Bagasse-based cogeneration project in Brazil

（Summary）

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Association of International Research Initiatives for Environmental Studies

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1. Background

1.1 Electricity mix

Brazil is a country whose electricity mix is dominated by hydropower. However, the solid economic growth of recent years has brought about a sharp increase in energy demand. Furthermore, development of hydropower has been reaching a plateau, and new gas and oil reserves are being discovered. Therefore, the share of hydropower is on a decline, as follows. This is especially pronounced in the South-Southeastern grid area which includes the State of Sao Paulo, where hydropower resource is relatively scarce and economic activity is high.

Table. Share of electricity by generation source

Year	1971	1973	1980	1985	1990	1995	1999	2000	2001
Fossil fuel	15.0%	9.4%	6.2%	4.6%	4.6%	4.9%	8.7%	8.4%	11.1%
Nuclear	0.0%	0.0%	0.0%	1.7%	1.0%	0.9%	1.2%	1.7%	4.4%
Hydropower	83.7%	89.4%	92.5%	92.1%	92.8%	92.1%	87.5%	87.3%	81.7%
Biomass, etc.	1.3%	1.2%	1.3%	1.6%	1.6%	2.0%	2.6%	2.6%	2.9%

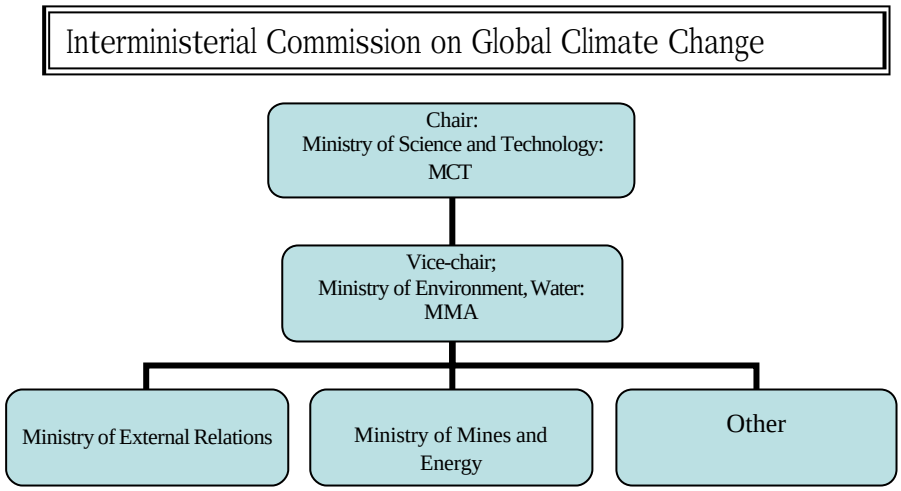
(Energy Statistics of Non-OECD Countries (2003))

Electricity is being deregulated. Large hydropower as well as transmission is run by state-owned Eletrobras, but independent power producers (IPPs) are coming into existence. Distribution is also privatised.

1.2 Climate change policy

Climate change policy in Brazil is governed by an interministerial committee (Comissão Interministerial de Mudança Global do Clima[1]) composed of 10 ministries, chaired by the Ministry of Science and Technology (MCT) and assisted by the Ministry of Environment. MCT's climate team, headed by Dr. Jose Gonzalez Miguez, is the central authority on climate policy in general, and is the designated national authority (DNA) of Brazil. National Focal Point (NFP) for the Framework Convention, however, is delegated to the ministry of Foreign Affairs.

[1] Address: Esplanada dos Ministérios, Bloco E - 2 andar - sala 242 70.067-900, Brasilia DF • Brazil. English homepage is: http://www.mct.gov.br/clima/ingles/comunic/cimgc.htm



Two important documents with respect to CDM project implementation are the following:

- Resolution # 1 of September 11, 2003: The Interministerial Commission on Global Climate Change, created by Decree of July 7, 1999, in the exercise of its powers under Article 3, paragraphs III and IV (hereafter the Resolution)
- Manual for submitting a CDM project to the interministerial commission on global climate change (hereafter the Manual)

The Resolution basically traces the Marrakech Accords verbatim. The one significant difference is the final page (Annex III) which denotes the sustainability conditions, as follows.

a) Contribution to local environmental sustainability
Assess the mitigation of local environmental impacts (solid wastes, liquid effluents, atmospheric pollutants, etc.) caused by the project in comparison with the estimated local environmental impacts for the reference scenario.

b) Contribution to development of working conditions and net job creation
Assess the commitment of the project to social and workplace responsibilities, health and education programs and defense of civil rights. Also assess the improvement in the qualitative and quantitative level of employment (direct and indirect) comparing the project scenario with the reference scenario.

c) Contribution to the distribution of income
Assess the direct and indirect effects of the quality of life of low-income populations, noting the socio-economic benefits provided by the project in relation to the reference scenario.

d) Contribution to training and technological development
Assess the degree of technological innovation of the project in relation to the reference scenario and the technologies used in activities comparable to those called for in the project. Also assess the possibility of reproduction of the technologies used, taking account of their demonstration effect, and evaluating the origin of the equipment, the existence of royalties and technology licenses and the need for international
technical assistance.

e) Contribution to regional integration and linkages with other sectors
The contribution to regional development can be measured in terms of the integration of the project with other socio-economic activities in the region where it is implanted.

