PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	**West Nile Electrification Project (WNEP)**
Version number of the PDD	**Version 3**
Completion date of the PDD	**September 10, 2013**

Project participant(s)	Uganda: West Nile Rural Electrification Company Limited (WENRECo) Sweden: Government of Sweden – Swedish Energy Agency; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) France: GDF Suez Japan: Chubu Electric Power Co., Inc. ; Japan International Cooperation Agency (JICA) ; Kyushu Electric Power Co., Inc. ; Mitsubishi Corporation ; MIT Carbon Fund Co., Ltd. (MIT) (withdrawn) ; Shikoku Electric Power Co., Inc. ; Tohoku Electric Power Co. Inc. ; The Tokyo Electric Power Co., Inc. ; The Chugoku Electric Power Co., Inc. ; Mitsui & Co. Ltd. Netherlands: Electrabel S.A.; The Netherlands, Ministry of Infrastructure and Environment (IenM); Ministry of Economic Affairs, Agriculture and Innovation (EL&I); International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) Norway: Government of Norway - Ministry of Foreign Affairs ; Norsk Hydro ASA ; Statoil ASA United Kingdom and Great Britain and Northern Ireland: BP Alternative Energy International Ltd. ; Deutsche Bank AG Finland: Fortum Corporation; Government of Finland – Ministry of Foreign Affairs and International Trade; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) Germany: RWE Power AG; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)

Host Party(ies)	Uganda
Sectoral scope(s) and selected methodology(ies)	Sectoral scopes: 1-Energy industries (renewables-/nonrenewable sources); Applied methodologies: AMS-I.D. ver. 9 - Grid connected renewable electricity generation AMS-II.B. ver. 7 - Supply side energy efficiency improvements – generation
Estimated amount of annual average GHG emission reductions	36,210 tCO2e

SECTION A. Description of project activity
A.1. Purpose and general description of project activity
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The overall objectives of the West Nile Electrification Project (WNEP) are to promote socio-economic development in rural Uganda and to reduce energy-related CO_2 emissions causing global climate change. The main project components of the WNEP are:

- Project Component #1: Installation and operation of a 3.5 MW (2 units of 1.75 MW) hydroelectric power plant; and
- Project Component #2: Installation and operation of a HFO-fired 1.5 MW generator. The generator will serve as a base-load plant during the construction phase of the hydroplant and as a peaking plant once the hydroplant becomes operational in 2007.

The project also upgrades and extends the distribution networks in Paidha, Nebbi, and Arua municipalities, in order to connect 4,000 additional customers, who would otherwise operate small, privately-owned generation facilities.

In 2001, the WNEP was identified as a potential CDM project and the original financial plan for the project includes carbon finance revenue from sales of CO_2 emission reductions. The starting date of the project is April 1, 2003. The WNEP is part of a ten-year World Bank lending program entitled Energy for Rural Transformation (ERT) that is being undertaken in the context of the on-going power sector reform in Uganda (pls. see Section A.4.4). The objectives of the ERT are to assist Uganda's rural energy sector in contributing to rural transformation and poverty alleviation and, at the same time, to protect the global environment through implementation of CO_2-neutral hydropower displacing diesel and petrol based electricity generation. As a complement to this project an 80 km sub-transmission line connecting Nebbi and Arua has been built with financial support from Norway. This line is transferred to the WNEP operator. The government of Uganda has developed the WNEP with assistance from the ERT program.

Significant barriers and extended delays have resulted in a long gestation time for the WNEP. The original intention in 2001 was to install two new, efficient diesel generators (1.5 MW and 1.0 MW), and to construct one 5.1 MW hydropower plant at the Nyagak site in the Nebbi District in Phase I of the ERT, plus an optional 1.5 MW hydropower plant in Olewa in the Arua District two years later. However, given an unanticipated low level of power demand in the project area, the project sponsor has subsequently redesigned the original project design in line with a more realistically expectable load in the West Nile region. The redesigned project is a 1.5 MW HFO-fired generator located in Arua, which has been in operation since May 2005, and a 3.5 MW hydroplant at Nyagak, which will begin generating power in 2007.

Taken together, Arua, Nebbi, and Paidha constitute the largest load centre in the West Nile region. The WNEP helps developing the hydropower potential of the West Nile region by installing one run-of-river hydro plant and by operating the power distribution system with a focus on these three regional urban centres.

The proposed project will reduce the demand for diesel fuel and abate GHG emissions (i.e., CO_2, N_2O and CH_4) from fuel trucks that would otherwise bring diesel fuel from supply centers to consumers residing in the project area. Given that the fuel supply centers are located in Mombassa, Kenya, approximately 3,000 km over land from the West Nile Region, the project activity will bring about a non-trivial reduction in transport-related GHG emissions.

Because an approved methodology for small-scale CDM project activities reducing GHG emissions from fuel transport currently does not exist, the World Bank Carbon Finance Business has submitted a proposal

for such a methodology to the small-scale working group on April 24, 2005. The submitted methodology is based on an approved large-scale methodology[1] as well as an approved consolidated methodology.[2] If the CDM Executive Board approves this or an applicable methodology, the project participants intend to claim the emission reductions from this anthropogenic source. This will possibly require a modification of the Project Design Document; and the necessary monitoring information and data must be collected by the project operator and must be verified by a DOE.

In essence, the proposed project activity will be contributing to the development of Uganda's indigenous renewable energy basis while meeting the growing demand for energy in the West Nile region. Diesel and petrol-based energy supply which currently is dominant in the project area is both insufficient and unreliable, whereas hydroelectric power will reliably deliver electricity that will stimulate economic development locally while reducing both local air pollution problems and CO_2 emissions contributing to global warming.

A.2. Location of project activity

A.2.1. Host Party(ies)

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Uganda

A.2.2. Region/State/Province etc.

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West Nile Region

A.2.3. City/Town/Community etc.

>>

Arua, Nebbi and Paidha

A.2.4. Physical/ Geographical location

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The hydroelectric plant will have an installed capacity of 2 x 1.75 MW (for a total rated discharge of 5 m^3/s and a gross head of 87 m) for a period of at least 25 years using the waters of the Nyagak River. The plant will be located close to the Paidha village.

The 1.5 MW HFO-fired generator will be located in the outskirts of Arua Municipality (6km from the town center).

The West Nile Region borders to the west on the Democratic Republic of Congo and to the north on Sudan. It comprises the districts of Nebbi, Arua, Moyo and Adjumani. Arua has a population of 850,000, Nebbi 450,000, and Moyo and Adjumani 110,000. The proposed project activity covers both urban and peri-urban areas. The West Nile Region has the potential to become one of Uganda's more productive agricultural areas, but insufficient and unreliable electricity supply has seriously constrained regional development, particularly in the agro-processing areas (e.g. coffee processing, cotton ginning, tea processing, edible oil extraction and grain milling).

