WEST NILE RURAL ELECTRIFICATION CO. LTD.

Project: 0775: West Nile Electrification Project (WNEP)

Project for CO_2 emission reduction by efficient thermal and hydro power generation in the West Nile region of Uganda.

FIRST MONITORING REPORT – Version 1

From: 1st January 2005
To: 31st October 2009

22,786 CERs

Niaz Hirani
General Manager
Place: Kampala, Uganda.
Date: 18th December 2009

CONTENTS

1. 1 INTRODUCTION

1.1.1 The West Nile Rural Electrification Co. Ltd., was created to manage the generation, distribution and sale of electricity in the West Nile region of Uganda, thereby promoting socio –economic development and also a reduction in energy related CO_2 emissions which cause changes in the global climate.

1.1.2 The project is categorized as a small scale project activity under category I. D " Grid connected renewable electricity generation" , and Category II. B "Supply side energy efficiency improvements – generation" The two categories relate to Project component # 1 and project component # 2 respectively.

1.1.3 The host party for the project is Uganda. Other parties involved are Finland, and the Netherlands.

1.1.4 The purpose of this monitoring report is to calculate the greenhouse gas emission reductions achieved by the West Nile electrification project for verification.

1.1.5 This monitoring report covers the period 1st January 2005 to 31st October 2009.

1.2 REFERENCES

1.2.1 The approved baseline methodologies applied are those for small scale project activity for the following categories;

I. D: Grid connected renewable electricity generation. Version 9. 28 July 2006, and
II. B: Supply side energy efficiency improvements – generation. Version 7.28 November 2005.

1.2.2 Project Design Document - Project for Carbondioxide CO_2 emissions reduction by use of more efficient thermal and Hydro electricity generation by the West Nile Rural Electrification Co. Ltd.

1.2.3 Validation Report – Validation of the CDM project for Carbondioxide CO_2 emissions reductions in the West Nile Electrification project by SGS Ltd.

1.2.4 The CDM Operations Plan for the West Nile Electrification Project, April 22 006

1.2.5 The project was registered by the CDM Executive Board on 10th February 2007.

1.2.6 The approved monitoring methodologies are;
Project Type I – Renewable Energy projects. Category I.D: Grid connected renewable electricity generation. Version 9. 28 July 2006
Project Type II – Energy Efficiency Improvement Projects. Category II.B Supply side energy efficiency improvements – generation. Version 7 28 November 2005

1.3 PROJECT ACTIVITY

1.3.1 The project comprises of two components;

Project Component #1: Installation and operation of 3.5 MW (2 units of 1.75 MW) hydroelectric power plant.
Project Component #2: Installation and operation of a HFO-fired 1.5 MW generator to serve as a base load plant during the construction phase of the Hydro plant and as a peaking plant once the Hydro is operational.

1.3.2 Furthermore, there is the upgrade and extension of the distribution grid in the townships of Arua, Nebbi and Paidha, and connection of additional customers who would have instead used privately owned generators.

1.3.3 The 1.5 MW HFO generator has been in operation since May 2005, and the 3.5 MW Hydro plant on Nyagak river is currently under construction and expected to be operational in 2010.

1.3.4 The project contributes to a reduction in the demand for diesel fuel and associated GHG emissions from fuel trucks that would have been bringing diesel for operation of privately owned generators in the project area. The main supply centre is Mombasa which is located 3000 km away. The project activity also contributes to a reduction in the GHG emissions related to this transportation.

2.1 MONITORING METHODOLOGY AND PLAN

2.1.1 For Project component # 1, the monitoring methodology applied is Project type I – Renewable Energy projects. Category I.D: Grid connected renewable electricity generation.
Monitoring in this case will consist of metering the electricity generated by the renewable technology. Since the Hydro power plant is still under construction, no data has been collected.

2.1.2 For Project component # 2, the monitoring methodology applied is Project type II – Energy Efficiency Improvement Projects. Category II. B: Supply side energy efficiency improvements – generation.

