CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

"Fuel switch at BSM sugar mills"

Version number of the document: 03

Date of the document: 19/03/2007

A.2. Description of the project activity:

The purpose of Beta San Miguel (BSM) project activity is to eliminate the consumption of fuel oil in steam boilers.

Before the implementation of the project activity, BSM sugar mills used fuel oil and bagasse as the main energy supply of energy. Fuel oil and bagasse were burned together in cogeneration systems that generated steam and power to attend process needs. The implementation of the project activity began in harvest 2001/2002, in the sugar mill San Rafael de Pucté (ISRP), with a second phase in 2004/2005, in the sugar mill Constancia (ICSA). Consequently, the use of fuel oil started to reduce and bagasse, to become the only energy supply of the mills. The objective of the project is to completely eliminate the use of fuel oil in the next years.

The project activity reduces emissions of greenhouse gases because of the avoidance of fossil fuel use (fuel oil). The scope of the project activity included several substitutions and improvements of equipments in the two sugar mills.

Beta San Miguel is the second largest sugar producer in Mexico and the first private producer in the country with a production of 609.9 thousand tonnes of sugar in the 2004/2005 harvest season, which represented 10.5% of Mexican production. Beta San Miguel started its operations in the Mexican sugarcane industry on November 1988 through the purchasing of four sugarcane mills from the Mexican government. The sugarcane industry privatization in Mexico took place in 1988 and it was concluded in 1992. Beta San Miguel produces brown sugar, white sugar and ethanol in five sugar mills: San Francisco Ameca, Quesería, San Rafael de Pucté, San Miguel del Naranjo e Constancia.

Project activity contributes to Sustainable Development for the following reasons:

- Elimination of fuel oil use will result in avoided environmental impacts from fuel oil use (extraction, refining, transport and final use).

- The elimination of fuel oil also results in the improvement of work conditions at the site because of the avoidance of activities such as, unloading, heating, cleaning pipelines and risk of oil spills.

- The project activity will also reduce the emission of air pollutants, especially particulate matter, sulphur oxides, nitrogen oxides and carbon monoxide, because the amount of bagasse burned will not increase significantly and the use of fuel oil will be eliminated.

- The project will also contribute to the mitigation of greenhouse gases emissions as bagasse is a neutral greenhouse gas emitting fuel

- Additionally, the transportation of fuel oil to the sugar mills will be eliminated resulting in a more environmentally friendly situation as the use of road trucks, carrying fuel oil, may result in traffic accidents and oil spills, with soil and water contamination.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host)	Beta San Miguel (private entity)	NO
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Mexico

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

The project activity encompasses two sugar mills listed in the table below with corresponding State and city. All of them are located in Mexico.

Plants, Cities and States

Plant	City	State
Ingenio Constancia (ICSA)	Tezonapa	Veracruz
Ingenio de San Rafael de Pucté (ISRP)	Othón P. Blanco	Quintana Roo

A.4.1.3. City/Town/Community etc:

Please, refer to Section A.4.1.2.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

BSM headquarters is located at Paseo de la Reforma, 397 – Cuauhtémoc, Mexico – D.F.

The detail of physical location of the two sugar mills is presented below:

Detail of physical location

Plant	Location
Ingenio Constancia (ICSA)	Constancia sugar mill is located in the municipality of Tezonapa, in the State of Veracruz. Near cities are Córdoba and Tierra Blanca. Geographical coordinates: Latitude North 18°36' 28" Longitude West 96°41' 17"
Ingenio de San Rafael de Pucté (ISRP)	San Rafael de Pucté sugar mill is located between Pucté and Alvalo Obregón, 63 km in the South of Chetumal Municipality, close to the border with Belize. Geographical coordinates:: Latitude North 18°15' 45" Longitude West 88°41' 00"

A.4.2. Category(ies) of project activity:

The project activity pertains to Sectoral Scopes 1 – Energy industries (renewable/non renewable sources) and 4 - Manufacturing industries.

A.4.3. Technology to be employed by the project activity:

BSM project uses conventional Rankine cycle steam systems operating in cogeneration. The steam produced in boilers drives steam turbines to attend sugar mills mechanical and electrical demands, and then is directed to the process in order to attend thermal energy demands.

Before the project activity, fuel oil and bagasse were burned. After project implementation bagasse started to substitute fuel oil in the attendance of plant energy demands.

BSM sugar mills are autonomous in terms of energy demands for the process (thermal, electrical and mechanical). The sugar mills operate with steam boilers producing steam that drives electromechanical loads and that attends thermal needs. Before the project implementation, the mills used to operate the boilers with fuel oil as main fuel and bagasse as secondary fuel.

The project activity reduced the consumption of fuel oil in the steam boilers. After the implementation of the project activity, the use of fuel oil has decreased significantly and is expected to be eliminated in the following years.

The following equipments are installed in the two cogeneration plants included in the project activity:

Cogeneration plants

Plant	Equipment
ISRP	5 steam boilers at 29 kgf/cm2, 360°C, 58 t/h, efficiency: 60%. Installed in 1978. Most recent retrofit: 2001. 9 MW of electricity generation capacity, with steam turbines, for internal consumption
ICSA	1 steam boiler at 42 kgf/cm2, 400°C, 110 t/h, efficiency: 78%. Installed in 1999. Most recent retrofit: 2002/2003. 12.5 MW of electricity generation capacity, with steam turbines, for internal consumption

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Amount of emission reductions for the first crediting period:

Years	Annual estimation of emission reductions in tonnes of CO2 e
2001 (from December 1 on)	**21,832**
2002	**10,921**
2003	**8,562**
2004	**38,915**
2005	**58,032**
2006	**58,032**
2007	**58,032**
2008 (until November 30)	**0**
Total estimated reductions (tonnes of CO2 e)	**254,326**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	**36,332**

A.4.5. Public funding of the project activity:

There is no public funding involved in the project activity.

SECTION B. Application of a baseline methodology

B.1 Title and reference of the approved baseline methodology applied to the project activity:

AM0036 –"Fuel switch from fossil fuels to biomass residues in boilers for heat generation", Version 1.1, dated on 29/09/2006.

Tool for the demonstration and assessment of additionality, Version 2, dated on 28/11/2005.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The AM0036 methodology is applied to the Project because it complies with all the conditions limiting the applicability of the methodology:

(i) The project activities switch from use of fossil fuels to biomass residues, in existing boilers, according to scenario 1 of the methodology: ***Retrofit of existing boilers.*** *The project activity is the retrofit of (an) existing boiler(s). The retrofit is made to the boiler(s) to enable (a) the use of biomass residues or (b) an increase in the use of biomass residues beyond historical levels, which would not be technically possible in any of the existing boilers without a retrofit or replacement of the boilers;*

(ii) The project activity is based on the operation of (a) heat generation boiler(s) in an agro-industrial plant generating the biomass residues, which are used in the activity;

(iii) If power is generated with heat from the boilers, it is not increased as a result of the project activity, i.e, the annual power generation during the crediting period is not more than 10% larger than the highest annual power generation in the most recent three years prior to the implementation of the project activity.

Any power increase beyond the limit of 10% was due to a corresponding increase in the production of sugar cane and bagasse, and can not be attributed to the project, as it can be seen in the Tables below, for harvest 05/06, in ISRP, and for harvest 04//05, in Constancia. In harvest 05/06, in Constancia, several auxiliary services were installed or their power was increased, such as the power increase for water pumps for steam condensation; new water extraction pump for a new water well; new pump station for the transference of liquor from the evaporators; use of an electrical pump for water feeding to the boiler, replacing a former pump with lower capacity. These new auxiliary services led to an energy consumption increase, and can not be attributed to the project activity, since there was a clear production expansion after harvest 04/05.

