Monitoring Report

Volume 1
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Start monitoring period: 25 June 2008
End monitoring period: 31 Jan 2009

Title: Straw generation project in Wei county Hebei province, P.R. China

UNFCCC Reference Number: 1546

Project developer

National Bio Energy Co., Ltd.,

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Verifier:	SGS

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1 Introduction

The purpose of this Monitoring Report is to calculate the emission reductions achieved by the project activity in the period covered by this report, and to serve as the basis for the verification of these reductions and issuance of the CERs.

1.1 Monitoring period

Monitoring period: 25 June 2008 – 31 Jan 2009

2 Project description

2.1 Title

Straw generation project in Wei county Hebei province, P.R. China

2.2 UNFCCC Reference Number

1546

2.3 Project summary

The project activity is to collect and utilise biomass residues to generate electricity. The biomass residue fired power plant has a total installed capacity of 25 MWe. The expected annual net generation of 126.5 GWh will be exported to the North China Power Grid.

2.4 Category of project activity

Using the agreed methodology ACM0006 version 4, the category of the project activity is:

- Sectoral scope 1: Energy industries
- Category: grid connected renewable electricity

3 Project timeline

Commission and first electricity generation date	31 January 2007
CDM registration date	25 June 2008
Start of this monitoring period	25 June 2008
End of this monitoring period	31 January 2009

4 Baseline methodology

4.1 Methodology

The project participants use the approved consolidated monitoring methodology ACM0006 (version 4) regarding grid-connected electricity generation from biomass residues, in conjunction with ACM0002 (version 6) to establish the grid emissions factor for renewable energy projects. The grid emissions factor has been fixed for the first 7-year crediting period.

In each year the amount of CERs actually generated by the project will vary depending on the net electricity supplied to the grid, project emissions due to transport and fossil fuel use, as well as methane emissions from the biomass combusted in the project scenario and avoided in the baseline as detailed in the PDD and summarised below.

4.2 Calculations Methodology

4.2.1 Electricity

The project participants used ACM0002 in the PDD to calculate the emissions factor for the net electricity displaced by the project. Following this methodology, the emission reductions achieved by the project activity from electricity generation can be calculated by multiplying the net electricity supplied to the grid and the appropriate emissions factor of the grid.

The emission reductions from electricity $ER_{electricity,y}$ by the project activity during a given year y is

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

Where EG_y is the net electricity supplied to the grid, $EF_{electricity,y}$ is the CO_2 emission factor of the grid and BE_y is the baseline emissions.

The emission factor $EF_{electricity,y}$ of the grid is represented as a combination of the Operating Margin and the Build Margin, and was fixed for the duration of the crediting period in the PDD. The Operating Margin emission factor $EF_{OM,y}$ was calculated in the PDD as 1.1208 tCO_2e/MWh. The Build Margin emission factor $EF_{BM,y}$ was calculated as 0.9397 tCO_2e/MWh. The weighted average of Operating and Build Margin emission factors is:

$$EF_{\text{electricity},y} = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

= 0.5 * 1.1208 + 0.5 *0.0397 = 1.03025 tCO_2/MWh

4.2.2 Project emissions from transport

Following ACM0006 in the PDD, the emissions from the transport were estimated in the

PDD from the projected total amount of biomass residues combusted, the average truck load, average distance the biomass gets transported to the project plant, and the CO_2 emissions factor from fuel used for transportation. During operation, the truck load, transport distance, truck types are monitored so that the following formula is used to calculate the project emission from transportation:

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \times AVD_y \times EF_{km,CO_2,y}$$

$$EF_{km,CO_2,y} = DPK \times Density_d \times NCV_d \times EF_d$$

4.2.3 Project emissions from fossil fuel use

Fossil fuels are used by forklift in plant, but no fossil fuels are combusted as auxiliary fuel for boiler start up in operation. Following ACM0006 in the PDD, the project participants established the formulae for calculating the emissions from fossil fuel use in the project plant, using the quantity of each fuel used and the appropriate emissions coefficient, as follows:

$$PEFF_y = (FF_{project,plant,d,y} + FF_{project,site,d,y}) \times NCV_d \times EF_d$$