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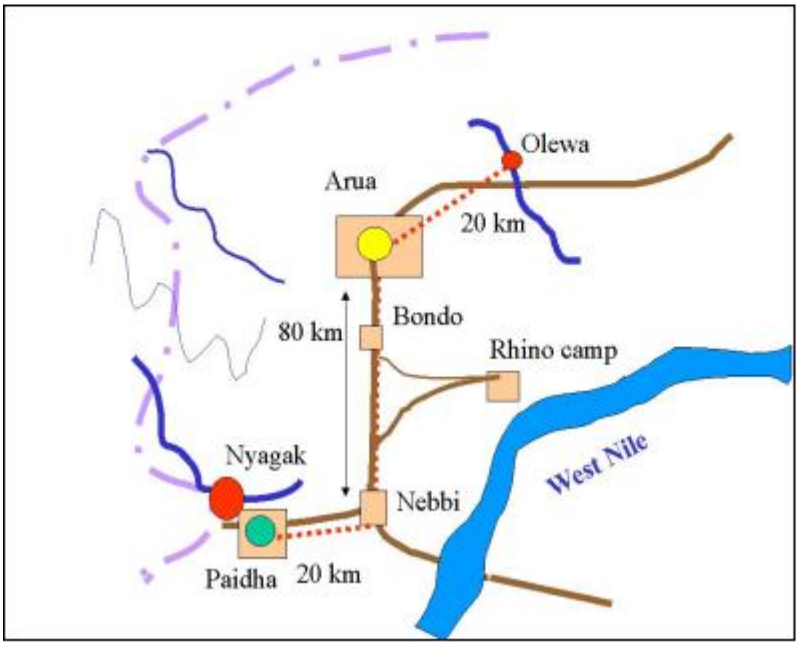
[1] AM0004. Version 02, 7 April 2004: "Grid-connected biomass power generation that avoids uncontrolled burning of biomass". http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_383333082

[2] ACM0003.Version 01, 13 May 2005: "Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture." http://cdm.unfccc.int/EB/Meetings/019/eb19repan07.pdf

Figure 1 gives a schematic depiction of the West Nile region. It shows the three population centres Arua, Nebbi, and Paidha, the hydropower stations at Nyagak and Olewa, and the sub-transmission lines (dotted lines).

Figure 1: Schematic Representation of Original Proposal for West Nile Electric System.



A.3. Technologies and/or measures

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The proposed Project Component # 1 will build and operate one 3.5 MW hydroelectric plant that will export its generation output to a mini-grid, thus displacing generation from fossil fuel-fired generators and engines. Two 1.75 MW Francis turbines manufactured by Mavel and supplied by Skoda have been selected through a competitive bidding process. It will include a diversion weir leading to a penstock and a powerhouse with transformers and switchgear. The power output will be fed to the existing grid though a 33kW over-head line. The hydroelectric station is expected to start generating power in spring 2007.

The proposed Project Component # 2 installs one 1.5 MW HFO-fired generator that generates at a higher efficiency rate than the diesel engines and small-size diesel/petrol generators currently supplying power to consumers in the project area. The annual energy savings from this component amount to TJ 52.96 at most.[3] The savings are thus below the 15 GWhe (TJ 54) threshold for Project Type II energy efficiency improvement projects, and the project is eligible to use the project category II.B methodology concerned with supply-side energy efficiency improvements.

A.4. Parties and project participants

Name of Party Involved (*)	Private and/or public entity(ies) project	Indicate if the Party

[3] See spreadsheet ‘energy savings’.

((host) indicates a host Party)	participants (as applicable)	involved wishes to be considered as project participant (Yes/No)
Uganda (host)	West Nile Rural Electrification Company Limited (WENRECo)	No
Sweden	Government of Sweden - Swedish Energy Agency; The International Bank for Reconstruction and Development (IBRD) acting as Trustee for the Prototype Carbon Fund ("PCF")	Yes
France	GDF Suez	No
Japan	Chubu Electric Power Co., Inc. ; Japan International Cooperation Agency (JICA) ; Kyushu Electric Power Co., Inc. ; Mitsubishi Corporation ; MIT Carbon Fund Co., Ltd. (MIT) (withdrawn) ; Shikoku Electric Power Co., Inc. ; Tohoku Electric Power Co. Inc. ; The Tokyo Electric Power Co., Inc. ; The Chugoku Electric Power Co., Inc. ; Mitsui & Co. Ltd.	No
Netherlands	Electrabel S.A.; The Netherlands, Ministry of Infrastructure and Environment (IenM); Ministry of Economic Affairs, Agriculture and Innovation (EL&I); International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)	Yes
Norway	Government of Norway - Ministry of Foreign Affairs ; Norsk Hydro ASA ; Statoil ASA	Yes
United Kingdom of Great Britain and Northern Ireland	BP Alternative Energy International Ltd. ; Deutsche Bank AG	No
Finland	Fortum Corporation; Government of Finland – Ministry of Foreign Affairs and International Trade; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)	Yes

Germany	RWE Power AG; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)	Yes
(*) 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.		

A.5. Public funding of project activity
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The Government of Uganda, through the Rural Electrification Fund (REF), supports the WNEP with underlying project financing. The REF is a Ugandan government fund established under the Uganda Electricity Act of 1999 which supports rural electrification in Uganda. Uganda, the World Bank (through IDA), and bilateral donors (Norway) contribute resources to the fund, and a number of eligible activities, including the WNEP, are supported through the REF. The WNEP receives a subsidy from the REF to help cover the capital cost of the 33/11 kW substation, the internal combustion unit, and the hydroplant at Nyagak, as well as a subsidy per new connection.[4] But the project activity will be driven by the private sector, and a concessionaire, the West Nile Rural Electrification Company (WENRECo), will build, operate and own the project.
The public-funding resources available for the underlying project financing will not purchase any GHG emission reductions (ERs) generated by the proposed project. Instead, the Prototype Carbon Fund — the World Bank is acting as trustee for the multilateral fund PCF — will purchase the ERs generated from the project activity. The financial resources of the PCF are exclusively private sector and non-ODA government resources.

The use of public funds for the underlying project financing will not result in a diversion of ODA resources.

A.6. Debundling for project activity
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The proposed project activity is not a de-bundled component of a large-size hydroelectric project and/or a large-size energy savings project activity undertaken in the West Nile region because all the debundling rules in Annex C are met. It is eligible as a small-scale project activity for the following reasons:

- Project Component #1: the WNEP will build the first hydroelectric power plant on the Nyagak River with a total nominal capacity of 3.5 MW, which is below the 15 MW threshold value; and
- Project Component #2: There is currently no other, similar small-scale energy saving CDM project under implementation in the West Nile or in the process of applying for CDM registration.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology
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[4] Information on subsidy available for validation.

The proposed project activity is eligible to apply the approved small-scale baseline methodologies for the following project categories:

I. D: Grid connected renewable electricity generation. Version 9. 28 July 2006.

II. B: Supply side energy efficiency improvements – generation. Version 7. 28 November 2005.

B.2. Project activity eligibility

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The proposed project activity consists of two project components that are eligible under the simplified modalities and procedures for small-scale CDM projects:

Project Type I - Renewable Energy Projects. Category I. D: Grid connected renewable electricity generation

The proposed Project Component # 1 falls into project category I.D given that it will build and operate one 3.5 MW hydroelectric plant that will supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.The 3.5 MW hydroelectric plant that will export its generation output to a mini-grid, thus displacing generation from fossil fuel-fired generators and engines.

