antônio Brennand (Alto Jauru) was corrected to modify "the changed key parameter in the original spreadsheet" only (which is the installed capacity of the project) as stated in §8 of the "Guidelines on assessment of different types of changes from the project activity as described in the registered PDD". Please refer to the reviewed cash flow attached to this response.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Antônio Brennand financial spreadsheet was revised and the presented value for civil works and equipments was re-adjusted to the original values applied at the project documentation sent for requesting registration. The revised spreadsheet was assessed and no deviation could be detected. The only altered parameter was the installed capacity of Antônio Brennand plant. <u>CL closed.</u>
Conclusion <i>Tick the appropriate checkbox</i>	<input type="checkbox"/> To be checked during the first periodic verification <input type="checkbox"/> Appropriate action was taken <input checked="" type="checkbox"/> Project documentation was corrected correspondingly <input type="checkbox"/> Additional action should be taken <input checked="" type="checkbox"/> The project complies with the requirements

5 VALIDATION ASSESSMENT SUMMARY

5.1 General

ARAPUTANGA CENTRAIS ELÉTRICAS S.A. has commissioned the TÜV NORD JI/CDM Certification Program (CP) to conduct a *validation regarding changes from the Project Activity as Described in the Registered PDD* of the project:

“ARAPutanga Centrais ELétricas S.A. – ARAPUCEL – Small Hydroelectric Power Plants Project”

with regard to the relevant requirements of the UNFCCC esp. the *Procedure for notifying and requesting approval of changes from the project activity as described in the registered project design document* (EB 48, Annex 66) ^{/PNRAC/} and the *Guidelines on assessment of different types of changes from the project activity as described in the registered PDD* ^{/GADTC/}.

In the course of the validation 6 Clarification Requests (CLs) were raised and closed successfully.

The review of the revised project design documentation and additional documents related to changes to the project design and monitoring plan; the subsequent background investigation and follow-up interviews have provided TÜV NORD JI/CDM CP with sufficient evidences for assessment.

5.2 Additionality

5.2.1 Methodology

In the original project documentation the additionality was justified in line with the requirements of ACM0002 ver. 5. This methodology requires making use of the additionality tool.

5.2.2 Decisive Route of Addtionality Justification

During the original validation of the project the additionality was justified on the basis of a barrier analysis (investment barrier, lack of infrastructure barrier, institutional barrier). Part of the investment barrier is a simplified financial analysis of the project activity.

Identified Significant barriers in the registered PDD identified are, besides of the instability in government electricity market policies, the investment climate in Brazil at time of implementation of the project activity, particularly the lack of a long-term debt market. Investing in long-term opportunities is connected with a higher risk than placing the money in short-term government bonds. Based on a simplified investment calculation for Antônio Brennand hydropower plant it was ~~demonstrated~~ indicated

that the higher risk of the investors could be compensated when the CER revenues would be considered in the expected financial return on equity.

There are no investment calculation spreadsheets available on UNFCCC website. Thus, investment data provided in the registered PDD cannot be reproduced on the basis of publicly available data valid at time of validation. Nevertheless the PPs provided the original investment calculation spreadsheets for all three hydropower plants. The authenticity of the original spreadsheets could not directly be verified. However, it can be confirmed that the figures in the investment calculation spreadsheet of Antônio Brennand plant are identical with the data provided in the registered PDD. The stated approximate return on equity of 17% for Indiavai hydropower plant complies also with the result in the original spreadsheet (17,08%).

The assessment of additionality in the publicly available validation report of the validating DOE includes few details only. There is no assessment of the investment calculation nor of the input parameters. Based on the limited information available in the validation report the current validation team concludes that the investment climate in Brazil was considered as the significant barrier at that time.

5.2.3 Re-Assessment of Additionality

During this validation regarding changes a revised version of the original validated PDD and related Excel spreadsheets were provided by the PPs and considered by the validation team. The modifications mainly reflect the technical changes done.

The additionality justification is based on the barrier analysis according to the “Tool for the demonstration and assessment of additionality”. Thus, the re-assessment focussed on the impacts of the capacity increase changes on the barriers claimed for additionality.