ISRP - Harvest	ISRP -Bagasse (dry tones)	ISRP - Energy generated (KWh)
Baseline: 98/99	149,063	16,136,761
99/00	159,249	18,382,580
00/01	169,617	**19,164,194**
Project: 01/02	188,595	19,348,012
02/03	179,110	17,918,328
03/04	177,060	16,445,468
04/05	198,442	20,863,598
05/06	225,567	25,590,220

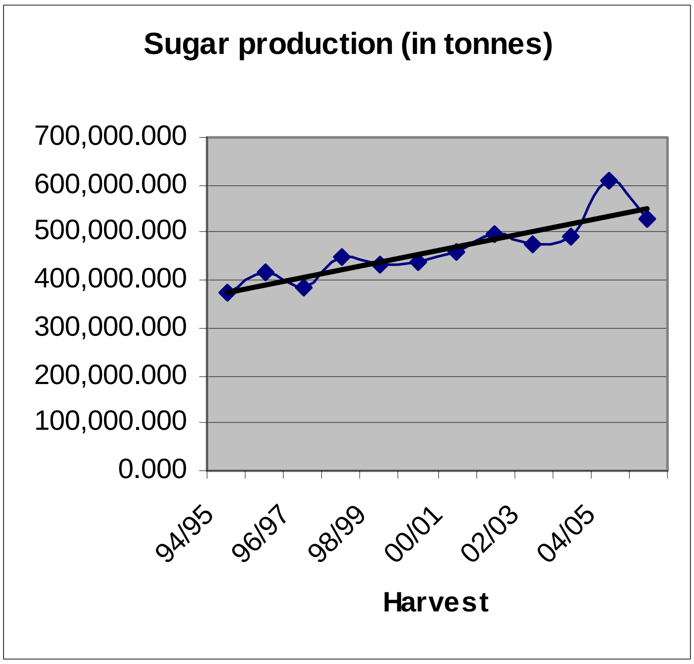
ICSA - Harvest	ICSA Bagasse (dry tones)	ICSA Energy generated (KWh
Baseline: 01/02	88,140	**11,791,138**
02/03	81,353	10,558,237
03/04	93,144	9,907,235
Project: 04/05	118,059	14,243,362
05/06	107,411	15,081,172

(iv) The use of biomass residues or increasing the use of biomass residues beyond historical levels is technically not possible at the project site without a significant capital investment in the retrofit of existing boilers. Beta San Miguel had to retrofit their boilers in order to operate them without fuel oil. The costs of these retrofits is shown in annexed spreadsheet “BSM IRR two phases ISRP - ICSA_2007.03.22.xls”;

(v) Existing boilers at the project site have used only biomass residues (and no other type of biomass) for heat generation during the most recent three years prior to the implementation of the project activity;

(vi) No biomass types other than biomass residues are used in the boiler(s) during the crediting period (some fossil fuels are co-fired);

(vii) For projects that use biomass residues from a production process (e.g. production of sugar), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar or in other substantial changes (e.g. product change) in this process. The graph below shows that the production for the sugar mill has had an incrementing trend for years, long before the implementation of the project activity. Already in 1999, BSM elaborated a strategic plan where the goal was to increase sugar production in more than 30% during the decade of 2000 (see annexed file "BSM Scenario 1999.ppt"). This project does not have an impact in processing capacity; BSM will not increase their installed capacity because of this project.



(viii) The biomass residues used at the project site, site where the project activity is implemented, are not stored for more than one year;

(ix) No significant energy quantities, except from mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion;

(x) The biomass residues are directly generated at the project site;

(xi) In case of project activities that involve the replacement or retrofit of existing boiler(s), all boiler(s) existing at the project site prior to the implementation of the project activity should be able to operate until the end of the crediting period without any retrofitting, i.e. the remaining technical lifetime of each existing boiler should at the start of the crediting period be larger than the duration of the crediting period

(7 years). The remaining lifetime of all the project boilers is larger than the duration of the crediting period, as shown in a document prepared by the company Servicios de Inspección, Ingenieria y Diagnostico S.A. de C.V, which is in charge of the maintenance of BSM's equipments (see annexed file "BSM lifetime equipments.pdf").

(xii) the most plausible baseline scenario for heat generation is H2: continued operation of the existing boilers using the same fuel mix or less biomass residues as in the past;

(xiii) the most plausible baseline scenario for the use of biomass residues is B3: the additional biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes.

B.3. Description of the sources and gases included in the project boundary

The spatial extent of the project boundary encompasses:

• the boilers and related equipment at the project site

The table below shows a summary of gases and sources included in the project boundary, and justification/explanation where gases and sources are not included.

	Source	Gas	Included?	Justification/Explanation
Baseline	Fossil fuel combustion in boilers for heat generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of the biomass residues	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Project participants decided to not include this emission source
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	On-site fossil fuel and electricity consumption	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass residues	CO_2	No	Biomass residues are produced inside the mills. No off-site transportation of biomass residues is necessary.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small

	Combustion of biomass residues for heat generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	This emission source must be included if project participants decide to include CH_4 emissions from uncontrolled burning or decay of the biomass residues in the baseline scenario.
		N_2O	No	Excluded for simplification. This emissions source is assumed to be very small
	Biomass storage	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small
		N_2O	No	Excluded for simplification. This emissions source is assumed to be very small

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

The baseline scenario was identified through the analysis of all realistic and credible alternatives to the project activity that are consistent with current laws and regulations.

Realistic and credible alternatives should be *separately* determined for the following two components of the project activity:

- Heat generation in the absence of the project activity;
- What would happen to the biomass residues in the absence of the project activity;

For **heat** generation, the alternatives are:

H1 The proposed project activity not undertaken as a CDM project activity (heat generation with biomass residues)
H2 Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past
H3 Continued operation of the existing boiler(s) using a different fuel (mix)
H4 Improvement of the performance of the existing boiler(s)
H5 Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past AND installation of (a) new boiler(s) that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing boiler(s)
H6 Replacement of the existing boiler(s) with new boiler(s)

For the use of **biomass**, the alternatives are:

B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters.
B3 The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes.
B4 The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation)
B5 The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)
B6 The biomass residues are used as fertilizer
B7 The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation)

As shown in the analysis done in step 3 of section B.5, the chosen baseline scenario is **H2** (Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past), **B3** (The additional biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes), for ICSA, and B3 and B6 (one part of the additional biomass residues is burnt in an uncontrolled manner without utilizing them for energy purposes; another part of the biomass residues were used as fertilizer) for ISRP.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

As determined by AM0036, the additionality of the project activity is demonstrated and assessed using the latest version of the “Tool for the demonstration and assessment of additionality” – Version 2.

The Tool is also used to identify the most plausible baseline scenario among all realistic and credible alternatives(s) to the project activity, i.e. the baseline scenario. Step 3 of the Tool is used to assess which of the alternatives are excluded from further consideration.

The following steps are applied:

Step 0. Preliminary screening based on the starting date of the project activity

The starting date of the CDM project activity, 14/04/2000 (date of the payment receipt of a consultancy contract for the evaluation of the necessary retrofit), falls between 01/01/2000 and the date of the registration of a first CDM project activity, 18/11/2004.

One document confirms that CDM was seriously considered in the decision to proceed with the project activity. It is based on agreements that were negotiated to a third party and are available under request. Since the beginning of the project, Beta San Miguel engines have been advised by a Brazilian Consultancy Office regarding technical improvements in its sites. There is

a letter of *Júlio Américo Gonzalez Consultoria e Projetos*, from February 2000, where it is clearly mentioned that the changes destined to switch fuels could be considered to generate carbon credits.

