



REVISED MONITORING PLAN

Registered Project Activity: **Rio Taquesi Hydroelectric Power Project**CDM Registration Reference: **1031**Date of revision: **15/September/2008****SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

Title: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

Approved consolidated baseline methodology reference number assigned by the CDM Executive Board: ACM0002, version 06

B.7 Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:***(Copy this table for each data and parameter)*

Data / Parameter:	EG_v (& EG_h when hourly dispatch data)	
Data unit:	MWh	
Description:	Electricity supplied to the grid by the Project	
Source of data to be used:	Records from HB’s metering system at Pichu substation and Chojlla Antigua, are used to discriminate the Project injections from the total injections of HB (i.e. removing injections not accrued as part of the CDM activity). CNDC’s SMEC records (CNDC is the Spanish acronym for National Load Dispatch Committee or the National Interconnected Grid Administrator; SMEC accounts for Commercial Metering System from which sales reports are done by the CNDC), are used in estimating Project’s injections to the commercial grid.	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	PERIOD	EG _y
	Year 1 (jul/02 - jun/03)	286,798
	Year 2 (jul/03 - jun/04)	232,835
	Year 3 (jul/04 - jun/05)	256,072
	Year 4 (jul/05 - jun/06)	218,918
	Year 5 (jul/06 - jun/07)	248,656
	Year 6 (jul/07 - jun/08)	248,656
	Year 7 (jul/08 - jun/09)	248,656
Description of measurement methods and procedures to be applied:	HB’s injections at Kenko node (node of the Trunk Integrated Grid for HB, where its billing is referred to) are measured through the Commercial Recording System, a meters’ system remotely accessed from CNDC’s premises. This data is hourly measured and monthly recorded. Project’s deliveries at Pichu substation are measured through HB’s own metering system	



	<p>and used to deduct from measurement records at Kenko, the injections of HB's non-Project's sources following the procedure described below:</p> <ol style="list-style-type: none"> 1. Project's energy measured at Pichu through HB's metering system is affected by the transmission losses between the plants and Pichu to obtain the Project's gross production (when measured data of hourly project's gross production is available, this latter is used instead of the gross energy derived as described above). 2. Chojlla Antigua (HB's non-Project power source) gross production measured at generator's terminals through HB's metering system is added to the result above 3. Project's gross production is divided by the total gross production above to get the proportion of Project's generation of the total injections 4. The above proportion is applied to Kenko records from SMEC for getting the Project's injection at Kenko (EG)
QA/QC procedures to be applied:	<p>Double check by audit of sales documents. Sales are calculated by the CNDC and reported in the Monthly Economic Transactions Report (DTE per the acronym of the term in Spanish "<i>Documento de Transacciones Economicas</i>"). The Project's metering system complies with technical specifications and CNDC standards. Registered information is compared to the information on the DTE. To prevent the use of energy from Chojlla Antigua for the emission reduction calculations, during for the periods in which Chojlla Antigua effectively injects power to the grid, Project injections should be lower than those resulting from the energy balance done with SMEC's data to calculate HB's chargeable energy</p>
Any comment:	

Data / Parameter:	$GEN_{j/k/n,y}$
Data unit:	MWh
Description:	Electricity generation of each power source / plant j, k or n
Source of data to be used:	CNDC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to Tables A-2 and A-3, Annex 3 of the PDD
Description of measurement methods and procedures to be applied:	Measurement is done through the Commercial Recording System, a meters' system remotely accessed from the CNDC premises. This data will be monthly measured and yearly recorded.
QA/QC procedures to be applied:	Commercial metering and recording of generation will be utilized. The QA/QC procedures will mainly consist of verifying whether the data is used by the CNDC for transactional purposes related to the electricity market.
Any comment:	



Data / Parameter:	$F_{i,y}$
Data unit:	ft ³ or l, for natural gas and diesel, respectively
Description:	Amount of fossil fuel consumed by each power source / plant
Source of data to be used:	<ul style="list-style-type: none"> ▪ CNDC's Mid Term Planning Report and Node Prices Report provide efficiency (<i>heat rate</i>) information ▪ SMEC records make available injections information ▪ SoE's (Superintendence of Electricity) ISE (Power Sector Information system) provides information on periodic – monthly and annual – fuel consumption by the thermoelectric plants and type of fuel by plant/unit.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please refer to Table A-2, Annex 3 of the PDD
Description of measurement methods and procedures to be applied:	<p>For those fossil fuel fired units in the system not equipped with fuel flow measurement devices that allow hourly records, hourly data is calculated from each generating unit production and heat rate following a procedure deemed acceptable by the CNDC, as follows:</p> <p>1. For each natural gas unit of the system, a regression model of the form:</p> $HR_{j,h} = aL_h^2 + bL_h + c$ <p>is determined.</p> <p>For dual fuel (natural gas and diesel) units, a dual regression model of the form:</p> $NGHR_{j,h} = aL_h + b$ <p>for the natural gas Heat Rate, and</p> $DHR_{j,h} = aL_h^b$ <p>for the diesel Heat Rate are determined.</p> <p>In the above equations, $HR_{[BTU/kWh]}$ for the natural gas units (and $NGHR$ and DHR for the dual fuel units) is the heat rate of the unit j at a given $L_{[%]}$ load level (i.e. the capacity at which the unit is dispatched as compared to its effective capacity) for the hour h. Load Level and Heat Rate data used for the above regression models are provided biannually to the CNDC by the owner of each generating unit along with the information requested by Regulation for the Mid Term Plan and Reference (Node) Price reports, and is made available to HB by the</p>