The investment barrier (access to finance barrier) in the PDD includes also a simplified investment calculation for Antônio Brennand (former Alto Jauru) hydropower plant. To be consistent throughout the project documentation, the PPs were requested to update the simplified investment calculation for Antônio Brennand plant including the actually installed capacity. The only altered input value of the financial analyses was the installed capacity of Antônio Brennand plant, which was adjusted to 21.96 MW instead of 20 MW. Parameters related to the installed capacity (e.g. total revenues) have been adapted accordingly. All others assumptions, formulas and calculations performed were maintained identical.

As discussed before the corrections of the rotational speed of the turbines and the number and power rating at Indiavai hydropower plant were only on editorial nature and did not affect the authorized installed capacity of the plant. To date it is not possible to verify whether the investment costs of Indiavai hydropower plant was based on 2 or 4 generators as an assessment of the input parameters is not included in the validation report nor in the registered PDD and related evidences are, due to the long time since investment decision, no longer available. Thus, the investment calculation spreadsheet for Indiavai hydropower plant remains unchanged.

5.2.4 Result of Additionality Re-Assessment

An impact of the increase of the installed capacity and estimated emission reductions at Antônio Brennand plant – to the barriers namely the investment barrier, the lack of Infrastructure barrier and the institutional barrier cannot be identified. This applies also for the corrected rotational speed of the turbines and the number of installed generators and its power rating. For further details please refer to table A-2 in Annex 2.

Within the barrier analysis a simplified investment analysis has been conducted to demonstrate the impact of the CERs to overcome the investment barrier. The revised investment calculation shows that investors ROE for Antônio Brennand (Alto Jauru) increased from 18.42% to 20.3%. The average ROE for the three power plants is increased from 17.9% to 18.7%. As it is not explicitly stated in the registered PDD or in the validation report the validation team can only assume that the SELIC rate was considered as benchmark. Table 5 shows the range (15,3 – 45,0%) and average (22.36%) of the SELIC rate since introduction in 1996 and indicates also a “current discount rate” of 18%. If these values would be considered now, a comparison of the revised investors ROE for Antônio Brennand as well as for all three power plants would show that in both cases the value is still below the average SELIC rate of the years 1996 – 2004 (22.36%). Compared to the mentioned discount rate valid at validation (18%) in both cases investors ROE would be above the benchmark. It should be noted that the investors ROE of all three hydropower plants was already close to or a bit higher than 18% at time of validation. The increase of the investors ROE from 18% to 20% to compensate the additional risk identified in the registered PDD is reached for Antônio Brennand plant now without CERs.

However, in accordance with § 4 of the additionality tool (version 1) the benchmarks can be derived from government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type. The given benchmarks derive from the Government Bond rates without an equity risk premium to reflect private investment. Thus, for the correct determination of the benchmark the SELIC rate plus the equity risk premium should be considered. Considering for example the historical (1928 – 2000) S&P500 premium over US-Treasury Bond (Available at <http://pages.stern.nyu.edu/~adamodar/>) as appropriate equity risk premium (7.2%), the benchmark would be 25.2% (taking into account the discount rate of 18% stated in the registered PDD).

Taking all aspects into consideration the validation team comes to the following conclusions:

- The additionality assessment is based on barrier analysis. No complete investment analysis was carried out.
- The technical changes do not impact the identified barriers. The investment barrier (access to finance barrier) is still considered as significant barrier.

- It is not unequivocally identifiable which benchmark was used in the simplified investment calculation for the purpose of comparison nor exists an assessment of the calculation and the input parameter from the validating DOE.
- If the benchmark would have been determined in compliance with the requirements of the additionality tool taking also a risk premium into account, the benchmark would be significantly higher and the expected financial return on equity for the whole project activity would still not compensate the additional risks for investors financing long term opportunities.
- The required increase of the return of equity for Antônio Brennard plant to compensate the additional investors risk identified in the registered PDD is achieved through the slight capacity increase. If this indicator is considered appropriate an impact of additionality through the change is given.