Project Type II - Energy Efficiency Improvement Projects. Category II. B: Supply side energy efficiency improvements – generation

The proposed Project Component # 2 installs one 1.5 MW HFO-fired generator that generates at a higher efficiency rate than the diesel engines and small-size diesel/petrol generators currently supplying power to consumers in the project area. The annual energy savings from this component amount to TJ 52.96 at most.[5] The savings are thus below the 15 GWhe (TJ 54) threshold for Project Type II energy efficiency improvement projects, and the project is eligible to use the project category II.B methodology concerned with supply-side energy efficiency improvements.

Efficiency factor and CO_2 emissions from generators and engines in the baseline scenario

A large number of interviews, extensive field visits, and solicited experts served as inputs when a comprehensive survey of the installed engines and diesel gen-sets in the West Nile region were prepared in 2001 in the context of the ERT lending program.[6] According to this survey, 182 generator sets were being operated in the urban and peri-urban areas of Arua, Nebbi, and Paidha. Moreover, many gen-sets were not connected to the UEB-grid for lack of UEB capacity. Additional 42 diesel engines were used for milling purposes – 36 engines were installed in businesses with the remainder installed in institutions or private houses. Based on this survey, the average efficiency was found to be 1.5 kWh/l of fuel, or 0.66 l/kWh. Thus the baseline emission rate was calculated to be 1.843 $kgCO_2/kWh$ (see worksheet ‘fuels’).[7]

[5] See spreadsheet ‘energy savings’.

[6] Survey available for validation.

[7] See Excel spreadsheet.

This level of fuel consumption falls conservatively within the range of standardised emission factors presented in the Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories (Table 2 below). This table sets an emission factor of 1.9 kgCO_2/kWh for 15-35 kWh diesel generator systems and 2.4 kgCO_2/kWh for systems with a capacity of less than 15kW.

Given that the hydroplant will deliver electricity to a grid, Project Component #1 falls into project category I.D. Diesel/petrol generation sets and diesel engines are the only sources of electricity generation in Arua, Nebbi, and Paidha prior to the implementation of this project component. This simplified methodology defines the energy baseline as 'the annual kWh generated by the renewable unit times an emission coefficient for a modern diesel generating unit of the relevant capacity operating at optimal load'.[8] Table 2 gives the approved standardized emission coefficients for various load factors and sizes of gen-sets.[9] As explained, the CO_2 emission per kWh coefficient for the diesel/petrol generators operated in the baseline scenario is based on the above comprehensive World Bank survey.

Table 2: Emission factors for diesel generator systems (CO_2e/kWh) for three different levels of load factor.

Cases	Mini-grid with 24 hours service	i) Mini-grid with temporary service (4-6 hr/d) ii) Productive applications iii) water pumps	Mini-grid with storage
Load factors (%)	25	50	100
<15 kW	2.4	1.4	1.2
>=15<35kW	1.9	1.3	1.1
>=35<135kW	1.3	1.0	1.0
>=135<200kW	0.9	0.8	0.8
>200kW	0.8	0.8	0.8

Source: Table I.D.1 in the Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories.

The proposed project also installs one new 1.5 MW HFO-fired generator. The generator provides electric power in the intermediate period until the hydroelectric power plant is constructed and is fully operational, and it will provide back-up capacity when the hydropower plant has become operational.

According to the approved methodology, in this situation the energy baseline should be calculated 'using a standard for the equipment that would otherwise have been installed.'[10] Given the extremely low rate of technology change observed in the West Nile Region, it seems both reasonable and conservative to assume that diesel/petrol gen-sets and diesel engines similar to those currently operating in the West Nile Region would be installed in the absence of the HFO-generator installed and operated by the CDM project. Again, the CO_2 emissions per kWh coefficient for the generators and engines operated in the baseline scenario is based on the above-mentioned comprehensive World Bank survey.

[8] I.D. Grid connected renewable electricity generation. "http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_2GHDC30TPDJK04LS07SY07X9MFZRG5. Paragraph 8.

[9] *Ibid*, paragraph 8.

[10] *Ibid*, Project Type II. Energy Efficiency Improvement Projects/II. B: Supply side energy efficiency improvements – generation. Paragraph 3.

B.3. Project boundary

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In accordance with methodology 1.D, regarding Project Component #1, "the project boundary encompasses the physical, geographical site of the renewable generation source," in this case the hydro plant to be developed and operated by the proposed project. Regarding Project Component #2, "the project boundary is the physical, geographical site of the fossil fuel fired power station unit affected by the efficiency measures."[11]

It is expected that the proposed project will supply power to a number of current and future consumers who would otherwise be operating their own private diesel gen-sets and engines. By increasing the installed grid-connected capacity and by interconnecting Nebbi and Paidha in the south to Arua in the north through a sub-transmission line, the project connects and serves consumers currently generating power on-site to an isolated electric grid. The project therefore signifies a change from a system of many, widely dispersed, small stand-alone power generators to an isolated grid system.

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO2 emissions from Diesel/petrol generation sets and diesel engines which are the only sources of electricity generation in Arua, Nebbi, and Paidha prior to the implementation of the project activity	CO_2	Yes	Main emission source.
		CH_4	No	
		N_2O	No	
		…		
	CO2 emission from diesel/petrol gen-sets and diesel engines similar to those currently operating in the West Nile Region that would be installed in the absence of the HFO-generator installed and operated by the CDM project	CO_2	Yes	Main emission source.
		CH_4	No	
		N_2O	No	
		…		
	…	…		
		…		
		…		
Project scenario	CO2 emissions from HFO generator installed and operated by the CDM project	CO_2	Yes	Main emission source.

[11] Paragraph 2. "Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities: Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activities". http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf.

B.4. Establishment and description of baseline scenario
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The baselines for Project Components I and II are calculated separately. Yet, both use an average emission coefficient of 1.843 CO_2/kWh for the diesel/petrol gen-sets and engines that would be operating in the project area in the absence of the proposed project which is calculated based on a comprehensive survey covering the service area in the West Nile region.

At the point of crediting period renewal, a designated operational entity shall establish that the baseline scenario and the baseline emission rate is still valid or has been updated taking account of new data.

Project Component #1

According to the approved methodology, the baseline is the net annual electricity output from the hydropower stations times an emission coefficient for a modern diesel unit. But as explained in section B.2, the PDD utilizes 1.843 kg CO_2/kWh as the baseline emission rate – a conservative rate based on a comprehensive user survey conducted in the West Nile project area and on expert opinion.

For the purpose of the PDD it is assumed that the hydro station can deliver 19,500 MWh per year over the lifetime of the project. This figure is the technology provider's estimate of the guaranteed electrical output and energy production, based on site-specific assumptions concerning head, river flow, biological flow, etc. Nevertheless, the project operator will continuously meter and record the net annual electricity output from the hydroplant over the life of the project.

Project Component #2

The baseline for the HFO generator will be calculated as the metered output (in kWh) from the HFO generator times the baseline emission rate 1.843 kg CO_2/kWh determined *ex-ante*. The baseline emission rate is calculated using the approach and inputs figures defined above.

It is assumed here that the HFO generator will deliver 4,049 MWh annually during Project Phase 1 (2005-2007), and that it will generate at full capacity (1.5 MW) for 30% of the time when the Nyagak hydroplant is operational.[12]

Date of completing the final draft of the baseline section: 10/09/2005.