STEP 1. Identification of alternative scenarios to the proposed CDM project activity that are consistent with current laws and regulations

The conditions of BSM project are the following:

- Conditions existent previously to the implementation of the project activity:
    - demands of heat and power of the sugar mills were attended internally through Rankine steam cogeneration plants;
    - the cogeneration plants used fuel oil as main fuel and co-fired Bagasse;
    - no other fuels were used;
    - all the biomass residues used in the cogeneration plants were used internally in the mills and not stored for more than one year;
    - all the biomass residues produced by the mills were used in the cogeneration plants.

- Conditions after the implementation of the project activity:
    - demands of heat and power of the sugar mills are attended internally through Rankine steam cogeneration plants;
    - consumption of fuel oil will be eliminated and completely substituted by biomass residues;
    - no other fuels will be used;
    - all the biomass residues used in the cogeneration plants will be used internally in the mills and will not be stored for more than one year;
    - all the biomass residues produced by the mills are used in the cogeneration plants.

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

All realistic and credible alternatives to the project activity that are consistent with current laws and regulations must be identified. Realistic and credible alternatives should be *separately* determined for the following two components of the project activity:

- Heat generation in the absence of the project activity;
- What would happen to the biomass residues in the absence of the project activity;

For **heat** generation:

H1 The proposed project activity not undertaken as a CDM project activity (heat generation with biomass residues)
H2 Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past

H3 Continued operation of the existing boiler(s) using a different fuel (mix)
H4 Improvement of the performance of the existing boiler(s)
H5 Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past AND installation of (a) new boiler(s) that is/are fired with the same fuel type(s) and the same fuel mix (or a lower share of biomass) as the existing boiler(s)
H6 Replacement of the existing boiler(s) with new boiler(s)

For the use of **biomass**:

B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters.
B3 The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes.
B4 The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation)
B5 The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)
B6 The biomass residues are used as fertilizer
B7 The proposed project activity not undertaken as a CDM project activity (use of the biomass residues for heat generation)
B8 Any other use of the biomass residues

After considering the specific conditions of BSM project activity and the possibilities presented in the methodology, different alternative scenarios are analyzed in the following steps for identification of the baseline scenario and additionality assessment:

Alternative heat scenarios considered in this project activity

Alternative	Heat
1	H1
2	H2
3	H4
4	H5
5	H6

Alternative biomass scenarios considered in this project activity

Alternative	Biomass
1	B1
2	B2
3	B3
4	B6
5	B7

Sub-step 1b. Enforcement of applicable laws and regulations:

All the alternatives are in compliance with all applicable legal and regulatory requirements.

There are no national and/or sectoral policies and circumstances that influence the decisions or impose obligations to the proposed project activity. The use of fuel oil and bagasse are not restricted nor demanded by any Federal and/or State legislation. Also, no sectoral policies incentive the use of bagasse or disincentive the use of fuel oil. Therefore, no sectoral policies and circumstances would make the project activity preferred, rather than the baseline scenario. The only national circumstance that foments the new technology is the participation of Mexico in the Kyoto Protocol, which allows the project to benefit from the CDM incentives.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Additionality is demonstrated through an investment benchmark analysis (option III)

Sub-step 2b and 2c– Option III - benchmark analysis

Spreadsheet "Mexico interest rates.xls", prepared by the *Centro de Estudios de las Finanzas Publicas* – Center of Studies of Public Finance, institution linked to the Mexican Government, shows that the bank passive rates, in pesos, were above 15%, on average, in 2000, when the decision for phase 1 of the project was made; and above 6%, on average, in 2003, when the decision for phase 2 of the project was made (see also the Table below. The original one in Spanish and the translation into English)

Centro de Estudios de las Finanzas Públicas

http://www.cefp.gob.mx/intr/e-stadisticas/esta28.xls

México: C e t e s [1] (tasa de rendimiento nominal anual), 1982-2007

(tasa nominal, promedio mensual y anual)

AÑO	Enero	Febrero	Marzo	Abril	Mayo	Junio	Julio	Agosto	Septiembre	Octubre	Noviembre	Diciembre	PROMEDIO
1996	40.99	38.58	41.45	35.21	28.45	27.81	31.25	26.51	23.90	25.75	29.57	27.23	31.39
1997	23.55	19.80	21.66	21.35	18.42	20.17	18.80	18.93	18.02	17.92	20.16	18.85	19.80
1998	17.95	18.74	19.85	19.03	17.91	19.50	20.08	22.64	40.80	34.86	32.12	33.66	24.76
1999	32.13	28.76	23.47	20.29	19.89	21.08	19.78	20.54	19.71	17.87	16.96	16.45	21.41
2000	16.19	15.81	13.66	12.93	14.18	15.65	13.73	15.23	15.06	15.88	17.56	17.05	15.24
2001	17.89	17.34	15.80	14.96	11.95	9.43	9.39	7.51	9.32	8.36	7.43	6.29	11.31
2002	6.97	7.91	7.23	5.76	6.61	7.30	7.38	6.68	7.34	7.66	7.30	6.88	7.09
2003	8.27	9.04	9.17	7.86	5.25	5.20	4.57	4.45	4.73	5.11	4.99	6.06	6.23
2004	4.95	5.57	6.28	5.98	6.59	6.57	6.81	7.21	7.36	7.76	8.20	8.50	6.82
2005	8.60	9.15	9.41	9.63	9.75	9.63	9.61	9.60	9.21	9.21	8.91	8.71	9.29
2006	7.88	7.61	7.37	7.17	7.02	7.02	7.03	7.03	7.06	7.05	7.04	7.04	7.19
2007	7.04	7.04											7.04

1.- Certificados de la Tesorería de la Federación a 28 días; es una tasas de interés pasiva -Instituciones de ahorro no bancarios- en México. Títulos de crédito al portador denominados en moneda nacional a cargo del Gobierno Federal. El Decreto mediante el cual la Secretaría de Hacienda y Crédito Público fue autorizada a emitir Cetes apareció publicado en el Diario Oficial de la Federación del 28 de noviembre de 1977, el cual fue abrogado por el Decreto publicado en el Diario Oficial de la Federación el 8 de julio de 1993. nd: No disponible.

Fuente: Elaborado por el Centro de Estudios de las Finanzas Públicas de la H. Cámara de Diputados, con datos del Banco de México.

México: C e t e s (*) (annual nominal interest rate), 1996-2007

(nominal interest rate, monthly and annual average)

Year	January	February	March	April	May	June	July	August	September	October	November	Deciember	AVERAGE
1996	40.99	38.58	41.45	35.21	28.45	27.81	31.25	26.51	23.90	25.75	29.57	27.23	31.39
1997	23.55	19.80	21.66	21.35	18.42	20.17	18.80	18.93	18.02	17.92	20.16	18.85	19.80
1998	17.95	18.74	19.85	19.03	17.91	19.50	20.08	22.64	40.80	34.86	32.12	33.66	24.76
1999	32.13	28.76	23.47	20.29	19.89	21.08	19.78	20.54	19.71	17.87	16.96	16.45	21.41
2000	16.19	15.81	13.66	12.93	14.18	15.65	13.73	15.23	15.06	15.88	17.56	17.05	15.24
2001	17.89	17.34	15.80	14.96	11.95	9.43	9.39	7.51	9.32	8.36	7.43	6.29	11.31
2002	6.97	7.91	7.23	5.76	6.61	7.30	7.38	6.68	7.34	7.66	7.30	6.88	7.09
2003	8.27	9.04	9.17	7.86	5.25	5.20	4.57	4.45	4.73	5.11	4.99	6.06	6.23
2004	4.95	5.57	6.28	5.98	6.59	6.57	6.81	7.21	7.36	7.76	8.20	8.50	6.82
2005	8.60	9.15	9.41	9.63	9.75	9.63	9.61	9.60	9.21	9.21	8.91	8.71	9.29
2006	7.88	7.61	7.37	7.17	7.02	7.02	7.03	7.03	7.06	7.05	7.04	7.04	7.19
2007	7.04	7.04	7.05										7.04

(*) Bonds of the Federal Government, for 28 days. It is a passive interest rate.

