VER Monitoring Report

Nobrecel Biomass Energy Project

Monitoring period 01/01/2008 – 31/10/2008

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Version 02

Project background

Nobrecel Biomass Energy Project has been validated at the same time as the last VER Verification.

Further background on this project is available in the attached VCS PD.

Parties involved are Brazil (Host Country) and the United Kingdom of Great Britain and Northern Ireland (other Parties). The project participants are Nobrecel S.A. Celulose e Papel and EcoSecurities Group Plc.

Verification Criteria

The project seeks to claim emission reductions prior to the CDM project registration date under the VCS 2007 standard.

Therefore, the following criteria apply:

1. Voluntary Carbon Standard 2007 [“VCS 2007”]. For verification, this standard requires application of ISO14064-3. The level of assurance shall be reasonable. This project reduces less than 1 Mt CO2e per year and the materiality level is therefore 5%.
2. Policy announcement from the VCS Association of 19 March 2008 regarding “Further Guidance for Projects that are Registered in Two GHG Programs”. This requires extra information over and above the information provided in the CDM PDD. These are items 1.12, 1.13, 1.14, 8.a and 8.2 of the VCS Project Description Template.
3. The monitoring plan has been included in the validated PD, which is based on ACM0006 version 6 of the CDM.

Conformity with VCS requirements

Project start date

Projects applying VCS 2007 have to start later than 1 January 2002. The project started in January 1st, 2002 and its operations in December 12th, 2001. The project conforms to the requirement.

The project was validated under the CDM program on 19th June 2007. Further validation as required per VCS 2007 will be carried out during verification in November 2008. The items to be validated are presented below in this monitoring report.

Project scope

The project applies a CDM methodology. It therefore applies a methodology, which is approved in the VCS Program.

Demonstrate that no GHG were created for subsequent removal or destruction

The project consists to reduce methane (CH4) and non-renewable carbon dioxide (CO2) emissions according to the emissions sources are included from the project boundary listed in the methodology. There are no GHG emissions created for the purpose of its subsequent removal. The project therefore complies with paragraph 1.12 of the VCS Project Description Template.

Demonstrate that no other environmental credits were generated

There is no other environmental credit system other than CDM in place in Brazil. The project can therefore not generate other environmental credits than VERs and CERs. The project therefore complies with paragraph 1.13 of the VCS Project Description Template.

Rejection under other GHG Programs (if applicable)

The project has been successfully validated and approved by the Brazilian DNA as a CDM project. The project did not apply for registration or issuance of emission reduction credits under any other GHG program. The paragraph 1.14 of the VCS Project Description Template is therefore not applicable to this project.

Proof of Title

The emission reductions associated to the project activity belong to the project participant Nobrecel S.A. Celulose e Papel, as can be demonstrated by Operational License in November, 30th 2009. The project therefore complies with paragraph 8.1 of the VCS Project Description Template.

Relation with other participants in emissions trading program (if applicable)

The project does not take place in a jurisdiction or sector in which binding limits are established on GHG emissions. Emission reductions achieved by this program do not limit the emissions of projects that take place in an emissions trading program. The paragraph 8.2 of the VCS Project Description Template is therefore not applicable to this project.

Monitoring results

Emission reduction

The calculated emission reduction is summarized in Annex A and amounts to a total of 85,057 tCO_2e in 2008.

Monitoring period covered

This is the second VER monitoring report of this project. It covers the period 01/01/2008 to 31/10/2008.

Presentation of monitoring results - spreadsheet

All monitoring data have been included in an Excel workbook. This includes:

1. Front page. This worksheet contains the project description and contact details.
2. Entrada de dados. All data collected by Nobrecel that is used for the calculations.
3. Grid Data. Information regarding the grid emission factor.
4. Reference data. Shows standard and reference values used in calculations.
5. ER calculation. This worksheet contains the calculation of emission reductions of each project component and general notes.
6. Anaerobic Decay. Spreadsheet used for calculate the methane generation using the first order decay model.
7. Monitored Data. A summary of data monitored and collected.