The barrier analysis clearly shows that the barriers are not affected by the technical changes carried out as a deviation from the project design originally validated and registered. Nevertheless, depending on the benchmark considered appropriate an impact on the financial return on equity could be identified for Antônio Brennard plant and thus the changes raise concerns with regard to additionality. Therefore the validation team seeks guidance from the Executive Board on the applicability of these changes.

Thus, the validation team has arrived at the conclusion that the additionality of the project activity is not affected by the technical changes carried out as a deviation from the project design originally validated and registered.

5.3 Scale of the Project activity

The project was already registered as a large scale project activity. The increase of the total installed capacity does not affect the scale of the project activity.

5.4 Applicability and application of the Approved Baseline Methodology

Neither the increase of the total installed capacity at Antônio Brennand plant nor the corrected rotational speed of the turbines nor the number of generators installed at Indiavaí plant and its power rating does not affect the applicability and the application of the approved baseline methodology. All applicability criteria are still met.

5.5 Other issues

Along with this validation regarding changes the PP has taken the opportunity to update information in the registered PDD which are not related to the technical changes. The validation team confirms that the changes are

- only of editorial nature and not related to the technical changes in question and
- the editorial changes are justified and correct.

In detail:

- name change of Alto Jauru to Antônio Brennand hydropower plant
- inclusion of additional project participants and their contact details

6 VALIDATION OPINION

The changes do ~~not~~ raise concerns with respect to aspects outlined in paragraph 10 c) of EB 48 Annex 66 i.e.

b. ☒ additionality of the project

c. ☐ scale of the CDM project activity and

d. ☐ applicability and application of the Approved Baseline Methodology under which the project activity has been registered.

Thus a ~~request for approval notification~~ of changes from the project activity as described in the registered PDD to the UNFCCC is deemed appropriate, in line with the requirements outlined in EB 48 Annex 66.

Formatiert: Einzug: Links: 3,17 cm,
Keine Aufzählungen oder
Nummerierungen, Tabstopps: Nicht an
1,27 cm

Essen, 20110-1205-2011



Jochen Schubert
TÜV NORD JI/CDM CP
Verification Team Leader

Essen, 20110-1205-2011



Eric Krupp
TÜV NORD JI/CDM CP
Final Approval

7 REFERENCES

Table 7-1: Documents provided by the project participant

Reference	Document
/ANEELo/	ANEEL Resolution No. 182 issued on 09/04/2003 ANEEL Resolution No. 834 issued on 13/07/2005 ANEEL Resolution No. 896 issued on 25/07/2005 ANEEL Resolution No. 928 issued on 29/07/2005
/ANEELi/	ANEEL Resolution No. 559 issued on 17/12/2001 ANEEL Resolution No. 502 issued on 06/08/2003
/ANEELab/	ANEEL Resolution No. 501 issued on 05/08/2003 ANEEL Resolution No. 223 issued on 17/04/2003
/OLI/	Operation License #291/2008 validity: 2010/01/19 (SHP Indiavaí) Environmental recuperation and monitoring report – June 2007
/OLJ/	Operation license 288/2008 validity: 2009/09/10 (SHP Antônio Brennd)
/OLO/	Operation License #289/2008 validity: 2009/09/10 (SHP Ombreiras) Environmental recuperation and monitoring report – May 2008
/RES-618/	ANEEL's Resolution # 618 of 2003/11/25
/PDD1/	Project Design Document for CDM project: "ARAPUtanga Centrais ELétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project", version 5, dated 2006-05-01, registered 2006-12-15.
/PDD2/	Revised PDD reflecting the intended / implemented changes (version 6, dated 2010/12/17)
/XLS1/	Financial Analysis of the registered PDD "FCF_Indiavaí(CER)-original" "FCF_AltoJauru(CER)-original" "FCF_Ombreiras (CER)-original"
/XLS/	Revised emission reduction calculation spreadsheet Revised Antônio Brennd financial analyses spreadsheet "FCF_AltoJauru(CER)-reviewed_inv antigo".