Source: Centro de Estudios de las Finanzas Públicas de la H. Cámara de Diputados (Center of Studies of Public Finance, institution linked to the Mexican Government), with data from Banco de México.

As shown in annexed spreadsheet "BSM IRR two phases ISRP - ICSA_2007.03.22.xls", without the incentives of CERS, the project phase 1's IRR is 6.7% and phase 2's IRR is – 2%.

Sub-step 2d– Sensitivity analysis

Since the project has no revenues, the only possible analysis would be done with an increase in the price of oil that would be replaced by the bagasse. A future increase in the price of oil was already foreseen by BSM for ISRP (please see spreadsheet "BSM IRR two phases ISRP -

ICSA_2007.03.22.xls"), so that the project's IRR is lower than the benchmark even when the conditions change in favor of the project.

Step 3. Barrier analysis

As showed below, the proposed project activity faces barriers that prevent the implementation of this type of proposed project activity; and that do not prevent the implementation of at least one of the alternatives.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity:

The following barriers would prevent the implementation of the proposed project activity if the project activity was not registered as a CDM activity:

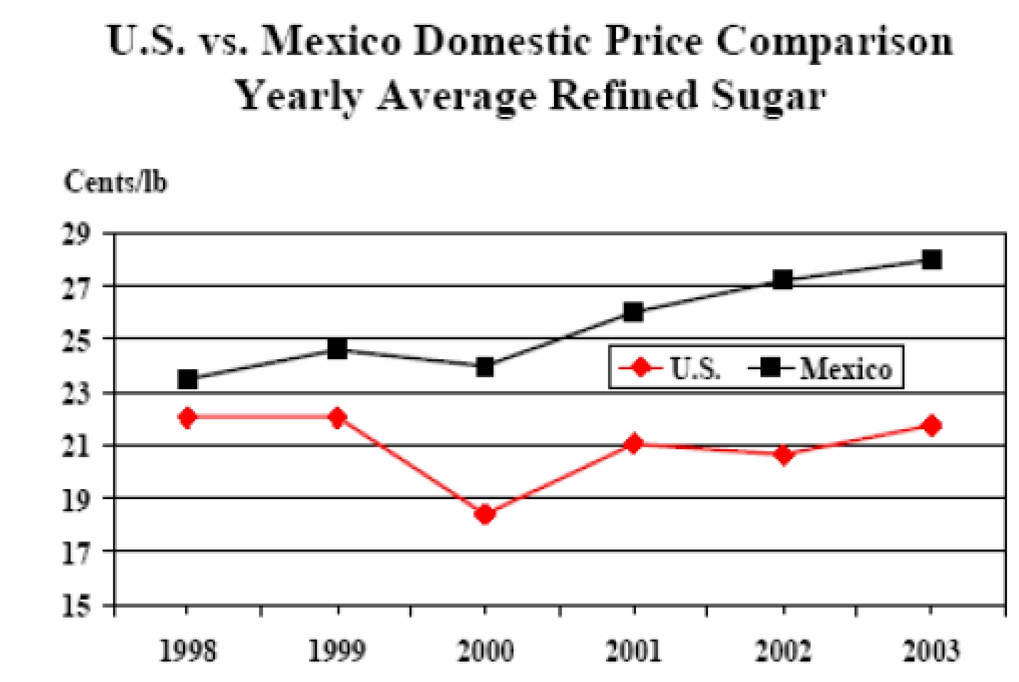
The history and organization of the Mexican sugar industry is complex, and the viability of the industry is a political imperative. At present, Mexico is the 7th largest producer of sugar globally and approximately 2.2 million Mexicans depend on the industry as their source of income. The industry on a whole accounts for more than 300,000 jobs, including cane cutters, seasonal field workers, and factory workers. Mexico is the 7th largest consumer of sugar in the world and has experienced strong consumption growth in recent years. This increased demand can be attributed to urbanization, a relatively young population and an increase in expendable income. Over the last forty years, the Mexican sugar industry experienced a number of government interventions that resulted in bankruptcy and technological stagnation. The mandated prices forced mill operators to postpone maintenance and depend upon government-supported loans for operating expenses. Eventually, the debts exceeded the mills asset values forcing the mills into government receivership. Instead of annually exporting half a million tons of sugar, Mexico became a substantial importer. During 1990-1991 the government promoted the privatization of the sector, yet due to a divergence between the cost of sugarcane and the price of sugar the industry fell into bankruptcy. Consequently, in September of 2001, the Mexican government once again nationalized a portion of the sugar industry. In total, 27 mills were nationalized representing approximately 50% of Mexican sugar production. The government has been embroiled in litigation associated with the expropriation since 2001 and has in fact lost one case which resulted in 4 mills being returned to their former owner (GAM).

Commercial barriers

At the time the investment decision was made, the Mexican sugar industry faced severe commercial barriers; as international prices decreased, increasing domestic costs and reductions in sales volume were negatively impacting the cash flows of the mills.

First, prices have decreased as a result of the price cap for sugar on the domestic market, the increasing competition of corn-based sweeteners, and the increasing imports of cheaper sugar from the US.

Second, production costs kept increasing every year. For example, sugarcane, labour and fuel costs increased 7, 11 and 19 percent respectively for the 2005-2006 sugar season.[1] The Mexican sugarcane price is higher than the U.S. price (see graph below); almost double the price in Guatemala and three times the price of Brazilian sugarcane.[2] Finally, sales volumes of Mexican sugar have decreased as a consequence of low competitiveness with the US market (see figure below), and a growing share of nationally produced or imported corn syrup in Mexico.[3] This situation has led the sugar industry to experience negative cash flows, increasing the difficulties for investment and the risk of any investment made.



Source: Knapp, 2004

Barriers due to prevailing practice

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[1] Angeles (2005), Sugar Industry Situation, Agriculture Commission, Mexico

[2] Knapp (2004), Robert Knapp, Horticultural and Tropical Products Division Foreign Agricultural Service, USDA

[3] Angeles (2005), Sugar Industry Situation, Agriculture Commission, Mexico.

The Project faces barriers related to current legal requirements both on the energy and sugar industry sectors. The “Law for Sustainable Development of the Mexican Sugar Industry” considers the payment of sugar cane to growers not only based on the sugar produced by the mill, but also based on all the byproducts produced from sugarcane (e.g. ethanol). In this sense, regardless of the efforts made by the companies to become more competitive and diversify their activities (e.g. by producing ethanol), this law increases the costs of alternative activities, reducing the expected financial returns and consequently their financial attractiveness.[4]