	<p>CNDC.</p> <p>2. Hourly, each fossil fuel unit's load level $L_{(%)}$ is calculated. For instance, if a unit of 90 [MW] of installed capacity is dispatched at 50 [MW] (hourly mean), its load level is $50/90(x100) = 55.55\%$.</p> <p>3. Hourly, the Heat Rate HR of each fossil fuel unit at its corresponding load level L is calculated using the $HR-L$ regression model of the unit.</p> <p>4. The calculated heat rate HR is then multiplied by the gross energy of the unit (i.e. the energy delivered by the respective unit to the grid as measured and recorded by the SMEC, affected by the losses):</p> $CE_{j,h} = HR_{j,h} \times \left[\frac{GEN_{j,h}}{1 - \% Losses} \right]$ <p>The resulting value of $CE_{(BTU)}$ is the amount of caloric energy used from the fossil fuel fed to the generating unit j in the hour h. Calculated as such, CE equals to the relation:</p> $CE = F \times NCV$ <p>Where NCV is the Net Caloric Value of the fuel, respectively. F then can be obtained dividing CE by NCV.</p> <p>Also, and given the above:</p> $F \times COEF = CE \times EF_{CO2} \times OXID$ <p>When measured hourly records of fuel consumption are available, this latter is used instead of the procedure described above. This data will be monthly measured and yearly recorded.</p>
QA/QC procedures to be applied:	Only data accepted by the CNDC for the dispatch model in place will be used.
Any comment:	CNDC's Mid Term Planning and Node Prices Reports, as well as SMEC's records, are available at CNDC's webpage or on request. Mid Term Planning Reports and Node Prices Reports are produced biannually by the CNDC and contain, for the purpose of this Monitoring Report and this parameter, the same information, although they are not produced at the same time, so, the use of any of them depends solely on its availability at the moment in which calculations are made. SoE's ISE information is available on request and it is used to compared the data calculated.

Data / Parameter:**MERIT ORDER**



Data / Parameter:	MERIT ORDER
Data unit:	This parameter does not have dimensions or units
Description:	The merit order in which power plants are dispatched
Source of data to be used:	CNDC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value varies normally on an hourly basis
Description of measurement methods and procedures to be applied:	The merit order results from arranging all dispatched units in accordance to its marginal cost (which is at its time a combination of the heat rate, the fuel cost and the Operation & Maintenance non-fuel costs of the Units), decreasingly. Merit order lists will be registered hourly and recorded monthly.
QA/QC procedures to be applied:	Only official information made available by the CNDC will be used.
Any comment:	

Data / Parameter:	GEN_{j/k/n,y} IMPORTS
Data unit:	MWh
Description:	Electricity imports to the project electricity system
Source of data to be used:	CNDC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	If an interconnection to foreign grids occurs in the future, measurement will be done through the Commercial Recording System and will be available from the CNDC in accordance to the applicable Imports/Exports Regulation. This data will be monthly measured and yearly recorded.
QA/QC procedures to be applied:	Commercial metering and recording of generation will be utilized. The QA/QC procedures will mainly consist of verifying whether the data is used by the CNDC for transactional purposes related to the electricity market.
Any comment:	To date, no imports occur since there are no international links. No such a links are under development either.

Data / Parameter:	COEF_i
Data unit:	tCO ₂ per mass or volume unit
Description:	CO ₂ emission coefficient of each fuel type
Source of data to be used:	Derives from NCV_i , $OXID_i$ and EF_{CO_2} as described in section B.6.1 of this PDD
Value of data applied for the purpose of calculating expected	There is no ONE SINGLE value for the COEF _i resulting for the estimations, but several values.