Calculation methodology

The calculation methodology of emission reductions for this project is in line with the methodology and is summarized below:

Emission reduction calculation took place in the following steps for the data generated:

1. Electricity component
    a. Net quantity of increased electricity generation as a result of the project activity (EG) is monitored by a calibrated energy meter.
    b. EG is multiplied by the Grid emission factor (EFGRID)
2. Displacement of heat component

a. Quantity of heat generated (Q) is monitored by a steam flow meter and controlled by a supervisory system.

b. The quantity of steam that would be generated in the baseline scenario using the same type of biomass is excluded from Q.

c. Q is multiplied by the emission factor (EFFUEL) of the fuel used in baseline and divided by the efficiency of the boiler that would be used in baseline scenario.

d. Any consumption of auxiliary fuel used is considered as project emissions.

e. The fuel used for biomass transportation is estimated considering the average distance from suppliers and the load capacity of each truck and considered as project emissions.

3. Methane avoidance component

a. The biomass residues used as fuel (BF) is consumed in the boiler and monitored by a weight bridge at Nobrecel's plant.

b. The avoided methane is calculated using the first order decay model according to "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", EB 26 and all default values for each biomass type.

c. Methane emissions from combustion of biomass residues is calculated using IPCC values and discounted from the project as project emissions.

4. All Emissions Reductions (ERs) are calculated as demonstrated below:

According to the Methodology the greenhouse gas emission reductions achieved by the project activity during a given year "y" (ERy) shall be estimated as follows:

Emission Reductions:

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$$

where:

ER_y = Emissions reductions of the project activity during the year y (tCO_2/yr)

$ER_{electricity,y}$ = Emission reductions due to displacement of electricity during the year *y* (tCO_2/yr)

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tCO_2/yr)

$BE_{biomass,\ y}$ = Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_2/yr)

PE_y = Project emissions during the year y (tCO_2/yr)

L_y = Leakage emissions during the year y (tCO_2/yr)

Project Emissions:

$$PE_y = PET_y + PEFF_y + GWP_{CH4} \cdot PE_{Biomass,CH4,y}$$

Where:

PET_y = CO_2 emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr)

$PEFF_y$ = CO_2 emissions from onsite combustion of fossil fuels (tCO_2/yr)

GWP_{CH_4} = Global Warming Potential for methane valid for the relevant commitment period

$PE_{Biomass,\ CH_4,\ y}$ = CH_4 emissions from the combustion of biomass residues during the year y (tCO_2/yr)

There is a small amount of project emissions from a tractor that has the function of moving the biomass residues at the site. This project emissions is calculated as follows:

$$PE_{tractor} = FF_{tractor} * EF_{diesel}$$

Where:

PE tractor = Project emissions from tractor

FF tractor = Amount of fossil fuel (i.e. diesel oil) consumed by the tractor (ton/year)

EF diesel = CO2 emission factor for the diesel oil (tCO_2e/ton)

As the amount of diesel consumed by the tractor is 180 L/day (or 162 kg/day, 59 ton/yr), the amount of emissions from this source is: 59 * 3,1849 = 189 tCO_2e.

Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass residues to the project plant (*PET_y*):

Emissions are calculated on the basis of distance and the average truck load:

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO2,y}$$

Where:

PETy = CO_2 emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr)

AVDy = Average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year y (Km).

$EF_{Km,CO_2,y}$ = Average CO2 emission factor for the trucks measured during the year y (tCO_2/Km)

$BF_{k,y}$ = Quantity of biomass residue type K combusted in the project plant during the year y (tons of dry matter)

TL_y = Average truck load of the trucks used (tons) during the year y.

Carbon dioxide emissions from on-site consumption of fossil fuels (*$PEFF_y$*)

$$PEFF_y = \sum_i \left(FF_{project\ plant,i,y} + FF_{project\ site,i,y} \right) \cdot NCV_i \cdot COEF_i$$

Where:

$FF_{project\ plant,i,y}$ = Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y (mass or volume unit per year)

$FF_{project\ site,i,y}$ = Quantity of fossil fuel type i combusted at the project site for other purposes that are attribute to the project activity during the year y (mass or volume unit per year)

NVCi = Net calorific value of fossil fuel type i (GJ / mass or volume unit)

$COEF_i$ = CO_2 emission factor for fossil fuel type i (CO_2/GJ)

<u>Note:</u> CO2 emissions form electricity consumption ($PE_{EC,y}$) not applicable.