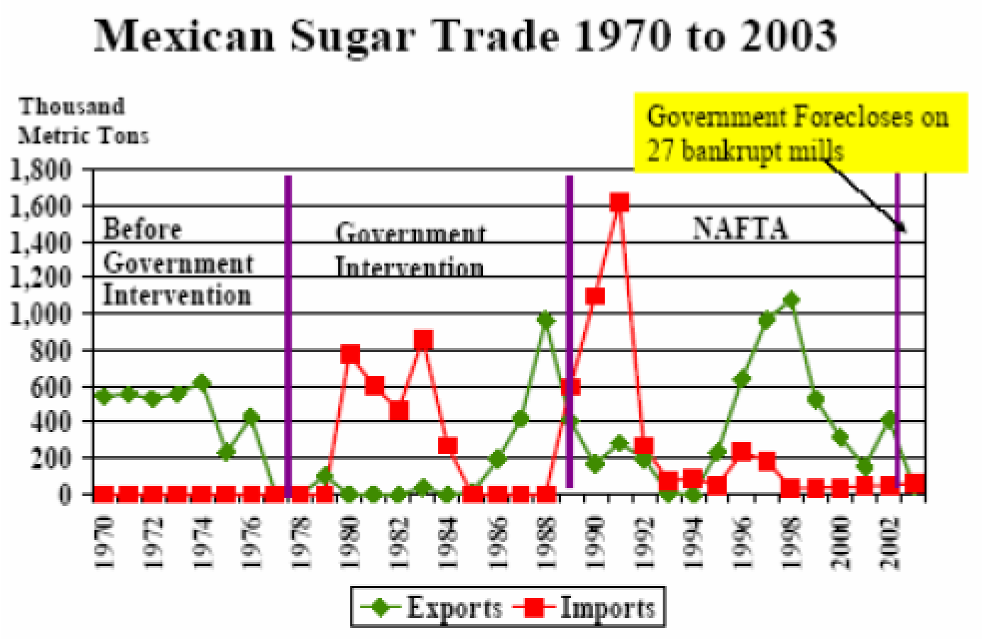
Institutional Barriers

The Project faces institutional barriers related to the commercial situation and structure of the sugar industry in Mexico:

First, there are the commercial and institutional uncertainties faced by the sugar industry in Mexico. The relationship between the sugar companies and sugar growers has been punctuated by yearly disputes, triggered by sugarcane’s price establishment. In solving such differences sugar growers usually undertake strikes and takeover the mills before the harvesting season begins. Such a situation represents a constant risk to all sugar mills, increasing the investment risk within the sector.

Second, the importance of the sugar industry to Mexico’s economic well-being entails ever-present risk of governmental intervention. “Over the last 40 years the Mexican sugar industry has experienced a progression of government interventions, resulting in bankruptcy and technological stagnation”[5].This produces a risky environment for investment. The situation at the time the investment decision was made by BSM is shown in the figure below:

[4] Sagarpa (2005), Ley de Desarrollo Sustentable de la Caña de Azucar, Mexico.
[5] Knapp (2004), Robert Knapp, Horticultural and Tropical Products Division Foreign Agricultural Service, USDA.



Source: Knapp, 2004

All these barriers are valid for the sugar industry in Mexico, and also for Beta San Miguel, and show a lack of a good environment for investing. All these barriers will be named, for the analysis in sub-step 3b below, **Barrier 1**: difficulty to obtain debt funding for this type of project activity.

Investment analysis done in step 2, for the analysis in sub-step 3b below, will be named **Barrier 2**: capital markets were very attractive in Mexico, at the time the investment decision was made, what made the investment in the capital markets more attractive than funding production.

Technological barriers

As a result of the uncertainty associated with the industry, Mexico currently lags behind other major sugar producing countries in the areas of technology, efficiency and the production of other co/byproducts from sugar cane.

In spite of the several technical consultancies Beta San Miguel contracted, they had many problems to reduce their demand for steam. Only after contracting the Brazilian company AGTECH, they started to acquire the technology to make the necessary changes in the evaporation process, in the mills and tanks areas, and in the boilers. For the changes in the mills area, it was necessary to contract also the services of another Brazilian company, Massato Kawasaki – Enga. Consult. Proj. Mec. S/C Ltda. All changes were done step by step, until the result was considered satisfying.

It is clear that the acquirement of the necessary technology for the fuel switch project was a slow and hard process and a considerable barrier for Beta San Miguel.

- This will be named, for the analysis in sub-step 3b below, Barrier 3: BSM had to require services of technical consultancies in order to develop the project.
-

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Table below shows how barriers affect each one of the alternative scenarios identified in Step 1.

Effect of barriers in each possible alternative heat scenario

	Alternative 1 **H1**	**Alternative 2** **H2**	**Alternative 3** **H4**	**Alternative 4** **H5**	**Alternative 5** **H6**
Barrier 1 **Debt funding not available**	Prevents implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation	Strongly prevents implementation
Barrier 2 **Capital markets are very attractive**	Prevents implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation	Strongly prevents implementation
Barrier 3 **Necessity of technical consultancies services**	Prevents implementation	Does not prevent implementation	Prevents implementation	Prevents implementation	Prevents implementation
Result of the analysis	Alternative 1 is prevented by identified barriers. It is an unlikely scenario, especially due to the investment that would be necessary for the retrofit of the boilers.	Alternative 2 is not prevented by identified barriers and remains as baseline candidate	Alternative 3 is prevented by identified barriers.	Alternative 4 is strongly prevented by identified barriers. It is a very unlikely scenario, especially due to the high investment that would be necessary for the installation of new boilers. This alternative is eliminated from consideration.	Alternative 5 is strongly prevented by identified barriers. It is a very unlikely scenario, especially due to the high investment that would be necessary for the installation of new boilers. This alternative is eliminated from consideration.

The barrier analysis shows that:

(i) Alternatives 4 and 5 are strongly prevented by identified barriers and for this reason are very unlikely scenarios. The project activity not undertaken as CDM (alternative 1) is also prevented by identified barriers. These alternatives are eliminated from further consideration.

(ii) Alternative 2 is not prevented by the barriers. For this reason it is chosen as baseline scenario.

(iii) The project scenario (alternative 3) remains as a possible additional scenario.

Effect of barriers in each alternative biomass scenario

	Alternative 1 **B1**	**Alternative 2** **B2**	**Alternative 3** **B3**	**Alternative 4** **B6**	**Alternative 5** **B7**
Barrier 1 **Debt funding not available**	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Strongly prevents implementation
Barrier 2 **Capital markets are very attractive**	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Strongly prevents implementation
Barrier 3 **Necessity of technical consultancies services**	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Prevents implementation
Result of the analysis	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Does not prevent implementation	Alternative 3 is strongly prevented by identified barriers. It is a very unlikely scenario, especially due to the high investment that would be necessary for the retrofit of the boilers. This alternative is eliminated from consideration.

Since biomass residues have already been used for heat generation at the project site prior to the implementation of the project activity, the most plausible baseline scenario for the use of the biomass residues should only be determined for the additional biomass residues used over and above the historical use levels.

The barrier analysis shows that:

(i) Alternative 5 is strongly prevented by identified barriers and for this reason is a very unlikely scenario. This alternative is eliminated from further consideration.

(ii) Alternative 1, 2, 3 and 4 are not prevented by the barriers. Alternative 3 results in lower baseline emissions and, since bagasse might continue to be used as fertilizer, in ISRP, alternative 4 also applies. For this reason, B3 and B6 are chosen as baseline scenario.

Therefore, chosen baseline scenario is **H2** (Continued operation of the existing boiler(s) using the same fuel mix or less biomass residues as in the past) and **B3** (The additional biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes) and **B6** (the biomass residues are used as fertilizer).

Step 4. Common practice analysis

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

The site of the *Comite de la Industria Azucarera* (Sugar Industry Committee) of Mexico (http://www.coaazucar.org/Coaazucar/menu6/final20.htm) shows a comparison of the rate *liters of fuel oil consumption/tones of sugar crane*, for harvest 2005/2006, in 58 sugar mills in Mexico. Out of these 58 mills, only 12 have a rate below 1.0. Just two of them have rate zero; one of them is ICSA (Constancia). ISRP (San Rafael) is ranked in position 8, with rate 0.64. Since only 20% of the sugar mills have a rate under 1.0, and only 3.4% have rate zero, it can be considered that this kind of Project is not the common practice in Mexico.

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

Sugar mills El Refugio, Queseria, Mahuixtlan, La Gloria, San Francisco Ameca, Lazaro Cardenas and San Miguel del Naranjo have similar rates (below 0.64) of *liters of fuel oil consumption/tones of sugar crane*.