4.2.4 Project emissions from electricity consumption in straw collection sites ($PE_{EC,y}$)

The electricity consumption due to straw cracker is estimated as the product of electricity consumption and an appropriate grid emission factor, as follows:

$$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y}$$

4.2.5 Methane from biomass

Finally, the project participants, using ACM0006, established in the PDD that methane emissions would occur in the baseline scenario. The biomass residue would have been burned in an uncontrolled manner or dumped and left to decay, generating significant methane emissions. Methane emissions from dumping biomass residues, and leaving them to decay, are higher than when they are burned in an uncontrolled manner. Therefore to be conservative, it is assumed, that all residues are burned. It was established in the PDD that the emissions can be calculated from the quantity of biomass that would not be used in absence of the project activity, with the net caloric value and the appropriate emissions factor (uncontrolled burning), as follows:

$$BE_{biomass,y} = GWP_{CH_4} \times \sum_k BF_{PJ,k,y} \times NCV_k \times EF_{burning,CH_4,k,y}$$

Accounting for the methane emissions in the baseline, methane emissions from the combustion in the project scenario also needs to be calculated. The formula used in the PDD presents project methane emissions, using the quantity of biomass used in the project activity, the net caloric value and the appropriate emissions factor (controlled burning in power plant), as follows:

$$PE_{Biomass,CH_4,y} = EF_{CH_4,BF} \times \sum_k BF_{k,y} \times NCV_k$$

The CO_2 equivalent emissions can be calculated as:

$$PE_{CO2} = GWP_{CH_4} \times PE_{Biomass,CH_4,y} = GWP_{CH_4} \times EF_{CH_4,BF} \times \sum_k BF_{k,y} \times NCV_k$$

4.2.6 Leakage

Following ACM0006 in the PDD, the project participants established that the leakage from the project activity is zero, as the surplus of biomass residues is far greater than the quantity of residues used ion the project plant (see section 7.3).

5 Monitoring data

5.1 Electricity

The net electricity displacement by the project is monitored through the use of metering equipment at the substation. With the emissions factor fixed for the crediting period, net electricity displacement is calculated from total exports to the grid and total imports from the grid at the power plant.

All metering equipment is calibrated regularly in line with industry standards. In addition, total supply and total imports are checked against invoices.

Table 1 Monitored electricity data and calculation (MWh)

Monitoring period		Exported Power Mwh
from	to	Es
6/25/08 0:00	7/20/08 0:00	11058.30
7/21/08 0:00	8/20/08 0:00	13244.55
8/21/08 0:00	9/20/08 0:00	12997.60
9/21/08 0:00	10/20/08 0:00	17054.40
10/21/08 0:00	11/20/08 0:00	16385.33
11/21/08 0:00	12/20/08 0:00	18414.00
12/21/08 0:00	1/31/2009 24:00:00	6275.22
	subtotal	95429.40
Monitoring period		Imported Power
from	to	Ei
6/25/08 0:00	7/15/08 8:00	1259.06
7/15/08 8:00	8/15/08 8:00	2,070.60
8/15/08 8:00	9/15/08 8:00	2,053.80
9/15/08 8:00	10/15/08 8:00	1,954.05
10/15/08 8:00	11/15/08 8:00	2,069.55
11/15/08 8:00	12/15/08 8:00	1,877.40
12/15/08 8:00	1/31/2009 24:00:00	1318.59

	subtotal	12603.05
		net generation supplied to the grid Mwh:
Es-Ei	=	**82826.36**

5.2 Transport

Transport emissions are calculated from AVD(Average round trip distance), TL(average truck load), $BF_{k,y}$ (the straws purchased for generation),and $EF_{km,CO_2,y}$ (average CO_2 emission factor for the trucks measured during the year y) The CO_2 emissions factor of the fuel used for transportation is calculated as 0.001576464, which is more than the IPCC default value, 0.001011t CO_2/km.

Table 2 Monitored data for transport emissions

	AVD (km)	TL (Tone)	BF_{ky} (Tone)	$EF_{km,CO_2,y}$ (Tone CO_2e/km)
Jun-08	16.26325	7.972954	14136.047	0.001576464
Jul-08	15.30656	8.427309	12590.4	0.001576464
Aug-08	14.14317	7.827819	17769.15	0.001576464
Sep-08	18.3106	8.029734	17191.66	0.001576464
Oct-08	21.49636	8.785946	19311.51	0.001576464
Nov-08	17.69006	10.37981	39484.814	0.001576464
Dec-08	19.67293	7.870234	45242.23	0.001576464
Jan-09	9.908789	7.120015	55813.8	0.001576464

Table 2.1 Calculation $EF_{km,CO_2,y}$

	A	B	C	D	E=A*B*C*D*2
Item	DPK (L/km)	Density(t/L)	NCV_d(TJ/t)	EF_d(tCO2/TJ）	$EF_{km,CO2,y}$
	0.29	0.00086	0.042652	74.1	0.001576464
Source	measured	reference	methodology	methodology	

5.3 Fossil fuel use

Emissions from project fossil fuel are calculated from the total amount of fossil fuels used (diesel only) and the appropriate coefficient.