The Manual denotes the necessary documents in order to obtain approval by the Brazilian authorities, which are as follows:

- PDD (English and Portuguese)
- Description of the project fulfilling the objective of Annex III (see above) of the Resolution
- Invitation letters for stakeholder comments
- Validation report by DOE (English and Portuguese)
- Declaration of the Project Participants, stipulating who is in charge and the means of communication with the Interministerial Commission on Global Climate Change Executive Secretariat
- Term of commitment in respect to sending the distribution document of the CERs which might be issued at every verification of the project activities for certification
- Conformity with the Environmental and Labor Legislation
- Declaration (in Portuguese) of the Designated Operational Entity that it is fully established in national territory and that it is capable of ensuring compliance with the relevant requirements of the Brazilian legislation.

Of these, the invitation letter and the validation report require immediate attention. Invitation letters should be sent to the Prefeitura (City Hall), Câmara dos vereadores (city council), State Environmental Agencies, Municipal Environmental Agencies, Brazilian Forum of NGOs and Social Movements for the Environment and Development, Community Associations, and the Public Prosecution Office. This could be considerable undertaking on the side of the project developers.

Another noteworthy point is that Brazil recognizes DOEs upon condition that they are located in Brazil; validation reports by foreign-based DOEs compiled by dispatching validators will not be accepted.

2. Overview of the project

A candidate project for the clean development mechanism under the Kyoto Protocol was identified.

The intended project participant is Unialco S.A, which is located in the western part of Sao Paulo State, Brazil. A project to comprehensively upgrade its bagasse-based boiler / generation facility to enable supply of electricity to the grid is conceived in its site.

The capacity of the project totals 30MW (of which 24MW will be exported to the grid). Annual expected electricity generation is at 104,299MWh. The project activity is characterised by the necessity to construct a long transmission line (32km) with substations. The detailed list of equipments is as follows:

Table 1. The technologies to be employed by the project activity

Category	Type
Boiler	1) Current: • CALDEMA AUP-40 boiler 120t-vapour/hr at 380C with a pressure of 21kgf/cm^2 (installation 2000) • CALDEMA AZ-380 boiler 110t-vapour/hr at 330C with a pressure of 21kgf/cm^2 (installation 1982) 2) Project • Installation of CALDEMA boiler AUP-67 200t-vapour at 420C with a pressure of 42kgf/cm^2 • Augmentation of AUP-40 boiler to 120t-vapour/hr at 420C with a pressure of 42kgf/cm^2 • Scrapping of AZ-380 boiler
Generator	1) Current • Four 1.5MW turbine / generators (installation 1982) 2) Project • Two counter-pressure turbo-generators, of 18,750kVA/15,000kW - 13,8kV (42kgf/cm2 (Manufacturer: TGM and WEG); • One condensation turbo-generator of 10.000kVA/8.000kW - 13,8kV (42kgf/cm2) (Manufacturer: TGM and WEG); • Scrapping of four 1.5MW turbine / generators.
Transmission facilities	1) Current • None 2) Project • 138kV high-tension line for 32km, from the plant to the Guararapes substation • Substation within the premises, to increase voltage from 13.8kV to 138kV.

Aeria1 view of the sugar plant

(source: Unialco S.A.)

View of the current boiler / generation facilities

(source: Unialco S.A.)

3. Overview of the survey process

3.1 Overall process

The present survey involved two trips (August / September, 2004 and February, 2005). The project site was visited in both occasions. In addition, meeting with the Brazilian government was conducted (the participant in the case of February, 2005 visit was Dr. Jose Miguez of the Ministry of Science and Technology, a member of CDM Executive Board).

A draft Project Design Document (PDD) was completed in January, 2005, and was subjected to a desk review. This was completed in February, 2005. A revised version of the PDD was completed and was submitted as part of the report of this project.

3.2 Desk review process

Desk review of the draft Project Design Document was carried out by a designated operational entity (JQA) during the period of January and Febuary, 2005. The following suggestions were made.

- Closer alignment to the approved methodology AM0015
- Explicit reference to Brazilian sustainable development criteria (Annex III of Resolution)
- Easy-to-understand explanation as well as reference on the level of technology.

Revision to take into account such factors is carried out. And more improvement to submit PDD to the board is required by trial-and-error procedure in the type C study programme on next stage.