Step 5. Impact of CDM registration

The approval and registration of the project activity as a CDM activity, and the attendant benefits and incentives derived from the project activity, will alleviate the identified barriers (Step 3) and thus enable the project activity to be undertaken for the following reasons:

- BSM is amongst the largest business groups in Mexico. The environmental aspect of BSM activities has always been in evidence because of the public perception of its positive and negative impacts. The registration of this project activity in the CDM will add positive value to the company.

- The registration of the project in the CDM will also result in financial benefits from the revenue obtained by selling CERs, what can help to reduce project costs.

As Step 5 is satisfied, the proposed CDM project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emissions reductions will be calculated through approved methodology AM0036.

Baseline emissions include CO_2 emissions from fossil fuel combustion in the boilers in the absence of the project activity. Since CH_4 emissions from the treatment of biomass residues are not included, baseline emissions due to uncontrolled burning or decay of the biomass residues (tCO_2e/yr) = 0; follows:

$$BE_y = BE_{HG,y}$$

Where:

BE_y = Baseline emissions during the year *y* (tCO_2e/yr)
$BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the boiler(s) (tCO_2 /yr).

Baseline emissions from fossil fuel combustion in the boiler(s) are determined by multiplying the heat generated with fossil fuels that are displaced by biomass residues with the CO_2 emission factor of the fossil fuel (bunker oil) that would be used in the absence of the project activity and by dividing by the average net efficiency of heat generation in the boiler(s), as follows:

$$BE_{HG,y} = \frac{HG_{PJ,biomass,y} \cdot EF_{FF,CO2,y}}{\eta_{boiler,FF}}$$

Where:

$BE_{HG,y}$ = Baseline emissions from fossil fuel combustion for heat generation in the boiler(s) (tCO_{2e} /yr)
$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
$EF_{FF,CO2,y}$ = CO_2 emission factor of the fossil fuel type displaced by biomass residues (tCO_{2e} /GJ)
$\eta_{boiler,FF}$ = Average net efficiency of heat generation in the boiler(s) when fired with fossil fuels

The determination of $HG_{PJ,biomass,y}$ depends on whether only fossil fuels would be used for heat generation in the absence of the project activity (case A) or whether along with fossil fuels some biomass residues also would be used in the absence of the project activity (case B). Case B is the alternative for this project.

In this case, only the use of biomass residues beyond historical levels should be attributed to the CDM project activity. Hence, $HG_{PJ,biomass,y}$ refers to the additional (i.e. additional to the baseline scenario) quantity of heat generated from the combustion of biomass residues, as a result of the CDM project activity.

$HG_{PJ,biomass,y}$ will be taken as the minimum value among the following two options:

(a) The difference between the total quantity of heat generated from biomass residues in all boilers at the project site in the year *y* ($HG_{PJ,biomass,total,y}$) and the highest annual historical heat generation with biomass residues among the most recent three years[2] prior to the implementation of the project activity, as follows:

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - MAX\left\{HG_{biomass,historic,n}; HG_{biomass,historic,n-1}; HG_{biomass,historic,n-2}\right\}$$

Where:

$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used in the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$ = Total heat generated from firing biomass residues in all boilers at the project site during the year *y* (GJ/yr)
$HG_{biomass,historic,n}$ = Historical annual heat generation from firing biomass residues in boilers at the project site during the year *n* (GJ/yr)
n = Year prior to the implementation of the project activity

(b) The difference between the total quantity of heat generated from biomass residues in all boilers in the year *y* ($HG_{PJ,biomass,total,y}$) and the total heat generation during the year *y* ($HG_{PJ,total,y}$) multiplied with the highest historical fraction of heat generation with biomass residues from the most recent three years[2], as follows:

$$HG_{PJ,biomass,y} = HG_{PJ,biomass,total,y} - HG_{PJ,total,y} \cdot MAX\left\{\frac{HG_{biomass,historic,n}}{HG_{total,historic,n}}; \frac{HG_{biomass,historic,n-1}}{HG_{total,historic,n-1}}; \frac{HG_{biomass,historic,n-2}}{HG_{total,historic,n-2}}\right\}$$

Where:

$HG_{PJ,biomass,y}$ = Heat generated with incremental biomass residues used as a result of the project activity during the year *y* (GJ/yr)
$HG_{PJ,biomass,total,y}$ = Total heat generated from firing biomass residues in all boilers at the project site during the year *y* (GJ/yr)
$HG_{PJ,total,y}$ = Total heat generated in boilers at the project site, using both biomass residues and fossil fuels, during the year *y* (GJ/yr)
$HG_{biomass,historic,n}$ = Historical annual heat generation from using biomass residues in boilers at the project site during the year *n* (GJ/yr)
$HG_{total,historic,n}$ = Historical annual total heat generation, from using biomass residues and fossil fuels, in boilers at the project site during the year *n* (GJ/yr)
n = Year prior to the implementation of the project activity

The historical fraction of heat generation with biomass residues can be determined based on the quantities of biomass residue types *k* and fossil fuel types *i* used historically in the boiler(s) at the project site, as follows:

$$\frac{HG_{biomass,historic,n}}{HG_{total,historic,n}} = \frac{\sum_k BF_{k,n} \cdot NCV_k}{\sum_k BF_{k,n} \cdot NCV_k + \sum_i FC_{i,n} \cdot NCV_i}$$

Where:

$HG_{biomass,historic,n}$ = Historical annual heat generation from using biomass residues in boilers at the project site during the year *n* (GJ/yr)
$HG_{total,historic,n}$ = Historical annual total heat generation, from using biomass residues and fossil fuels, in boilers at the project site during the year *n* (GJ/yr)
$BF_{k,n}$ = Quantity of biomass residue type *k* used in all boiler(s) at the project site during the historical year *n* (tons of dry matter or liter)[4]
NCV_k = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter or GJ/liter)
$FC_{i,n}$ = Quantity of fossil fuel type *i* fired in all boiler(s) at the project site during the historical year *n* (mass or volume unit)[5]
NCV_i = Net calorific value of the fossil fuel type *i* (GJ / mass or volume unit)
n = Year prior to the implementation of the project activity

Leakage:

If for a certain biomass residue type *k* used in the project leakage effects cannot be ruled out, leakage effects for the year *y* shall be calculated as follows:

$$LE_y = EF_{CO2,LE} \cdot \sum_n BF_{LE,n,y} \cdot NCV_n$$

Where:

LE_y = Leakage emissions during the year *y* (tCO_2/yr)
$EF_{CO2,LE}$ = CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)
$BF_{LE,n,y}$ = Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage can not be ruled out using one of the approaches L_1, L_2, L_3 or L_4 (tons of dry matter or liter)
NCV_n = Net calorific value of the biomass residue type *n* (GJ/ton of dry matter or GJ/liter)
n = Biomass residue type *n* for which leakage can not be ruled out using one of the approaches L_1, L_2, L_3 or L_4

In case of approaches L_1, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type *n* that is obtained from the relevant source or sources.

In case of approaches L_2 or L_3, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type *k* used for heat generation as a result of the project activity during the year *y* ($BF_{LE,n,y} = BF_{PJ,k,y}$, where $n=k$).