Name of person/entity determining the baseline:
Dr. Lasse Ringius
Senior Environmental Specialist
Carbon Finance Unit
The World Bank
1818 H Street, NW
Washington, D.C. 20433
USA

The International Bank for Reconstruction and Development (IBRD) is acting as trustee for the Prototype Carbon Fund, and is a project participant.

[12] The annual output in Project Phase 1 is based on the performance and generation data from June 2005, while the scenario for Project Phase 2 reflects the project owner's expectations as to the future expectable load in the West Nile region.

B.5. Demonstration of additionality

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While off-grid electricity in rural Uganda is supplied mainly by diesel and gasoline (petrol) gen-sets, there has been considerable interest among donors in harnessing the local hydropower resources as part of an electrification scheme for the West Nile at least since the 1990s.[13] But political, financial, social, and institutional barriers have so far precluded small hydropower development in this region. In particular, the lack of a capital market accessible to IPPs, the utility company's inability to provide the required financing, the consumers' low ability-to-pay, and the high up-front investment would preclude the WNEP from coming to fruition. Moreover, energy sector and infrastructure investments in Uganda are considered highly risky. The economic, political, inflation and currency risks for the most part cannot be mitigated and they therefore raise the required discount rate significantly and reduce the business prospects for power development investments in the West Nile region. These barriers fall under eligible barrier Class A ("Investment barrier"), Class C ("Barrier due to prevailing practice") and Class D ("Other barriers") identified for small-scale CDM projects.

The proposed project activity has been tendered internationally on a "build, own and operate" basis, with two 20-year licences (generation and distribution) granted to the winning bidder by the Electricity Regulatory Authority (ERA). WNEP has received financial assistance because of high project costs and risks – and in order to make the project sufficiently attractive to an IPP. The Rural Electrification Fund in Uganda, which has been established with ERT support, will provide a "smart subsidy". The smart subsidy is a capital investment subsidy for investment in generation, sub-transmission lines, distribution lines, and customer connections. Additionally, the GOU completed an 80 km sub-transmission line connecting Nebbi and Arua, which has been transferred to the WNEP operator (WENRECo).

The number of privately-owned diesel and petrol generation sets in the West Nile region has grown consistently since the late 1990s.[14] This trend will most likely prevail until substantial investments are made in an alternative regional electricity supply system. However, it is unlikely that the UEB would increase its generation capacity in the region any time soon. Thus, the business-as-usual scenario, i.e. increased private sector generator and mill engine ownership, is the most plausible option for future electrification of the West Nile in the absence of the proposed project activity.

[13] A few off-grid renewable energy resources (less than 1 MW nationally) supported by major international (donor) subsidies have been developed (e.g., church missions). No private hydro investments have been made in Uganda; hydropower in Uganda to date has been funded either by governments or by international NGOs. Private hydropower investments have been considered in Uganda only in the past several years, but none have been financed thus far.

[14] Indeed, between the August-September 2000 West Nile surveys and interviews with municipal authorities during the ERT April-May 2001 appraisal mission, at least another 30 gen-sets, with a total installed capacity of 1 MW, have been installed within the system boundary. In contrast, effectively no new consumers have been added to the local grid for over 20 years. West Nile had over 2,000 customers in 1979 compared to fewer than 1,000 in 2001.

The key national and regional level barriers to the WNEP are described below. Additionally, the implications of these barriers for the WNEP are examined. Over 30 businesses operating in Uganda, including the largest commercial banks, the largest multinational corporations and Ugandan businesses, were interviewed in order to understand the barriers to the proposed project activity. As well, interviews were conducted with regional and international development banks, investment and export credit insurance and guarantee agencies.[15]

Overview of Barriers in Uganda

Although Uganda has experienced dramatic economic growth over the past fifteen years, dependency on neighbouring countries (Congo, Sudan and Rwanda) and regional instability has resulted in economic insecurity.[16] Security is the primary barrier in Uganda today, particularly in the western and northern regions where small rebel groups continue to operate in opposition to the current government. Relations with Sudan and Congo have been poor for a number of years. This has frequently fed internal instability (fuelled and supported by antagonistic neighbours) and has led to insecurity in border areas.

Dependence and energy security in Uganda are important issues, particularly with regard to fuel supplies. Uganda is land-locked and depends upon its petroleum supplies transiting through Kenya from the Indian Ocean port of Mombassa. Political tensions between Kenya and Uganda have periodically led to border closures and disruption of petroleum and other supplies to Uganda. Uganda is hoping to open up a second overland route through Tanzania. However, for the foreseeable future it will continue to import fuels such as diesel through Kenya.

Uganda follows a positive policy and attitude towards foreign direct investment. However, because of historical precedence, such as post-independence expropriation of private sector assets,[17] and the perceived high risks of power generation, transmission and distribution systems, Uganda is currently not attractive to potential private sector investors. Leading credit ratings agencies (Moody’s, Fitch, and S&P) do not rate Uganda — a strong indicator, in itself, of the high country risk.

Economic Barriers

The West Nile is one of the most rapidly expanding economies in Uganda but it lacks banking and other financial and economic infrastructure and intermediation.[18] The lack of adequate and reliable electricity

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[15] Institutions consulted included the East Africa Association (in Uganda and the UK), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), the Oversees Private Investment Corporation (US), the Commonwealth Development Corporation (UK), the Export Credit Guarantee Department (UK), the Kreditanstalt für Wiederaufbau (Germany), the International Bank for Reconstruction and Development (World Bank) including the World Bank's Uganda Resident Representative Office and Country Team, the European Investment Bank (EIB), commercial banks, the Uganda Investment Authority, the Uganda Manufacturers Association, Uganda's Private Sector Foundation, among others. Some information was provided on a confidential basis and cannot be attributed to specific sources in many cases. Yet, detailed information can be provided for validation purposes.

[16] This section is based on discussions held with, or reviews of materials from, Economist Intelligence Unit, World Bank Uganda Country Team, IFC Uganda Resident Missions, British Foreign and Commonwealth Office (FCO), British Export Credit Guarantee Department, Commonwealth Development Corporation, European Investment Bank, US Export Import Bank and Overseas Private Investment Corporation, East African Association, Uganda Investment Authority, and the banking sector in Uganda.

[17] It should be noted, though, that under Museveni (since 1986) the GOU has not expropriated any private property and property expropriated under previous governments was restituted.

[18] There are no effective credit markets operating in the region (only two commercial banks have small branches in these two districts with three quarters of a million people); there is no financial intermediation for infrastructure investments, particularly in rural areas; and there are no insurance schemes for hydroelectric investments.

supply has seriously constrained West Nile's development, particularly in the agro-processing sector. Most of the businesses are in the informal sector, hence almost no ties with formal credit or finance exist.

Larger businesses that rely upon their own diesel or gasoline generated electricity face stiff competition from businesses connected to the main grid in other parts of Uganda (even if electricity supplies on the main grid are often unreliable and insufficient to meet business requirements). West Nile businesses in areas as diverse as welding and printing periodically shut down due to high energy costs.[19] For example, the costs of transporting welded products and printed materials from Kampala can be less than that of using own-generators to provide electricity. Increase in fuel costs caused by supply disruptions, inflation, and depreciation pose major economic risks to West Nile businesses.