Table 3 Monitored data for fossil fuel use (tonne)

Monitoring Period	FF_{diesel}(L)
Jun-08	9993.0
Jul-08	8415.0
Aug-08	10760.0
Sep-08	10050.0
Oct-08	9720.6
Nov-08	13990.0
Dec-08	13155.0
Jan-09	12139.5

5.4 Electricity consumed in the straw collection sites

The electricity is consumed in the straw collection sites because of the crack of straws. The consumption is monitored as bellow table.

Table 4 Electricity consumed in the straw collection sites

Monitoring period	Imported Power （straw collection sites)
	Mwh
Jun-08	0
Jul-08	0.00
Aug-08	0.00
Sep-08	0.00
Oct-08	0.00
Nov-08	0.00
Dec-08	173.16
Jan-09	353.70
	526.8657

5.5 Methane emissions

Methane emissions in both the baseline and project scenario are calculated from the amount of biomass residue burned in the project plant. Cotton straw and maize were used in this monitoring period. The quantities (BF_i) and net calorific value (NCV) of each kind of biomass residues are monitored as following table shown.

Table 5 Monitored BF (tonne) and NCV (TJ/tonne)

	$BF_{ky,dry\ matter}$ (tonne)	
	cotton	maize
Jun-08	11927.99	0.00
Jul-08	9995.44	0.00
Aug-08	14343.06	0.00
Sep-08	14331.80	0.00
Oct-08	15895.86	0.00
Nov-08	30846.39	1875.69
Dec-08	19918.03	476.04
Jan-09	10935.82	626.81
total	128194.40	2978.54
NCV (TJ/t)	0.012825	0.010875

6 Quality assurance and quality control measures

6.1 Roles and responsibilities

National Bio Energy Wei County Co., Ltd is the daughter company of National Bio Energy

Co., Ltd. The staff from the onsite subsidiary company conduct the monitoring procedures and work based on the monitoring methodology described.
The monitoring data and reports are processed and stored first in the plant office.

6.2 Training

The staffs responsible for monitoring or for auditing these data have been trained according to the CDM monitoring and management methodology.

6.3 Calibrations

All metering equipment are calibrated and checked for accuracy in line with industry standards.

6.4 Quality control

Monitored data has been cross-checked with invoicing, approved and signed off.

7 Emission reduction calculations

7.1 Project emissions

Project emissions are the sum of the emissions from transport, onsite fossil fuel use,electricity consumption in straw collection sites,and methane emissions from burning biomass residues in the project plant:

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \times AVD_y \times EF_{km,CO_2,y}$$

$$EF_{km,CO_2,y} = DPK \times Density_d \times NCV_d \times EF_d$$

$EF_{km,CO_2,y}$ is calculated as 0.001576464,which is more than the IPCC default value 0.001011 kg/km.

$$PEFF_y = (FF_{project,plant,d,y} + FF_{project,site,d,y}) \times COEF_{co_2,i}$$

$$=(FF_{project,plant,d,y} + FF_{project,site,d,y}) \times NCV_d \times EF_d$$

$COEF_{co_2,i}$ calculated from net caloric value of diesel and Emission Factor of diesel, all estimated and adopted in the PDD: $COEF_{co_2,i} = NCV_d \times EF_d$ = 0.042652 TJ/tonne * 74.1 tCO_2/TJ = 3.16 tCO_2e/t.

$PE_{Biomass,CH_4,y} = EF_{CH_4,BF} \times \sum_k BF_{k,y} \times NCV_k$ With the GWP_{CH_4} = 21, and the methane emissions factor for burning biomass in a controlled manner $EF_{CH_4,BF}$ = 30 $kgCH_4/TJ$ with a conservativeness factor of 1.37.

Using the data presented in section 5, total project emissions can now be calculated as the aggregate of the above.

Table 5 Project emissions calculation (tCO_2e)

Monitoring Period	PET_y	$PEFF_{diesel}$	EC_y	$PE_{biomass}$	Project Emission
Jun-08	45.46	27.16	0.00	152.98	225.59
Jul-08	36.05	22.87	0.00	128.19	187.11
Aug-08	50.61	29.25	0.00	183.95	263.81
Sep-08	61.80	27.32	0.00	183.81	272.92
Oct-08	74.49	26.42	0.00	203.86	304.77
Nov-08	106.08	38.03	0.00	419.66	563.77
Dec-08	178.28	35.76	178.40	261.55	654.00
Jan-09	122.45	33.00	364.40	148.29	668.14
Total	675.23	239.79	542.80	1682.29	3140.12