In case of approach L_4, $(BF_{LE,n,y} \cdot NCV_n)$ corresponds to the lower value of

(a) The quantity of fuel types *m*, expressed in energy quantities, that are used by the former user of the biomass residue type *k* and for which leakage can not be ruled out because the fuels used are either (i) fuels types other than biomass residues (e.g. fossil fuels or biomass types other than biomass residues) or (ii) are biomass residues but leakage can not be ruled out for those types of biomass residues with approaches L_2 or L_3; as follows:

$$BF_{LE,n,y} \cdot NCV_n = \sum_m FC_{former\ user,m,y} \cdot NCV_m$$

Where:

$BF_{LE,n,y}$ = Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage can not be ruled out using approach L_4 (tons of dry matter or liter)[4]
NCV_n = Net calorific value of the biomass residue type *n* (GJ/ton of dry matter or GJ/liter)
n = Biomass residue type *n* for which leakage can not be ruled out using approach L_4
$FC_{former\ user,m,y}$ = Quantity of fuel type *m* used by the former user of the biomass residue type *n* during the year *y* (mass or volume unit)[5]
NVC_m Net calorific value of fuel type *m* (GJ/ton of dry matter or GJ/liter)
m =Fuel type *m*, being either (i) a fuel type other than a biomass residue (e.g. fossil fuel or biomass other than biomass residues) or (ii) a biomass residues for which leakage can not be ruled out with approaches L_2 or L_3

(b) The quantity of biomass residue type *k*, expressed in energy quantities, used for heat generation as a result of the project activity during the year *y* ($BF_{LE,n,y} = BF_{PJ,k,y}$, where $n=k$).

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

Data / Parameter:	**$\eta_{boiler,FF}$**
Data unit:	-
Description:	Average net efficiency of heat generation in the boiler(s) when fired with fossil fuels
Source of data used:	On-site measurements
Value applied:	60%, for ISRP boilers; 78%, for ICSA boiler
Justification of the choice of data or description of measurement methods and procedures actually	Direct method was used (dividing the net heat generation by the energy content of the fuels fired).

applied :	
Any comment:	

Data / Parameter:	HGbiomass,historic,n / HGbiomass,historic,n-1 / HGbiomass,historic,n-2
Data unit:	GJ
Description:	Historical annual heat generation from firing biomass residues in boilers at the project site during the year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to the implementation of the project activity
Source of data used:	Onsite measurements
Value applied:	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Justification of the choice of data or description of measurement methods and procedures actually applied :	Heat generation is determined as the difference of the enthalpy of the steam or hot water generated by the boiler(s) minus the enthalpy of the feed-water, the boiler blow-down and any condensate return. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
Any comment:	The three most recent historical years prior to the implementation of the project activity in each sugar mill were used to represent the situation of the baseline at the project site.

Data / Parameter:	BFk,n / BFk,n-1 / BFk,n-2
Data unit:	Tons of dry matter or liter
Description:	Quantity of biomass residue type *k* fired in all boiler(s) at the project site during the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the project activity.
Source of data used:	Onsite measurements
Value applied:	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use weight or volume meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be cross-checked with the quantity of heat generated and fuel purchase receipts.
Any comment:	The three most recent historical years prior to the implementation of the project activity in each sugar mill were used to represent the situation of the baseline at the project site.

Data / Parameter:	FCi,n / FCi,n-1 / FCi,n-2
Data unit:	Mass or volume unit
Description:	Quantity of fossil fuel type *i* fired in all boiler(s) at the project site during

	the historical year *n*, *n-1* or *n-2*, where *n* corresponds to the year prior to implementation of the project activity.
Source of data used:	Onsite measurements
Value applied:	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use weight or volume meters. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts
Any comment:	The three most recent historical years prior to the implementation of the project activity in each sugar mill were used to represent the situation of the baseline at the project site.

Data / Parameter:	**$EF_{FF,CO2,oil}$**
Data unit:	Kg CO2/litre
Description:	CO2 emission factor for the bunker oil the fossil fuel type displaced by biomass residues for the year *y*
Source of data used:	IPCC default values used
Value applied	3.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	Since there were no local measurements of the bunker oil emission factor, IPCC default values were used

B.6.3 Ex-ante calculation of emission reductions:

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions during the year *y* (tCO_2/yr)
BE_y = Baseline emissions during the year *y* (tCO_2/yr)
PE_y = Project emissions during the year *y* (tCO_2/yr)
LE_y = Leakage emissions during the year *y* (tCO_2/yr) (zero for this project activity)

Project emissions

Project emissions shall include CO_2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity.

CH_4 emissions from combustion of biomass residues for heat generation are not included and there is no fossil fuel consumption (besides that co-fired in the boiler) at the project site attributable to the project activity. Electricity consumption is required only for mechanical treatment of the biomass residues. Both sugar mills had already in the baseline equipments for the mechanical treatment of the sugar cane. Since no specific mechanical treatment for bagasse was required in the project, project emissions (P_y) are considered to be zero.

Leakage

Approx. 10-15% of the biomass residues were not burned in the boilers, in the baseline, in ISRP. See Tables below:

ISRP Harvest	Bagasse produced (dry tones)	Bagasse not burned (dry tones)
98/99	149,063	25,341
99/00	159,249	23,887
00/01	169,617	19,336
01/02	188,595	21,594
02/03	179,110	25,971
03/04	177,060	21,247
04/05	198,442	21,829
05/06	225,567	27,068

ICSA Harvest	Bagasse produced (dry tones)	Bagasse not burned (dry tones)
01/02	88,140	0
02/03	81,353	0
03/04	93,144	0
04/05	118,059	0
05/06	107,411	4,296

Baseline scenarios for biomass residues are B3 and B6, as shown in section B.5. The recommended biomass approach for these scenarios is L1. It must be demonstrated that at the sites where the project activity is supplied from with biomass residues, the biomass residues have not been collected or utilized but have been dumped and left to decay, land-filled or burnt without energy generation prior to the implementation of the project activity.

Presently, there is no market for bagasse in the ISRP region. In the ICSA region there is a pulp factory of Kimberly Clark that might be interested in purchasing bagasse from ICSA. Notwithstanding, the present commercial conditions (good price of fuel oil) do not favour the use of bagasse by Kimberly Clark. Even if Kimbertly Clark would use this bagasse, it would be replacing fuel oil, so that there would be a decrease of fossil fuel consumption due to the diversion of the biomass and, therefore, no leakages

In ISRP, part of the unburned bagasse was used as a fertilizer, in the baseline. Presently, ISRP produces fertilizers from a mixture of ashes and liquor, so that there are no leakages.

In ISRP, in the project phase, all the Bagasse not burned has been stored partly to be burned in temporary operation halts and partly for use in the next harvest.

For the reasons explained, leakages (L_y) are considered to be zero

Estimated baseline emissions:

Baseline emissions are estimated as shown in section B.6.1.

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

Over the first 7-year crediting period, the project is expected to create the following emissions reductions:

Years	Estimation of project activity emissions	Estimation of baseline emissions	Estimation of leakage	Estimation of overall emissions reductions
	(tonnes of CO2e)	(tonnes of CO2e)	(tonnes of CO2e)	(tonnes of CO2e)
2001 (from December 1 on)	0	21,832	0	21,832
2002	0	10,921	0	10,921
2003	0	8,562	0	8,562
2004	0	38,915	0	38,915
2005	0	58,032	0	58,032
2006	0	58,032	0	58,032
2007	0	58,032	0	58,032
2008 (until November 30)	0	0	0	0
Total (tonnes of CO2e)	0	254,326	0	254,326

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EF** $_{FF,CO2,\ oil}$
Data unit:	Kg CO2/litre
Description:	CO2 emission factor for the oil displaced by biomass residues for the year *y*
Source of data to be used:	IPCC default values used
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3.12
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, collect additional information or conduct additional measurements
Any comment:	-

Data / Parameter:	$BF_{k,y}$
Data unit:	Tons of dry matter
Description:	Quantity of biomass residue (Bagasse) fired in all boiler(s) at the project site during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Description of measurement methods and procedures to be applied:	Measurements will be done ccontinuously, and aggregated at least annually. Use weight or volume meters. The quantity shall be crosschecked with the quantity of heat generated and any fuel purchase receipts.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	-