4. Baseline and additionality

4.1 Baseline

Two scenarios were taken as the baseline ("no-action" and "self-sufficiency"). Both assume that electricity will not be supplied to the grid. Baseline GHG emission factor is determined according to the simple adjusted operating margin (factor the most recent three years), in order to minimise monitoring-related work. Drawing upon the work carried out by the International Energy Agency (IEA) as well as previously submitted PDDs of similar project, the baseline GHG emission factor was calculated as follows, applying the simple adjusted operating margin method as defined by Approved Methodology AM0015: " Bagasse-based cogeneration connected to an electricity grid"

Table 2. Development of baseline GHG emission factor

Parameter	Data type	Value	Referene
$EM_{OM,y}$	Simple operating margin (South-Southeast grid)	0.719t-CO_2/MWh	IEA, *Road-Testing Baselines for Greenhouse Gas Mitigation Projects in the Electric Power Sector.*
λ	Fraction of the time which low-cost/must-run plants are on the margins	0.457 for 2001 0.550 for 2002 0.582 for 2003 Average: 0.530	ONS (Operador Nacional do Sistema, as quoted in the Vale do Rosario Bagasse Cogeneration Project
R	Share of low-cost/must-run generation	64%	Data for South-southeastern grid, as indicated in the IEA literature above.
$EF_{OMA,y}$	Adjusted operating margin	0.338 t-CO_2/MWh	=0.719 * (1-0.530) = 0.338
$EF_{BM,y}$	Build margin	0.569 t-CO_2/MWh	Data for South-southeastern grid, as indicated in the IEA literature above.
$EF_{CM,y}$	Combined margin	0.453 t-CO_2/MWh	(0.338 + 0.569) / 2

4.2 Additionality

Additionality: additionality assessment is carried out according to the "Tool for the demonstration and assessment of additionality".

Table 3. Demonstration of additionality

Step 1 (Definition of alternatives)	Two alternatives are defined, as follows: 1) "No-action" option (ongoing use of current facilities) "No-action" scenario is the most inexpensive option, since no investment takes place. 2) "Self-sufficiency" option (expansion of the current facilities for the purpose of self-sufficiency) "Self-sufficiency" scenario presupposes that the facility will reinstall its electricity generation facilities, but does not include construction of a hugely costly transmission line to export it.
Step 3 (Barrier analysis)	The following barriers are identified and analyzed • Investment barrier (size of investment, financial risk) • Technical barrier (risk of entering new business, maintenance of transnission
Step 4 (Common practice analysis)	• Electricity supply from bagasse-based generation is a relatively rare activity, much of which is made possible through CDM. • Among similar projects, none entail such a long transmission line as this project.
Step 5 (Impact of registration)	Impact of registration can be manifold, as follows • Anthropogenic greenhouse gas emission reductions; • The financial benefit of the revenue obtained by selling CERs • Improved public relations
Step 2 (investment analysis)	Project IRR is calculated to be 9.6% without CER, and 10.6% with CER

4.3 Monitoring

Since baseline GHG emission is calculated from an emission factor estimated ex ante, main monitoring parameter is limited to electricity supplied to the grid. Use of fossil fuel for startup purposes will be monitored, and GHG emission will be taken into account.

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However, it is expected that GHG emission factor calculated this way will underestimate the GHG reduction of the project activity. Therefore, it is proposed that the dispatch analysis operating margin, if provided by the Brazilian government and if deemed applicable through external verification, will be used.

4.4 GHG reduction, crediting period

Since no leakage is anticipated, it is proposed that annual emission reduction be calculated on the basis of electricity provided to the grid and the grid displacement margin. The former is estimated at 104,299MWh/yr, while the latter ($EF_{CM,y}$ of table 2) is estimated at 0.453t-CO_2/yr. Therefore, the resulting annual GHG reduction by the project is:

104,299MWh * 0.453t-CO_2/MWh = 47,247t-CO_2/yr

For the project, a renewable crediting period of seven years is desired (starting date is at July, 1, 2006). If the baseline grid displacement margin ($EF_{CM,y}$) of 0.453t-CO_2/yr. stood during the two renewal period, the overall

emissions reduction during the entire crediting period will be:

104,299MWh * 0.453t-CO_2/MWh * 7 yr * 3 = 992,196t-CO_2/yr

4.4 Other factors

The project proponent has submitted the RAP (preliminary environmental assessment) to the Sao Paulo State. The RAP concludes that the project activity does not result in consumption of local resources, would not cause adverse effects, and will be beneficial for the region.

5. Next steps

The project proponent is highly motivated; a memorandum of understanding (MOU) has been exchanged between the project proponents to work towards realization of the project activity as CDM.

Steps to be taken include the following:

- Finalization of PDD and translation into Portuguese, taking into account pending issues such as the approval of the RAP.
- Validation by a DOE which is based in Brazil
- Invitation to key stakeholders including environmental and social NGOs in Brazil, as per the Manual as outlined in chapter 1. .
- Application to the Brazilian government for approval.