Methane emissions from combustion of biomass residues (*$PE_{Biomass,CH4,y}$*)

$$PE_{Biomass,CH4,y} = EF_{CH4,BF} \cdot \sum_{k} BF_{k,y} \cdot NCV_k$$

Where:

$PE_{Biomass,CH4,y}$ = CH_4 emissions from the combustion of biomass residues during the year y (tCH_4/yr)

$BF_{K,y}$ = Quantity of biomass residue type K combusted in the project plant during the year y (tons of dry matter)

NCV_K = Net calorific value of the biomass residue type K (GJ/ton of dry matter)

$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ)

Emission reductions due to displacement of electricity

$$ER_{electricity,y} = EG_y \cdot EF_{electricity,y}$$

Where:

$ER_{electricity,y}$ = Emission reductions due to displacement of electricity during the year y (tCO_2/yr)

EG_y = Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh).

$EF_{electricity,y}$ = CO_2 emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

Determination of EG_y

$$EG_y = MIN\left\{\begin{array}{c} EG_{project\ plant,y} \\ EG_{total,y} - \dfrac{EG_{historic,3yr}}{3} \end{array}\right\}$$

Where:

EG_y = Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year (MWh/yr).

$EG_{project\ plant,y}$ = Net quantity of electricity generated in the project plant duirng the year y (MWh/yr)

$EG_{total,y}$ = Net quantity of electricity generated in all power units at the project site, generated from firing the same type(s) of biomass residues as in the project plant, including the new power unit installed as part of the project activity and any previously existing units, during the year ey (MWh/yr)

$EG_{historic,3yr}$ = Net quantity of electricity generated fduring the most recent three years in all power plants at the project site, generated ffrom firing the same type(s) of biomass residues as used in the fproject fplant (MWh).

Emission reductions or increases due to displacement of heat

$$ER_{heat,y} = \frac{Q_y \cdot EF_{CO2,BL,heat,i}}{\varepsilon_{boiler}}$$

And

$$Q_y = MIN\left\{\begin{matrix} Q_{project\ plant,y} \\ Q_{total,y} - \frac{Q_{historic,3yr}}{3} \end{matrix}\right\} - \frac{Q_{biomass,historic,3yr}}{3}$$

Where:

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tCO_2/yr)

Q_y = Quantity of increased heat generation in the project plant (incremental to heat generation in any existing cogeneration plants) that displaces heat generation in fossil fuel fired boilers during the year y (GJ/yr)

$Q_{project\ plant,y}$ = Net quantity of heat generated in the cogeneration project plant from firing biomass residues during the year y (GJ)

$Q_{total,y}$ = Net quantity of heat generated in all cogeneration units at the project site, generated from firing the same type(s) of biomass residues as in the project plant, including the cogeneration unit installed as part of the project activity and any previously existing units, during the year *y* (GJ)

$Q_{historic,\ 3yr}$ = Net quantity of heat generated during the most recent three years in all cogeneration plants at the project site, generated from firing the same type(s) of biomass residues as in the project plant (GJ)

ε_{boiler} = Energy efficiency of the boiler that would be used in the absence of the project activity

$EF_{CO2,BL,heat}$ = CO_2 emission factor of the fossil fuel type *i* used for heat generation in the absence the project activity (tCO_2/GJ)

Baseline emissions due to natural decay or uncontrolled burning of anthropogenic sources of biomass residues

Baseline emissions are calculated assuming, for both scenarios viz., natural decay and uncontrolled burning, that the biomass residues would be burnt in an uncontrolled manner. Baseline emissions are calculated by multiplying the quantity of biomass residues that would not be used in the absence of the project activity with the net calorific value and an appropriate emission factor, as follows:

$$BE_{biomass,y} = GWP_{CH4} \cdot \sum_{k} BF_{PJ,k,y} \cdot NCV_k \cdot EF_{burning,CH4,k,y}$$

Where:

$BE_{biomass,y}$ = Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year *y* (tCO_2e/yr)

GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

$BF_{PJ,K,y}$ = Incremental quantity of biomass residue type *k* used as a result of the project activity in the project plant during the year *y* (tons of dry matter)

NCV_K = Net calorific value of the biomass residue type *k* (GJ/ton of dry matter)

$EF_{burning,CH4,K,y}$ = CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y* (tCH_4/GJ)

Baseline emissions are calculated using the "*Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*", EB 26. The variable $BE_{CH4,SWDS,y}$ calculated by the tool corresponds to $BE_{biomass,y}$ in ACM0006. Use from the respective quantities of biomass residues that are prevented from anaerobic decay ($BF_{PJ,k,y}$ or fractions of it) as the waste quantities prevented from disposal ($W_{j,x}$) is in the tool.