Data / Parameter:	HGPJ,total,y
Data unit:	GJ/yr
Description:	Total heat generated in all boilers at the project site, firing both biomass residues and fossil fuels, during the year *y*
Source of data to be used:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Description of measurement methods and procedures to be applied:	Measurements will be done continuously, and aggregated annually. Heat generation is determined as the difference of the enthalpy of the steam or hot water generated by the boiler(s) minus the enthalpy of the feed-water, the boiler blow-down and any condensate return. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
QA/QC procedures to be applied:	The consistency of metered net heat generation should be cross-checked with the quantity of biomass and/or fossil fuels fired (e.g. check whether the net heat generation divided by the quantity of fuel fired results in a reasonable thermal efficiency that is comparable to previous years).
Any comment:	

Data / Parameter:	FCi,y
Data unit:	Mass or volume unit
Description:	Quantity of fossil fuel type *i* fired in all boiler(s) at the project site during
Source of data to be used:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Description of measurement methods and procedures to be applied:	Measurements will be done ccontinuously, and aggregated at least annually. Use weight or volume meters. The quantity shall be cross-checked with the quantity of heat generated and any fuel purchase receipts.
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	

Data / Parameter:	**$NCV_{bagasse}$**
Data unit:	GJ/tones
Description:	Net calorific value of biomass residues
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Description of measurement methods and procedures to be applied:	Data will be measured at least every six months, taking at least three samples for each measurement. Measurements shall be carried out at reputed laboratories and according to relevant international standards.
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass.
Any comment:	-

Data / Parameter:	**NCV_{oil}**
Data unit:	GJ/tones
Description:	Net calorific value of oil
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annexed spreadsheet BSM CERs calculation - AM0036-2007.03.19.xls
Description of measurement methods and procedures to be applied:	Appropriateness of the data will be reviewed annually.
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, collect additional information or conduct additional measurements.
Any comment:	-

Data / Parameter:	

Data unit:	MWh
Description:	Electricity generation during the year y at the project site
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This value will be monitored annually
QA/QC procedures to be applied:	
Any comment:	-

Data / Parameter:	
Data unit:	
Description:	Demonstration that the biomass residues would continue not to be collected or utilized, e.g. by an assessment whether a market has emerged for that type of biomass residue or by showing that it would still not be feasible to utilize the biomass residues for any purposes.
Source of data to be used:	Information from sugar mills ISRP and ICSA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This procedure will be done annually
QA/QC procedures to be applied:	
Any comment:	-

B.7.2 Description of the monitoring plan:

Project operator and manager is Beta San Miguel. The company has maintenance and operations procedures, which include the monitoring of process variables, instruments calibration and quality

control, according to company policies and engineering best practices. For this reason, no major changes in monitoring and QA/QC procedures will be required for the CDM project activity related variables and parameters.

During the implementation of the project activity, special training was required for the operation of the new equipment installed. All data necessary for the monitoring of the project activity is normally monitored as part of plants operations. Therefore, there are several existing reports from which the information will be obtained, depending on the area involved. The data is kept electronically in the system, with back-up available. Monthly reports are produced from these data.

All monitored data related with the project activity will be stored until two years after the end of the crediting period.

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

The baseline and monitoring studies were conducted according to approved methodology AM0036 –"Fuel switch from fossil fuels to biomass residues in boilers for heat generation", Version 1.1, dated on 29/09/2006.

They were completed on 04/01/2007 by Ricardo Besen of Ecoinvest Carbon S.A.

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SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date of the CDM project is 14/04/2000

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

25y-0m

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

C.2.1. Renewable crediting period

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

01/12/2001

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

This section is left blank on purpose.

C.2.2.2. Length:

This section is left blank on purpose.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The growing global concern on sustainable use of resources is driving a requirement for more sensitive environmental management practices. Increasingly this is being reflected in government policy and legislation. In Mexico the situation is not different. Environmental rules and licensing policies are very demanding in line with the best international practices.

In Mexico there are three environmental legislation spheres: municipal, state and federal. SERMANAT – *Secretaría de Medio Ambiente y Recursos Naturales* is the federal organ, each State and Municipality has it main environmental organ.

In 2004, some legislative changes had been made and the companies are adapting themselves to it. According to *Ley General del Equilibrio Ecológico y la Protección al Ambiente* (Environmental Protection Law), Beta San Miguel sugar mills are subject to legislation concerning atmospheric emissions and dangerous waste management.

Atmospheric emissions

The current legislation regarding registration and transfer of contaminant establishes that the sugar mills must:

- Control the atmospheric emissions to assure that it is in accordance with the technical standards;

- Have an emergency plan in case of deviation regarding the standards;

- Develop and publicize annually atmospheric emissions inventory and submit it to authorized laboratories analysis.

The result of a successful submission of those assessments is the "*Licencia de Funcionamiento*", which reflects the environmental federal agency (SEMARNAT) positive understanding about the environmental project concepts.

All the sugar mills are under licensing process and the documentation is available under request.

Dangerous waste management

In order to obtain the *Registro de Empresa Generadora de Residuos Peligrosos* (Registry of Dangerous Waste Generator Company) and the *Registro de Empresa Generadora de Residuos no Peligrosos* (Registry of No Dangerous Waste Generator Company), the sugar mills made an inventory of all the dangerous waste under their management, determine generated and transferred volumes, utilize only authorized transportation companies to carry the products, keep daily registration of all this, and inform it half-yearly to SEMARNAT (documentation under request)

Environmental Auditing

Aware of the importance of having a responsible behaviour, in 2005 ISRP joined the *Programa Industria Limpia* (Clean Industry Program). The program requires that members develop an environmental auditing program with the objective of understanding, controlling and continuous improvement of its environment aspects.

The investigation that precedes the environment auditing analyses:

- Resources usage
- Legislation to be observed
- Impacts on climate and air quality
- Geological and soil impacts
- Hydrological impacts (surface and groundwater)
- Socio-economical aspects (necessary infra-structure, legal and institutional etc.)
- Local stakeholders comments
- Mitigation measures
- Monitoring plan
- Energy optimization

The first phase of the project is expected to end by 2007.

The environmental auditing results were approved by PROFEPA – *Procuraduría Federal de Protección al Medio Ambiente* (Federal Agency of Environmental Protection), which has quarterly followed up and validated the program.

ISO 9001:2000

Beta San Miguel is the first Mexican sugar group to achieve ISO 9001:2000. The quality management system of its mills is annually audited according this international quality standard.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impact of the project activity is not considered significant and a complete environmental impact assessment was not required. After the assessment of the preliminary environmental report by the state environmental authority some minor requirements were made in order to issue the licenses. Project proponents attended all the requirements.

SECTION E. Stakeholders' comments

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

Beta San Miguel invited, in December 2005, local stakeholders for comments on the CDM project “Fuel switch and capacity expansion in grid connected electricity generation at BSM sugar mills”. Several organizations and entities were invited for comments on the project:

- City Halls of all the cities involved in the project
- City Council of all the cities involved in the project
- Environmental Department of all the cities involved in the project
- Environmental Agency of the states involved in the project
- Public Attorney Entities of the states involved in the project
- NGOs of all the cities involved in the project

E.2. Summary of the comments received:

No comments were received.

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

No comments were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Beta San Miguel
Street/P.O.Box:	Paseo de la Reforma, 397
Building:	
City:	Cuauhtemóc
State/Region:	D.F.
Postfix/ZIP:	06500
Country:	Mexico
Telephone:	+52 +55 5242-7858
FAX:	
E-Mail:	luisalbertor@bsm.com.mx
URL:	www.bsm.com.mx
Represented by:	Mr. Luis Alberto Radilla Padilla
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2 – Information regarding public Funding

There is no public funding involved in the project activity.

Annex 3 – Baseline Information

See annexed spreadsheet "BSM CERs calculation - AM0036- 2007.03.19.xls"

Annex 4 – Monitoring Plan

This section is intentionally left blank (see section B.7.2 for monitoring plan).