Political Barriers

Civil war in Uganda in the 1970s and the early 1980s deteriorated the electricity infrastructure and supplies as well and undermined investor confidence. While the West Nile has enjoyed political stability under the current Ugandan government for fifteen years, it remains vulnerable to the insurgency in the north of Uganda in so far as traffic and transport in and out of the West Nile is affected. The Lord's Resistance Army's brutal campaign against rural communities and government supporters between Central Uganda and West Nile is expected to continue for some time. Though the West Nile region is not directly affected, the major trade routes to Kampala can become insecure, making air traffic the only safe means of transport into and from the region. This, however, increases the cost of conducting business in the region, slowing down the economic activity. Civil unrest in neighbouring Congo and Sudan add further political risk.

Interference by local politicians in the operations of the WNEP could pose another political barrier. For instance, granting and maintaining rights of way to the hydropower sites, control over water resources, and tariff setting are potential political issues that any investor must take into consideration.

Corruption is unfortunately substantial and is officially cited by President Museveni as one of the major impediments to Uganda's continued growth and development. President Museveni has pledged that Government of Uganda institutions will root out corruption and some progress has been made. Nonetheless, foreign investors in Uganda perceive corruption as a growing concern.[20]

Summary of Barriers

In order to determine the baseline scenario, three plausible scenarios for increasing and improving the future power supply in the West Nile region should be considered. These three scenarios can be summarized as follows:

- The *Business-as-Usual* option is a continuation of the current trend, i.e., a demand increase would be met by an increase in privately-owned and operated petrol and diesel generators and auto-generation by business, institutions and households; in addition, the UEB (or its successor) would continue to supply the existing consumers with 4 hours of unreliable power (often load-shedded for days at a time) daily;
- *Extension of the National Grid* implies construction of a transmission line to the main grid at the closest point at Gulu, nearly 200 km east of the West Nile region; and
- *Hydropower Mini-Grid* – i.e., the proposed WNEP, which entails the refurbishment and extension of an isolated mini-grid with a 3.5 MW mini-hydro plant as source of base load power.

[19] Based on interviews with a number of businessmen during the course of this work and the design of the ERT.
[20] More information on this and other aspects of this risk assessment can be provided.

The mini-hydro plant would be complemented by an efficient 1.5 HFO plant which would provide shoulder and peak load.

Table 3 shows that major fixed-asset investments in rural Uganda face high barriers. Foreign investors investing in rural power supply in Uganda will typically require a return on equity (RoE) around 30-35 %.[21] The BAU option, in contrast, does not face these country barriers.

Table 3: Summary of Country Barriers to Foreign Direct Investment in Uganda.

Scenario Barrier type	Private Gen-sets	Extension of Main Grid to West Nile / WNEP
Investment barriers	Not applicable	**High**: Low investor confidence due to civil war and expropriations under previous governments (till 1986); Supply risk: Land-locked Uganda depends on imports via road through Kenya; Corruption is a growing concern.
Economic barriers	Not applicable	**High**: Lack of banking, financial and economic infrastructure; High costs in West Nile region due to poor transport links; Dependency of economy on volatile cash crops revenues.
Political barriers	Not applicable	**High**: Problematic external security situation: conflicts in south Sudan and Congo could spill over into Uganda; Internal security situation not fully under control: rebel activities in northern Uganda; and Possible political interference with business decisions: new regulatory system is untested.
Inflation and foreign exchange barriers	Not applicable	**High**: Vulnerability of Ugandan currency to external factors (ODA, world market coffee price etc.); and Significant inflationary pressure.

Table 4 shows that a very high barrier for the grid extension option exists at present and most likely in the foreseeable future. This option should be regarded as infeasible. The WNEP option, however, is feasible with public support. The investment barrier is high, but due to the envisaged smart subsidy and the earnings from carbon revenue, it will be possible to lower the barriers sufficiently to make the project attractive to the private sector. Finally, the BAU option is presenting the lowest barriers. In the prevalent multi-barrier environment, it represents the most likely option in the absence of outside intervention.

Table 4: Summary of Project Specific Barriers.

Scenario Type of barrier	Private Gen-sets	Grid Extension	WNEP
Technological barriers	**None**	**High**: Power shortages in the main grid; Rebel activities in northern Uganda; Transport problems.	**Low**: Studies have confirmed feasibility. Engineering problems cannot be excluded.
Investment barriers	**None**	**High**: Opportunity costs of grid extension are large.	**Medium**: Week economic growth (export prices, poor roads). Demand for power too low for viable operation.

[21] As cited by the Utility Reform Unit, Ministry of Finance through discussions with potential investors for concessions on the main UEB grid, and reinforced through discussions with AES Nile Power (Bujagali), and members of the UK Power Sector Working Group (PSWG).

Scenario Type of barrier	Private Gen-sets	Grid Extension	WNEP
Barriers due to prevailing practice	**None**	**Medium:** Outcome of UEB privatisation and decentralization uncertain Political interference in business decisions possible	**High**: No experience with new Electricity Act and regulatory system. Political interference in tariff setting cannot be excluded. Problems with construction and operation licenses.
Inflation and foreign exchange barriers	**Low**: impact on prices of fuel and machinery	**Medium:** Probably substantial foreign investment needed	**Medium**: Cost of diesel in Uganda. Substantial foreign direct investment needed. Repatriation of profits could be uncertain.
Additional investment barriers	**Low**: price increases for fuel and machinery	**High**: Opportunity costs of grid extension are high	**High**: Investment in non-removable asset. Cost overruns (construction and operation). Construction delays. Customers default. Fees and licenses higher than expected.
Aggregate barriers	**Low**	**High**	**Medium**

In summary, due to preventive barriers, the WNEP would not be implemented without government support. The fact that the Government of Uganda, the World Bank and other donors are willing to provide financial assistance to the project shows that it is a widely shared view that the WNEP would not happen as a purely commercial investment. Therefore, given that the government has discarded the grid extension option as it considers that this option does not meet the requirements for secure and safe power supply, the only alternative that does not face barriers is the business-as-usual scenario and the project activity must be viewed as additional.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
>>
<u>Baseline Emissions:</u>

Project Component #1: Hydroelectric Plant

First, concerning the hydroelectric component of the proposed project, the GHG emissions in the baseline scenario are estimated using the following formula and the baseline emission rate for diesel/petrol gen-sets and diesel engines (see B.4):

$$E\ (tonne\ CO_2\ /\ yr) = GEN_{Nyagak} * ER_{BL}$$

Where:
GEN_{Nyagak} = metered annual generation output from Nyagak hydroplant (MWh)
ER_{BL} = baseline emission rate (CO_2/kWh).

ER_{BL} is calculated on the basis of a comprehensive survey and corresponds well to the emission factors presented in AMS ID.

Project Component #2: HFO-fired Generator

$$E\ (tonne\ CO_2 / yr) = GEN_{TH} * ER_{BL}\ (tCO_2/MWh)$$

Where:
GEN_{TH} = metered annual generation output from thermal generator (MWh)
ER_{BL} = baseline emission rate (CO_2/kWh).

<u>Project Emissions:</u>

According to Version 9 of AMS I.D. and registered PDD, there are no project emissions generated from hydropower component. Therefore, the total project CO_2 emissions are the sum for the emissions from the two fossil fuels used, in this case HFO and diesel under component #2.

Component #2: HFO-fired Generator

For Project Component #2, the project emissions generated by the HFO-fired generator must be included. These CO_2 emissions are calculated in this section.