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

Where:

$BE_{CH_4, SWDS,y}$ = Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO2e)

Φ = Model correction factor to account for model uncertainties (0.9)

f = Fraction of methane captured at the SWDS and flared, combusted or used in another manner.

$BE_{CH4,SWDS,y}$ = Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO2e)

GWP_{CH_4} = Global Warming Potential (GWP) of methane, valid for the relevant commitment period

OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)

F = Fraction of methane in the SWDS gas (volume fraction) (0.5)

DOC_f = Fraction of degradable organic carbon (DOC) that can decompose

MCF = Methane correction factor

Wj,x = Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)

DOC_j = Fraction of degradable organic carbon (by weight) in the waste type *j*

K_j = Decay rate for the waste type *j*

j = Waste type category (index)

X = Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)

Y = Year for which methane emissions are calculated.

a. **Annex A** – Data obtained from monitoring results with emission reduction calculations, 01/01/2008 to 31/10/2008

NOBRECEL Biomass energy project
Emission Reduction Calculations

Methane avoidance	*Symbol*	*Data Source*	jan/08	fev/08	mar/08	abr/08	mai/08	jun/08	jul/08	ago/08	set/08	out/08
Uncontrolled burning or aerobic decay baseline	BE (B1)	Calculated	57	57	60	56	49	43	54	48	37	50
Incremental biomass (uncontrolled burning)	BF_{ae}	Monitored	1.375	1.381	1.441	1.353	1.189	1.039	1.303	1.155	891	1.200
GWPch4 * NCV * EF burning * conservative factor		meth default	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
anaerobic decay baseline	BE (B2)	Calculated	4.517	4.521	4.561	4.502	4.392	4.291	4.469	4.369	4.192	4.400
Incremental biomass under anaerobic decay (also called *w*)	BF_{an}	Monitored	12.376	12.426	12.971	12.181	10.697	9.351	11.728	10.394	8.023	10.801
Fraction of Methane capture in SWDS and flared or combusted	F	Monitored	0	0	0	0	0	0	0	0	0	0
GWP_{CH4}	GWP_{CH4}	meth default	21	21	21	21	21	21	21	21	21	21
Incremental Biomass transported (third parties)	BF_T	Monitored	12.352	12.758	13.366	10.857	11.680	10.039	12.025	10.155	7.915	9.036
Incremental Own biomass	BF_P	Monitored	1.398	1.049	1.047	2.677	206	351	1.005	1.394	999	2.966
TOTAL Incremental Biomass	BF_{Total}	Monitored	13.751	13.807	14.413	13.535	11.886	10.390	13.031	11.549	8.914	12.001
Displacement of heat	*Symbol*	*Data Source*	jan/08	fev/08	mar/08	abr/08	mai/08	jun/08	jul/08	ago/08	set/08	out/08
Emission Reduction	ER heat	Calculated	3.579	3.505	3.806	3.497	3.642	4.099	3.926	3.618	2.374	3.763
Heat emission factor	EF heat ($EF_{CO2,BL,heat,j}$)	Calculated	0,130	0,130	0,130	0,130	0,130	0,130	0,130	0,130	0,130	0,130
Increased steam generated	Q	Calculated	27.489	26.919	29.238	26.862	27.977	31.488	30.160	27.788	18.239	28.906
Steam produced by the new boiler	$Q_{project\ plant}$	Monitored	34.611	34.042	36.360	33.984	35.099	38.610	37.283	34.910	25.361	36.028