2.1.3 The monitoring methodology conforms to the approved monitoring methodology for this project type stating as follows: " Energy Savings shall be measured after implementation of the efficiency measures by calculating the energy content of the fuel used by the generating Unit, and the energy content of electricity or steam produced by the unit. Thus both fuel use and output need to be metered" Also: " A standard emission coefficient for the fuel used by the generating unit is also needed. IPCC default values for emission coefficients may be used."

The monitoring data collected for this crediting period is

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic / paper)	For how long is archived data to be kept?	Comment
1.a	Amount of fuel combusted by generator	FC_j	Liters	(m)	Daily, monthly	100%	Paper, electronic	Until 2 yrs after end of crediting period	
1.b	Generation output	GEN_{TH}	MWh	(m)	Daily	100%	Paper, electronic	Until 2 yrs after end of crediting period	
1.c	Density	$DEN_{prjct,fuel\ j}$	t/m^3	(m)	Monthly	100%	Paper, electronic	Until 2 yrs after end of crediting period	Verified data
1.d	Calorific value	NCV	MJ/kg	(m)	Monthly	100%	Paper, electronic	Until 2 yrs after end of crediting period	Verified data
1.e	Heat rate	$HR_{prjct,fuel\ j}$	MJ/kWh	(e)	Monthly	100%	Paper, electronic	Until 2 yrs after end of crediting period	The heat rate was calculated using the verified data calorific value of fuel(s)
2.a	Generation output, hydro plant	GEN_{Nyagak}	MWh	(m)	Daily	100%	Paper, electronic	Until 2 yrs after end of crediting period	

2.2 CALCULATION OF EMISSION REDUCTIONS

2.2.1 Project emissions

The total CO_2 emissions is the sum for the emissions from the two fossil fuels used, in this case HFO and diesel. The formula applied is;

$$E\ (\text{tonne}\ CO_2\ /\ yr) = FC_{HFO} * DEN_{HFO} * NCV_{HFO} * CEF_{HFO} * CF_{C\text{-}CO2} + FC_{diesel} * DEN_{diesel} * NCV_{diesel} * CEF_{diesel} * CF_{C\text{-}CO2}$$

Where:

$E_{project}$	=	CO_2 emissions (tonne CO_2) from the project
FC_{HFO}	=	quantity of HFO consumed in litres as measured & reported
FC_{diesel}	=	quantity of diesel consumed in litres as measured & reported
DEN_{HFO}	=	Density (Kg/l) of HFO
DEN_{diesel}	=	Density (Kg/l) of diesel
NCV_{HFO}	=	Net calorific value of HFO, IPCC ($TJ/10^3t$)
NCV_{diesel}	=	Net calorific value of diesel, IPCC ($TJ/10^3t$)
CEF_{HFO}	=	Carbon emission factor of HFO IPCC (gC/MJ)
CEF_{diesel}	=	Carbon emission factor of diesel IPCC (gC/MJ)
$CF_{C\text{-}CO2}$	=	Carbon- CO_2 conversion factor (44/12)

For the crediting period under review, the following parameters were used for the calculation.

2.2.2 Calculation of FC_{HFO} and FC_{diesel}

The quantities of HFO and diesel consumed for the crediting period were measured and recorded on a daily basis. The summary of the total monthly quanties recorded is given in the table below. Details of the monthly consumption are given in appendix 1

2.2.3 Calculation of DEN_{HFO} and DEN_{diesel}

The density of the HFO and diesel received at the generating plant is recorded. These details are also included as part of the assumptions in the calculation worksheets and are provided in appendix 2

2.2.4 Calculation of NCV_{HFO} and NCV_{diesel}

The net calorific values of HFO and diesel received at the generating plant is also recorded. These details are also included as part of the assumptions in calculation worksheets and are provided in appendix 3

2.2.5 Calculation of CEF_{HFO} and CEF_{diesel}

The Carbon emission factors of HFO and Diesel were pre-determined and the following figures were used for the calculations.

Parameter	**Value**
CEF_{HFO}	21.10 (gC/MJ)
CEF_{diesel}	20.20 (gC/MJ)

2.2.6 Calculation of $CF_{C\text{-}CO2}$

The Carbon- CO_2 conversion factor is also pre-determined. The value used in the calculations is 44/12 or 3.67

The project activity does not cause any leakages, so the calculated emissions are equal to the project activity emissions.