7.2 Baseline emissions

Baseline emissions are the sum of the emissions from displaced electricity, and the methane emissions from the burning of biomass residues in an uncontrolled manner in the baseline scenario:

$ER_{electricity,y} = EG_y \times EF_{electricity,y}$ With $EF_{electricity,y}$ calculated and fixed in the PDD as 1.03025 tCO2e/MWh

$BE_{biomass,y} = GWP_{CH_4} \times \sum_k BF_{PJ,k,y} \times NCV_k \times EF_{burning,CH_4,k,y}$ With the GWP_{CH_4} = 21, and the methane emissions factor for burning biomass in an uncontrolled manner $EF_{burning,CH_4,k,y}$ = 300 $kgCH_4/TJ$ with a conservativeness factor of 0.73.

Using the data presented in section 5, total baseline emissions can now be calculated as the aggregate of the above.

Table 6 Baseline emissions calculation (tCO_2e)

Monitoring period	Power supply baseline emission*	uncontrolled biomass baseline**	baseline emission
Jun-08	0.00	0.00	0.00
Jul-08	10095.67	413.72	10509.39
Aug-08	11511.96	593.67	12105.64
Sep-08	11274.85	593.21	11868.06
Oct-08	15557.14	657.95	16215.08
Nov-08	14748.83	1354.40	16103.23
Dec-08	17036.83	844.13	17880.96
Jan-09	5106.57	478.59	5585.16
total	85331.85	5429.38	90761.23

Note:

for the simpler reason, it is not actual time when the power was recorded,
* and the actual time can be seen in table 1;
** assume baseline emission in June is zero, to be conservative

7.3 Leakage emissions

In line with the approved methodology ACM0006 (version 4), the PDD determined that no leakage would occur due to diversion of biomass from other uses to the project plant. In the PDD, option L2 was used to demonstrate that there is an abundant surplus of biomass in the region of the project activity which is not utilised.

During this monitoring period, the utilization of the types of biomass used by this project have been monitored by the project participants, and the total available biomass and other utilizations in the area (not including this project) was from the official statistics.

Project participants use the biomass resource investigation report to demonstrate that the biomass used in this project activity did not lead to leakage emissions by increasing fossil fuel consumption elsewhere. The data shows that the project does not influence the biomass utilization structure in Wei county, and that the two types of biomass were all in abundant surplus during this monitoring period.

Table 7 below demonstrates that the quantity of available biomass in the region is 'at least 25% larger than the quantity of biomass utilised (e.g. for energy generation or as feedstock), including the project plant.'

Table 7 Demonstration of abundant surplus of biomass availability

biomass type	cotton straw	maize
total biomass generation in the region (10^4t)	30.7029	2.5
available biomss (10^4t)	30.3958	2.45
biomass used excluding project (10^4t)	4.5	0.05
project demand (10^4t)	18.8643	0.4334
total used biomass including project (10^4t)	23.3643	0.4834
available biomass/total used biomass	131.41%	517.17%
avundant surplus?(more than 25%?)	yes	yes

Sources: 'Report of Resource Investigation in Wei county' 2008

Thus, the leakage from this project is neglected and considered as zero: $L_y = 0$.

7.4 Summary of emission reductions during the monitoring period

Table 8 Emission reductions calculation (tCO_2e)

Monitoring period	Project emission	Baseline emission	Leakgae	Emission Reduction
Jun-08	225.59	0.00	0.00	-225.59

Jul-08	187.11	10509.39	0.00	10322.28
Aug-08	263.81	12105.64	0.00	11841.83
Sep-08	272.92	11868.06	0.00	11595.13
Oct-08	304.77	16215.08	0.00	15910.31
Nov-08	563.77	16103.23	0.00	15539.46
Dec-08	654.00	17880.96	0.00	17226.97
Jan-09	668.14	5585.16	0.00	4917.02
total	3140.12	90761.23	0.00	**87621.11**

Annex 1: The energy balance calculation for the verification period

The total inputs of all types of fuels combusted and useful output of electricity from the project are presented below. From this data the conversion efficiency of the project in this period is calculated as 20.45%.

The energy input and output in the project activity in this period

	FF_i(Tonne)	NCV(TJ/Tonne)	Energy(TJ)
Cotton straw	128,194.40	0.012825	1,644.09
maize	2,978.54	0.010875	32.39
diesel	75.87	0.042652	3.24
total			1,679.72

Energy balance

$E_{total}=E_{biomass1}+E_{biomass2}+E_{fossil}$ = 1679.72089 TJ

E_{out} =EG= 95429.40 Mwh= 343.54584 TJ

e= E_{out}/E_{total} = 20.45%