Steam produced by old boilers	Q_{CRQ}	Monitored	21.569	19.471	20.643	17.906	18.155	20.834	23.312	23.030	20.361	20.671
Total steam produced	Q_{TOTAL}	Calculated	56.179	53.513	57.003	51.890	53.254	59.444	60.595	57.940	45.723	56.699
Heat from all old boilers	$Q_{historic}$	Fixed	0	0	0	0	0	0	0	0	0	0
Heat from biomass boilers	$Q_{biomass}$	Fixed	7.122	7.122	7.122	7.122	7.122	7.122	7.122	7.122	7.122	7.122
Electricity generation	*Symbol*	*Data Source*	jan/08	fev/08	mar/08	abr/08	mai/08	jun/08	jul/08	ago/08	set/08	out/08
Net electricity generation for Ers calculation	EG	Calculated	1.414	2.302	2.104	2.037	1.916	1.820	1.997	2.028	1.386	2.099
net electricity generated by project	$EG_{project\ plant}$	Monitored	1.538	2.417	2.239	2.050	1.977	1.868	2.072	2.058	1.410	2.143
net electricity generated by old equip	EG_{old}	Monitored	223	0	0	0	0	0	0	0	0	0
Total electricity generated	EG_{total}	Calculated	1.761	2.417	2.239	2.050	1.977	1.868	2.072	2.058	1.410	2.143
Historical electrivity generated by the plant	$EG_{historic,3yr}$	Fixed	0	0	0	0	0	0	0	0	0	0
Project Emission	*Symbol*	*Data Source*	jan/08	fev/08	mar/08	abr/08	mai/08	jun/08	jul/08	ago/08	set/08	out/08
Transportation of biomass residues	PET	Calculated	97	101	105	86	92	79	47	40	31	36
Biomass transported (third parties)	BF_T	Monitored	12.352	12.758	13.366	10.857	11.680	10.039	12.025	10.155	7.915	9.036
Truck Load	TL	Estimated	10	10	10	10	10	10	20	20	20	20
Average Distance	AVD	Estimated	150	150	150	150	150	150	150	150	150	150
Truck emission factor	EF_{km}	Estimated	0,00053	0,00053	0,00053	0,00053	0,00053	0,00053	0,00053	0,00053	0,00053	0,00053
on-site consumption of fossil fuel	PEff	Calculated	16	15	15	15	15	15	15	15	15	15
Fossil fuel consumption site	$FF_{project\ site}$	Monitored	5	5	5	5	5	5	5	5	5	5
Fossil fuel consumption plant	$FF_{project\ plant}$	Monitored	0	0	0	0	0	0	0	0	0	0
Fossil fuel emission factor	$EF_{CO2,FF}$	IPCC	3,11	3,11	3,11	3,11	3,11	3,11	3,11	3,11	3,11	3,11
consumption of electricity	PE_{EC}	Calculated	35	32	38	4	17	14	21	8	7	12
shredder consumption	EC_P (EC shredder/chopper)	Calculated	125	115	135	13	62	48	75	29	24	44
shredder work hours	H	Monitored	623	574	673	64	308	242	374	147	120	219
Grid Emission Factor	EF_{GRID}	O.N.S.	0,2823	0,2823	0,2823	0,2823	0,2823	0,2823	0,2823	0,2823	0,2823	0,2823
combustion of biomass residues	$PE_{biomass,CH4}$	Calculated	0	0	0	0	0	0	0	0	0	0
Total Emission Reductions	*Symbol*	*Data Source*	jan/08	fev/08	mar/08	abr/08	mai/08	jun/08	jul/08	ago/08	set/08	out/08
Displacement of heat	ERheat	Calculated	3.579	3.505	3.806	3.497	3.642	4.099	3.926	3.618	2.374	3.763
Electricity generation	ERelectricity	Calculated	399	650	594	575	541	514	564	573	391	593
Methane Avoidance	BEbiomass	Calculated	4.574	4.578	4.621	4.558	4.441	4.334	4.523	4.417	4.229	4.449
Project Emission	PE	Calculated	113	116	121	101	108	95	63	56	47	51
Leakage	L	Calculated	0	0	0	0	0	0	0	0	0	0
$ER_{heat} + ER_{electricity} + BE_{biomass} - PE - L$	ER	Calculated	8.438	8.616	8.900	8.529	8.516	8.853	8.950	8.552	6.948	8.754