2.2.7 Baseline emissions

Base line emissions is a product of the emission factor in the baseline scenario and the energy generated by the HFO thermal power plant for the monitoring period.

$E_{baseline} = GEN_{TH} * ER_{BL}$

Where:

$E_{baseline}$ = CO_2 emissions (tonne CO_2) in the baseline scenario

GEN_{TH} = metered generation output from the thermal generator (mWh)
ER_{BL} = baseline emission rate (tCO_2 / kWh)

2.2.8 Calculation of GEN_{TH}

The energy generated from the thermal generator is measured on a daily basis. The monthly figures are presented in the appendix 4

2.2.9 Calculation of ER_{BL}

The baseline emission rate was pre-determined. It was calculated on the basis of a comprehensive survey and corresponds well to the emission factors presented I AMS ID.

The base line emission rate for the West Nile projects is a product of the following diesel parameters

Parameter	**Value**
Density (kg/l)	0.87
Net calorific value (MJ/kg)	43.33
Carbon emission factor (tC/TJ)	20.20
Carbon- CO_2 conversion factor	3.667
Consumption based on 15% efficiency (l / kWh)	0.66

The baseline emission rate used is 1.843 kg CO_2 / kWh

2.2.10 Calculation of Emission reductions

The emission reductions are the difference between the baseline emissions, and the project emission.

The table below shows the emission reductions calculated for this crediting period

Month	**Baseline emissions**	**Project emissions**	**Emission reductions**
January 2005	0	0	0
February 2005	0	0	0
March 2005	0	0	0
April 2005	0	0	0
May 2005	754.71	384.37	370.34
June 2005	605.98	301.44	304.54
July 2005	771.66	388.15	383.51
August 2005	532.63	257.32	275.30
September 2005	591.05	272.36	318.69
October 2005	647.26	335.39	311.87
November 2005	615.93	318.82	297.11
December 2005	810.00	383.99	426.01

January 2006	812.39	375.70	436.69
February 2006	781.80	369.25	412.55
March 2006	805.58	374.04	431.54
April 2006	756.00	364.53	391.47
May 2006	791.02	379.32	411.70
June 2006	803.56	362.58	440.96
July 2006	876.53	391.98	484.55
August 2006	875.61	398.93	476.68
September 2006	871.56	378.54	493.02
October 2006	921.50	415.20	506.30
November 2006	904.73	408.66	496.07
December 2006	976.61	429.61	547.00

January 2007	966.11	422.31	543.80
February 2007	871.56	382.26	489.30
March 2007	949.29	409.19	540.10
April 2007	945.80	456.20	489.60
May 2007	824.20	379.10	445.10
June 2007	961.10	437.10	524.00
July 2007	983.60	438.20	545.40
August 2007	942.00	420.50	521.50
September 2007	941.60	407.60	534.00
October 2007	1053.60	456.40	597.20
November 2007	1069.7	458.7	611.00
December 2007	1124.2	497.9	626.4

January 2008	578.0	262.7	315.3
February 2008	572.1	282.5	289.5
March 2008	904.9	389.1	515.9
April 2008	1023.8	438.0	585.8
May 2008	864.0	370.3	493.7
June 2008	862.3	356.0	506.3
July 2008	971.4	400.5	570.9
August 2008	769.6	321.8	447.9
September 2008	824.9	354.9	470.1
October 2008	877.5	388.3	489.1
November 2008	566.2	249.9	316.3
December 2008	639.7	281.7	358.0

January 2009	615.0	272.2	342.8
February 2009	252.9	122.4	130.5
March 2009	182.6	83.1	99.6
April 2009	0	0	0
May 2009	233.1	103.9	129.2
June 2009	887.8	390.9	496.9
July 2009	1027.5	443.2	584.3
August 2009	562.5	245.2	317.3
September 2009	339.8	149.0	190.8
October 2009	807.4	354.4	453.0
TOTAL			22,786.23

The total number of ERs applied for this crediting period are therefore 22,786.