It is assumed in this PDD that the HFO-fired generator will deliver 4,049 MWh annually during the construction phase of the Nyagak hydroplant (Project Phase 1) and that it will generate at full capacity (1.5 MW) for 30 per cent of the time when the hydroplant has become operational in Project Phase 2. The project operator will implement the monitoring plan and will continuously measure and record data on the fuel consumption and generation output from the HFO-fired generator over the life of the project.

Project Phase 1:

This PDD assumes output and fuel consumption as given by recent generator performance data in Arua in the West Nile region.[22]

The first step is to calculate the share of the two types of fossil fuels consumed by the generator—heavy fuel oil and diesel—in the overall amount of fuel energy:[23]

$$\text{fuel energy}_{HFO} + \text{fuel energy}_{diesel} = \text{total fuel energy}$$

The total energy content of the fuel consumed (FC) is the product of amount of fuel, fuel density (DEN), and net calorific values (NCV) ($TJ/10^3t$) as per the IPCC. More formally:

Fuel energy: liters of fuel * density * calorific value

Or, $FC_{HFO} * DEN_{HFO} * NCV_{HFO} + FC_{diesel} * DEN_{diesel} * NCV_{diesel}$

[22] Information from project proponent.
[23] While running almost exclusively on HFO, the generator will occasionally be consuming a small amount of diesel.

The quantity of fossil fuel consumed is measured and/or reported, if relevant for each fuel separately, by the project operator.

Project Phase 2:

Assuming a HFO/diesel fuel ratio similar to that in Project Phase 1, the amount of CO_2 emitted in this phase is calculated as the emission reductions in Project Phase 1 times the estimated generation output in this phase.

Project Output Phase 2 = 8760 h*1.5 MW*0.3 = 3,942 MWh

E (tonne CO_2 / yr) = 3,942 MWh/4,049MWh*3,672 t CO_2 = 3,575 t CO_2

B.6.2. Data and parameters fixed ex ante

<table>
<tr><td>Data/Parameter</td><td>EF_{BL}</td></tr>
<tr><td>Unit</td><td>tCO_2/MWh</td></tr>
<tr><td>Description</td><td>Baseline emission factor</td></tr>
<tr><td>Source of data</td><td>“An average emission coefficient for the diesel/petrol gen-sets and engines that would be operating in the project area in the absence of the proposed project which is calculated based on a comprehensive survey covering the service area in the West Nile region’’</td></tr>
<tr><td>Value(s) applied</td><td>1.843</td></tr>
<tr><td>Purpose of data</td><td>Baseline emissions for both components</td></tr>
<tr><td>Additional comment</td><td>The baseline emission factor was calculated using the following diesel parameters:
<table>
<tr><td>Parameter</td><td>Value</td></tr>
<tr><td>Density (Kg/l)</td><td>0.87</td></tr>
<tr><td>Net Calorific value (MJ/Kg)</td><td>43.33</td></tr>
<tr><td>Carbon emission factor (Tc/TJ)</td><td>20.20</td></tr>
<tr><td>Carbon – CO_2 conversion factor</td><td>3.667</td></tr>
<tr><td>Consumption based on 15% efficiency (l /kWh)</td><td>0.66</td></tr>
</table>
</td></tr>
</table>

Data/Parameter	CEF_i
Unit	gC/MJ
Description	Carbon emission factor of fuel *i*
Source of data	IPCC
Value(s) applied	CEF_{HFO} = 21.10 CEF_{diesel} = 20.20
Purpose of data	Project
Additional comment	-

Data/Parameter	CF_{C-CO2}
Unit	None
Description	Carbon – CO_2 Conversion factor
Source of data	IPCC
Value(s) applied	44/12
Purpose of data	Project
Additional comment	-

B.6.3. Ex-ante calculation of emission reductions
>>

Baseline Emissions:

Project Component #1: Hydroelectric Plant

E (tonne CO_2 / yr) = 19,500 MWh*1.843 kg CO_2/kWh
= 35,934 t CO_2

Project Component #2: HFO-fired Generator

In the case of Project Component #1, it is assumed that the HFO-fired generator will be delivering 4,049 MWh annually during Project Phase 1:

E (tonne CO_2 / yr) = 4,049 MWh*1.843 tCO2/MWh = 7,461 tCO_2

Alternatively, the CO_2 emissions can be calculated utilizing the heat rate.

E (tonne CO_2 / yr) = 4,049 MWh*24.9 GJ/MWh*20.2 tC/TJ*44/12 = 7,461 tCO_2

The last calculation is useful from the point of view of comparing the heat rate in the project case, as per E.1.2.1, with the heat rate in the baseline scenario. The heat rate of the HFO-fired generator (11.8 GJ/MWh) represents an improvement of approximately 52.6% over the heat rate in the baseline scenario (24.9 GJ/MWh). The thermal generator operating in the WNEP project thus delivers a significant energy improvement over the gensets and engines that would otherwise have been in operation in the absence of the project.

For Project Phase 2, where it is assumed that the generator will be delivering at full capacity (1.5 MW) during 30% of the time, i.e. 3,942 MWh:

E (tonne CO_2 / yr) = 3,942 MWh*1.843 tCO_2/MWh = 7,264 t CO_2

Project Emissions:

Component #2: HFO-fired Generator

Project phase 1:

Total fuel energy consumed is:

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

= 1,042,896 l HFO*0.943 kg/l*41.21 TJ/10^3t + 192,252 l diesel*0.87 kg/l*43.33 TJ/10^3t
= 40,528 GJ + 7,247 GJ = 47,775 GJ

This implies that the relative share of HFO is 85% (40,528 GJ/47,775 GJ) and 15% for diesel (7,247 GJ/ 47,775 GJ).

Moreover, the heat rate (HR) is calculated as follows:

HR = ($\sum FC_i$ * DEN_i *NCV_i) / $GEN_{TH,gross}$ = 47,775 GJ/4,049 MWh = 11.8 GJ/MWh

The second step is to calculate the amount of CO_2 generated by the project. Using IPCC carbon emission factors (gC/MJ), the annual CO_2 emissions (E) generated by this project component are calculated as follows.

E = (0.85%*4,049 MWh)*11.8 GJ/MWh*21.1 tC/TJ*44/12 +
(0.15%*4,049 MWh)*11.8 GJ/MWh*20.2 tC/TJ*44/12 =
3,135.7 t CO_2 + 536.8 t CO_2 = 3,672 t CO_2.