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emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Calculated using the corresponding formulae of section B.6.1 and coming from the characteristics of the units
QA/QC procedures to be applied:	Only official information made available by the CNDC will be used.
Any comment:	

Data / Parameter:	NCV_i																				
Data unit:	Natural Gas: BTU/ft ³ Diesel oil: BTU/l																				
Description:	Net calorific value (energy content) per mass or volume unit of a fuel <i>i</i> ,																				
Source of data to be used:	CNDC																				
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table border="0"> <tr> <td>Natural gas:</td> <td></td> </tr> <tr> <td> Plant</td> <td> NCV</td> </tr> <tr> <td> Guaracachi</td> <td> 907 BTU/PC</td> </tr> <tr> <td> Karachipampa</td> <td> 945 BTU/PC</td> </tr> <tr> <td> Aranjuez</td> <td> 945 BTU/PC</td> </tr> <tr> <td> V. Hermoso</td> <td> 922 BTU/PC</td> </tr> <tr> <td> Carrasco</td> <td> 934 BTU/PC</td> </tr> <tr> <td> Kenko</td> <td> 920 BTU/PC</td> </tr> <tr> <td> Bulo Bulo</td> <td> 920 BTU/PC</td> </tr> <tr> <td>Diesel oil:</td> <td>33,710 BTU/l</td> </tr> </table>	Natural gas:		Plant	NCV	Guaracachi	907 BTU/PC	Karachipampa	945 BTU/PC	Aranjuez	945 BTU/PC	V. Hermoso	922 BTU/PC	Carrasco	934 BTU/PC	Kenko	920 BTU/PC	Bulo Bulo	920 BTU/PC	Diesel oil:	33,710 BTU/l
Natural gas:																					
Plant	NCV																				
Guaracachi	907 BTU/PC																				
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Kenko	920 BTU/PC																				
Bulo Bulo	920 BTU/PC																				
Diesel oil:	33,710 BTU/l																				
Description of measurement methods and procedures to be applied:	Comes from information declared by the agents connected to the power grid and deemed valid by the CNDC.																				
QA/QC procedures to be applied:	Only official information made available by the CNDC will be used.																				
Any comment:	Data given above is valid only for the period July 2002 – August 2002 and varies usually monthly in accordance to the quality and properties of the fuel, also variable.																				

Data / Parameter:	OXID_i
Data unit:	Per unit or percentage
Description:	Is the oxidation factor of the fuel <i>i</i>
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Natural Gas: 1 per unit (100%) Diesel oil: 1 per unit (100%)



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Description of measurement methods and procedures to be applied:	No measurement is applicable
QA/QC procedures to be applied:	Only information from IPCC will be used
Any comment:	

Data / Parameter:	EF_{CO₂,i}
Data unit:	tCO ₂ /BTU
Description:	CO ₂ emission factor per unit of energy of the fuel <i>i</i>
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Natural Gas: 5.92E-08 [tCO ₂ /BTU] Diesel Oil: 7.81E-08 [tCO ₂ /BTU]
Description of measurement methods and procedures to be applied:	Calculated from carbon contents (made available by IPCC Guidelines), conversion factor between Joule and BTU and relation of molecular masses of Carbon and Carbon Dioxide
QA/QC procedures to be applied:	Only information from IPCC will be used
Any comment:	

Data / Parameter:	Plant name
Data unit:	Text – does not have units
Description:	Identification of power source / plant for the Operating Margin
Source of data to be used:	CNDC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Various
Description of measurement methods and procedures to be applied:	No measurement is applicable. Determination of power sources will be done following the merit order identification process. This data will be recorded yearly and kept archived during the crediting period.
QA/QC procedures to be applied:	Only official information made available by the CNDC will be used.
Any comment:	Power sources for OM calculation can vary every fifteen minutes, the resulting lists for any given crediting period are large.

Data / Parameter:	Plant name
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Data unit:	Text – does not have units
Description:	Identification of power source / plant for the Build Margin
Source of data to be used:	CNDC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3
Description of measurement methods and procedures to be applied:	No measurement is applicable. Determination of power sources will be done following the merit order identification process. This data will be recorded yearly and kept archived during the crediting period.
QA/QC procedures to be applied:	Only official information made available by the CNDC will be used.
Any comment:	

B.7.2 Description of the monitoring plan:

The approved monitoring methodology ACM0002 enables the Project proponent to rely exclusively on data and information, as described in B.6.1, available from the CNDC in Bolivia. The essential information to be monitored includes metering records, hourly generation of each unit in the system, estimated total fuel consumption, and calculated heat rate for all fossil fuel fired generation units within the system. The required data is compiled and archived by the CNDC and will be transferred to the Project participants for duplicate archival storage. Contrasts of HB's own meters is done periodically since the main meters are also revenue meters and have to comply with CNDC approved standards. The data listed in B.6.1 is sufficient to estimate emissions occurring within the Project boundary, determine the baseline, and identify increased emissions outside the Project boundary in the event that transmission facilities are constructed in the future that would enable imports or exports from the grid system.

The instructions in the approved monitoring methodology ACM0002 will be followed and reported annually in a formal Monitoring Report.

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