2.2.11 Calculation of the Heat rate

The heat rate (HR) is the ratio of the total energy content of the fuel consumed in mega joules (MJ), to the total electric energy generated in Kilowatt hours (kWh)

The total energy content of the fuel consumed is the product of the amount of fuel (FC), fuel density (DEN) and the Net Calorific value (NCV).

Total Fuel energy = Fuel Energy $_{HFO}$ + Fuel Energy $_{Diesel}$

$$= FC_{HFO} * DEN_{HFO} * NCV_{HFO} + FC_{Diesel} * DEN_{Diesel} * NCV_{Diesel}$$

The energy generated (GEN) is measured and recorded as explained in section 2.2.8 above.

The heat rate (HR) is therefore calculated and monitored. The monthly averages are presented in appendix 5

2.2.12 Calculation of Generation output, Hydro plant

The energy generated from the Hydro plant is not reported for this crediting period, since the Hydro plant is still under construction. The monthly figures are therefore reported as zero values as shown in appendix 4

2.3 QUALITY CONTROL AND ASSURANCE.

2.3.1 The information on fuel consumption, generation output and other parameters necessary for the calculation of emission reductions is collected under the supervision of the Generation Superintendent. The staff responsible for operation of the power plant are collecting information on a daily basis with the QC / QA responsibility assigned to the Generation superintendent. The Generation Superintendent checks the quality, consistency and comprehensiveness of the collected information on a daily basis. The information is recorded in both paper and electronic form. The manager checks the data information.

2.3.2 The QA / QC procedures followed by WENRECo. will be consistent with the QA / QC procedures generally put in practice at Thermal Power plants around the world and in CDM projects in which the World Bank is a project participant. Professional support will be sought when the operations of the Nyagak Hydro power plant commence.

2.4 ENVIRONMENTAL IMPACTS.

The purpose of the project activity is to generate power safely and efficiently and in accordance with applicable environmental standards in Uganda.

A certificate of approval for the Environmental Impact Assessment for the Thermal plant in Arua was issued in 2005. It requires the company to implement an environment monitoring plan, as contained in the project brief, and also to ensure good record keeping.

Appendix 1 – Fuel Consumed

Month	FC_{HFO} (l)	FC_{diesel} (l)
January 2005	0	0
February 2005	0	0
March 2005	0	0
April 2005	0	0
May 2005	122,489	5,941
June 2005	92,249	9,307
July 2005	125,400	5,841
August 2005	82,117	6,292
September 2005	88,885	4,609
October 2005	104,247	12,000
November 2005	104,344	4,714
December 2005	124,731	2,744
January 2006	123,146	2,530
February 2006	119,631	2,766
March 2006	122,866	1,855
April 2006	116,498	5,063
May 2006	128,758	2,101
June 2006	119,812	1,226
July 2006	129,780	1,068
August 2006	128,321	5,939
September 2006	126,609	881
October 2006	135,445	1,331
November 2006	132,443	3,037
December 2006	141,349	856
January 2007	140,660	825
February 2007	125,437	1,157
March 2007	135,913	1,311
April 2007	150,359	2,373
May 2007	122,910	1,712
June 2007	144,945	1,227
July 2007	145,717	938
August 2007	138,970	2,068
September 2007	135,776	1,845
October 2007	152,905	0
November 2007	153,665	0
December 2007	164,210	0
January 2008	86,417	2000
February 2008	82,791	13,312
March 2008	130,562	0
April 2008	144,937	1,765
May 2008	100,423	25,663
June 2008	107,636	12,989
July 2008	112,457	21,285
August 2008	79,068	31,398
September 2008	91,475	29,674
October 2008	127,701	2,565
November 2008	83,535	0
December 2008	93,698	0

January 2009	90,434	0
February 2009	40,833	170
March 2009	27,900	0
April 2009	0	0
May 2009	34,432	0
June 2009	128,956	1,008
July 2009	148,684	0
August 2009	73,698	9,453
September 2009	48,401	1,704
October 2009	118,153	630

Appendix 2 – Density of fuels.