Table 7-2: Background investigation and assessment documents

Reference	Document
/ACM0002/	Approved CDM Methodology ACM0002, version 05: “Consolidated baseline methodology for grid-connect electricity generation from renewable sources”, May 19 th 2005.
/CPM/	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)
/GADTC/	Guidelines on assessment of different types of changes from the project activity as described in the registered PDD (EB 48; Annex 67)
/IPPC/	1. 1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book 2. 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book
/KP/	Kyoto Protocol (1997)
/MA/	Decision 3/CMP. 1 (Marrakesh – Accords)
/PNRAC/	Procedures for notifying and requesting approval of changes from the project activity as described in the registered PDD (EB 48, Annex 66)
/PRC/	Procedure for requesting changes from the project activity as described in the registered project design document (EB 48, Annex 67)
/TA/	Tool for the demonstration and assessment of additionality (Ver. 1).
/VAL/	Validation Report “Araputanga Centrais Elétricas S.A. – ARAPUCEL – Small Hydroelectric Power Plants Project” issued by TÜV SÜD Industrie Service GmbH, dated 2006-06-13
/VR/	3 rd periodic Verification Report “ARAPutanga Centrais ELétricas S.A. – ARAPUCEL – Small Hydroelectric Power Plants Project”, revision 2, 06-04-2010, issued by TÜV NORD
/VVM/	UNFCCC Validation and Verification Manual (Version as per EB 55)

Table 7-3: Websites used

Reference	Link	Organisation
/aneel/	www.aneel.gov.br	National Agency of Electric Energy from Brazil
/bcb/	http://www.bcb.gov.br/	Brazilian Central Bank
/CCEE/	www.ccee.org.br	Brazilian Chamber of Electricity Energy Commercialization
/dna-HP/	www.mct.gov.br	DNA of Brazil
/mf/	http://www.receita.fazenda.gov.br/	Brazilian Secretariat of the Federal Revenue
/unfccc/	http://cdm.unfccc.int	UNFCCC
/ipcc/	www.ipcc-nggip.iges.or.jp	IPCC publications

Table 7-4: List of interviewed persons

Reference		Name	Organisation / Function
/IM01/	<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms	Agnelo Jikume Karf	Brennand Energias – Local Director
/IM01/	<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms	Alfredo Tadini Ramos	Ombreiras Energia S/A – General Responsible
/IM01/	<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms	Alessandro Galdino	Ombreiras Energética – Maintenance Responsible
/IM01/	<input checked="" type="checkbox"/> Mr. <input type="checkbox"/> Ms	Renata O. Freitas	Ecoinvest – Consultant

¹⁾ Means of Interview: (Telephone, E-Mail, Visit)

ANNEX

A1: Assessment of Financial
Parameters

A2: Assessment of Barrier analysis



ANNEX 1: ASSESSMENT OF FINANCIAL PARAMETERS

Table A-1: Assessment of Financial Parameters

<input type="checkbox"/>	No financial parameters are used for additionality justification						
<input checked="" type="checkbox"/>	Assessment of all financial parameters see below						
Parameter	Value applied	Unit	Source of Information (please indicate document and page)	Reference	DOE ASSESSMENT		
					Correctness of value applied	Appropriateness of information source	Comment
Installed capacity of Antônio Brennand plant	21.96	MW	ANEEL Dispatch No. 223 dated 2003/04/17	/ANEELab /	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	The value applied is in line with the official document issued by ANEEL.



ANNEX 2: ASSESSMENT OF BARRIER ANALYSIS

Table A-2: Assessment of Barrier Analysis

<input type="checkbox"/>	No barrier parameters are used for additionality justification			
<input checked="" type="checkbox"/>	Assessment of barriers see below			
Kind of Barrier (invest, tech, other)	Description of Barrier	Evidence used	Assessment of validation team	
			Appropriateness of information source	Explanation of final result