Phase 2

Project Output Phase 2 = 8760 h*1.5 MW*0.3 = 3,942 MWh

E (tonne CO_2 / yr) = 3,942 MWh/4,049MWh*3,672 t CO_2 = 3,575 t CO_2

B.6.4. Summary of ex-ante estimates of emission reductions

Year	**Baseline emissions from project component 1 (t CO_2e)**	**Baseline emissions from project component 2 (t CO_2e)**	**Project emissions from project component 2 (t CO_2e)**	**Leakage (t CO_2e)**	**Emission reductions (t CO_2e)**
Year 2005	0	7,461	3,672	0	3,789
Year 2006	0	7,461	3,672	0	3,789
Year 2007	35,934	7,264	3,575	0	39,623
Year 2008	35,934	7,264	3,575	0	39,623
Year 2009	35,934	7,264	3,575	0	39,623
Year 2010	35,934	7,264	3,575	0	39,623
Year 2011	35,934	7,264	3,575	0	39,623
Year 2012	35,934	7,264	3,575	0	39,623
Year 2013	35,934	7,264	3,575	0	39,623
Year 2014	35,934	7,264	3,575	0	39,623
Year 2015	35,934	7,264	3,575	0	39,623
Year 2016	35,934	7,264	3,575	0	39,623
Year 2017	35,934	7,264	3,575	0	39,623
Year 2018	35,934	7,264	3,575	0	39,623
Year 2019	35,934	7,264	3,575	0	39,623
Year 2020	35,934	7,264	3,575	0	39,623
Year 2021	35,934	7,264	3,575	0	39,623
Year 2022	35,934	7,264	3,575	0	39,623
Year 2023	35,934	7,264	3,575	0	39,623
Year 2024	35,934	7,264	3,575	0	39,623
Year 2025	35,934	7,264	3,575	0	39,623
Total	682,752	152,943	75,278	77,665	760,417
Total number of crediting years	21				
Annual average over the crediting period	36,210 tCO2e				

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data related to component 2: The HFO plant

Data / Parameter	FC_{HFO}
Unit	Liters
Description	Amount of fuel (HFO) combusted by generator
Source of data	Plant register
Value(s) applied	
Measurement methods and procedures	Measured by dipsticks and/or flow meters
Monitoring frequency	Monitored continuously and recorded daily.
QA/QC procedures	Calibration of flow meter will be conducted as per manufacturer specifications, national standards, or international guidelines as appropriate
Purpose of data	Baseline emissions and project emissions
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	FC_{DIESEL}
Unit	Liters
Description	Amount of fuel (diesel) combusted by generator
Source of data	Plant register
Value(s) applied	
Measurement methods and procedures	Measured by dipsticks and/or flow meters
Monitoring frequency	Monitored continuously and recorded daily
QA/QC procedures	Calibration of flow meter will be conducted as per manufacturer specifications, national standards, or international guidelines as appropriate.
Purpose of data	Baseline emissions and project emissions
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	$GEN_{TH,gross}$
Unit	MWh
Description	Gross generation, HFO plant
Source of data	Plant register
Value(s) applied	
Measurement methods and procedures	Continuous measurement, recorded daily Using an electricity meter
Monitoring frequency	Continuous measurement, recorded daily
QA/QC procedures	Meter calibration will be conducted as per manufacturer specifications, national standards, or international guidelines as appropriate
Purpose of data	Baseline emissions
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	AUX_{TH}
Unit	MWh
Description	Auxiliary consumption, HFO plant
Source of data	Plant register
Value(s) applied	
Measurement methods	Using a separate meter measuring an auxiliary consumption alone

and procedures	
Monitoring frequency	Continuous measurement, recorded daily
QA/QC procedures	Meter calibration will be conducted as per manufacturer specifications, national standards, or international guidelines as appropriate
Purpose of data	Baseline emissions
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	GEN_{TH}
Unit	MWh
Description	Generation output, HFO plant
Source of data	Plant operator
Value(s) applied	
Measurement methods and procedures	Calculated as the difference between the gross electricity generation ($GEN_{TH,gross}$) and the auxiliary consumption (AUX_{TH})
Monitoring frequency	Calculated and recorded daily
QA/QC procedures	
Purpose of data	Baseline emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	$DEN_{prjct,HFO}$
Unit	t/m^3
Description	Density of fuel HFO
Source of data	Independent laboratory
Value(s) applied	
Measurement methods and procedures	Measured, based on one sample taken on each load of fuel delivered to the facility
Monitoring frequency	One sample taken on each load of fuel delivered to the facility
QA/QC procedures	Laboratories accredited in accordance with ISO/IEC 17025:2005 A second sample will be kept at the HFO power plant until reception of the test results.
Purpose of data	Project emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	$DEN_{prj,diesel}$
Unit	t/m^3
Description	Density of fuel diesel
Source of data	IPCC guideline/International Energy Agency
Value(s) applied	
Measurement methods and procedures	
Monitoring frequency	Updated annually
QA/QC procedures	Option a) – c) cannot be applicable as per Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". This is due to the fact that density of diesel is not provided by the fuel supplier in invoices and measurement by project entity turns out to be too costly on each barrel basis, as well that regional

	data is not public available. Therefore, the most conservative value available from International Standards such as IPCC Guidelines and IEA reports will be applied and updated annually.
Purpose of data	Project emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting

Data / Parameter	NCV_{HFO}
Unit	MJ/kg
Description	Calorific value of HFO
Source of data	Independent laboratory
Value(s) applied	
Measurement methods and procedures	Measured, based on one sample taken on each load of fuel delivered to the facility
Monitoring frequency	Once every load of fuel delivered to the facility
QA/QC procedures	Laboratories accredited in accordance with ISO/IEC 17025:2005 A second sample will be kept at the HFO power plant until reception of the test results.
Purpose of data	Project emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	NCV_{diesel}
Unit	MJ/kg
Description	Calorific value of diesel
Source of data	IPCC guideline
Value(s) applied	
Measurement methods and procedures	As per “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” (Version 2)”, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Monitoring frequency	Any future revision of the IPCC Guidelines should be taken into
QA/QC procedures	
Purpose of data	Project emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

Data / Parameter	$HR_{prjct,fuel\ j}$
Unit	MJ/kWh
Description	Heat rate
Source of data	Plant operator
Value(s) applied	
Measurement methods and procedures	Project operator will calculate heat rate daily, using data on calorific value of fuel(s). $HR = (\sum FC_i * DEN_i * NCV_i) / GEN_{TH,gross}$
Monitoring frequency	Calculated and recorded daily
QA/QC procedures	Archived on paper, or electronic version until 2 yrs after end of crediting period
Purpose of data	Project Emission
Additional comment	

Data related to component 1: The hydropower plant on the Nyagak river

Data / Parameter	GEN_{Nyagak}
Unit	MWh
Description	Net electricity export, hydro plant
Source of data	Plant register
Value(s) applied	
Measurement methods and procedures	Continuous measurement, reported daily Using an electricity meter
Monitoring frequency	Continuous measurement
QA/QC procedures	Meter calibration will be conducted as per manufacturer specifications, national standards, or international guidelines as appropriate
Purpose of data	Baseline emission
Additional comment	Archived on paper, or electronic version until 2 yrs after end of crediting period

B.7.2. Sampling plan
>>
N/A

B.7.3. Other elements of monitoring plan
>>
Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken

Information on fossil fuel consumption, generation output, and various other performance variables are currently being collected under the oversight of the manager of the HFO generator in Arua in the West Nile region. The staff responsible for the operation of the power plant is collecting information daily and the ultimate responsibility for QC/QA is assigned to the manager. The manager checks the quality, consistency and comprehensiveness of the collected information on a daily basis and compares with kept data records. The information is recorded in both paper and electronic form before it is electronically stored. The manager finally quality checks the information and data before it is reported to the WENRECo management team.

The QC/QA procedures that will be followed by WENRECo will be fully consistent with the QC/QA procedures generally put into practice at hydroelectric stations around the world and in CDM projects in which the World Bank is a project participant. Professional support and experience will be sought when the operational and management approach is identified and put in place at the Nyagak hydrostation.