Month	DEN_{HFO} (Kg/l)	DEN_{diesel} (Kg/l)
January 2005	N/A	N/A
February 2005	N/A	N/A
March 2005	N/A	N/A
April 2005	N/A	N/A
May 2005	0.943	0.87
June 2005	0.938	0.87
July 2005	0.937	0.87
August 2005	0.929	0.87
September 2005	0.929	0.87
October 2005	0.941	0.87
November 2005	0.939	0.87
December 2005	0.945	0.87
January 2006	0.944	0.87
February 2006	0.953	0.87
March 2006	0.949	0.87
April 2006	0.950	0.87
May 2006	0.947	0.87
June 2006	0.946	0.87
July 2006	0.946	0.87
August 2006	0.944	0.87
September 2006	0.943	0.87
October 2006	0.941	0.87
November 2006	0.942	0.87
December 2006	0.945	0.87
January 2007	0.939	0.87
February 2007	0.953	0.87
March 2007	0.937	0.87
April 2007	0.940	0.87
May 2007	0.960	0.87
June 2007	0.939	0.87
July 2007	0.941	0.87
August 2007	0.936	0.87
September 2007	0.929	0.87
October 2007	0.931	0.849
November 2007	0.931	0.849
December 2007	0.946	0.849
January 2008	0.937	0.849
February 2008	0.936	0.849
March 2008	0.931	0.849
April 2008	0.935	0.849
May 2008	0.942	0.849
June 2008	0.937	0.849
July 2008	0.956	0.849
August 2008	0.948	0.849
September 2008	0.947	0.849
October 2008	0.937	0.849
November 2008	0.938	0.849
December 2008	0.947	0.849
January 2009	0.944	0.849
February 2009	0.941	0.849
March 2009	0.933	0.849
April 2009	N/A	N/A

May 2009	0.937	0.849
June 2009	0.935	0.849
July 2009	0.931	0.849
August 2009	0.931	0.849
September 2009	0.931	0.849
October 2009	0.931	0.849

Appendix 3 - Net Calorific Values.

Month	NCV_{HFO} (MJ/Kg)	NCV_{diesel} (MJ/Kg)
January 2005	N/A	N/A
February 2005	N/A	N/A
March 2005	N/A	N/A
April 2005	N/A	N/A
May 2005	41.16	43.33
June 2005	41.14	43.33
July 2005	40.90	43.33
August 2005	40.64	43.33
September 2005	40.64	43.33
October 2005	41.23	43.33
November 2005	41.58	43.33
December 2005	41.25	43.33
January 2006	41.00	43.33
February 2006	41.00	43.33
March 2006	40.88	43.33
April 2006	40.92	43.33
May 2006	40.98	43.33
June 2006	40.98	43.33
July 2006	40.97	43.33
August 2006	40.80	43.33
September 2006	40.70	43.33
October 2006	41.75	43.33
November 2006	41.48	43.33
December 2006	41.34	43.33
January 2007	41.11	43.33
February 2007	40.99	43.33
March 2007	41.17	43.33
April 2007	41.11	43.33
May 2007	41.02	43.33
June 2007	41.17	43.33
July 2007	41.06	43.33
August 2007	41.23	43.33
September 2007	41.22	43.33
October 2007	41.43	42.32
November 2007	41.43	42.32
December 2007	41.43	42.32
January 2008	41.05	42.32
February 2008	41.21	42.32
March 2008	41.35	42.32
April 2008	41.30	42.32
May 2008	41.26	42.32
June 2008	41.18	42.32
July 2008	41.33	42.32
August 2008	41.04	42.32
September 2008	41.13	42.32
October 2008	41.20	42.32
November 2008	41.20	42.32
December 2008	41.02	42.32
January 2009	41.20	42.32
February 2009	40.99	42.32

March 2009	41.25	42.32
April 2009	N/A	N/A
May 2009	41.62	42.32
June 2009	41.58	42.32
July 2009	41.36	42.32
August 2009	41.43	42.32
September 2009	41.43	42.32
October 2009	41.43	42.32