<p><u>Access to finance barrier</u> (Investment Barrier)</p>	<p>As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has caused a severe negative impact on the financing of energy projects in Brazil.</p> <p>Financial domestic markets with a maturity of greater than 1 year are practically non-existent in Brazil. Experience has shown that in moments of financial stress the duration of savings instruments have contracted to levels close to one day with a massive concentration in overnight banking deposits. Savers do not hold long-term financial contracts due to the inability to price-in the uncertainty involved in the preservation of purchasing power value. (Arida et al., 2005).</p> <p>The lack of a local long-term market results not from a disinterest of financial investment opportunities, but from the reluctance of creditors and savers to lengthen the term of their placements. It has made savers opt for the most liquid investments and to place their money in short-term government bonds instead of investing in long-term opportunities that could finance infrastructure projects.</p> <p>Investors will only finance long term opportunities when the compensation of the additional risk is clearly above the SELIC rate.</p>	<p>/PDD2/ /xls1/ /xls/</p>	<p><input checked="" type="checkbox"/></p>	<p><u>Neither the small increase of the total installed capacity at Antônio Brennand plant nor the corrected rotational speed of the turbines nor the number of generators installed at Indiavai plant and its power rating have no</u> impact on the general investment environment in Brazil. Therefore it can be concluded that the financing conditions of the project activity remains the same.</p> <p>Within the barrier analysis a simplified investment analysis has been conducted to demonstrate the impact of the CERs to overcome the investment barrier. The revised investment calculation shows that investors ROE for Antônio Brennand (Alto Jauru) increased from 18.42% to 20.3%. The average ROE for the three power plants is increased from 17,9% to 18,7%, which is still below the average SELIC rate of the years 1996 – 2004 (22.36%). The given benchmarks derive from the Government Bond rates without an equity risk premium to reflect private investment. Taking a respective equity risk premium into account would result in a higher benchmark. Therefore it can be concluded that the expected financial return on equity for the whole project activity would still not compensate the additional risks for investors financing long term opportunities.</p> <p>The investment barrier (<u>access to finance barrier</u>) is not affected by the changes and is still considered significant.</p>
--	--	--	--	--



Lack of Infrastructure	The region where the project is located is isolated and undeveloped. There is a lack of infrastructure such as roads, reliable electricity, communication and transportation. The project sponsors had to develop these facilities before the implementation of the project. In addition there were no qualified personnel available in the region due of the lack of schools and universities.	/PDD2/	<input checked="" type="checkbox"/>	<u>Neither the small alteration of the total installed capacity at Antônio Brennand plant nor the corrected rotational speed of the turbines nor the number of generators installed at Indiavai plant its power rating</u> has ve <u>no</u> impact on this barrier. The lack of infrastructure remains unaltered considering the small increase of the total installed capacity from 74MW to 75.96MW (increase of 2.65%) <u>or the technical design of the turbines or generators installed</u> . Therefore, it can be concluded that this barrier is not impacted by the capacity <u>modification</u> s of the project.
Institutional Barrier	Since 1995 government electricity market policies have been continuously changing in Brazil. Too many laws and regulations were created to try to organize and to provide incentives for new investments in the energy sector. The results of such regulatory instability were the contrary to what was trying to be achieved. During the rationing period electricity prices surpassed BRL 600/MWh (around USD 200/MWh) and the forecasted marginal price of the new energy reached levels of BRL 120 – 150/MWh (around USD 45). In the middle of 2004 the average price was below BRL 50/MWh (less than USD 20/MWh). The volatility of the electricity price in Brazil has a correlation with the instability in government policies in the period, with 3 different regulatory environments in a 10 year period (from 1995 to 2004). In theory the new regulatory framework has the potential to reduce market risk considerably. Nevertheless only time will prove the efficiency of the new model in relation to market risks reduction and private investment attraction. In that sense, it will interesting to evaluate the results of the first auction of licenses for the construction of new power plants in order to correctly assess the success of the implementation of the new regulatory framework.	/PDD2/	<input checked="" type="checkbox"/>	<u>Neither the small alteration of the total installed capacity at Antônio Brennand plant nor the corrected rotational speed of the turbines nor the number of generators installed at Indiavai plant its power rating</u> has ve <u>no</u> impact on this barrier. The Institutional barrier remains unaltered considering the increase of the total installed capacity from 74MW to 75.96MW (increase of 2.65%) <u>or the technical design of the turbines or generators installed</u> . Therefore, it can be concluded that this barrier is not impacted by the capacity <u>modification</u> s of the project.