Monitoring Management structure

The operator of the West Nile Hydro Power project will have certain operational and data collection obligations to fulfil, in order to minimise greenhouse gas emissions and to ensure that sufficient information is available to calculate ERs in a transparent manner and to allow for a successful verification of these ERs.

A separate, detailed monitoring plan (MP) and work sheets will be developed specifically for this project activity. The operator shall comply with the data collection, testing and analysis, and data management obligations contained in this MP. Key parameters define the performance of the project and the operator shall integrate the data collection requirements into the company’s database and information collection policies. Table 6 summarizes the management structure and the division of responsibility among the project participants.

Table 6: Management and Operation System: Roles of Project Partners

	WENRECO	The World Bank
Monitoring System	- Review MP and suggest adjustments if necessary - Develop and establish management and operations system - Establish and maintain monitoring system and implement MP - Prepare for initial verification and project commissioning	- Review monitoring and management system - Ensure project meets the Bank requirements and safeguards - Arrange for initial verification
Data Collection and Provision	- Establish and maintain data measurement and collection system and collect data for all MP indicators and inputs as required - Maintain valid permits and licenses and collect information on compliance with relevant Ugandan regulations - Collect relevant information on electricity generation and fuel consumption by power plants in Uganda	- Review date collection systems
Data Computation	- Enter data in MP worksheets - Use MP worksheets to calculate ERs	- Review completed worksheets
Data Storage Systems	- Implement record maintenance system - Store and maintain records (paper trail) - Forward completed worksheets to the World Bank - Complete brief annual report	- Receive copies of key records and reports - Maintain the Bank records
Performance Monitoring and Reporting	- Analyze data and compare project performance with project targets - Analyze system problems, recommend and implement improvements (performance management) - Prepare and forward periodic reports	- Review reports - Evaluate performance and assist with performance management, if necessary
MP Training and Capacity Building	- Develop and establish MP training, skills review and feedback system - Ensure that operational staff is trained and enabled to meet the needs of this MP	-
Quality Assurance, Audit and Verification	- Establish and maintain quality assurance system with a view to ensuring transparency and allowing for audits and verification - Prepare for and facilitate audits and verification process	- Supervise the Project - Arrange for initial and periodic verification

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
01/04/2003

C.1.2. Expected operational lifetime of project activity

>>
25 years

C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
Renewable crediting period of 3*7 years

C.2.2. Start date of crediting period
>>
01/01/2005

C.2.3. Length of crediting period
>>
7 years

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
>>
The purpose of the project activity is to generate power safely and efficiently and in accordance with applicable environmental standards in Uganda. The design of the Nyagak hydroelectric power station will allow for a continuous ecological river flow of 100-500 l/s from the head pond, or another smaller value approved by the Ministry of Water, Lands and Environment. The head pond will have a storage capacity of at least 130,000 m^3. The expected gross head is 87 m.

The principal environmental impacts of a project such as the Nyagak hydro project are the construction and operation of a reservoir and a dam. However, since the project does not involve a large dam, but a relatively small regulating basin (app. 15m long, 12m deep and 9.5m wide), the environmental impacts will be low and can easily be mitigated. The land that will be inundated is cultivated except close to the riverbank, which is lined by elephant grass and Arundinaria alpina. The potential for methane release from inundation of vegetation is therefore insignificant.

In 2002, in accordance with Ugandan law, an environmental impact assessment was conducted for the Bondo-Nebbi transmission line and for the Nyagak and Olewa hydropower projects, for which the National Environmental Management Authority (NEMA) of Uganda issued a "Certificate of Approval of Environmental Impact Assessment". Both the impact statement and the certificate of approval are on file for inspection by the validator.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders
>>
The World Bank contracted Action Aid (Uganda) as the lead NGO to undertake the Social Intermediation exercise for the West Nile Electrification Concession. Action Aid (Uganda) in turn contracted Community Empowerment for Rural Development (CEFORD) to carry out the Social Intermediation in the towns of Arua, Nebbi and Paidha.

The tasks of CEFORD in the Social Intermediation exercise included:

- Informing the community groups of the impending opportunities that could enable them access electricity.
- Facilitating a process through which communities can freely contribute to the business plan their opinions on power generation, transmission and distribution including strengths, weaknesses,

opportunities and threats if any relating to ownership and management of the proposed investment that could impact on the successful implementation and sustainability of the project.
- Feed back to the financial and technical consultants views emanating from these consultative processes for consideration during the designing of the business plan.

For each of the towns, consultations in form of meetings were held with Local Council Executives (LC 1-LC5), Government Civil servants in the respective towns, Business Community representatives, Private Companies and individual interviews with randomly selected households.

E.2. Summary of comments received

>>

According to the Report on Social Intermediation for the West Nile Electricity Concession (Utility) under the Energy for Rural Transformation Project (ERT) the main findings from the consultations were the following ones.

Main findings:

- People urgently want electricity power, regardless of the source. There was open sign of fatigue about the issue of providing electricity to West Nile and statements like "We now want actions instead of further talks" came from all consultations.
- There is a general feeling that the whole issue is highly political because it always comes when Elections are nearing. They expressed similar sentiments about the road issue (Karuma-Arua).
- People (both government officials and civilians) wish to be involved in the planning, implementation and management of the project through consultations and forging partnership with the main private investor.
- The population does not only want to benefit from the final service delivery in the form of electricity power but also from the implementation activities like supply of labour, materials and food. They also want to be shareholders in the project. In Arua, the proposal is to buy shares through the West Nile Power Utility Company while Nebbi and Paidha are not very keen about this company.
- People in Arua seem to be more informed about the project and other opportunities for rural electrification than those in Nebbi and Paidha. Arua district has even gone ahead to form a Power Committee (30 members) at the district level to discuss, and create awareness on issues of power for the population.
- There is a strong recommendation to form a West Nile Power Committee to discuss and oversee the process of implementing and managing the project.
- The proposal to develop Nyagak hydro power site under survey should not bar any other interested private investor from developing other sites in West Nile like Olewa.
- While the people in Arua have no objection about the transmission line passing through Nebbi-Okollo-Bondo to Arua Municipality, there is strong objection from the people of Nebbi and Paidha. They prefer it to pass through Nyapea- Warr- Logiri.
- The people in Arua accept the installation of the 1.5 MW generator set in Arua but those in Nebbi and Paidha are against it.

The stakeholder consultation process and the comments received during the process are detailed in the Report on Social Intermediation for the West Nile Electricity Concession (Utility) under the Energy for Rural Transformation Project (ERT). The report is on file for inspection by the validator.

E.3. Report on consideration of comments received

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The project sponsor and the World Bank have responded in detail to many comments received from stakeholders and concerned parties. World Bank staff has addressed issues concerning the project's status and CDM eligibility, as well as more technical questions concerning the design, site, generation output, environmental impacts etc.

SECTION F. Approval and authorization

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National Environmental Management Authority (NEMA) of Uganda issued a "Certificate of Approval of Environmental Impact Assessment". Both the impact statement and the certificate of approval are on file for inspection by the validator.

- - - - -

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Appendix 2: Affirmation regarding public funding

Appendix 3: Applicability of selected methodology

Appendix 4: Further background information on ex ante calculation of emission reductions

Appendix 5: Further background information on monitoring plan

Appendix 6: Summary of post registration changes

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities” (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		