Appendix 4 - Units generated by the thermal power plant in Arua, and Hydro power plant in Nyagak

Month	GEN_{TH} (kWh)	GEN_{Nyagak} (kWh)
January 2005	N/A	0
February 2005	N/A	0
March 2005	N/A	0
April 2005	N/A	0
May 2005	409,500	0
June 2005	331,300	0
July 2005	418,700	0
August 2005	289,000	0
September 2005	320,700	0
October 2005	364,100	0
November 2005	347,200	0
December 2005	439,500	0
January 2006	440,800	0
February 2006	424,200	0
March 2006	437,200	0
April 2006	410,200	0
May 2006	429,200	0
June 2006	436,000	0
July 2006	475,600	0
August 2006	475,100	0
September 2006	472,900	0
October 2006	500,000	0
November 2006	490,900	0
December 2006	529,900	0
January 2007	524,200	0
February 2007	472,900	0
March 2007	515,100	0
April 2007	513,200	0
May 2007	447,200	0
June 2007	521,500	0
July 2007	533,700	0
August 2007	511,100	0
September 2007	510,900	0
October 2007	571,700	0
November 2007	580,400	0
December 2007	610,000	0
January 2008	313,600	0
February 2008	310,400	0
March 2008	491,000	0
April 2008	555,500	0
May 2008	468,800	0
June 2008	467,900	0
July 2008	527,100	0
August 2008	417,600	0
September 2008	447,600	0
October 2008	476,100	0
November 2008	307,200	0
December 2008	347,100	0

January 2009	333,700	0
February 2009	137,239	0
March 2009	99,100	0
April 2009	0	0
May 2009	126,500	0
June 2009	481,700	0
July 2009	557,500	0
August 2009	305,190	0
September 2009	184,400	0
October 2009	438,090	0
TOTALS	**28,617,819**	**0**

Appendix 5 – Heat rate

Month	**HR** (MJ/kWh)
January 2005	N/A
February 2005	N/A
March 2005	N/A
April 2005	N/A
May 2005	12.194
June 2005	11.803
July 2005	12.242
August 2005	12.340
September 2005	11.513
October 2005	12.896
November 2005	11.811
December 2005	11.324
January 2006	11.046
February 2006	11.269
March 2006	11.113
April 2006	11.858
May 2006	11.552
June 2006	10.758
July 2006	10.664
August 2006	11.208
September 2006	10.359
October 2006	10.719
November 2006	10.933
December 2006	10.481
January 2007	10.415
February 2007	10.470
March 2007	10.228
April 2007	11.706
May 2007	11.678
June 2007	10.885
July 2007	10.646
August 2007	10.931
September 2007	10.350
October 2007	
November 2007	
December 2007	
January 2008	11.0
February 2008	13.0
March 2008	10.3
April 2008	10.9
May 2008	10.3
June 2008	9.9
July 2008	9.9
August 2008	10.1
September 2008	10.7
October 2008	10.5
November 2008	11.055
December 2008	10.393
January 2009	10.102
February 2009	9.75
March 2009	7.83
April 2009	
May 2009	

June 2009	10.2
July 2009	10.109
August 2009	9.3
September 2009	10.58
October 2009	10.4

Appendix 6 - List of abbreviations used

CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER(s)	Certified Emission Reductions
C	Carbon
CO_2	Carbondioxide
ERs	Emission Reductions
gC	Grams of Carbon
GHG	Green House Gas
HFO	Heavy Fuel Oil
ID	Identification
IPCC	Inter-governmental Panel on Climate Change
kg	Kilogram
kWh	Kilo Watt Hour
l	Litre
mWh	Mega Watt Hour
MJ	Mega Joules
MW	Mega Watts
NCV	Net Calorific Value
PDD	Project Design Document
QA	Quality Assurance
QC	Quality Control
SGS	Societe Generale de Surveillance
t	Tonnes
t / m^3	Tonnes / cubic meter
tCO_2	Tonnes of Carbondioxide
TJ	Tera-joule
WENRECo	West Nile Rural Electrification Co. Ltd.
Yr	Year